ABBEYCONSULTANTS

Energy Statement

Land West of Ashington, West Sussex

Bellway Homes Limited (South London)

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1. Assessment Information

Project Name	Ashington
Project Address	Land West of Ashington, West Sussex
Developer	Bellway Homes Limited (South London)
Developer Address	Bellway Homes Limited (South London), Redhill, Surrey, RH1 1QT
Architect	DHA Architecture Ltd
Architect's Address	Brooklands Farm Business Park, Bottle Lane, Binfield, Berkshire, RG24 5QX
Project Description	Erection of 180 residential units, including landscaping, access, parking, sports pavilion, multi-use game area and grass pitch and associated infrastructure.

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01	MH	26/01/22	Initial Issue
02			
03			

This document has been prepared for Bellway Homes Limited (South London) only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

2. Executive Summary

This document has been prepared by Abbey Consultants (Southern) Ltd, a specialist environmental and energy consultancy on behalf, to accompany a planning application for the provision of 180 new residential dwellings at Land West of Ashington, West Sussex.

The proposed strategy has been based around the relevant objectives of Horsham District Council's Horsham District Planning Framework (Adopted November 2015). This report considers sustainability and includes an assessment of the predicted energy and CO_2 demand for the proposed development. In the formulation of this strategy, much consideration has been given to minimising the carbon emissions of the proposed development, and to ensure the development is constructed to rigorous sustainability standards.

In keeping with the requirements of Horsham District Council, this report comprises of the following:

- A Building Regulation baseline energy assessment for the proposed development.
- Energy conservation measures to be undertaken in the design of the development.
- A calculation of CO_2 savings that are to be achieved as a result of energy efficiency measures.
- An appraisal of the potential options for on-site renewables or low and zero carbon technologies.
- An outline specification of the proposed water efficiency measures to limit the internal water usage of each dwelling to less than 110 litres per person per day.

The proposed site will be built to Part L 2021 of the Building Regulations using the new SAP 10.2 methodology. However, at the time of writing this report the new SAP 10.2 software is not fully functional. Therefore, the main assessment detailed within this energy strategy has been carried out in accordance with Building Regulations Part L1A 2013 using the SAP 2012 methodology.

The development will reduce regulated CO_2 emissions by integrating a range of passive design and energy efficiency measures throughout the building. These measures include improving building fabric standards beyond the requirements of Part L of the Building Regulations. These measures enable the proposed scheme to go beyond Target Emission Rates (TER) and Target Fabric Energy Efficiency (TFEE) minimum standards via energy efficiency measures alone.

Following reduction of the energy demand through fabric and energy efficiency improvements, the 'Be Green' stage of the energy hierarchy details that ASHP technology will be utilised to provide a low carbon energy solution for the heating and hot water of the largest (4 & 5 bed) house types. Highly efficient gas boilers have been specified to all remaining house types. Electric heating along with hot water heat pumps have been specified to the apartments. In addition, an estimated 169.80 kWp of PV panels will be installed to roof elevations across the development.

All of the measures detailed herein combine to see a saving of 198.98 tonnes of CO_2 per year compared to the Building Regulations Part L 2013 baseline. This represents a 54% reduction and adheres to the requirements of the Horsham District Planning Framework (2015).

A summary of the overall reduction in residential CO_2 emissions after each stage of the energy hierarchy is summarised in the table below.

Table 1: Carbon Emissions Building Regulation's (TER) comparison

Element	CO_2 – Regulated (tonnes/year) SAP 2012
Part L1A 2013 Revised Baseline	369.30
After Energy Hierarchy	170.32
Saving	198.98
Improvement	54%

In addition, the fabric specification detailed within this energy strategy ensures that the average Dwelling Fabric Energy Efficiency improves upon the average Target Fabric Energy Efficiency (as defined by Building Regulations Part L1A 2013) by 21%. This is detailed within the table below.

Table 2: Residential FEE Performance

Element	Target Fabric Energy Efficiency (TFEE) kWh/m²/year	Dwelling Fabric Energy Efficiency (DFEE) kWh/m²/year	Improvement (%)
Development Total	52.33	41.48	21%

The table below details that 29% of the developments total predicted energy demand (TER) will be generated through on-site renewable and low carbon energy sources.

Table 3: Percentage of the Development's Energy Demand from Renewables

Item	Energy (kWh p.a.)
Total energy generated through on-site renewable and low carbon energy sources	123,298
Total predicted energy demand of the development (TER)	431,946
% of Total Energy Generated Through Renewables	**29%**

Using the specifications detailed within this energy strategy, an initial background assessment has also been carried out in the new SAP 10 software, which includes all of the dwelling types contained within this development proposal. The initial assessment has demonstrated that if the principles of this energy strategy are adhered to, then compliance with Building Regulations Part L 2021 will be achieved. The BREL reports produced from the initial assessment in SAP 10 can be found in the appendices.

Energy and Sustainability Summary

The strategy achieves and meets the following requirements:

- Includes improved optimal building fabric improvements, energy efficient design of building services.
- Utilises heat pump technology and provides an estimated 169.80 kWp of PV across the development to increase the carbon and energy savings.
- Complies with Part L 2013 Building Regulations and will reduce carbon emissions by 54% compared to the Part L1A 2013 baseline.
- Specifies low Nox emitting domestic boilers to the houses (where ASHP not specified).
- The fabric energy efficiency (DFEE) achieves a 21% reduction over the minimum standards defined by Building Regulations Part L1A 2013 (TFEE).
- 29% of the total predicted energy demand will be generated through on-site renewable and low carbon energy sources.
- In keeping with the requirements of Horsham District Council Policy 37, the strategy details a specification of water efficiency measures which will limit the internal water consumption of the dwellings to no more than 110 litres/person/day.
- The proposals detailed within this strategy adhere to the principles and requirements of the current adopted planning policy standards of Horsham District Council.
- The energy strategy will also achieve compliance with the new Building Regulations Part L 2021.

3. INTRODUCTION

This document has been prepared by Abbey Consultants (Southern) Ltd, a specialist environmental and energy consultancy on behalf of Bellway Homes Limited (South London).

The following report establishes a baseline assessment of the energy demands and associated CO_2 emissions for the development. The energy hierarchy approach of Be Lean, Be Clean and Be Green is then followed to ensure the maximum viable reductions in energy and regulated CO_2 emissions is achieved.

The proposed development is described as:

Erection of 180 residential units, including landscaping, access, parking, sports pavilion, multi-use game area and grass pitch and associated infrastructure.

The report takes into consideration the layout, use and requirements for the development to recommend a strategy that integrates the most suitable technologies available that are commercially viable, whilst also adhering to the requirements of the Horsham District Council's Horsham District Planning Framework (Adopted November 2015).

Figure 1 presents the proposed site layout.

Figure 1: Site Plan



4. Planning Policy

An effective planning system is required to contribute to achieving sustainable development.

Sustainable development is defined as having the following three overarching objectives which are interdependent and need to be pursued in mutually supportive ways: an economic objective, a social objective, and an environmental objective.

1. Economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

2. Social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

3. Environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

4.1 National Planning Policy Framework (NPPF) 2021

The NPPF sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

Chapter 14 Meeting the challenge of climate change, flooding and coastal change

The following paragraphs set out the Government's position in response to reducing carbon emissions:

Paragraph 154: New development should be planned for in ways that:

a. avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
b. can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

Paragraph 155. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a. provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
b. consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
c. identify opportunities for development to draw its energy supply from decentralised, renewable, or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

Paragraph 157: In determining planning applications, local planning authorities should expect new development to:

a. comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
b. take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Paragraph 158: When determining planning applications for renewable and low carbon development, local planning authorities should:

a. not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

4.2 Planning update March 2015

Housing Standard Review

Following the technical Housing Standards Review, Government issued a Ministerial Statement in March 2015 withdrawing all national standards that applied to residential development. This had the impact of cancelling the Code for Sustainable Homes and BREEAM as it pertains to residential development, aside from the management of legacy cases.

Zero Carbon Homes: supporting small builders

The government highlighted their commitment to implementing the zero carbon homes standard in 2016 and in addition to the future strengthening of minimum on-site energy performance requirements introduced in the Infrastructure Act 2015 the powers needed to enable off-site carbon abatement measures (Allowable Solutions) to contribute to achieving the zero carbon standards. However they recognised achieving the zero carbon standards would be a challenge for home builders and in particular smaller home builders and consulted on how an exemption for small sites could operate.

It was decided there would be an exemption for small housing sites of 10 units or fewer, which are most commonly developed by small scale home builders and can be more expensive to develop irrespective of the size of the builder, from the allowable solutions element of the zero carbon homes target. All new homes will be required to meet the strengthened on-site energy performance standard but those building on small sites will not be required to support any further off-site carbon abatement measures.

Housing standards: streamlining the system

It was agreed that all new homes need to be high quality, accessible and sustainable. To achieve this, the government created a new approach for the setting of technical standards for new housing. This rationalises the many differing existing standards into a simpler, streamlined system which it is hoped would reduce burdens and help bring forward much needed new homes.

The new system comprises new additional optional Building Regulations on water and access, and a new national space standard (hereafter referred to as “the new national technical standards”). This system complements the existing set of Building Regulations.

Plan making

From the date the Deregulation Bill 2015 is given Royal Assent, local planning authorities and qualifying bodies preparing neighbourhood plans should not set in their emerging Local

Plans, neighbourhood plans, or supplementary planning documents, any additional local technical standards or requirements relating to the construction, internal layout or performance of new dwellings. This includes any policy requiring any level of the Code for Sustainable Homes to be achieved by new development; the government has now withdrawn the code, aside from the management of legacy cases.

Local planning authorities and qualifying bodies preparing neighbourhood plans are to consider their existing plan policies on technical housing standards or requirements and update them as appropriate, for example through a partial Local Plan review, or a full neighbourhood plan replacement in due course. Local planning authorities may also need to review their local information requirements to ensure that technical detail that is no longer necessary is not requested to support planning applications.

The optional new national technical standards should only be required through any new Local Plan policies if they address a clearly evidenced need, and where their impact on viability has been considered, in accordance with the National Planning Policy Framework and Planning Guidance. Neighbourhood plans should not be used to apply the new national technical standards.

For the specific issue of energy performance, local planning authorities will continue to be able to set and apply policies in their Local Plans which require compliance with energy performance standards that exceed the energy requirements of Building Regulations until commencement of amendments to the Planning and Energy Act 2008 in the Deregulation Bill 2015.

This is expected to happen alongside the introduction of zero carbon homes policy in late 2016. The government has stated that, from then, the energy performance requirements in Building Regulations will be set at a level equivalent to the (outgoing) Code for Sustainable Homes Level 4. Until the amendment is commenced, it is expected local planning authorities to take this statement of the government's intention into account in applying existing policies and not set conditions with requirements above a Code level 4 equivalent. This statement does not modify the National Planning Policy Framework policy allowing the connection of new housing development to low carbon infrastructure such as district heating networks.

Decision taking, transition and compliance:

Where there is an existing plan policy which references the Code for Sustainable Homes, it was decided authorities may continue to apply a requirement for a water efficiency standard equivalent to the new national technical standard, or in the case of energy a standard consistent with Code Level 4.

4.3 Local Policy

Horsham District Council
Horsham District Planning Framework
Adopted November 2015

Policy 35

Strategic Policy: Climate Change

Development will be supported where it makes a clear contribution to mitigating and adapting to the impacts of climate change and to meeting the district's carbon reduction targets as set out in the Council's Acting Together on Climate Change Strategy, 2009.

Measures which should be used to mitigate the effects of climate change include;

1. Reduced energy use in construction;
2. Improved energy efficiency in new developments, including influencing the behaviour of occupants to reduce energy use;
3. The use of decentralised, renewable and low carbon energy supply systems;
4. The use of patterns of development which reduce the need to travel, encourage walking and cycling and include good accessibility to public transport and other forms of sustainable transport; and

Development must be designed so that it can adapt to the impacts of climate change, reducing vulnerability, particularly in terms of flood risk, water supply and changes to the district's landscape. Developments should adapt to climate change using the following measures:

1. Provision of appropriate flood storage capacity in new building development;
2. Use of green infrastructure and dual use SuDS to help absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration;
3. Use of measures which promote the conservation of water and/or grey water recycling; and
4. Use of site layout, design measures and construction techniques that provide resilience to climate change (opportunities for natural ventilation and solar gain).

If it is not possible to incorporate the adaption and mitigation measures proposed, an explanation should be provided as to why this is the case.

Policy 36

Strategic Policy: Appropriate Energy Use

Energy hierarchy

All development will be required to contribute to clean, efficient energy in Horsham based on the following hierarchy:

1. Lean – use less energy – e.g. through demand reduction
2. Clean – supply energy efficiently – e.g. through heat networks
3. Green – use renewable energy sources

District Heating and Cooling

Commercial and residential developments in Heat Priority Areas or the strategic development locations will be expected to connect to district heating networks where they exist using the following hierarchy, or incorporate the necessary infrastructure for connection to future network.

Development should demonstrate that the heating and cooling systems have been selected in accordance with the following heating and cooling hierarchy;

1. Connection to existing (C)CHP distribution networks
2. Site wide renewable (C)CHP
3. Site wide gas-fired (C)CHP
4. Site wide renewable community heating/cooling
5. Site wide gas-fired community heating/cooling
6. Individual building renewable heating
7. Individual building heating, with the exception of electric heating

All (C)CHP must be of a scale and operated to maximise the potential for carbon reduction. Where site-wide (C)CHP is proposed, consideration must be given to extending the network to adjacent sites.

Energy Statements

All applications for residential or commercial development must include an Energy Statement demonstrating and quantifying how the development will comply with the Energy Hierarchy.

Developments in Heat Priority Areas and strategic developments should demonstrate and quantify how the development will comply with the heating and cooling hierarchy. Horsham District Council will work proactively with applicants on major developments to ensure these requirements are met.

Renewable energy schemes

The council will permit schemes for renewable energy (e.g. solar) where they do not have a significant adverse effect on landscape and townscape character, biodiversity, heritage or cultural assets or amenity value. Community initiatives which seek to deliver renewable and low carbon energy will be encouraged.

Policy 36

Sustainable Construction

Proposals must seek to improve the sustainability of development. To deliver sustainable design, development should incorporate the following measures where appropriate according to the type of development and location:

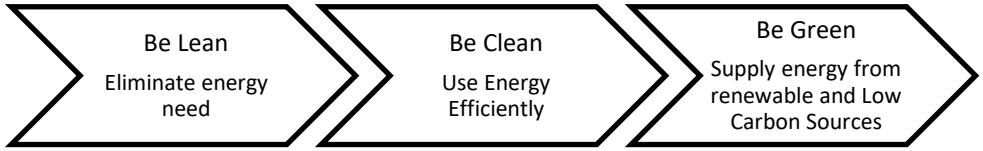
1. Maximise energy efficiency and integrate the use of decentralised, renewable and low carbon energy;
2. Limit water use to 110 litres/person/day;
3. Use design measures to minimise vulnerability to flooding and heatwave events;
4. Be designed to encourage the use of natural lighting and ventilation;
5. Be designed to encourage walking, cycling, cycle storage and accessibility to sustainable forms of transport;
6. Minimise construction and demolition waste and utilise recycled and low-impact materials;
7. Be flexible to allow future modification of use or layout, facilitating future adaption, refurbishment and retrofitting;
8. Incorporate measures which enhance the biodiversity value of development.

All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of design.

New homes and workplaces should include the provision of high-speed broadband access and enable provision of future technologies where available.

5. Development Approach

The proposed energy strategy follows the established and widely accepted Energy Hierarchy of eliminate energy need (Be Lean), Use energy efficiently (Be Clean) and supply energy from renewable and low carbon sources (Be Green) to enable the maximum viable reductions in regulated and total CO_2 emissions over the baseline.



The proposed energy supply solutions aim to match energy profiles of the development ensuring effective use. The proposed solutions consider viability and flexibility of the scheme from both a technical and economic point of view by identifying best combination of energy efficiency measures as well as decentralised and renewable energy supply solutions.

Using these principles, Bellway Homes Limited (South London) will deliver the following objectives:

- Comply with the relevant regulatory requirements.
- Ensure that a reduction in CO_2 beyond Part L 2013 standards is achieved across the site through fabric and energy efficiency measures.
- To propose to reduce energy consumption and carbon dioxide emissions further through the use of on-site renewable or low and zero carbon technologies (LZC).
- Incorporate a number of construction practices and measures to ensure sustainability will be incorporated including waste practices, environmental pollution management and material sourcing.

5.1 Carbon Conversion Factors

The report has been prepared using SAP 2012 Building Regulation carbon conversion factors as detailed in the table below.

Table 4: Carbon conversion factors

Fuel Type	SAP 2012 CO_2 Conversion Factors (kg/kWh)	SAP 10.2 CO_2 Conversion Factors (kg/kWh)
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.136

Although the above SAP 2012 conversion factors have been used for the main assessment of this report. The UK Government has now published a new Standard Assessment Procedure, SAP 10.2. The CO_2 conversion factors for SAP 10.2 are stated within the table above and will be used for assessments against the new Part L of the Building Regulations (2021).

6. Energy Calculations (Baseline)

A baseline total energy demand has been established for the proposed development. Reductions in demand due to energy conservation measures are considered and form the basis of the energy strategy which follows.

Floor plans for the development have been used in conjunction with proposed building specifications to prepare the sample SAP calculations.

SAP calculations have been carried out to Approved Document Part L1A 2013. The relevant energy loads have been collated from the full SAP calculation sheets and entered into a spreadsheet that can be found in the appendices, which calculates the total energy and CO_2 demand.

Regulated Energy Demand is calculated from the energy associated with space heating, hot water and fixed electrical demands (for lights, fans and pumps).

Unregulated energy is the annual electrical energy demand from appliances and would be calculated using the methodology as suggested by SAP 2012. SAP calculations are extended to allow for CO_2 emissions associated with appliances and cooking, and to allow for site-wide electricity generation technologies.

Total Energy Demand for the development is calculated from the regulated energy demand figures given above and an additional energy demand associated with unregulated energy.

Energy savings are measured in terms of a reduction in CO_2 emissions and kWh, which are calculated from their association with a particular fuel source. CO_2 Conversion Factors have been taken from Table 2, Building Regulations Part L1A 2013.

6.1 Sample SAP Calculations

Stroma's FSAP 2012 has been used to evaluate the CO_2 emissions on a representative sample of the residential dwellings. Using the mix of the development, the energy usage and CO_2 emissions for each type are extrapolated on a weighted basis to evaluate the total predicted energy and CO_2 performance for all the residential units.

The following table provides the mix used to determine the baseline energy and CO_2 demand for the residential units.

Table 5: Residential Mix

House Type	Quantity	House Type	Quantity
The Blenmere	7	The Arkwright	12
The Harper	16	The Weaver	10
The Tillman – ET	15	The Tenterer	2
The Tillman – MT	1	The Framer	4
The Coiner	14	The Watchmaker	3
The Reedmaker	9	The Lacemaker	16
The Pargeter	13	2 Bed GF	3
The Baker – ET	6	2 Bed MF	3
The Baker – MT	2	2 Bed EF	1
The Cartographer	4	2 Bed TF	4
The Ploughwright	1	1 Bed GF	6
The Saddler	5	1 Bed MF	6
The Hillard – DET	6	1 Bed EF	2
The Hillard – ET	1	1 Bed TF	8
		TOTAL:	**180**

6.2 Calculation of Baseline Energy and CO_2 Emissions

Thermal insulation levels and air tightness standards for the baseline case are assumed to just meet the requirements Part L1A 2013 of Building Regulations. The baseline specification as determined by SAP 2012 is detailed in the table below.

Table 6: Baseline design specification – Part L1A 2013

Element	Baseline Design Specification
Ground Floor	0.13 W/m2K
Exposed Floor	0.13 W/m2K
External Wall	0.18 W/m2K
Party Wall	0.00 W/m2K
Roof – insulated at ceiling	0.13 W/m2K
Roof – insulated at slope	0.13 W/m2K
Roof – flat	0.13 W/m2K
Glazing U-Value	1.40 W/m2K
Door U-Value	1.2 W/m2K
Design Air Permeability	5.00
Space Heating	Mains Gas 88.6% efficient
Heating Controls	Heating System controls
Domestic Hot water	Mains Gas
Ventilation	Natural ventilation with intermittent fans
Low Energy Lighting	100%
Thermal Bridging	Appendix R values

6.3 Energy And CO_2 Demand (Baseline)

Using the specification detailed and the outputs from SAP for the sample units, the baseline energy and carbon figures for the development are detailed in the table below.

Table 7: Predicted Carbon Emissions: Part L1A 2013 Gas Baseline Unit (TER)

Element **Part L1A 2013**	Space Heating Demand	Hot Water demand	Pumps and fans	Lighting	Totals
Energy: Gas Baseline (kWh p.a.)	753,094	437,531	13,500	71,151	**1,275,276**
CO_2 Associated with total Energy Demand (kgCO_2 p.a./a)	162,668	94,507	7,007	36,927	**301,109**

It should be noted that the baseline figures detailed above have been generated assuming gas heating. This will be needed to demonstrate the carbon emissions reduction that will be achieved through the energy efficiency measured (detailed in the 'Be Lean' section to follow) as this scenario will also assume gas heating. Alternative heating solutions will be explored in the latter stages of this report, however, these are considered to be renewable or low carbon technologies so they can only be accounted for at the "Be Green" stage of this energy strategy.

When electric heating systems are used, a different fuel factor is applied meaning that a different baseline TER will be generated. This will be the case in the latter stages of this energy strategy, where updated figures will be detailed.

7. Passive Design and Energy Efficient Measures (Be Lean)



In accordance with the Energy Hierarchy, the energy demands of the development should be reduced as much as practically viable. The desire is to achieve Part L 2013 Building Regulations compliance before low carbon or renewable measures are introduced.

A range of measures to reduce CO_2 emissions and increase resilience to climate change are proposed in the building design including good building fabric standards as well as energy efficient M&E systems and lighting.

7.1 Passive Design

'Passive design' is design that takes advantage of the climate to maintain a comfortable temperature range in the home. Passive design reduces or eliminates the need for auxiliary heating or cooling in the home.

The importance of passive design cannot be overstated. Paying attention to the principles of good passive design suitable for the climate effectively 'locks in' thermal comfort, low heating and cooling bills, and reduced greenhouse gas emissions for the life span of the home.

The development will incorporate a range of passive design measures and energy efficient building fabric that will reduce the demand for space heating, ventilation, and artificial lighting and negate the need for cooling.

Passive design utilises natural sources of heating and cooling, such as the sun and cooling breezes and consideration has been achieved by appropriately orientating the dwellings on the proposed development and ensuring the specification of the building envelope is suitably robust. A well-designed building envelope minimises unwanted heat gain and loss.

Openable windows are proposed but are not essential to provide a fresh air supply.

Standard intermittent fans have been considered but are judged to be inappropriate due to the high energy efficiency requirements and the CO_2 reduction target. A mechanical ventilation strategy to extract air is therefore deemed to be more suitable.

The ventilation strategy will be reviewed again and developed as the design progresses to ensure compliance with all the relevant regulations and standards. Should certain elevations be affected by noise issues restricting the opening of windows, enhanced mechanical ventilation will be introduced to reduce the risk of overheating. It is assumed, in this scenario, that all windows can still be opened (albeit intermittently) for purge ventilation.

The proposed glazed areas have been designed to maximise daylight and optimise solar gains. The glazing specification has been reviewed to ensure that they provide a balance between solar control and solar gain.

7.2 Building Fabric

To reduce demand for space heating, emphasis has been placed on providing a very high standard of fabric efficiency and reducing heat loss through the building envelope. Approved Document Part L1A 2013 sets out the limiting fabric parameters for each of the building elements. Each stated value represents the area-weighted average U-value. The following table details the proposed U-values to be used in the described exposed element within the fabric of the development.

Table 8: Proposed U-Values - Houses

Element	Baseline Design Specification	Maximum Allowable SAP 2012	Proposed Design Stage Specification
Ground Floor	0.13 W/m²K	0.25 W/m²K	0.10 W/m²K
Exposed Floor	0.13 W/m²K	0.25 W/m²K	0.17 W/m²K
External Walls	0.18 W/m²K	0.30 W/m²K	0.25 W/m²K
Party Wall	0.00 W/m²K	0.20 W/m²K	0.00 W/m²K
Roof – insulated at ceiling	0.13 W/m²K	0.20 W/m²K	0.09 W/m²K
Roof – insulated at slope	0.13 W/m²K	0.20 W/m²K	0.13 W/m²K
Roof – flat	0.13 W/m²K	0.20 W/m²K	0.13 W/m²K
Glazing U-Value	1.40 W/m²K	2.00 W/m²K	U = 1.20 W/m²K G = 0.47 BFRC Certificate
Door U-Value	1.20 W/m²K	2.00 W/m²K	1.00 - 1.30 W/m²K

Table 9: Proposed U-Values - Apartments

Element	Baseline Design Specification	Maximum Allowable SAP 2012	Proposed Design Stage Specification
Ground Floor	0.13 W/m²K	0.25 W/m²K	0.10 W/m²K
Exposed Floor	0.13 W/m²K	0.25 W/m²K	0.15 W/m²K
External Walls	0.18 W/m²K	0.30 W/m²K	0.23 W/m²K
Communal Walls	0.18 W/m²K	0.30 W/m²K	0.25 W/m²K
Party Wall	0.00 W/m²K	0.20 W/m²K	0.00 W/m²K
Roof – insulated at ceiling	0.13 W/m²K	0.20 W/m²K	N/A
Roof – insulated at slope	0.13 W/m²K	0.20 W/m²K	N/A
Roof – flat	0.13 W/m²K	0.20 W/m²K	0.13 W/m²K
Glazing U-Value	1.40 W/m²K	2.00 W/m²K	U = 1.20 W/m²K G = 0.47 BFRC Certificate
Door U-Value	1.20 W/m²K	2.00 W/m²K	1.00 - 1.30 W/m²K

To further minimise heat loss through the building envelope, air leakage will be made a priority. The airtightness of the dwellings will be set to a level of 4.65m³/h/m². In addition, it is proposed that all openings will have Hi-Therm lintels installed to maximise thermal efficiency.

Such levels of airtightness, along with the proposed enhanced fabric measures, will increase comfort and warmth as well as save future residents money on energy bills.

Repeated thermal bridges such as timber studs or mortar joints are already covered by U-value calculations. Non-repeating thermal bridges are intermittent and occur at specific points in the construction. They are often caused by discontinuities in the thermal envelope. They commonly occur around openings and other instances where materials of different thermal conductivities form part of the external envelope.

Accredited construction details for all wall junctions will be specified to minimise the effects of non-repeating thermal bridging and reduce heat loss further. By specifying and ensuring that ACDs are designed into the build, CO_2 emissions can be reduced by up to 5%.

Table 10: Proposed DAP and Target Psi Values

Element	Baseline Design Specification	Maximum Allowable SAP 2012	Proposed Design Stage Specification
Air Permeability	5.00	10.00	4.65
Psi Values	Appendix R	0.15	0.04

All dwellings will be specified to have 100% of their lighting outlets classed as low energy, thus reducing the future homeowner's electricity bill. Orientation and layout have also been given consideration to help limit heat loss in winter and maximise the potential for free cooling in summer, to limit the risk of overheating.

Overall, the proposed passive design measures for this development will provide households with a resource to reduce their energy demand and heat their homes to a satisfactory standard at an affordable cost.

The proposed specification will provide a robust long term solution, future proofing the dwelling for years to come.

As detailed previously, gas boilers have been assumed for the heating at this stage of the energy hierarchy. Alternative heating solutions will be explored at the latter stage of this energy strategy, however, these alternative heating solutions are considered to be renewable or low carbon technologies so their benefit in terms of energy and CO_2 reduction can only be accounted for at the 'Be Green' stage of this energy strategy. The gas boiler assumption at this stage of the hierarchy allows for the performance of the proposed building fabric and energy efficiency measures to be independently assessed.

7.3 Fabric Energy Efficiency (FEE)

Dwelling Fabric Energy Efficiency (DFEE) rates and Target Fabric Energy Efficiency (TFEE) rates sit alongside the requirements for Target CO_2 Emission Rates (TER) and Dwelling CO_2 Emission Rates (DER) in Building Regulations.

The Target Fabric Energy Efficiency rate is the minimum energy performance requirement for a new dwelling and it is expressed as the amount of energy demand in units of kilowatt-hours per square metre of floor area per year.

The energy strategy has reduced energy demand through fabric and energy efficiency measures. They demand has been shown to have been reduced by 21% as detailed in the table below.

Table 11: Residential FEE Performance

Element	Target Fabric Energy Efficiency (TFEE) kWh/m²/year	Dwelling Fabric Energy Efficiency (DFEE) kWh/m²/year	Improvement (%)
Development Total	52.33	41.48	21%

7.4 Energy And CO_2 Demand (Be Lean)

Using the specification detailed and the outputs from SAP, the 'Be Lean' energy and carbon figures for the development are detailed in the table below, and an improvement can be seen when compared to the baseline figures outlined in the previous section.

Table 12: Predicted Energy Demand and Carbon Emissions: Be Lean

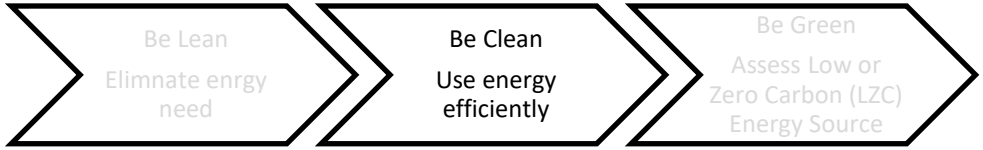
Element Part L1A 2013	Space Heating Demand	Hot Water demand	Pumps and fans	Lighting	Totals
Energy: Be Lean (kWh p.a.)	625,186	259,460	21,650	71,151	**977,447**
CO_2 ($kgCO_2$ p.a./a) SAP 2012	135,040	56,043	11,237	36,927	**239,247**

A summary of the energy savings at the 'Be Lean' stage can be found in table below.

Table 13: CO_2 Savings: Be Lean

Element	CO_2 – Regulated (tonnes/year) SAP 2012
Part L1A 2013 Gas Baseline	301.11
After 'Be Lean'	239.25
Saving	61.86
Improvement	21%

8. SUPPLY ENERGY EFFICIENTLY (BE CLEAN)



Combined Heat and Power (CHP)

Decentralised energy refers to energy that is generated off the main grid. This may include micro-renewables, heating and cooling. It can also refer to energy from waste plants, combined heat and power, district heating and cooling, as well as geothermal, biomass or solar energy. Decentralised Energy schemes can serve a single building or a whole community, even being built out across entire cities.

The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

1. Connect to local or existing planned heat networks.
    a. Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required).
    b. Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network).
    c. Use ultra-low NOx gas boilers.
2. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements of national and local planning policy.
3. Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

There are many benefits of decentralised heat generation and Combined Heat and Power (CHP) in terms of cost and CO_2 emissions savings. However, technology such as this is more significant for larger developments, ideally complimented with some non-residential use of heat and electricity. The proposed development size of 180 dwellings is at the low end of what the industry tends to view as viable for such systems. The development is for residential only and this will result in 'peaky' thermal demands with little anchor load to enable efficient operation of gas fired CHP. This option also risks the potential to increase costs to residents.

The site is neither sufficiently dense nor large enough to warrant investment from 3rd party managing agents or Energy Supply Companies (ESCos). The proposed development would need to be run by an independent agent/company and there would be very little if any interest among existing ESCos in servicing such a small-scale system. Even if it was possible, the cost of managing fuel procurement, customer billing, operation and maintenance would lead to disproportionally and unnecessary high service charges to residents compared to the provision of heat from individual gas boilers.

Based on the anticipated timescale of the proposed development and the predicted trajectory of the national electricity grid decarbonisation, the development of a district heat network powered by fossil fuels is also not considered to be the most carbon efficient approach.

The incorporation of a gas fired combined heat and power (CHP) network will lock the development into relatively carbon intensive gas-fired heating and hot water technology, and will not facilitate the transition to less carbon intensive solutions.

9. Renewables Or LZC Technology (Be Green)



The following low and zero carbon technologies have been considered for this scheme:

- Air Source Heat Pump (ASHP)
- Domestic Hot Water Heat Pumps
- Photovoltaic Panels (PV)
- Ground Source Heat Pump (GSHP)
- Wind Turbines
- Biomass Boiler
- Solar Thermal

The assessment has shown that individual Air Source Heat Pumps, Domestic Hot Water Heat Pumps and PV are considered to be the most suitable renewable energy options for this development.

All other renewable energy technology options are summarised in the appendices and have been deemed as not appropriate for this development.

9.1 Air Source Heat Pumps (ASHP)

Air at any temperature above absolute zero contains some energy. An air source heat pump transfers some of this energy as heat from one place to another, for example, between the outside and inside of a building. This can provide space heating and hot water. A system can be designed to transfer heat in either direction, to heat or cool the interior of the building in winter and summer respectively. For simplicity, the description below focuses on use for interior heating.

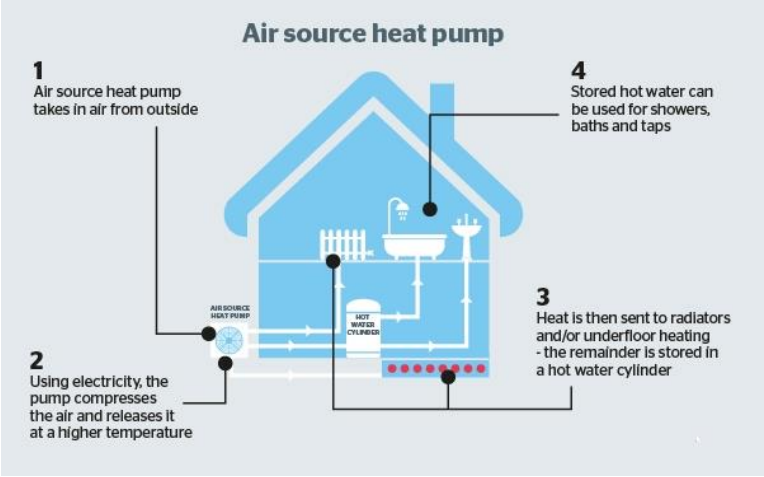
The technology is similar to a refrigerator/freezer or air conditioning unit. The different effect is due to the physical location of the different system components. Just as the pipes on the back of a refrigerator become warm as the interior cools, so an ASHP warms the inside of a building whilst cooling the outside air.

The main components of an ASHP are:

- An outdoor heat exchanger coil, which extracts heat from ambient air.
- An indoor heat exchanger coil, which transfers the heat into hot air ducts, an indoor heating system such as water-filled radiators or underfloor circuits and a domestic hot water tank.

The figure below demonstrates the typical operation of an ASHP system used to supply space heating and hot water to a property.

Figure 2: Example diagram of ASHP System



Some of the key advantages of ASHPs are listed below:

- ASHPs save carbon emissions. Unlike burning oil, gas, LPG or biomass, a heat pump produces no carbon emissions on-site (and no carbon emissions at all, if a renewable energy source is used to power them).
- They save space. There are no fuel storage requirements.
- They require less maintenance than combustion based heating systems.
- Heat pumps can provide cooling in summer, as well as heating in winter.
- There is no combustion involved and no direct emission of harmful gases.

ASHPs will require electricity to operate, however this electricity can be supplied by renewable sources. This will future proof the home against the decarbonisation of the electricity grid.

In an attempt for this scheme to be less dependent on the use of gas heating, the Developer is committed to specifying the use of individual ASHPs the largest (4 & 5 bed) house types. This will equate to 51 houses on the scheme. The ASHP are to be discreetly located within the boundary of each plot. The full design of this system will be further developed during the detailed design stage.

9.2 VAILLANT AROSTOR DOMESTIC HOT WATER HEAT PUMP

Incredibly efficient and sustainable, aroSTOR uses thermal energy to heat hot water collected via an external air duct or it can be recycle hot air from within the room where it's installed. The only other energy needed is the electricity to run the appliance.

aroSTOR heat pumps use only R290 natural refrigerant, which is used widely in household appliances such as domestic fridge freezers. With R290, aroSTOR gives excellent performance for water heating as it can deliver 60° in the cylinder without any need for a back-up heater, whilst still providing strong efficiency levels.

Some of the features and benefits of the aroSTOR hot water heat pump are listed below:

- Flexible siting options – a small footprint and range of 360° air duct accessories offers flexible options for siting of the appliance.
- Highly energy efficient and reliable – gives high COP of >3.19 and best possible ErP label of A+.
- Controls – comes with integrated control.
- High quality material and components – stainless steel tank comes with a five year warranty (two years for other components).
- Extremely quiet operation – advanced insulation and use of rubber on the compressor for quiet operation.
- Hot water on demand – self-managing hot water comfort with electrical back up heater for hot water boost (and Legionella protection).

The use of the Vaillant aroSTOR (200 litre) is proposed for the apartments on this development to efficiently supply their hot water demand. The space heating for the apartments will be supplied through the use of electric panel heaters.

Although the electric panel heaters and aroSTOR heat pumps will require electricity to operate, the future shift towards carbon neutrality will mean the electricity can eventually be generated solely through renewable sources. Therefore, there is less dependence on fossil fuels and this will future proof the homes against the ongoing decarbonisation of the electricity grid.

Figure 3: Diagram of the Vaillant aroSTOR



A product specification sheet for the Vaillant aroSTOR has been included within the appendices.

The design of this system will be further developed during the detailed design stage.

The predicted energy savings through the use of the hot water heat pump compared with gas heating is detailed in the table below.

Table 14: Energy Saved Through Use Heat Pump Technology

Item	Quantity	Metric
Total energy saving through use of individual air source heat pumps and domestic hot water heat pump (compared with gas alternative)	259,260	kWh/year

9.3 Summary of Building Services

The building services and systems to be employed within the dwellings are summarised in the following table.

Table 15: Summary of Building Services

Building Service Element	Specification
4 & 5 Bed House Types:	Air Source Heat Pumps Mitsubishi Ecodan
2 & 3 Bed House Types:	Ideal Logic Gas Boilers Efficiency 89% SEDBUK 2009
Heating for The Apartments:	Electric Panel Heaters Vaillant aroSTOR to hot water
Heating Hot Water Controls:	Time and Temperature Zone Control Delayed Start Stat No Weather Compensation
Flue Gas Heat Recovery:	Yes (where gas boilers are used)
Cylinder: **Heat Loss:**	180 – 210 litre cylinder (dependent on property size) 1.1 – 1.5 kWh/24 Hr
Ventilation:	System 3 fans Decentralised MEV – Titon Solitude
Waste Water Heat Recovery:	Yes (to houses only)

9.4 PHOTOVOLTAIC PANELS (PV)

Solar PV technology offers advantages over other low carbon and renewable energy technologies for the following reasons:

Density/scale

Solar technologies are modular and can be sized to available space constraints and would easily be integrated into the roofscape of the proposed development.
Solar PV technologies typically require 2-3 times more space to generate the equivalent energy or abate similar emissions as solar thermal panels, but they can be sized to the maximum available roof space.

Technology Integration

Solar technologies can be easily integrated into the built environment using available roof space. Since they are modular and easily fixed to buildings, they can access solar irradiation in almost any location. The technologies can be integrated on almost any roof structure or vertical façade without compromising structural or aesthetic requirements.
Solar PV systems are generally connected to the dwelling or block via an inverter and any excess generation not utilised on-site is exported seamlessly to the local grid.

Cost-effectiveness

Solar PV costs have reduced dramatically in the last 2-3 years in the UK, due to increasing demand for the technology driven by sustainability requirements and the Government's stimulus package known as the Feed-In Tariffs (FiTs) scheme which rewards renewable electricity generation with premium tariffs.

CO_2 Abatement Capacity

Solar PV generates electricity and abates ~2.5 - 3 times more CO_2 than an alternative renewable energy technology that displaces use of gas (e.g. solar hot water technology and/or biomass boilers). Solar PV is well proven with good historical data showing that its performance credentials generally match or exceed manufacturers' claims/modelled generation profiles.

As previously stated, the main assessment detailed herein has been carried out in SAP 2012 in accordance with Building Regulations Part L1A 2013. However, the site will be built to the new Part L (2021). Each house type has therefore also been assessed against the new Building Regulations Part L 2021. This assessment has ultimately identified the estimated quantity of PV that will be required to each plot to ensure compliance with Part L 2021 requirements.

The PV schedule below estimates the quantity of PV panels that will be required to each dwelling type.

Table 16: Type by Type PV Schedule

Type	PV Per Plot (kWp)	No. of Plots	Total PV (kWp)
The Blenmere	1.8	7	12.6
The Harper	2.1	16	33.6
The Tillman – ET	1.2	15	18
The Tillman – MT	0.9	1	0.9
The Coiner	1.5	14	21
The Baker – ET	0.9	6	5.4
The Baker – MT	0.6	2	1.2
The Ploughwright	1.2	1	1.2
The Hillard – DET	2.1	6	12.6
The Hillard – ET	2.1	1	2.1
The Tenterer	1.8	2	3.6
The Framer	2.1	4	8.4
The Lacemaker	3	16	48
2 Bed TF	0.3	4	1.2
	TOTAL:	**566**	**169.8**

Solar radiation falling upon a roof varies depending on its orientation. A figure has been included within the appendices detailing the most appropriate roof elevations for the installation of PV. However, for the purpose of this assessment it has been assumed that all PV panels are Southeast facing. Once the scheme has been fully designed it will be necessary for a full PV design to be developed whereby the actual orientation of each PV panel will be detailed and taken into account for the design stage SAP calculations.

The predicted CO_2 and energy savings by the introduction of the photovoltaic panels can be summarised as detailed in the table below and will abate the following in terms of energy and CO_2.

Table 17: Summary of PV including Energy and CO_2 abatement

Item	Quantity	Metric
Assumed Power of PV Cell	300	Wp
Total No. of PV Cells	566	No
Total kWp	169.8	kWp
Total Energy saving	136,383	kWh/year
Total CO_2 saving	70,783	$kgCO_2$/year

9.5 Energy And CO_2 Demand (Be Green)

As detailed previously, a revised Building Regulations baseline TER must now be generated due to some dwellings being specified with electric heating systems which utilises a different fuel factor in the generation of the TER compared with gas heating. The revised Building Regulations baseline TER is detailed in the table below.

Table 18: Predicted Carbon Emissions: Part L1A 2013 Revised Baseline (TER)

Element Part L1A 2013	Space Heating Demand	Hot Water demand	Pumps and fans	Lighting	Totals
Energy: Revised Baseline (kWh p.a.)	748,177	439,229	13,500	71,151	**1,272,057**
CO_2 Associated with total Energy Demand ($kgCO_2$ p.a./a)	206,452	118,911	7,007	36,927	**369,297**

Using the specification detailed and the outputs from the SAP calculations, the 'Be Green' energy and carbon figures for the development are detailed in the table below, and an improvement can be seen when compared to the previous stages of the energy hierarchy.

Table 19: Predicted Energy Demand and Carbon Emissions: Be Green

Element Part L1A 2013	Space Heating Demand	Hot Water demand	Pumps and fans	Lighting	PV	Totals
Energy: Be Green (kWh p.a.)	432,964	198,722	15,350	71,151	-136,383	**581,804**
CO_2 ($kgCO_2$ p.a./a) SAP 2012	130,914	65,299	7,967	36,927	-70,783	**170,324**

A summary of the energy savings at the 'Be Green' stage can be found in the table below.

Table 20: CO_2 Savings: Be Green compared against Part L1A 2013 Revised Baseline

Element	CO_2 – Regulated (tonnes/year) SAP 2012
Part L1A 2013 Revised Baseline	369.30
After 'Be Green'	170.32
Saving	198.98
Improvement	54%

The CO_2 emissions savings demonstrated above are a 54% reduction compared to the Building Regulations Part L1A 2013 baseline.

9.6 Total Energy Saved Through Renewables

The tables below details how much of the developments total predicted energy (TER) will be generated through on-site renewable and low carbon energy sources.

Table 21: Total Energy Generated Through Renewables

Item	Energy (kWh p.a.)
Total energy saving through use of individual air source heat pumps and domestic hot water heat pump (compared with gas alternative)	259,260
Energy generated through PV	136,383
Total energy generated through on-site renewable and low carbon energy sources	**395,643**

Table 22: Percentage of the Development's Energy Demand from Renewables

Item	Energy (kWh p.a.)
Total energy generated through on-site renewable and low carbon energy sources	395,643
Total predicted energy demand of the development (TER)	1,272,057
% of Total Energy Generated Through Renewables	**31%**

10. Compliance With Building Regulations Part L 2021

As of 15th June 2022 a new Part L of the Building Regulations (2021) has come into effect. This means that this development proposal will have to be built to comply with the new Part L (2021) requirements.

The new Part L (2021) utilises a new SAP methodology known as SAP 10.2. This has been adopted by the Government as the UK methodology for calculating the energy performance of dwellings. However, at the time of writing this report the new SAP 10.2 software is not fully functional. Therefore, the main assessment detailed within this energy strategy has been carried out in accordance with Building Regulations Part L1A 2013 using the SAP 2012 methodology.

Using the specifications detailed within this energy strategy, an initial background assessment has been carried out in the new SAP 10 software, which includes all of the dwelling types included within this development proposal. The initial assessment has demonstrated that if the principles of this energy strategy are adhered to, then compliance with Building Regulations Part L 2021 will be achieved. The BREL reports produced from the initial assessment in SAP 10 can be found in the appendices.

11. Summer Overheating and Cooling

With a continual drive for energy efficiency through both the Building Regulations and Local Planning Authority requirements, the risk of overheating to dwellings in the summer months is becoming more prevalent. Overheating can be a mild discomfort or a hazard to health if managed incorrectly, so it is vitally important that overheating risk be mitigated to ensure the dwelling will be both energy efficient and comfortable to live in.

Summer overheating is caused when there is excess build-up of heat within a dwelling. This can occur where there is excessive solar gain and limited means to absorb excess heat into the building fabric or purge this heat through ventilation. Summer overheating can be managed through a variety of measures and the chosen solution will vary from development to development. These measures can include:

Limiting solar gain

Glazing g value: This is a measure of how much solar radiation penetrates the glazing. The lower the g value the less solar gain enters a dwelling. Glazing with low g values may have a darker tint to the glazing, so aesthetic considerations are also a factor. Lower g values (below 0.5) are often required in apartments with single facades. Specifying g values below 0.2 will increase cost substantially and also limit the number of available suppliers for glazing.

External shading: Windows can be shaded with Brise Soleil or balconies of the dwelling above to reduce solar gain the in the summer months. If aligned correctly external shading can reduce solar gain in summer and still allow for it in winter when the sun is lower.

Internal Shading: Blinds can be used to limit solar gain in a dwelling. They can either be automatic, triggered by the sun's presence on the window, or operated manual. Manual operation requires the occupant to be present however, so this option is not a reliable option when trying to mitigate overheating risk.

Purging excess heat build up

Thermal Mass: thermal mass is the measure of a dwellings ability to absorb energy. A dwelling with a high thermal mass (high proportion of concrete) has the ability to absorb heat during the day, which helps maintain a steady internal temperature. This heat can be released back into the dwelling at night time, when the temperature of the dwelling is lower, helping to maintain a consistent internal temperature.

Ventilation: A dwelling can be ventilated to purge excess heat build-up. This can be done through openable windows, especially where cross ventilation is possible. Where ventilation through windows isn't possible, due to security, noise or pollution issues, Mechanical Ventilation can be used. The ventilation rates required to purge a dwelling can often be quite high, requiring oversized systems.

The SAP calculations have been used to assess the risk of overheating. The results of the assessment in SAP 2012 show that the dwellings have, at worst, only a 'medium' risk of overheating and is therefore acceptable in terms of meeting Building Regulations requirements. This has been achieved using the following strategy:

- Thermal Mass
- Decentralised Mechanical Ventilation
- A G figure of 0.40 – 0.50 to the glazing

11.1 Overheating Results: SAP calculations

The dwellings have been assessed as per the requirements of SAP 2012 Appendix P. The results are detailed as follows and are shown to comply with Building Regulations.

During the detailed design stage, the overheating will be reviewed using the simplified methodology as described in Building Regulations Part O 2021 and TM59 dynamic modelling if required.

Table 23: Results of Overheating Assessment – SAP 2012 Appendix P

Overheating Assessment Appendix P				
Dwelling	**Dwelling Type**	**Overheating June**	**Overheating July**	**Overheating August**
The Blenmere	House	Not significant	Slight	Slight
The Harper	House	Not significant	Slight	Slight
The Tillman – ET	House	Not significant	Not significant	Slight
The Tillman – MT	House	Not significant	Slight	Slight
The Coiner	House	Not significant	Slight	Slight
The Reedmaker	House	Not significant	Slight	Slight
The Pargeter	House	Not significant	Slight	Slight
The Baker – ET	House	Not significant	Not significant	Not significant
The Baker – MT	House	Not significant	Slight	Slight
The Cartographer	House	Not significant	Slight	Slight
The Ploughwright	House	Not significant	Slight	Slight
The Saddler	House	Not significant	Not significant	Not significant
The Hillard – DET	House	Not significant	Slight	Slight
The Hillard – ET	House	Not significant	Slight	Slight
The Arkwright	House	Not significant	Slight	Slight
The Weaver	House	Not significant	Slight	Slight
The Tenterer	House	Not significant	Slight	Slight
The Framer	House	Not significant	Medium	Slight
The Watchmaker	House	Not significant	Slight	Slight
The Lacemaker	House	Not significant	Slight	Slight
2 Bed GF	Flat	Slight	Medium	Medium
2 Bed MF	Flat	Not significant	Slight	Slight
2 Bed EF	Flat	Not significant	Slight	Slight
2 Bed TF	Flat	Not significant	Slight	Slight
1 Bed GF	Flat	Slight	Medium	Medium
1 Bed MF	Flat	Not significant	Slight	Slight
1 Bed EF	Flat	Not significant	Slight	Slight
1 Bed TF	Flat	Not significant	Slight	Slight

12. Sustainable Design and Construction: Materials and Waste

The selection of materials is determined by a number of factors, such as architectural context, design rationale, carbon embodiment and maintenance requirements. The proposed development will concentrate on sustainable design, with selected materials in line with local vernacular and landscape character.

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.
Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy.

Wherever feasible, there will be a commitment to using materials that are also from renewable sources and recycled e.g. secondary aggregates. The use of recycled materials (e.g. crushed concrete from waste used for hard-standing or recycled fibreglass insulation) has zero embodied energy impact, other than that expended in their processing or transport.

Timber would be sourced, where practical, certified by FSC, PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials will have a zero-ozone depleting potential.

Construction Waste will be managed during both the construction and operational phases according to the following waste hierarchy:

Step 1: Eliminate Waste
Construction practice and design should reduce waste wherever possible through measures including:

- Efficient procurement avoiding over-supply and excessive packaging; and
- Eliminating waste at the design stage.

Step 2: Reuse waste materials
Reuse waste materials, ideally in its current location, avoiding the energy costs associate with transport and recycling.

Step 3: Recycle/compost waste materials
Recover materials through recycling and substitute for primary materials. Compost organic material to produce rich soils that replace fertilisers, ideally in a closed system to avoid the emissions released by organic material in landfill.

Step 4: Recover energy
If it cannot be reused or recycled, use waste instead of fossil fuels in energy generation to recover embodied energy.

Step 5: Disposal to landfill
Usually the last resort. Disposal to landfill wastes materials and embodied energy.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

During the construction phase, the principal contractor, will be required to implement the Site Waste Management Plan (SWMP) which will detail responsibilities for resource management, what types of waste will be generated, how the waste will be managed (e.g. reduced, reused or recycled), which contractors will be used and how the quantity of waste generated by the project will be measured. It will also cover handling and storage of materials to avoid damage, efficient purchasing arrangements to minimise over ordering and segregation of construction waste to maximise potential for reuse/recycling.

The development will be constructed using industry leading procedures for the on-site segregation of waste products and will look to segregate waste under following categories:

- Mixed Waste
- Light mixed and compactible

- Inert
- Timber
- Plasterboard
- Mixed Metals
- Hazardous
- Other

A designated area will be identified for waste management for each phase and clear signage will be provided to ensure correct segregation of waste.

Waste will be minimised using the following techniques:

- Managing materials efficiently
- Consideration taken for build dimensions to avoid cut bricks, offcuts plasterboard etc.
- Mass balancing exercise will be undertaken to retain as much material on site as possible therefore minimising waste to landfill
- Site layout and programme reviewed to maximise the reuse of site won materials
- Any demolition concrete waste will be crushed and re-used on site for hardcore
- Suppliers will be responsible for their own removal of packaging
- Details a specification in order to limit the water consumption of the dwellings to 110 litres/person/day

13. Water Saving Measures

Household water reduction measures will include the following where applicable:

- Water efficient taps.
- Water efficient cisterns.
- Low output showers.
- Flow restrictors to manage water pressures to achieve optimum levels.
- Water meters to all premises with guidance on water consumption and savings.

The following specification or similar will be adopted on the development to ensure that the water efficiency of the dwelling will achieve a maximum of 110 litres per head per day in line with the requirements of Policy 36 of the Horsham District Planning Framework (2015).

Table 24: Specification of flow rates and volumes for water using appliances

Water using Appliance	Comment
WC Cisterns	Dual Flush to be limited to maximum of 6/4
Baths	Capacity no greater than 190 litres
Basin taps	Flow rates to be no greater than 2.5 litres/minute
Kitchen taps	Flow rates to be no greater than 10 litres/minute
Shower	Flow rates to be no greater than 8 litres/minute
Water softener	Not to be installed
Washing Machine	Water usage to be limited to 17.16 Litres per KG
Dishwasher	Water Usage to be limited to 4.5 litres per place setting

Table 25: Water Calculations

Water Calculations					
Installation Type	Unit	Capacity	Use Factor	Fixed use	**Total Use**
		Flow rate		(l/p/day)	**(l/p/day)**
WC Single Flush	Volume (l)	0.00	4.42	0.00	0.00
WC Dual Flush	Full Flush (l)	6.00	1.46	0.00	8.76
	Pt Flush (l)	4.00	2.96	0.00	11.84
WC's (Multiple)	Volume (l)	0.00	4.42	0.00	0.00
Taps Exc. Kitchen	Flow Rate	2.50	1.58	1.58	5.53
Bath (shower present)	(l/m)	190.00	0.11	0.00	20.90
Shower (bath present)	(l/m)	8.00	4.37	0.00	34.96
Bath Only	(l)	0.00	0.50	0.00	0.00
Shower Only	(l/m)	0.00	5.60	0.00	0.00
Kitchen Taps	(l/m)	10.00	0.44	10.36	14.76
Washing Machines	(l/kg/dry)	8.17	2.10	0.00	17.16
Dishwashers	(l/place)	1.25	3.60	0.00	4.50
Waste Disposal	(l/m)	0.00	3.08	0.00	0.00
Water Softener	(l/m)	0.00	1.00	0.00	0.00
Total Calculated Water Use (l/p/day)					**118.41**
Grey/Rain Water Reused (l)					0.00
Normalisation Factor	(Factor)				0.91
Total Internal Consumption (l/p/day)					**107.75**
External Water Use Allowance (l)					5.00
Total Consumption Part G (l/p/day)					**112.75**

14. Conclusions

The energy strategy detailed within this Sustainability Plan has followed the accepted Energy Hierarchy of 'Be Lean', 'Be Clean' and 'Be Green'. The energy strategy proposed for the development can be summarised as below.

Table 26: Summary of Proposed Energy Strategy

Element	Strategy
Passive	Optimised design to enable controlled solar gain and improved direct and indirect natural lighting
Fabric	Building fabric U values have been enhanced over and above those detailed with Part L1A 2013
Heating	4 & 5 Bed Houses – ASHP 2 & 3 Bed Houses – Ideal Logic Gas Boiler Apartments – Electric Panel Heaters
Hot Water	Houses – ASHP/Gas Boilers and Hot Water Cylinders Apartments – Vaillant aroSTOR Hot Water Heat Pump
Cooling	None
Ventilation	Mechanical extract ventilation system 3 Low design air permeability (DAP)
Lighting	Energy efficient LED Lighting where applicable
Renewables	Estimated 169.80 kWp of PV across the development
Low Carbon Technologies	Waste water heat recovery (to houses) Flue gas heat recovery (where gas boiler are used)

14.1 Total Residential CO_2 And Energy Savings

A summary of the overall reduction in residential CO_2 emissions after each stage of the energy hierarchy is summarised in the table below.

Table 27: Carbon Emissions Building Regulation's (TER) comparison

Element	CO_2 – Regulated (tonnes/year) SAP 2012
Part L1A 2013 Revised Baseline	369.30
After Energy Hierarchy	170.32
Saving	198.98
Improvement	54%

The CO_2 emissions savings demonstrated above are a 54% reduction compared to the Building Regulations Part L1A 2013 baseline.

In addition, the fabric specification detailed within this energy strategy ensures that the average Dwelling Fabric Energy Efficiency improves upon the average Target Fabric Energy Efficiency (as defined by Building Regulations Part L1A 2013) by 21%. This is detailed within the table below.

Table 28: Residential FEE Performance

Element	Target Fabric Energy Efficiency (TFEE) kWh/m²/year	Dwelling Fabric Energy Efficiency (DFEE) kWh/m²/year	Improvement (%)
Development Total	52.33	41.48	21%

The table below details that 29% of the developments total predicted energy demand (TER) will be generated through on-site renewable and low carbon energy sources.

Table 29: Percentage of the Development's Energy Demand from Renewables

Item	Energy (kWh p.a.)
Total energy generated through on-site renewable and low carbon energy sources	123,298
Total predicted energy demand of the development (TER)	431,946
% of Total Energy Generated Through Renewables	**29%**

Using the specifications detailed within this energy strategy, an initial background assessment has also been carried out in the newly released SAP 10 software, which includes all of the dwelling types included within this development proposal. The initial assessment has demonstrated that if the principles of this energy strategy are adhered to, then compliance with Building Regulations Part L 2021 will be achieved. The BREL reports produced from the initial assessment in SAP 10 can be found in the appendices.

Energy and Sustainability Summary

The strategy achieves and meets the following requirements:

- Includes improved optimal building fabric improvements, energy efficient design of building services.
- Utilises heat pump technology and provides an estimated 169.80 kWp of PV across the development to increase the carbon and energy savings.
- Complies with Part L 2013 Building Regulations and will reduce carbon emissions by 54% compared to the Part L1A 2013 baseline.
- Specifies low Nox emitting domestic boilers to the houses (where ASHP not specified).
- The fabric energy efficiency (DFEE) achieves a 21% reduction over the minimum standards defined by Building Regulations Part L1A 2013 (TFEE).
- 29% of the total predicted energy demand will be generated through on-site renewable and low carbon energy sources.
- In keeping with the requirements of Horsham District Council Policy 37, the strategy details a specification of water efficiency measures which will limit the internal water consumption of the dwellings to no more than 110 litres/person/day.
- The proposals detailed within this strategy adhere to the principles and requirements of the current adopted planning policy standards of Horsham District Council.
- The energy strategy will also achieve compliance with the new Building Regulations Part L 2021.

15. APPENDICES

The following pages detail:

- Appendix A: Energy and CO_2 Performance Type by Type
- Appendix B: Alternative Renewable Energy Options
- Appendix C: Vaillant aroSTOR Technical Datasheet
- Appendix D: PV Roof Elevations Layout
- Appendix E: SAP Output Sheets
- Appendix F: BREL Reports (SAP 10 Initial Assessment)

15.1 Appendix A: Energy and CO_2 Performance Type By Type

Table 30: Energy Performance Type by Type (Gas Heating Types)

Energy	Include Unregulated Energy			No	Building Regs Version		2013	Predicted Energy Demand			
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Development Total
The Blenmere	House	93.7	7	3240	0	0	1235	118	387	4981	34866
The Harper	House	93.52	16	2401	0	0	1236	118	401	4156	66502
The Tillman – ET	House	93.46	15	3403	0	0	1263	119	409	5195	77919
The Tillman – MT	House	93.46	1	2713	0	0	1265	119	409	4505	4505
The Coiner	House	79.94	14	2699	0	0	1185	112	363	4359	61022
The Baker – ET	House	79.94	6	3000	0	0	1211	113	366	4690	28142
The Baker – MT	House	79.94	2	2307	0	0	1213	113	366	3999	7999
The Ploughwright	House	93.7	1	3643	0	0	1264	119	388	5414	5414
The Saddler	House	68.75	5	3881	0	0	1148	107	323	5459	27295
The Hillard – DET	House	96.56	6	3763	0	0	1242	120	421	5546	33273
The Hillard – ET	House	96.56	1	3172	0	0	1243	120	421	4956	4956
The Tenterer	House	91.62	2	3360	0	0	1229	117	381	5086	10173
The Framer	House	96.38	4	3875	0	0	1242	119	394	5630	22520
The Lacemaker	House	111.83	16	3955	0	0	1677	128	444	6204	99269
Totals			96								483,854

Table 31: Energy Performance Type by Type (Electric Heating Types)

Energy	Include Unregulated Energy		No	Building Regs Version		2013	Predicted Energy Demand			
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Development Total
The Reedmaker	House	119.72	9	1226	0	0	1131	55	465	2877	25892
The Pargeter	House	123.98	13	1195	0	0	1134	57	457	2842	36951
The Cartographer	House	100.36	4	1195	0	0	1107	47	417	2766	11065
The Arkwright	House	138.32	12	1212	0	0	1141	63	487	2904	34845
The Weaver	House	154.42	10	1191	0	0	1147	70	512	2921	29208
The Watchmaker	House	174.73	3	1365	0	0	1152	80	551	3148	9444
2 Bed GF	Flat	70.71	3	2278	0	0	524	32	320	3154	9462
2 Bed MF	Flat	70.71	3	1804	0	0	524	32	320	2680	8040
2 Bed EF	Flat	71.95	1	2297	0	0	528	33	341	3198	3198
2 Bed TF	Flat	70.81	4	2548	0	0	524	32	316	3421	13682
1 Bed GF	Flat	50.41	6	1769	0	0	460	23	234	2486	14915
1 Bed MF	Flat	50.41	6	1391	0	0	460	23	234	2108	12649
1 Bed EF	Flat	50.41	2	2253	0	0	460	23	234	2970	5939
1 Bed TF	Flat	50.41	8	1663	0	0	460	23	234	2380	19043
Totals			84								234,334

Table 32: CO_2 Performance Type by Type (Gas Heating Types)

CO2	Include Unregulated Energy			No	Building Regs Version		2013	Predicted CO2 Demand			
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Development Total
The Blenmere	House	93.7	7	700	0	0	267	61	201	1229	8603
The Harper	House	93.52	16	519	0	0	267	61	208	1055	16881
The Tillman – ET	House	93.46	15	735	0	0	273	62	212	1282	19232
The Tillman – MT	House	93.46	1	586	0	0	273	62	212	1133	1133
The Coiner	House	79.94	14	583	0	0	256	58	188	1085	15195
The Baker – ET	House	79.94	6	648	0	0	262	58	190	1158	6950
The Baker – MT	House	79.94	2	498	0	0	262	58	190	1009	2018
The Ploughwright	House	93.7	1	787	0	0	273	62	201	1323	1323
The Saddler	House	68.75	5	838	0	0	248	55	168	1309	6547
The Hillard – DET	House	96.56	6	813	0	0	268	62	219	1362	8171
The Hillard – ET	House	96.56	1	685	0	0	268	62	219	1234	1234
The Tenterer	House	91.62	2	726	0	0	265	61	198	1250	2499
The Framer	House	96.38	4	837	0	0	268	62	205	1372	5487
The Lacemaker	House	111.83	16	854	0	0	362	67	230	1514	24217
Totals			96								119,488

Table 33: CO_2 Performance Type by Type (Electric Heating Types)

CO2	Include Unregulated Energy		No	Building Regs Version		2013	Predicted CO2 Demand			
Type	Dwelling Name	TFA	No of Types	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)	Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	Unit Total	Development Total
The Reedmaker	House	119.72	9	636	0	0	587	28	241	1493	13438
The Pargeter	House	123.98	13	620	0	0	589	29	237	1475	19178
The Cartographer	House	100.36	4	620	0	0	575	25	216	1436	5743
The Arkwright	House	138.32	12	629	0	0	592	33	253	1507	18085
The Weaver	House	154.42	10	618	0	0	595	37	266	1516	15159
The Watchmaker	House	174.73	3	709	0	0	598	41	286	1634	4901
2 Bed GF	Flat	70.71	3	1182	0	0	272	17	166	1637	4911
2 Bed MF	Flat	70.71	3	936	0	0	272	17	166	1391	4173
2 Bed EF	Flat	71.95	1	1192	0	0	274	17	177	1660	1660
2 Bed TF	Flat	70.81	4	1323	0	0	272	17	164	1775	7101
1 Bed GF	Flat	50.41	6	918	0	0	239	12	121	1290	7741
1 Bed MF	Flat	50.41	6	722	0	0	239	12	121	1094	6565
1 Bed EF	Flat	50.41	2	1169	0	0	239	12	121	1541	3082
1 Bed TF	Flat	50.41	8	863	0	0	239	12	121	1235	9884
Totals			84								121,619

15.2 Appendix B: Alternative Renewable Energy Options

The following alternative options to supply low carbon and renewable energy generation have been explored and discounted based on the following reasons:

Wind Turbines

Wind turbines come in a variety of sizes and shapes. Turbines of 1 kW can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available.

A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier)

- Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required.
- Noise considerations can be an issue dependent on density and build-up of the surrounding area.
- Buildings in the immediate area can disrupt wind speed and reduce performance of the system.
- Planning permission will be required along with suitable space to site the turbine, whether ground installed or roof mounted.

Wind turbines have been discounted due to concerns over reliable wind resources. The use of wind turbines is likely to present aesthetic as well as nuisance issues.

Biomass Boilers

Providing a heating system fuelled by plant-based materials such as wood, crops or food waste. Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.

Biomass is considered a technically-viable option for this development scheme as there are no apparent physical constraints on site in terms of installing biomass boilers or storing a sufficient supply.

- There are, however, concerns regarding a sustainable supply of biomass to the site.
- The capital installation cost would also be high which leads us to the conclusion that biomass would not be a commercially-viable option for this development scheme.

Ground Source Heat Pumps (GSHP)

Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10°C at 4 metres depth). This leads to a reliable source of heat for the building.

Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.

Discounted on the grounds of costs and available space. Incompatible with individual gas boilers and blocks of apartments.

Solar Thermal

Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months and overheating of the system.

Unsuitable for blocks of flats and low carbon reduction efficiency compared to photovoltaic systems. Solar hot water systems for flatted blocks are only suitable where a central boiler plant room is provided to accommodate a central thermal store.

15.3 APPENDIX C: VAILLANT AROSTOR TECHNICAL DATASHEET



Vaillant is the leading premium brand for sustainable and responsible system solutions, ensuring your customers experience comfort for their home. Our products have high energy efficiency ratings and low emissions, with an enviable reputation for performance, quality and reliability.

Introducing the domestic hot water heat pump with natural refrigerant: The aroSTOR

The aroSTOR range of domestic hot water heat pumps features 200 and 270 litre models.
The range is incredibly efficient and sustainable, using thermal energy to heat hot water. This thermal energy can be collected via an external air duct, or it can recycle hot air from within the room where it's installed, provided there is sufficient ventilation. The only other energy needed is the electricity to run the appliance.

ErP A+

Visit **www.vaillant.co.uk/aroSTOR** to find out more

Technical data

aroSTOR heat pump 200 and 270 litres

	aroSTOR 200 litre	aroSTOR 270 litre
General		
Nominal capacity	200l	270l
Outer diameter	634 mm	634 mm
Height	1,458 mm	1,783 mm
Weight (when empty)	55kg	68kg
Weight (filled)	255kg	338kg
Cylinder material	Stainless steel	Stainless steel
Heat insulation	Polyurethane foam 50 mm	Polyurethane foam 50 mm
Type of electric heater	Immersion / Ti	Immersion / Ti
Thermal losses 55°C	1,61 kW/24h	1,77 kW/24h
DHW temperature range (HP only)	30 to 60°C	30 to 60°C
Max. temperature of DHW HP inlet domestic water	70°C	70°C
Minimal air flow range	320 m3/h	320 m3/h
Nominal air flow range	350 m3/h	350 m3/h
Maximum air flow range (non ducted)	400 m3/h	400 m3/h
Maximum pressure	6 bar	6 bar
Max. hot water temperature (HP + back up heater)	65°C	65°C
Maximum pressure of the T&P relief valve	7 bar	7 bar
Maximum temperature of the T&P relief valve	90°C	90°C
Electrical specifications		
Max. power consumption (HP + back up heater)	1900 watts	1900 watts
Max. power consumption (HP only)	700 watts	700 watts
Voltage and frequency of the product's power supply	230v - 50Hz	230v - 50Hz
Max amperage of the power supply circuit	8 amp	8 amp
Length of the electrical cable supplied	1.5m	1.5m
IP rating	IPX4	IPX4
Nominal heat output of the electric back-up heater	1.2kW	1.2kW
Connections		
Connections for the hot water circuit	M 3/4"	M 3/4"
Connecting the temperature and pressure relief valve	M 3/4"	M 3/4"
Max. flexible air duct length	10m	10m
Max. rigid air duct length	20m	20m
Min. distance between product and adjacent structures	0mm	0mm
Fuse size	13 amp	13 amp
Specifications for the heat pump (in accordance with EN 16147:2017)		
Refrigerant type	R290	R290
Refrigerant volume for complete filling	0.15kg	0.15kg
Minimum and maximum air temperatures	-7 to 35°C	-7 to 35°C
Sound power level	52 dB	52 dB
Coefficient of performance	3.19	3.14
Maximum usable domestic hot water at 54°C	247 litres	349 litres
Full re-heat time at A7	7.04 hr	10.15 hr
(in accordance with EN 16147:2017)		
Tapping profile	L	L
ErP rating (A+ - F)	A+	A+
Seasonal efficiency	132%	130%

15.4 Appendix D: PV Roof Elevations Layout

The figure below highlights (with blue circles) the most appropriate roof elevations for maximising sunlight exposure and are recommended for the installation of PV panels.

Figure 4: PV Roof Elevations Layout



15.5 APPENDIX E: SAP OUTPUT SHEETS (SAP 2012)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed EF

Address : 1 Bed EF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			6.54	x	1/[1/(1.2)+ 0.04]	=	7.49			(27)
Windows Type 2			2.1	x	1/[1/(1.2)+ 0.04]	=	2.4			(27)
Floor			50.41	x	0.15	=	7.5615	75	3780.75	(28)
Walls Type1	34.28	8.64	25.64	x	0.23	=	5.9	93.8	2405.03	(29)
Walls Type2	19.01	2.12	16.89	x	0.23	=	3.84	93.8	1584.28	(29)
Total area of elements, m²			103.7							(31)
Party wall			15.28	x	0	=	0	45	687.6	(32)
Party ceiling			50.41					30	1512.3	(32b)
Internal wall **			93.46					9	841.14	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.95 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10811.1 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 214.46 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 40.83 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.04	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	60.87	60.79	60.79	60.79	60.79	60.79	60.79	60.79	60.79	60.79	60.79	60.79	

Average = Sum(39)$_{1...12}$ /12= 60.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	

Average = Sum(40)$_{1...12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Output from water heater (annual)$_{1...12}$ | 1491.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	40.48	35.4	36.53	31.85	30.56	26.37	24.44	28.04	28.38	33.07	36.1	39.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	54.4	52.68	49.1	44.23	41.08	36.63	32.84	37.69	39.41	44.45	50.14	52.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	264.48	262.81	253.16	237.71	222.3	207.22	197.26	202.05	209.84	225.46	243.4	256.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.47	x	1.11	=	25.17	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.47	x	1.11	=	48.1	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.47	x	1.11	=	81.73		(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.47	x	1.11	=	131.27		(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.47	x	1.11	=	176.84		(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.47	x	1.11	=	189.31		(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.47	x	1.11	=	176.75		(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.47	x	1.11	=	140.23		(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.47	x	1.11	=	98.26		(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.47	x	1.11	=	57.25		(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.47	x	1.11	=	31.05		(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.47	x	1.11	=	20.98		(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.47	x	1.11	=	14.93		(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.47	x	1.11	=	29.2		(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.47	x	1.11	=	48.09		(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.47	x	1.11	=	70.13		(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.47	x	1.11	=	85.95		(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.47	x	1.11	=	87.98		(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.47	x	1.11	=	83.76		(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.47	x	1.11	=	71.95		(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.47	x	1.11	=	55.93		(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.47	x	1.11	=	34.65		(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.47	x	1.11	=	18.61		(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.47	x	1.11	=	12.27		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.09	77.3	129.81	201.41	262.79	277.3	260.51	212.18	154.19	91.9	49.66	33.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	304.57	340.11	382.97	439.12	485.09	484.51	457.77	414.23	364.03	317.36	293.06	289.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.71	0.56	0.63	0.86	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.67	19.95	20.34	20.7	20.91	20.98	20.96	20.78	20.33	19.85	19.48	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.67	0.49	0.56	0.83	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.95	18.17	18.58	19.13	19.61	19.85	19.9	19.9	19.72	19.12	18.43	17.89	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.63	18.82	19.18	19.66	20.09	20.31	20.37	20.36	20.19	19.65	19.05	18.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.63	18.82	19.18	19.66	20.09	20.31	20.37	20.36	20.19	19.65	19.05	18.58	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.83	0.66	0.49	0.56	0.82	0.96	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	302.39	336.02	373.16	409.44	402.96	318.88	223.3	230.39	297.65	303.98	289.48	288.15	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	872.54	846.38	770.69	654.11	509.82	347.31	229.35	240.8	370.02	550.12	726.49	874.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	424.19	342.96	295.76	176.16	79.51	0	0	0	0	183.13	314.64	436.2	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2252.56 (98)

Space heating requirement in kWh/m²/year 44.68 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	424.19	342.96	295.76	176.16	79.51	0	0	0	0	183.13	314.64	436.2	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	424.19	342.96	295.76	176.16	79.51	0	0	0	0	183.13	314.64	436.2	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2252.56 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Efficiency of water heater 324.52 (216)

(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	45.82	40.31	42.16	37.55	36.63	32.48	30.95	34.29	34.33	38.95	41.49	44.63	

Total = Sum(219a)$_{1...12}$ = 459.6 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2252.56	
Water heating fuel used		459.6	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	23.48		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		23.48	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2969.53	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	1169.08	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	238.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1407.61	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	12.19	(267)
Electricity for lighting	(232)	x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =				1541.18	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				30.57	(273)
EI rating (section 14)					78	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed EF

Address : 1 Bed EF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			6.54	x1/[1/(1.4)+ 0.04]		=	8.67			(27)
Windows Type 2			2.1	x1/[1/(1.4)+ 0.04]		=	2.78			(27)
Floor			50.41	x	0.13	=	6.5533			(28)
Walls Type1	34.28	8.64	25.64	x	0.18	=	4.62			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.04			(29)
Total area of elements, m²			103.7							(31)
Party wall			15.28	x	0	=	0			(32)
Party ceiling			50.41							(32b)
Internal wall **			93.46							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10811.1 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.15 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 40.36 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.01	23.85	23.7	22.97	22.84	22.21	22.21	22.09	22.45	22.84	23.11	23.4	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	64.36	64.21	64.05	63.33	63.2	62.57	62.57	62.45	62.81	63.2	63.47	63.75	

Average = Sum(39)$_{1...12}$ /12= 63.33 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.28	1.27	1.27	1.26	1.25	1.24	1.24	1.24	1.25	1.25	1.26	1.26	

Average = Sum(40)$_{1...12}$ /12= 1.26 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Output from water heater (annual)$_{1...12}$ | 1773.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.22	72.2	77.27	71.28	71.3	65.8	65.18	68.78	67.8	73.81	75.52	79.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	109.16	107.44	103.86	98.99	95.83	91.39	87.6	92.45	94.17	99.21	104.9	107.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	322.24	320.57	310.92	295.47	280.06	264.98	255.02	259.81	267.6	283.22	301.16	314.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.63	x	0.7	=	21.25	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.63	x	0.7	=	40.62	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.63	x	0.7	=	69.02	(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.63	x	0.7	=	110.86	(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.63	x	0.7	=	149.33	(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.63	x	0.7	=	159.87	(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.63	x	0.7	=	149.26	(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.63	x	0.7	=	118.42	(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.63	x	0.7	=	82.98	(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.63	x	0.7	=	48.35	(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.63	x	0.7	=	26.22	(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.63	x	0.7	=	17.72	(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.63	x	0.7	=	12.6	(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.63	x	0.7	=	24.66	(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.63	x	0.7	=	40.61	(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.63	x	0.7	=	59.22	(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.63	x	0.7	=	72.58	(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.63	x	0.7	=	74.3	(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.63	x	0.7	=	70.74	(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.63	x	0.7	=	60.76	(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.63	x	0.7	=	47.23	(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.63	x	0.7	=	29.26	(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.63	x	0.7	=	15.72	(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.63	x	0.7	=	10.37	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	33.86	65.27	109.62	170.08	221.92	234.17	219.99	179.18	130.21	77.61	41.94	28.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	356.1	385.85	420.54	465.55	501.98	499.14	475.01	438.98	397.81	360.83	343.09	342.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.88	0.72	0.56	0.62	0.86	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.81	20.06	20.42	20.74	20.93	20.98	20.97	20.83	20.44	20.01	19.67	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.86	19.86	19.86	19.88	19.88	19.89	19.89	19.89	19.88	19.88	19.87	19.87	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.79	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.13	18.32	18.68	19.19	19.62	19.84	19.88	19.88	19.75	19.23	18.61	18.11	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.81	18.97	19.28	19.73	20.11	20.32	20.36	20.36	20.22	19.76	19.22	18.79	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.81	18.97	19.28	19.73	20.11	20.32	20.36	20.36	20.22	19.76	19.22	18.79	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.94	0.85	0.67	0.49	0.55	0.81	0.96	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.54	381.53	411.05	438.15	425.09	333.02	231.04	239.71	322.49	344.96	338.7	340.37	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	934.07	903.54	818.85	685.61	531.2	357.59	235.41	247.08	384.45	578.87	769.44	930.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	431.92	350.79	303.4	178.17	78.95	0	0	0	0	174.02	310.13	438.84	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2266.23 (98)

Space heating requirement in kWh/m²/year 44.96 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	431.92	350.79	303.4	178.17	78.95	0	0	0	0	174.02	310.13	438.84	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	461.94	375.18	324.49	190.56	84.44	0	0	0	0	186.12	331.69	469.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2423.78 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Efficiency of water heater 79.8 (216)

(217)m=	87.16	86.97	86.48	85.36	83.31	79.8	79.8	79.8	79.8	85.2	86.58	87.25	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	198.09	175.32	185.93	169.94	171.46	161.15	155.91	169.5	168.7	176.5	182.31	193.49	

Total = Sum(219a)$_{1...12}$ = 2108.3 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2423.78	
Water heating fuel used		2108.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4840.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	523.54	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	455.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			978.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =			1139.24	(272)

TER = 33.28 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed GF

Address : 1 Bed Corner GF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			6.54	x1/[1/(1.2)+ 0.04]		=	7.49			(27)
Windows Type 2			2.1	x1/[1/(1.2)+ 0.04]		=	2.4			(27)
Floor			50.41	x	0.1	=	5.041	75	3780.75	(28)
Walls Type1	34.28	8.64	25.64	x	0.23	=	5.9	93.8	2405.03	(29)
Walls Type2	19.01	2.12	16.89	x	0.23	=	3.81	93.8	1584.28	(29)
Total area of elements, m²			103.7							(31)
Party wall			15.28	x	0	=	0	45	687.6	(32)
Party ceiling			50.41					30	1512.3	(32b)
Internal wall **			93.46					9	841.14	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10811.1 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 214.46 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.8 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.2 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.04	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	52.24	52.16	52.16	52.16	52.16	52.16	52.16	52.16	52.16	52.16	52.16	52.16	

Average = Sum(39)$_{1...12}$ /12= 52.17 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.04	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Output from water heater (annual)$_{1...12}$ | 1491.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	40.48	35.4	36.53	31.85	30.56	26.37	24.44	28.04	28.38	33.07	36.1	39.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	54.4	52.68	49.1	44.23	41.08	36.63	32.84	37.69	39.41	44.45	50.14	52.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	264.48	262.81	253.16	237.71	222.3	207.22	197.26	202.05	209.84	225.46	243.4	256.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.47	x	1.11	=	25.17	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.47	x	1.11	=	48.1	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.47	x	1.11	=	81.73	(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.47	x	1.11	=	131.27	(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.47	x	1.11	=	176.84	(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.47	x	1.11	=	189.31	(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.47	x	1.11	=	176.75	(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.47	x	1.11	=	140.23	(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.47	x	1.11	=	98.26	(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.47	x	1.11	=	57.25	(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.47	x	1.11	=	31.05	(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.47	x	1.11	=	20.98	(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.47	x	1.11	=	14.93	(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.47	x	1.11	=	29.2	(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.47	x	1.11	=	48.09	(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.47	x	1.11	=	70.13	(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.47	x	1.11	=	85.95	(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.47	x	1.11	=	87.98	(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.47	x	1.11	=	83.76	(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.47	x	1.11	=	71.95	(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.47	x	1.11	=	55.93	(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.47	x	1.11	=	34.65	(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.47	x	1.11	=	18.61	(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.47	x	1.11	=	12.27	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.09	77.3	129.81	201.41	262.79	277.3	260.51	212.18	154.19	91.9	49.66	33.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	304.57	340.11	382.97	439.12	485.09	484.51	457.77	414.23	364.03	317.36	293.06	289.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.83	0.65	0.49	0.56	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.92	20.18	20.53	20.82	20.96	20.99	20.98	20.87	20.49	20.07	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.8	0.61	0.44	0.5	0.79	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.63	19	19.5	19.88	20.02	20.05	20.05	19.94	19.46	18.84	18.36	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.01	19.19	19.52	19.95	20.29	20.43	20.46	20.46	20.35	19.91	19.38	18.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.01	19.19	19.52	19.95	20.29	20.43	20.46	20.46	20.35	19.91	19.38	18.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.79	0.6	0.44	0.5	0.78	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	302.46	335.92	372.14	403.86	385.25	291.49	199.28	207.49	283.94	302.03	289.4	288.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	768.51	745.47	679.11	576.33	448.02	304.25	201.42	211.58	325.97	485.58	640.35	769.99	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	346.74	275.22	228.38	124.18	46.7	0	0	0	0	136.56	252.68	358.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1768.89 (98)

Space heating requirement in kWh/m²/year 35.09 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	346.74	275.22	228.38	124.18	46.7	0	0	0	0	136.56	252.68	358.42	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	346.74	275.22	228.38	124.18	46.7	0	0	0	0	136.56	252.68	358.42	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1768.89 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Efficiency of water heater 324.52 (216)

(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	45.82	40.31	42.16	37.55	36.63	32.48	30.95	34.29	34.33	38.95	41.49	44.63	

Total = Sum(219a)$_{1...12}$ = 459.6 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1768.89	
Water heating fuel used		459.6	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	23.48		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		23.48	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2485.85	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	918.05	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	238.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1156.59	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	12.19	(267)
Electricity for lighting	(232) x		0.519	=	121.39	(268)
Total CO2, kg/year		sum of (265)…(271) =			1290.16	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			25.59	(273)
EI rating (section 14)					82	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed GF

Address : 1 Bed Corner GF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			6.54	x1/[1/(1.4)+ 0.04]		=	8.67			(27)
Windows Type 2			2.1	x1/[1/(1.4)+ 0.04]		=	2.78			(27)
Floor			50.41	x	0.13	=	6.5533			(28)
Walls Type1	34.28	8.64	25.64	x	0.18	=	4.62			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.04			(29)
Total area of elements, m²			103.7							(31)
Party wall			15.28	x	0	=	0			(32)
Party ceiling			50.41							(32b)
Internal wall **			93.46							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 10811.1 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.58 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.79 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.01	23.85	23.7	22.97	22.84	22.21	22.21	22.09	22.45	22.84	23.11	23.4	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	59.79	59.63	59.48	58.76	58.62	57.99	57.99	57.88	58.24	58.62	58.9	59.18	

Average = Sum(39)$_{1...12}$ /12= 58.76 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.17	1.16	1.15	1.15	1.15	1.16	1.16	1.17	1.17	

Average = Sum(40)$_{1...12}$ /12= 1.17 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Output from water heater (annual)$_{1...12}$ | 1773.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.22	72.2	77.27	71.28	71.3	65.8	65.18	68.78	67.8	73.81	75.52	79.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	109.16	107.44	103.86	98.99	95.83	91.39	87.6	92.45	94.17	99.21	104.9	107.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	322.24	320.57	310.92	295.47	280.06	264.98	255.02	259.81	267.6	283.22	301.16	314.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.63	x	0.7	=	21.25	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.63	x	0.7	=	40.62	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.63	x	0.7	=	69.02	(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.63	x	0.7	=	110.86	(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.63	x	0.7	=	149.33	(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.63	x	0.7	=	159.87	(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.63	x	0.7	=	149.26	(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.63	x	0.7	=	118.42	(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.63	x	0.7	=	82.98	(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.63	x	0.7	=	48.35	(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.63	x	0.7	=	26.22	(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.63	x	0.7	=	17.72	(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.63	x	0.7	=	12.6	(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.63	x	0.7	=	24.66	(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.63	x	0.7	=	40.61	(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.63	x	0.7	=	59.22	(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.63	x	0.7	=	72.58	(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.63	x	0.7	=	74.3	(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.63	x	0.7	=	70.74	(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.63	x	0.7	=	60.76	(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.63	x	0.7	=	47.23	(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.63	x	0.7	=	29.26	(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.63	x	0.7	=	15.72	(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.63	x	0.7	=	10.37	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	33.86	65.27	109.62	170.08	221.92	234.17	219.99	179.18	130.21	77.61	41.94	28.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	356.1	385.85	420.54	465.55	501.98	499.14	475.01	438.98	397.81	360.83	343.09	342.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.69	0.53	0.59	0.84	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	19.93	20.17	20.5	20.79	20.95	20.99	20.98	20.87	20.52	20.11	19.79	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.94	0.82	0.6	0.41	0.46	0.76	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.36	18.54	18.89	19.37	19.75	19.93	19.96	19.96	19.85	19.39	18.81	18.34	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.99	19.15	19.45	19.86	20.21	20.38	20.41	20.4	20.3	19.88	19.38	18.97	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.15	19.45	19.86	20.21	20.38	20.41	20.4	20.3	19.88	19.38	18.97	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.94	0.83	0.64	0.46	0.52	0.79	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.55	381.45	410.55	435.57	416.65	318.62	218.28	227.26	314.52	343.66	338.58	340.4	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	878.41	849.63	770.04	644.26	498.63	334.94	220.83	231.75	361	544.28	723.2	874.16	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	390.49	314.62	267.46	150.26	61	0	0	0	0	149.26	276.92	397.12	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2007.12 (98)

Space heating requirement in kWh/m²/year 39.82 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	390.49	314.62	267.46	150.26	61	0	0	0	0	149.26	276.92	397.12	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	417.64	336.49	286.05	160.71	65.24	0	0	0	0	159.64	296.17	424.72	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2146.66 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Efficiency of water heater 79.8 (216)

(217)m=	86.93	86.71	86.16	84.91	82.73	79.8	79.8	79.8	79.8	84.79	86.3	87.02	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	198.63	175.85	186.62	170.86	172.66	161.15	155.91	169.5	168.7	177.35	182.91	194	

Total = Sum(219a)$_{1...12}$ = 2114.14 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2146.66	
Water heating fuel used		2114.14	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4569.68	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	463.68	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	456.65	(264)
Space and water heating	(261) + (262) + (263) + (264) =				920.33	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =				1080.64	(272)

TER = 31.48 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed MF

Address : 1 Bed MF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			6.54	x1/[1/(1.2)+ 0.04]		=	7.49			(27)
Windows Type 2			2.1	x1/[1/(1.2)+ 0.04]		=	2.4			(27)
Walls Type1	34.28	8.64	25.64	x	0.23	=	5.9	93.8	2405.03	(29)
Walls Type2	19.01	2.12	16.89	x	0.23	=	3.84	93.8	1584.28	(29)
Total area of elements, m²			53.29							(31)
Party wall			15.28	x	0	=	0	45	687.6	(32)
Party floor			50.41					40	2016.4	(32a)
Party ceiling			50.41					30	1512.3	(32b)
Internal wall **			93.46					9	841.14	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 22.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9046.75 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 179.46 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.29 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.68 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.04	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	45.72	45.64	45.64	45.64	45.64	45.64	45.64	45.64	45.64	45.64	45.64	45.64	

Average = Sum(39)$_{1...12}$ /12= 45.65 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Output from water heater (annual)$_{1...12}$ | 1491.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	40.48	35.4	36.53	31.85	30.56	26.37	24.44	28.04	28.38	33.07	36.1	39.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	54.4	52.68	49.1	44.23	41.08	36.63	32.84	37.69	39.41	44.45	50.14	52.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	264.48	262.81	253.16	237.71	222.3	207.22	197.26	202.05	209.84	225.46	243.4	256.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.47	x	1.11	=	25.17	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.47	x	1.11	=	48.1	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.47	x	1.11	=	81.73		(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.47	x	1.11	=	131.27		(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.47	x	1.11	=	176.84		(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.47	x	1.11	=	189.31		(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.47	x	1.11	=	176.75		(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.47	x	1.11	=	140.23		(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.47	x	1.11	=	98.26		(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.47	x	1.11	=	57.25		(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.47	x	1.11	=	31.05		(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.47	x	1.11	=	20.98		(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.47	x	1.11	=	14.93		(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.47	x	1.11	=	29.2		(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.47	x	1.11	=	48.09		(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.47	x	1.11	=	70.13		(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.47	x	1.11	=	85.95		(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.47	x	1.11	=	87.98		(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.47	x	1.11	=	83.76		(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.47	x	1.11	=	71.95		(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.47	x	1.11	=	55.93		(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.47	x	1.11	=	34.65		(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.47	x	1.11	=	18.61		(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.47	x	1.11	=	12.27		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.09	77.3	129.81	201.41	262.79	277.3	260.51	212.18	154.19	91.9	49.66	33.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	304.57	340.11	382.97	439.12	485.09	484.51	457.77	414.23	364.03	317.36	293.06	289.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.9	0.76	0.58	0.43	0.5	0.76	0.94	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.98	20.26	20.6	20.86	20.97	20.99	20.99	20.9	20.55	20.12	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	20.55	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.74	0.54	0.39	0.45	0.73	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.58	18.81	19.21	19.69	20.02	20.14	20.16	20.16	20.08	19.63	19.01	18.52	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.13	19.32	19.67	20.09	20.39	20.5	20.52	20.52	20.44	20.04	19.5	19.07	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.13	19.32	19.67	20.09	20.39	20.5	20.52	20.52	20.44	20.04	19.5	19.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.88	0.73	0.54	0.39	0.45	0.72	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	300.51	332.41	364.6	386.27	355.14	261.41	177.72	185.44	261.36	292.97	286.36	286.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	677.83	658.26	600.85	510.68	396.63	269.41	179.09	188.04	289.2	430.6	565.78	678.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	280.73	218.98	175.77	89.58	30.87	0	0	0	0	102.4	201.19	291.65	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1391.15 (98)

Space heating requirement in kWh/m²/year 27.6 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	280.73	218.98	175.77	89.58	30.87	0	0	0	0	102.4	201.19	291.65	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	280.73	218.98	175.77	89.58	30.87	0	0	0	0	102.4	201.19	291.65	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1391.15 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Efficiency of water heater 324.52 (216)

(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	45.82	40.31	42.16	37.55	36.63	32.48	30.95	34.29	34.33	38.95	41.49	44.63	

Total = Sum(219a)$_{1...12}$ = 459.6 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1391.15	
Water heating fuel used		459.6	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	23.48		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		23.48	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2108.12	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	722.01	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	238.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =			960.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	12.19	(267)
Electricity for lighting	(232) x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =			1094.11	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			21.7	(273)
EI rating (section 14)				85	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed MF

Address : 1 Bed MF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			6.54	x1/[1/(1.4)+ 0.04]		=	8.67			(27)
Windows Type 2			2.1	x1/[1/(1.4)+ 0.04]		=	2.78			(27)
Walls Type1	34.28	8.64	25.64	x	0.18	=	4.62			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.04			(29)
Total area of elements, m²			53.29							(31)
Party wall			15.28	x	0	=	0			(32)
Party floor			50.41							(32a)
Party ceiling			50.41							(32b)
Internal wall **			93.46							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 9046.75 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.07 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 26.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.01	23.85	23.7	22.97	22.84	22.21	22.21	22.09	22.45	22.84	23.11	23.4	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	50.73	50.57	50.42	49.7	49.56	48.93	48.93	48.81	49.17	49.56	49.83	50.12	

Average = Sum(39)$_{1...12}$ /12= 49.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1	1	0.99	0.98	0.97	0.97	0.97	0.98	0.98	0.99	0.99	

Average = Sum(40)$_{1...12}$ /12= 0.99 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Output from water heater (annual)$_{1...12}$ | 1773.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.22	72.2	77.27	71.28	71.3	65.8	65.18	68.78	67.8	73.81	75.52	79.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	109.16	107.44	103.86	98.99	95.83	91.39	87.6	92.45	94.17	99.21	104.9	107.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	322.24	320.57	310.92	295.47	280.06	264.98	255.02	259.81	267.6	283.22	301.16	314.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.63	x	0.7	=	21.25	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.63	x	0.7	=	40.62	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.63	x	0.7	=	69.02	(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.63	x	0.7	=	110.86	(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.63	x	0.7	=	149.33	(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.63	x	0.7	=	159.87	(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.63	x	0.7	=	149.26	(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.63	x	0.7	=	118.42	(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.63	x	0.7	=	82.98	(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.63	x	0.7	=	48.35	(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.63	x	0.7	=	26.22	(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.63	x	0.7	=	17.72	(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.63	x	0.7	=	12.6	(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.63	x	0.7	=	24.66	(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.63	x	0.7	=	40.61	(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.63	x	0.7	=	59.22	(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.63	x	0.7	=	72.58	(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.63	x	0.7	=	74.3	(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.63	x	0.7	=	70.74	(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.63	x	0.7	=	60.76	(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.63	x	0.7	=	47.23	(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.63	x	0.7	=	29.26	(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.63	x	0.7	=	15.72	(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.63	x	0.7	=	10.37	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	33.86	65.27	109.62	170.08	221.92	234.17	219.99	179.18	130.21	77.61	41.94	28.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	356.1	385.85	420.54	465.55	501.98	499.14	475.01	438.98	397.81	360.83	343.09	342.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.81	0.61	0.45	0.51	0.78	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.17	20.39	20.68	20.9	20.98	21	21	20.94	20.67	20.32	20.04	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.1	20.1	20.11	20.11	20.11	20.1	20.1	20.09	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.92	0.76	0.53	0.36	0.41	0.7	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	19	19.31	19.73	20	20.1	20.11	20.11	20.06	19.73	19.22	18.81	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.51	19.78	20.15	20.39	20.48	20.5	20.5	20.44	20.14	19.7	19.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.51	19.78	20.15	20.39	20.48	20.5	20.5	20.44	20.14	19.7	19.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.78	0.57	0.4	0.45	0.73	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.44	380.98	408.59	426.64	391.05	282.73	190.05	198.77	291.32	339	337.99	340.34	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	764.22	738.97	669.68	558.83	430.83	287.95	190.64	199.93	311.99	472.78	628.13	759.14	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	305.62	240.57	194.25	95.18	29.6	0	0	0	0	99.54	208.89	311.59	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1485.24 (98)

Space heating requirement in kWh/m²/year 29.46 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	305.62	240.57	194.25	95.18	29.6	0	0	0	0	99.54	208.89	311.59	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	326.87	257.29	207.75	101.8	31.66	0	0	0	0	106.46	223.42	333.25	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1588.49 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Efficiency of water heater 79.8 (216)

(217)m=	86.32	86.03	85.32	83.72	81.45	79.8	79.8	79.8	79.8	83.74	85.56	86.43	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	200.02	177.24	188.46	173.28	175.36	161.15	155.91	169.5	168.7	179.58	184.48	195.33	

Total = Sum(219a)$_{1...12}$ = 2129.01 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1588.49	
Water heating fuel used		2129.01	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4026.39	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	343.11	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	459.87	(264)
Space and water heating	(261) + (262) + (263) + (264) =				802.98	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =				963.29	(272)

TER = 27.87 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed TF

Address : 1 Bed TF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			6.54	x1/[1/(1.2)+ 0.04]		=	7.49			(27)
Windows Type 2			2.1	x1/[1/(1.2)+ 0.04]		=	2.4			(27)
Walls Type1	34.28	8.64	25.64	x	0.23	=	5.9	93.8	2405.03	(29)
Walls Type2	19.01	2.12	16.89	x	0.23	=	3.81	93.8	1584.28	(29)
Roof	50.41	0	50.41	x	0.09	=	4.54	9	453.69	(30)
Total area of elements, m²			103.7							(31)
Party wall			15.28	x	0	=	0	45	687.6	(32)
Party floor			50.41					40	2016.4	(32a)
Internal wall **			93.46					9	841.14	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.9 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7988.14 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 158.46 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.84 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.74 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	20.04	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	19.96	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	50.78	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	50.7	

Average = Sum(39)$_{1...12}$ /12= 50.71 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Output from water heater (annual)$_{1...12}$ | 1491.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	40.48	35.4	36.53	31.85	30.56	26.37	24.44	28.04	28.38	33.07	36.1	39.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	54.4	52.68	49.1	44.23	41.08	36.63	32.84	37.69	39.41	44.45	50.14	52.69	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	264.48	262.81	253.16	237.71	222.3	207.22	197.26	202.05	209.84	225.46	243.4	256.59	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.47	x	1.11	=	25.17	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.47	x	1.11	=	48.1	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.47	x	1.11	=	81.73		(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.47	x	1.11	=	131.27		(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.47	x	1.11	=	176.84		(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.47	x	1.11	=	189.31		(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.47	x	1.11	=	176.75		(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.47	x	1.11	=	140.23		(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.47	x	1.11	=	98.26		(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.47	x	1.11	=	57.25		(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.47	x	1.11	=	31.05		(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.47	x	1.11	=	20.98		(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.47	x	1.11	=	14.93		(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.47	x	1.11	=	29.2		(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.47	x	1.11	=	48.09		(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.47	x	1.11	=	70.13		(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.47	x	1.11	=	85.95		(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.47	x	1.11	=	87.98		(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.47	x	1.11	=	83.76		(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.47	x	1.11	=	71.95		(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.47	x	1.11	=	55.93		(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.47	x	1.11	=	34.65		(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.47	x	1.11	=	18.61		(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.47	x	1.11	=	12.27		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	40.09	77.3	129.81	201.41	262.79	277.3	260.51	212.18	154.19	91.9	49.66	33.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	304.57	340.11	382.97	439.12	485.09	484.51	457.77	414.23	364.03	317.36	293.06	289.84	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.9	0.79	0.62	0.47	0.54	0.78	0.94	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.51	19.69	20	20.41	20.75	20.93	20.98	20.97	20.82	20.38	19.86	19.46	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	20.5	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.89	0.76	0.58	0.42	0.48	0.75	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.08	18.33	18.79	19.37	19.82	20.02	20.07	20.06	19.91	19.33	18.6	18.01	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.71	18.92	19.32	19.82	20.23	20.42	20.47	20.46	20.31	19.79	19.15	18.64	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.71	18.92	19.32	19.82	20.23	20.42	20.47	20.46	20.31	19.79	19.15	18.64	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.94	0.88	0.75	0.57	0.42	0.48	0.74	0.92	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	298.73	329.97	361.57	385.28	363.03	276.89	191.94	198.81	267.62	290.85	284.24	285.16	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	731.49	711.05	649.86	553.8	432.27	294.97	196.05	205.7	314.81	465.81	610.91	732.34	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	321.97	256.09	214.49	121.33	51.52	0	0	0	0	130.17	235.2	332.7	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1663.46 (98)

Space heating requirement in kWh/m²/year 33 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	321.97	256.09	214.49	121.33	51.52	0	0	0	0	130.17	235.2	332.7	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	321.97	256.09	214.49	121.33	51.52	0	0	0	0	130.17	235.2	332.7	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1663.46 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	148.69	130.81	136.82	121.87	118.86	105.39	100.44	111.29	111.42	126.41	134.65	144.85	

Efficiency of water heater 324.52 (216)

(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	45.82	40.31	42.16	37.55	36.63	32.48	30.95	34.29	34.33	38.95	41.49	44.63	

Total = Sum(219a)$_{1...12}$ = 459.6 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1663.46	
Water heating fuel used		459.6	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	23.48		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		23.48	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2380.43	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	863.34	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	238.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1101.87	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	12.19	(267)
Electricity for lighting	(232)	x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =				1235.44	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				24.51	(273)
EI rating (section 14)					83	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 1 Bed TF

Address : 1 Bed TF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.41	(1a) x	2.4	(2a) =	120.98	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50.41	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		120.98	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.17 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.35 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.34	0.34	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			6.54	x1/[1/(1.4)+ 0.04]		=	8.67			(27)
Windows Type 2			2.1	x1/[1/(1.4)+ 0.04]		=	2.78			(27)
Walls Type1	34.28	8.64	25.64	x	0.18	=	4.62			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.04			(29)
Roof	50.41	0	50.41	x	0.13	=	6.55			(30)
Total area of elements, m²			103.7							(31)
Party wall			15.28	x	0	=	0			(32)
Party floor			50.41							(32a)
Internal wall **			93.46							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 7988.14 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.61 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.82 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	24.01	23.85	23.7	22.97	22.84	22.21	22.21	22.09	22.45	22.84	23.11	23.4	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	57.83	57.67	57.51	56.79	56.66	56.03	56.03	55.91	56.27	56.66	56.93	57.22	

Average = Sum(39)$_{1...12}$ /12= 56.79 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	82.09	79.1	76.12	73.13	70.15	67.16	67.16	70.15	73.13	76.12	79.1	82.09	

Total = Sum(44)$_{1...12}$ = 895.52 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	121.74	106.47	109.87	95.79	91.91	79.31	73.49	84.33	85.34	99.46	108.57	117.89	

Total = Sum(45)$_{1...12}$ = 1174.17 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.26	15.97	16.48	14.37	13.79	11.9	11.02	12.65	12.8	14.92	16.28	17.68	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Output from water heater (annual)$_{1...12}$ | 1773.78 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	81.22	72.2	77.27	71.28	71.3	65.8	65.18	68.78	67.8	73.81	75.52	79.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	85.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	13.24	11.76	9.57	7.24	5.41	4.57	4.94	6.42	8.62	10.94	12.77	13.61	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	148.3	149.84	145.96	137.7	127.28	117.49	110.94	109.41	113.28	121.54	131.96	141.76	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	31.51	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	-68.09	(71)

Water heating gains (Table 5)

(72)m=	109.16	107.44	103.86	98.99	95.83	91.39	87.6	92.45	94.17	99.21	104.9	107.45	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	322.24	320.57	310.92	295.47	280.06	264.98	255.02	259.81	267.6	283.22	301.16	314.35	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.54	x	10.63	x	0.63	x	0.7	=	21.25	(74)
North	0.9x 0.77	x	6.54	x	20.32	x	0.63	x	0.7	=	40.62	(74)

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North	0.9x	0.77	x	6.54	x	34.53	x	0.63	x	0.7	=	69.02	(74)
North	0.9x	0.77	x	6.54	x	55.46	x	0.63	x	0.7	=	110.86	(74)
North	0.9x	0.77	x	6.54	x	74.72	x	0.63	x	0.7	=	149.33	(74)
North	0.9x	0.77	x	6.54	x	79.99	x	0.63	x	0.7	=	159.87	(74)
North	0.9x	0.77	x	6.54	x	74.68	x	0.63	x	0.7	=	149.26	(74)
North	0.9x	0.77	x	6.54	x	59.25	x	0.63	x	0.7	=	118.42	(74)
North	0.9x	0.77	x	6.54	x	41.52	x	0.63	x	0.7	=	82.98	(74)
North	0.9x	0.77	x	6.54	x	24.19	x	0.63	x	0.7	=	48.35	(74)
North	0.9x	0.77	x	6.54	x	13.12	x	0.63	x	0.7	=	26.22	(74)
North	0.9x	0.77	x	6.54	x	8.86	x	0.63	x	0.7	=	17.72	(74)
West	0.9x	0.77	x	2.1	x	19.64	x	0.63	x	0.7	=	12.6	(80)
West	0.9x	0.77	x	2.1	x	38.42	x	0.63	x	0.7	=	24.66	(80)
West	0.9x	0.77	x	2.1	x	63.27	x	0.63	x	0.7	=	40.61	(80)
West	0.9x	0.77	x	2.1	x	92.28	x	0.63	x	0.7	=	59.22	(80)
West	0.9x	0.77	x	2.1	x	113.09	x	0.63	x	0.7	=	72.58	(80)
West	0.9x	0.77	x	2.1	x	115.77	x	0.63	x	0.7	=	74.3	(80)
West	0.9x	0.77	x	2.1	x	110.22	x	0.63	x	0.7	=	70.74	(80)
West	0.9x	0.77	x	2.1	x	94.68	x	0.63	x	0.7	=	60.76	(80)
West	0.9x	0.77	x	2.1	x	73.59	x	0.63	x	0.7	=	47.23	(80)
West	0.9x	0.77	x	2.1	x	45.59	x	0.63	x	0.7	=	29.26	(80)
West	0.9x	0.77	x	2.1	x	24.49	x	0.63	x	0.7	=	15.72	(80)
West	0.9x	0.77	x	2.1	x	16.15	x	0.63	x	0.7	=	10.37	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	33.86	65.27	109.62	170.08	221.92	234.17	219.99	179.18	130.21	77.61	41.94	28.08	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	356.1	385.85	420.54	465.55	501.98	499.14	475.01	438.98	397.81	360.83	343.09	342.43	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.68	0.51	0.57	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	19.98	20.22	20.54	20.82	20.96	20.99	20.99	20.89	20.55	20.16	19.84	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.93	0.81	0.59	0.4	0.45	0.75	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.64	18.98	19.45	19.81	19.97	19.99	19.99	19.9	19.47	18.9	18.44	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.07	19.22	19.52	19.93	20.25	20.4	20.43	20.42	20.33	19.94	19.45	19.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.07	19.22	19.52	19.93	20.25	20.4	20.43	20.42	20.33	19.94	19.45	19.05	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.93	0.82	0.62	0.45	0.5	0.78	0.95	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.55	381.39	410.26	434.15	412.24	311.68	212.47	221.49	310.42	342.94	338.51	340.4	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	854.09	826.06	748.68	626.14	484.3	324.97	214.42	225	350.66	529.11	702.96	849.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	372.4	298.82	251.79	138.23	53.61	0	0	0	0	138.52	262.41	378.89	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1894.67 (98)

Space heating requirement in kWh/m²/year 37.59 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	372.4	298.82	251.79	138.23	53.61	0	0	0	0	138.52	262.41	378.89	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	398.29	319.59	269.29	147.84	57.34	0	0	0	0	148.15	280.65	405.23	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2026.38 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	172.66	152.47	160.79	145.07	142.84	128.59	124.42	135.26	134.62	150.38	157.85	168.82	

Efficiency of water heater 79.8 (216)

(217)m=	86.81	86.58	86.01	84.69	82.46	79.8	79.8	79.8	79.8	84.6	86.16	86.91	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	198.89	176.11	186.96	171.3	173.22	161.15	155.91	169.5	168.7	177.77	183.2	194.25	

Total = Sum(219a)$_{1...12}$ = 2116.96 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2026.38	
Water heating fuel used		2116.96	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		233.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4452.22	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	437.7	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	457.26	(264)
Space and water heating	(261) + (262) + (263) + (264) =				894.96	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	121.39	(268)
Total CO2, kg/year	sum of (265)…(271) =				1055.27	(272)

TER = 30.7 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed EF

Address : 2 Bed Mid EF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.95	(1a) x	2.4	(2a) =	172.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.95	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		172.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows			7.98	x	1/[1/(1.2)+ 0.04]	=	9.14			(27)
Floor			71.95	x	0.15	=	10.7925	75	5396.25	(28)
Walls Type1	24.67	7.98	16.69	x	0.23	=	3.84	93.8	1565.52	(29)
Walls Type2	29.35	2.12	27.23	x	0.23	=	6.19	93.8	2554.17	(29)
Total area of elements, m²			125.97							(31)
Party wall			29.87	x	0	=	0	45	1344.15	(32)
Party ceiling			71.95					30	2158.5	(32b)
Internal wall **			139.53					9	1255.77	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.71 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14274.37 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 198.39 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.99 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.71 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.6	28.49	28.49	28.49	28.49	28.49	28.49	28.49	28.49	28.49	28.49	28.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	74.31	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	

Average = Sum(39)$_{1...12}$ /12= 74.21 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	1.03	

Average = Sum(40)$_{1...12}$ /12= 1.03 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.65 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	97.51	93.97	90.42	86.87	83.33	79.78	79.78	83.33	86.87	90.42	93.97	97.51	

Total = Sum(44)$_{1...12}$ = 1063.77 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	144.61	126.47	130.51	113.78	109.18	94.21	87.3	100.18	101.38	118.14	128.96	140.04	

Total = Sum(45)$_{1...12}$ = 1394.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	21.69	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.34	21.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	171.56	150.82	157.46	139.86	136.13	120.29	114.25	127.13	127.46	145.09	155.04	167	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	171.56	150.82	157.46	139.86	136.13	120.29	114.25	127.13	127.46	145.09	155.04	167	

Output from water heater (annual)$_{1...12}$ 1712.1 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.08	42.05	43.39	37.83	36.3	31.33	29.03	33.31	33.71	39.28	42.88	46.56	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.29	17.13	13.93	10.55	7.89	6.66	7.19	9.35	12.55	15.93	18.6	19.83	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.8	203.9	198.62	187.39	173.21	159.88	150.97	148.88	154.16	165.39	179.57	192.9	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	(71)

Water heating gains (Table 5)

(72)m=	64.63	62.58	58.33	52.55	48.79	43.51	39.02	44.77	46.82	52.8	59.56	62.59	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	343.11	341	328.27	307.87	287.27	267.43	254.57	260.39	270.91	291.51	315.11	332.7	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	7.98	x	46.75	x	0.47	x	1.11	=	135.02	(78)
South	0.9x 0.77	x	7.98	x	76.57	x	0.47	x	1.11	=	221.13	(78)
South	0.9x 0.77	x	7.98	x	97.53	x	0.47	x	1.11	=	281.67	(78)
South	0.9x 0.77	x	7.98	x	110.23	x	0.47	x	1.11	=	318.35	(78)
South	0.9x 0.77	x	7.98	x	114.87	x	0.47	x	1.11	=	331.74	(78)

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South	0.9x	0.77	x	7.98	x	110.55	x	0.47	x	1.11	=	319.26		(78)
South	0.9x	0.77	x	7.98	x	108.01	x	0.47	x	1.11	=	311.93		(78)
South	0.9x	0.77	x	7.98	x	104.89	x	0.47	x	1.11	=	302.93		(78)
South	0.9x	0.77	x	7.98	x	101.89	x	0.47	x	1.11	=	294.24		(78)
South	0.9x	0.77	x	7.98	x	82.59	x	0.47	x	1.11	=	238.5		(78)
South	0.9x	0.77	x	7.98	x	55.42	x	0.47	x	1.11	=	160.04		(78)
South	0.9x	0.77	x	7.98	x	40.4	x	0.47	x	1.11	=	116.67		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	135.02	221.13	281.67	318.35	331.74	319.26	311.93	302.93	294.24	238.5	160.04	116.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	478.13	562.12	609.94	626.22	619.01	586.69	566.5	563.32	565.15	530.02	475.16	449.37	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.93	0.86	0.72	0.56	0.58	0.78	0.94	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.97	20.22	20.5	20.75	20.92	20.98	20.98	20.88	20.56	20.1	19.72	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.92	0.84	0.68	0.5	0.52	0.74	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.42	18.71	19.07	19.46	19.79	20	20.05	20.05	19.96	19.55	18.89	18.34	(90)

fLA = Living area ÷ (4) = 0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.16	19.48	19.83	20.13	20.32	20.38	20.38	20.29	19.91	19.32	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.16	19.48	19.83	20.13	20.32	20.38	20.38	20.29	19.91	19.32	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.95	0.91	0.82	0.67	0.48	0.51	0.73	0.91	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	471.67	546.97	579.73	568.69	510.51	392.57	274.68	287.55	410.43	482.21	462.97	444.63	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1085.15	1058.04	962.99	810.86	625.87	424.78	280.53	295.11	459.17	690.64	906.92	1085.83	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	456.42	343.44	285.15	174.36	85.83	0	0	0	0	155.07	319.64	477.05	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2296.97	(98)
Space heating requirement in kWh/m²/year	31.92	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	100	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	456.42	343.44	285.15	174.36	85.83	0	0	0	0	155.07	319.64	477.05	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	456.42	343.44	285.15	174.36	85.83	0	0	0	0	155.07	319.64	477.05	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2296.97 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	171.56	150.82	157.46	139.86	136.13	120.29	114.25	127.13	127.46	145.09	155.04	167

Efficiency of water heater 324.52 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	52.87	46.47	48.52	43.1	41.95	37.07	35.21	39.17	39.28	44.71	47.78	51.46

Total = Sum(219a)$_{1...12}$ = 527.58 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2296.97
Water heating fuel used		527.58
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	32.58	(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		32.58 (231)
Electricity for lighting		340.66 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3197.8 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	1192.13	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	273.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1465.94	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	16.91	(267)
Electricity for lighting	(232) x	0.519	=	176.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1659.66	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			23.07	(273)
EI rating (section 14)				81	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed EF

Address : 2 Bed Mid EF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	71.95	(1a) x	2.4	(2a) =	172.68	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	71.95	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		172.68	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.17 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.36 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.33	0.36	0.39	0.41	0.42

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.57	0.56	0.56	0.56	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows			7.98	x	1/[1/(1.4)+ 0.04]	=	10.58			(27)
Floor			71.95	x	0.13	=	9.353499			(28)
Walls Type1	24.67	7.98	16.69	x	0.18	=	3			(29)
Walls Type2	29.35	2.12	27.23	x	0.18	=	4.9			(29)
Total area of elements, m²			125.97							(31)
Party wall			29.87	x	0	=	0			(32)
Party ceiling			71.95							(32b)
Internal wall **			139.53							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.38 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14274.37 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.67 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.05 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	34.5	34.27	34.04	32.96	32.76	31.83	31.83	31.65	32.19	32.76	33.17	33.6	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.55	77.32	77.09	76.02	75.82	74.88	74.88	74.71	75.24	75.82	76.22	76.65	

Average = Sum(39)$_{1...12}$ /12= 76.02 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.07	1.07	1.06	1.05	1.04	1.04	1.04	1.05	1.05	1.06	1.07

Average = Sum(40)$_{1...12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.29 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.65 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	97.51	93.97	90.42	86.87	83.33	79.78	79.78	83.33	86.87	90.42	93.97	97.51

Total = Sum(44)$_{1...12}$ = 1063.77 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	144.61	126.47	130.51	113.78	109.18	94.21	87.3	100.18	101.38	118.14	128.96	140.04

Total = Sum(45)$_{1...12}$ = 1394.77 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.69	18.97	19.58	17.07	16.38	14.13	13.1	15.03	15.21	17.72	19.34	21.01

(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

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Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	195.53	172.47	181.44	163.07	160.1	143.49	138.23	151.1	150.66	169.07	178.25	190.97	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	195.53	172.47	181.44	163.07	160.1	143.49	138.23	151.1	150.66	169.07	178.25	190.97	

Output from water heater (annual)$_{1...12}$ 1994.38 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.82	78.85	84.14	77.26	77.04	70.75	69.77	74.05	73.13	80.02	82.31	87.31	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	114.63	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	19.29	17.13	13.93	10.55	7.89	6.66	7.19	9.35	12.55	15.93	18.6	19.83	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	201.8	203.9	198.62	187.39	173.21	159.88	150.97	148.88	154.16	165.39	179.57	192.9	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	34.46	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	-91.7	(71)

Water heating gains (Table 5)

(72)m=	119.39	117.34	113.09	107.3	103.55	98.27	93.77	99.53	101.57	107.56	114.31	117.35	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	400.87	398.76	386.03	365.63	345.03	325.19	312.33	318.15	328.67	349.27	372.87	390.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x 0.77	x	7.98	x	46.75	x	0.63	x	0.7	=	114.02	(78)
South	0.9x 0.77	x	7.98	x	76.57	x	0.63	x	0.7	=	186.73	(78)
South	0.9x 0.77	x	7.98	x	97.53	x	0.63	x	0.7	=	237.86	(78)
South	0.9x 0.77	x	7.98	x	110.23	x	0.63	x	0.7	=	268.84	(78)
South	0.9x 0.77	x	7.98	x	114.87	x	0.63	x	0.7	=	280.15	(78)

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South	0.9x	0.77	x	7.98	x	110.55	x	0.63	x	0.7	=	269.6	(78)
South	0.9x	0.77	x	7.98	x	108.01	x	0.63	x	0.7	=	263.42	(78)
South	0.9x	0.77	x	7.98	x	104.89	x	0.63	x	0.7	=	255.82	(78)
South	0.9x	0.77	x	7.98	x	101.89	x	0.63	x	0.7	=	248.48	(78)
South	0.9x	0.77	x	7.98	x	82.59	x	0.63	x	0.7	=	201.41	(78)
South	0.9x	0.77	x	7.98	x	55.42	x	0.63	x	0.7	=	135.15	(78)
South	0.9x	0.77	x	7.98	x	40.4	x	0.63	x	0.7	=	98.52	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	114.02	186.73	237.86	268.84	280.15	269.6	263.42	255.82	248.48	201.41	135.15	98.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	514.89	585.49	623.89	634.47	625.18	594.79	575.75	573.96	577.15	550.68	508.02	488.98	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.89	0.74	0.56	0.58	0.8	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.12	20.33	20.58	20.8	20.95	20.99	20.99	20.92	20.65	20.26	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.04	20.04	20.05	20.05	20.05	20.05	20.04	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.94	0.85	0.66	0.45	0.47	0.72	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.65	18.88	19.18	19.55	19.84	20.01	20.05	20.05	19.98	19.64	19.09	18.62	(90)

fLA = Living area ÷ (4) = 0.36 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.12	19.32	19.59	19.92	20.18	20.35	20.38	20.38	20.32	20	19.51	19.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.12	19.32	19.59	19.92	20.18	20.35	20.38	20.38	20.32	20	19.51	19.09	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.97	0.93	0.86	0.68	0.49	0.51	0.74	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	510.81	576.22	604.52	592.85	534.72	407.08	280.2	293.48	429.57	512.14	499.51	485.96	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1149.18	1114.88	1009.06	837.36	643.17	430.38	283.25	297.51	467.86	712.83	945.8	1141.22	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	474.95	361.98	300.97	176.05	80.69	0	0	0	0	149.31	321.33	487.51	

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Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	2352.79	(98)
Space heating requirement in kWh/m²/year	32.7	(99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system	0	(201)
Fraction of space heat from main system(s) (202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1	93.5	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	474.95	361.98	300.97	176.05	80.69	0	0	0	0	149.31	321.33	487.51	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	507.96	387.14	321.9	188.28	86.3	0	0	0	0	159.69	343.67	521.41	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2516.35 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	195.53	172.47	181.44	163.07	160.1	143.49	138.23	151.1	150.66	169.07	178.25	190.97

Efficiency of water heater	79.8	(216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	87.09	86.75	86.16	85.02	83.09	79.8	79.8	79.8	79.8	84.48	86.37	87.21	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	224.51	198.82	210.59	191.8	192.68	179.82	173.22	189.35	188.8	200.12	206.38	218.98

Total = Sum(219a)$_{1...12}$ = 2375.07 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2516.35
Water heating fuel used		2375.07
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		340.66 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5307.09 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.216	=	543.53	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	513.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1056.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	176.8	(268)
Total CO2, kg/year	sum of (265)…(271) =			1272.28	(272)

TER = 25.76 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed GF

Address : 2 Bed GF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.71	(1a) x	2.4	(2a) =	169.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			7.95	x	1/[1/(1.2)+ 0.04]	=	9.1			(27)
Windows Type 2			2.76	x	1/[1/(1.2)+ 0.04]	=	3.16			(27)
Floor			70.71	x	0.1	=	7.071	75	5303.25	(28)
Walls Type1	42.64	10.71	31.93	x	0.23	=	7.34	93.8	2995.03	(29)
Walls Type2	19.01	2.12	16.89	x	0.23	=	3.81	93.8	1584.28	(29)
Total area of elements, m²			132.36							(31)
Party wall			20.93	x	0	=	0	45	941.85	(32)
Party ceiling			70.71					30	2121.3	(32b)
Internal wall **			123.56					9	1112.04	(32c)
Internal wall **			38.02					75	2851.5	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16909.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 239.14 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.53 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.78 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.11	28	28	28	28	28	28	28	28	28	28	28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	66.89	66.78	66.78	66.78	66.78	66.78	66.78	66.78	66.78	66.78	66.78	66.78	

Average = Sum(39)$_{1...12}$ /12= 66.79 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.75	93.23	89.71	86.19	82.67	79.16	79.16	82.67	86.19	89.71	93.23	96.75	

Total = Sum(44)$_{1...12}$ = 1055.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.47	125.48	129.49	112.89	108.32	93.47	86.62	99.39	100.58	117.22	127.95	138.95	

Total = Sum(45)$_{1...12}$ = 1383.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.52	18.82	19.42	16.93	16.25	14.02	12.99	14.91	15.09	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	170.42	149.83	156.44	138.97	135.27	119.55	113.57	126.34	126.66	144.17	154.03	165.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	170.42	149.83	156.44	138.97	135.27	119.55	113.57	126.34	126.66	144.17	154.03	165.9	

Output from water heater (annual)$_{1...12}$ — 1701.16 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	47.7	41.72	43.05	37.54	36.02	31.08	28.8	33.05	33.44	38.97	42.54	46.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.95	17.44	18.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	198.95	201.01	195.81	184.74	170.75	157.62	148.84	146.77	151.97	163.05	177.03	190.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	(71)

Water heating gains (Table 5)

(72)m=	64.12	62.09	57.87	52.13	48.41	43.17	38.71	44.42	46.45	52.38	59.09	62.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.11	336.12	323.7	303.71	283.51	263.97	251.24	256.91	267.14	287.33	310.51	327.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	7.95	x	10.63	x	0.47	x	1.11	=	30.59	(74)
North	0.9x	0.77	x	7.95	x	20.32	x	0.47	x	1.11	=	58.47	(74)
North	0.9x	0.77	x	7.95	x	34.53	x	0.47	x	1.11	=	99.35	(74)
North	0.9x	0.77	x	7.95	x	55.46	x	0.47	x	1.11	=	159.58	(74)
North	0.9x	0.77	x	7.95	x	74.72	x	0.47	x	1.11	=	214.96	(74)
North	0.9x	0.77	x	7.95	x	79.99	x	0.47	x	1.11	=	230.13	(74)
North	0.9x	0.77	x	7.95	x	74.68	x	0.47	x	1.11	=	214.85	(74)
North	0.9x	0.77	x	7.95	x	59.25	x	0.47	x	1.11	=	170.46	(74)
North	0.9x	0.77	x	7.95	x	41.52	x	0.47	x	1.11	=	119.45	(74)
North	0.9x	0.77	x	7.95	x	24.19	x	0.47	x	1.11	=	69.6	(74)
North	0.9x	0.77	x	7.95	x	13.12	x	0.47	x	1.11	=	37.74	(74)
North	0.9x	0.77	x	7.95	x	8.86	x	0.47	x	1.11	=	25.5	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.47	x	1.11	=	19.62	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.47	x	1.11	=	38.38	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.47	x	1.11	=	63.2	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.47	x	1.11	=	92.17	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.47	x	1.11	=	112.96	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.47	x	1.11	=	115.64	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.47	x	1.11	=	110.09	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.47	x	1.11	=	94.57	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.47	x	1.11	=	73.5	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.47	x	1.11	=	45.54	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.47	x	1.11	=	24.46	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.47	x	1.11	=	16.13	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.21	96.84	162.55	251.75	327.93	345.76	324.94	265.02	192.95	115.13	62.2	41.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.32	432.96	486.24	555.46	611.44	609.74	576.18	521.93	460.09	402.46	372.71	369.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.86	0.67	0.5	0.58	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.08	20.3	20.61	20.86	20.97	21	20.99	20.9	20.57	20.2	19.92	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.53	20.53	20.53	20.53	20.53	20.53	20.53	20.53	20.53	20.53	20.53	20.53	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.95	0.83	0.63	0.45	0.52	0.82	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.72	18.9	19.23	19.66	19.99	20.11	20.13	20.13	20.05	19.62	19.08	18.67	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.14	19.3	19.59	19.98	20.29	20.4	20.42	20.42	20.34	19.94	19.46	19.1	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.14	19.3	19.59	19.98	20.29	20.4	20.42	20.42	20.34	19.94	19.46	19.1	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.82	0.62	0.44	0.51	0.81	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	387.18	430.41	478.43	523.72	502.57	376.37	253.93	265.47	370.43	389.99	370.49	368.62	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	992.79	961.78	874.39	740.02	573.49	387.65	255.32	268.47	416.51	623.77	825.71	994.91	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	450.58	357.08	294.6	155.74	52.77	0	0	0	0	173.93	327.76	465.97	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2278.41 (98)

Space heating requirement in kWh/m²/year 32.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	450.58	357.08	294.6	155.74	52.77	0	0	0	0	173.93	327.76	465.97	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	450.58	357.08	294.6	155.74	52.77	0	0	0	0	173.93	327.76	465.97	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2278.41 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	170.42	149.83	156.44	138.97	135.27	119.55	113.57	126.34	126.66	144.17	154.03	165.9

Efficiency of water heater 324.52 (216)

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(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	52.52	46.17	48.21	42.82	41.68	36.84	35	38.93	39.03	44.42	47.46	51.12	

Total = Sum(219a)$_{1...12}$ = 524.21 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2278.41	
Water heating fuel used		524.21	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	32.02		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		32.02	(231)
Electricity for lighting		319.52	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3154.15	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1182.5	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	272.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1454.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	16.62	(267)
Electricity for lighting	(232) x		0.519	=	165.83	(268)
Total CO2, kg/year		sum of (265)…(271) =			1637.01	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			23.15	(273)
EI rating (section 14)					81	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed GF

Address : 2 Bed GF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.71	(1a) x	2.4	(2a) =	169.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.43	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.36	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

TER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			7.95	x1/[1/(1.4)+ 0.04]		=	10.54			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Floor			70.71	x	0.13	=	9.1923			(28)
Walls Type1	42.64	10.71	31.93	x	0.18	=	5.75			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.04			(29)
Total area of elements, m²			132.36							(31)
Party wall			20.93	x	0	=	0			(32)
Party ceiling			70.71							(32b)
Internal wall **			123.56							(32c)
Internal wall **			38.02							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.72 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16909.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 8.97 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 43.7 (37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.99	33.76	33.53	32.46	32.26	31.33	31.33	31.15	31.69	32.26	32.66	33.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	77.69	77.46	77.23	76.16	75.96	75.02	75.02	74.85	75.38	75.96	76.36	76.79	

Average = Sum(39)$_{1...12}$ /12= 76.16 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.1	1.1	1.09	1.08	1.07	1.06	1.06	1.06	1.07	1.07	1.08	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.75	93.23	89.71	86.19	82.67	79.16	79.16	82.67	86.19	89.71	93.23	96.75	

Total = Sum(44)$_{1...12}$ = 1055.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.47	125.48	129.49	112.89	108.32	93.47	86.62	99.39	100.58	117.22	127.95	138.95	

Total = Sum(45)$_{1...12}$ = 1383.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.52	18.82	19.42	16.93	16.25	14.02	12.99	14.91	15.09	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.4	171.48	180.41	162.17	159.25	142.76	137.54	150.32	149.86	168.14	177.23	189.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.4	171.48	180.41	162.17	159.25	142.76	137.54	150.32	149.86	168.14	177.23	189.87	

Output from water heater (annual)$_{1...12}$ — 1983.44 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.45	78.52	83.8	76.96	76.76	70.51	69.54	73.79	72.87	79.72	81.97	86.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.95	17.44	18.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	198.95	201.01	195.81	184.74	170.75	157.62	148.84	146.77	151.97	163.05	177.03	190.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	(71)

Water heating gains (Table 5)

(72)m=	118.88	116.85	112.63	106.89	103.17	97.93	93.47	99.18	101.21	107.14	113.85	116.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.87	393.88	381.46	361.47	341.27	321.73	309	314.67	324.9	345.09	368.27	385.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

TER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	7.95	x	10.63	x	0.63	x	0.7	=	25.84	(74)
North	0.9x	0.77	x	7.95	x	20.32	x	0.63	x	0.7	=	49.37	(74)
North	0.9x	0.77	x	7.95	x	34.53	x	0.63	x	0.7	=	83.9	(74)
North	0.9x	0.77	x	7.95	x	55.46	x	0.63	x	0.7	=	134.76	(74)
North	0.9x	0.77	x	7.95	x	74.72	x	0.63	x	0.7	=	181.53	(74)
North	0.9x	0.77	x	7.95	x	79.99	x	0.63	x	0.7	=	194.33	(74)
North	0.9x	0.77	x	7.95	x	74.68	x	0.63	x	0.7	=	181.44	(74)
North	0.9x	0.77	x	7.95	x	59.25	x	0.63	x	0.7	=	143.95	(74)
North	0.9x	0.77	x	7.95	x	41.52	x	0.63	x	0.7	=	100.87	(74)
North	0.9x	0.77	x	7.95	x	24.19	x	0.63	x	0.7	=	58.77	(74)
North	0.9x	0.77	x	7.95	x	13.12	x	0.63	x	0.7	=	31.87	(74)
North	0.9x	0.77	x	7.95	x	8.86	x	0.63	x	0.7	=	21.54	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	42.4	81.78	137.27	212.6	276.92	291.99	274.4	223.8	162.94	97.23	52.53	35.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	438.27	475.66	518.72	574.07	618.19	613.72	583.4	538.47	487.84	442.31	420.8	420.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.89	0.72	0.55	0.62	0.87	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.85	19.96	20.19	20.51	20.79	20.95	20.99	20.98	20.87	20.52	20.14	19.83	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.96	0.85	0.64	0.44	0.5	0.8	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.46	18.64	18.96	19.43	19.81	20	20.03	20.03	19.92	19.46	18.9	18.45	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.94	19.09	19.38	19.8	20.15	20.32	20.36	20.35	20.24	19.82	19.32	18.92	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.94	19.09	19.38	19.8	20.15	20.32	20.36	20.35	20.24	19.82	19.32	18.92	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.86	0.67	0.48	0.54	0.82	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	436.39	472.25	510.38	546.23	529.59	408.27	278.86	290.45	399.84	427.27	417.34	419.27	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1136.97	1098.88	994.65	829.91	641.5	429.46	281.83	295.91	463.09	700.15	933.06	1130.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.23	421.1	360.29	204.25	83.27	0	0	0	0	203.02	371.32	528.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2693.41 (98)

Space heating requirement in kWh/m²/year 38.09 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	521.23	421.1	360.29	204.25	83.27	0	0	0	0	203.02	371.32	528.94	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	557.46	450.37	385.34	218.45	89.05	0	0	0	0	217.14	397.13	565.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2880.66 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.4	171.48	180.41	162.17	159.25	142.76	137.54	150.32	149.86	168.14	177.23	189.87

Efficiency of water heater 79.8 (216)

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(217)m=	87.32	87.12	86.62	85.43	83.18	79.8	79.8	79.8	79.8	85.32	86.74	87.4

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.63	196.83	208.27	189.83	191.46	178.89	172.36	188.37	187.8	197.08	204.32	217.23

Total = Sum(219a)$_{1...12}$ = 2355.07 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2880.66	
Water heating fuel used		2355.07	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		319.52	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5630.24	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	622.22	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	508.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1130.92	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	165.83	(268)
Total CO2, kg/year		sum of (265)…(271) =			1335.67	(272)

TER = 27.69 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed MF

Address : 2 Bed Corner MF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.71	(1a) x	2.4	(2a) =	169.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			7.95	x1/[1/(1.2)+ 0.04]		=	9.1			(27)
Windows Type 2			2.76	x1/[1/(1.2)+ 0.04]		=	3.16			(27)
Walls Type1	42.64	10.71	31.93	x	0.23	=	7.34	93.8	2995.03	(29)
Walls Type2	19.01	2.12	16.89	x	0.23	=	3.84	93.8	1584.28	(29)
Total area of elements, m²			61.65							(31)
Party wall			20.93	x	0	=	0	45	941.85	(32)
Party floor			70.71					40	2828.4	(32a)
Party ceiling			70.71					30	2121.3	(32b)
Internal wall **			123.56					9	1112.04	(32c)
Internal wall **			38.02					75	2851.5	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14434.41 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 204.14 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.59 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.79 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.11	28	28	28	28	28	28	28	28	28	28	28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	58.9	58.79	58.79	58.79	58.79	58.79	58.79	58.79	58.79	58.79	58.79	58.79	

Average = Sum(39)$_{1...12}$ /12= 58.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	

Average = Sum(40)$_{1...12}$ /12= 0.83 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	96.75	93.23	89.71	86.19	82.67	79.16	79.16	82.67	86.19	89.71	93.23	96.75	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1055.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.47	125.48	129.49	112.89	108.32	93.47	86.62	99.39	100.58	117.22	127.95	138.95	

Total = Sum(45)$_{1...12}$ = 1383.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.52	18.82	19.42	16.93	16.25	14.02	12.99	14.91	15.09	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	170.42	149.83	156.44	138.97	135.27	119.55	113.57	126.34	126.66	144.17	154.03	165.9	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	170.42	149.83	156.44	138.97	135.27	119.55	113.57	126.34	126.66	144.17	154.03	165.9	

Output from water heater (annual)$_{1...12}$ — 1701.16 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	47.7	41.72	43.05	37.54	36.02	31.08	28.8	33.05	33.44	38.97	42.54	46.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.95	17.44	18.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	198.95	201.01	195.81	184.74	170.75	157.62	148.84	146.77	151.97	163.05	177.03	190.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	(71)

Water heating gains (Table 5)

(72)m=	64.12	62.09	57.87	52.13	48.41	43.17	38.71	44.42	46.45	52.38	59.09	62.1	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.11	336.12	323.7	303.71	283.51	263.97	251.24	256.91	267.14	287.33	310.51	327.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	7.95	x	10.63	x	0.47	x	1.11	=	30.59	(74)
North	0.9x	0.77	x	7.95	x	20.32	x	0.47	x	1.11	=	58.47	(74)
North	0.9x	0.77	x	7.95	x	34.53	x	0.47	x	1.11	=	99.35	(74)
North	0.9x	0.77	x	7.95	x	55.46	x	0.47	x	1.11	=	159.58	(74)
North	0.9x	0.77	x	7.95	x	74.72	x	0.47	x	1.11	=	214.96	(74)
North	0.9x	0.77	x	7.95	x	79.99	x	0.47	x	1.11	=	230.13	(74)
North	0.9x	0.77	x	7.95	x	74.68	x	0.47	x	1.11	=	214.85	(74)
North	0.9x	0.77	x	7.95	x	59.25	x	0.47	x	1.11	=	170.46	(74)
North	0.9x	0.77	x	7.95	x	41.52	x	0.47	x	1.11	=	119.45	(74)
North	0.9x	0.77	x	7.95	x	24.19	x	0.47	x	1.11	=	69.6	(74)
North	0.9x	0.77	x	7.95	x	13.12	x	0.47	x	1.11	=	37.74	(74)
North	0.9x	0.77	x	7.95	x	8.86	x	0.47	x	1.11	=	25.5	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.47	x	1.11	=	19.62	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.47	x	1.11	=	38.38	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.47	x	1.11	=	63.2	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.47	x	1.11	=	92.17	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.47	x	1.11	=	112.96	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.47	x	1.11	=	115.64	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.47	x	1.11	=	110.09	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.47	x	1.11	=	94.57	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.47	x	1.11	=	73.5	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.47	x	1.11	=	45.54	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.47	x	1.11	=	24.46	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.47	x	1.11	=	16.13	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	50.21	96.84	162.55	251.75	327.93	345.76	324.94	265.02	192.95	115.13	62.2	41.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	388.32	432.96	486.24	555.46	611.44	609.74	576.18	521.93	460.09	402.46	372.71	369.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.93	0.8	0.6	0.45	0.51	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.01	20.14	20.37	20.68	20.9	20.98	21	20.99	20.93	20.63	20.25	19.97	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.58	20.58	20.58	20.58	20.58	20.58	20.58	20.58	20.58	20.58	20.58	20.58	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.77	0.57	0.4	0.47	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.88	19.07	19.41	19.84	20.13	20.21	20.22	20.22	20.16	19.78	19.24	18.83	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.26	19.44	19.74	20.12	20.39	20.48	20.49	20.49	20.42	20.07	19.59	19.21	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.26	19.44	19.74	20.12	20.39	20.48	20.49	20.49	20.42	20.07	19.59	19.21	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.76	0.56	0.4	0.46	0.74	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	385.99	427.99	472.18	505.45	466	338.84	227.74	238.43	342.73	381.5	368.39	367.73	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	881.3	854.59	778.4	659.81	510.83	345.4	228.56	240.19	371.83	556.61	734.16	882.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	368.51	286.68	227.83	111.14	33.35	0	0	0	0	130.28	263.35	383.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1804.24 (98)

Space heating requirement in kWh/m²/year 25.52 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	368.51	286.68	227.83	111.14	33.35	0	0	0	0	130.28	263.35	383.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	368.51	286.68	227.83	111.14	33.35	0	0	0	0	130.28	263.35	383.11	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1804.24 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	170.42	149.83	156.44	138.97	135.27	119.55	113.57	126.34	126.66	144.17	154.03	165.9

Efficiency of water heater 324.52 (216)

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(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	52.52	46.17	48.21	42.82	41.68	36.84	35	38.93	39.03	44.42	47.46	51.12	

Total = Sum(219a)$_{1...12}$ = 524.21 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1804.24	
Water heating fuel used		524.21	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	32.02		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		32.02	(231)
Electricity for lighting		319.52	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2679.98	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	936.4	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	272.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1208.47	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	16.62	(267)
Electricity for lighting	(232) x		0.519	=	165.83	(268)
Total CO2, kg/year		sum of (265)…(271) =			1390.91	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			19.67	(273)
EI rating (section 14)					84	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed MF

Address : 2 Bed Corner MF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.71	(1a) x	2.4	(2a) =	169.7	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.71	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.7	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.43 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.36 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			7.95	x1/[1/(1.4)+ 0.04]		=	10.54			(27)
Windows Type 2			2.76	x1/[1/(1.4)+ 0.04]		=	3.66			(27)
Walls Type1	42.64	10.71	31.93	x	0.18	=	5.75			(29)
Walls Type2	19.01	2.12	16.89	x	0.18	=	3.04			(29)
Total area of elements, m²			61.65							(31)
Party wall			20.93	x	0	=	0			(32)
Party floor			70.71							(32a)
Party ceiling			70.71							(32b)
Internal wall **			123.56							(32c)
Internal wall **			38.02							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14434.41 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 5.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 31.28 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.99	33.76	33.53	32.46	32.26	31.33	31.33	31.15	31.69	32.26	32.66	33.09	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	65.28	65.04	64.82	63.74	63.54	62.61	62.61	62.44	62.97	63.54	63.95	64.37	

Average = Sum(39)$_{1...12}$ /12= 63.74 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.92	0.92	0.92	0.9	0.9	0.89	0.89	0.88	0.89	0.9	0.9	0.91	

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.95 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.75	93.23	89.71	86.19	82.67	79.16	79.16	82.67	86.19	89.71	93.23	96.75	

Total = Sum(44)$_{1...12}$ = 1055.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.47	125.48	129.49	112.89	108.32	93.47	86.62	99.39	100.58	117.22	127.95	138.95	

Total = Sum(45)$_{1...12}$ = 1383.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.52	18.82	19.42	16.93	16.25	14.02	12.99	14.91	15.09	17.58	19.19	20.84	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.4	171.48	180.41	162.17	159.25	142.76	137.54	150.32	149.86	168.14	177.23	189.87	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.4	171.48	180.41	162.17	159.25	142.76	137.54	150.32	149.86	168.14	177.23	189.87	

Output from water heater (annual)$_{1...12}$ — 1983.44 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.45	78.52	83.8	76.96	76.76	70.51	69.54	73.79	72.87	79.72	81.97	86.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	113.16	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.09	16.07	13.07	9.89	7.4	6.24	6.75	8.77	11.77	14.95	17.44	18.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	198.95	201.01	195.81	184.74	170.75	157.62	148.84	146.77	151.97	163.05	177.03	190.17	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	34.32	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	-90.53	(71)

Water heating gains (Table 5)

(72)m=	118.88	116.85	112.63	106.89	103.17	97.93	93.47	99.18	101.21	107.14	113.85	116.86	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.87	393.88	381.46	361.47	341.27	321.73	309	314.67	324.9	345.09	368.27	385.57	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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North	0.9x	0.77	x	7.95	x	10.63	x	0.63	x	0.7	=	25.84	(74)
North	0.9x	0.77	x	7.95	x	20.32	x	0.63	x	0.7	=	49.37	(74)
North	0.9x	0.77	x	7.95	x	34.53	x	0.63	x	0.7	=	83.9	(74)
North	0.9x	0.77	x	7.95	x	55.46	x	0.63	x	0.7	=	134.76	(74)
North	0.9x	0.77	x	7.95	x	74.72	x	0.63	x	0.7	=	181.53	(74)
North	0.9x	0.77	x	7.95	x	79.99	x	0.63	x	0.7	=	194.33	(74)
North	0.9x	0.77	x	7.95	x	74.68	x	0.63	x	0.7	=	181.44	(74)
North	0.9x	0.77	x	7.95	x	59.25	x	0.63	x	0.7	=	143.95	(74)
North	0.9x	0.77	x	7.95	x	41.52	x	0.63	x	0.7	=	100.87	(74)
North	0.9x	0.77	x	7.95	x	24.19	x	0.63	x	0.7	=	58.77	(74)
North	0.9x	0.77	x	7.95	x	13.12	x	0.63	x	0.7	=	31.87	(74)
North	0.9x	0.77	x	7.95	x	8.86	x	0.63	x	0.7	=	21.54	(74)
West	0.9x	0.77	x	2.76	x	19.64	x	0.63	x	0.7	=	16.57	(80)
West	0.9x	0.77	x	2.76	x	38.42	x	0.63	x	0.7	=	32.41	(80)
West	0.9x	0.77	x	2.76	x	63.27	x	0.63	x	0.7	=	53.37	(80)
West	0.9x	0.77	x	2.76	x	92.28	x	0.63	x	0.7	=	77.84	(80)
West	0.9x	0.77	x	2.76	x	113.09	x	0.63	x	0.7	=	95.39	(80)
West	0.9x	0.77	x	2.76	x	115.77	x	0.63	x	0.7	=	97.65	(80)
West	0.9x	0.77	x	2.76	x	110.22	x	0.63	x	0.7	=	92.97	(80)
West	0.9x	0.77	x	2.76	x	94.68	x	0.63	x	0.7	=	79.86	(80)
West	0.9x	0.77	x	2.76	x	73.59	x	0.63	x	0.7	=	62.07	(80)
West	0.9x	0.77	x	2.76	x	45.59	x	0.63	x	0.7	=	38.45	(80)
West	0.9x	0.77	x	2.76	x	24.49	x	0.63	x	0.7	=	20.66	(80)
West	0.9x	0.77	x	2.76	x	16.15	x	0.63	x	0.7	=	13.62	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	42.4	81.78	137.27	212.6	276.92	291.99	274.4	223.8	162.94	97.23	52.53	35.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	438.27	475.66	518.72	574.07	618.19	613.72	583.4	538.47	487.84	442.31	420.8	420.73	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.84	0.64	0.47	0.53	0.81	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.1	20.2	20.41	20.69	20.9	20.99	21	21	20.94	20.68	20.35	20.08	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.15	20.15	20.15	20.17	20.17	20.18	20.18	20.18	20.18	20.17	20.16	20.16	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.79	0.56	0.38	0.44	0.74	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.94	19.1	19.39	19.8	20.07	20.17	20.18	20.18	20.13	19.79	19.31	18.92	(90)

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.33	19.47	19.74	20.1	20.35	20.45	20.46	20.46	20.41	20.09	19.66	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.33	19.47	19.74	20.1	20.35	20.45	20.46	20.46	20.41	20.09	19.66	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.59	0.41	0.47	0.76	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	436.36	471.93	508.67	536.67	497.78	360.09	240.96	252.16	370.44	422.69	416.93	419.27	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	981.1	947.91	857.98	714	549.92	366.15	241.55	253.38	397.15	603.26	803.5	973.13	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	405.29	319.86	259.89	127.67	38.8	0	0	0	0	134.34	278.33	412.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1976.24 (98)

Space heating requirement in kWh/m²/year 27.95 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	405.29	319.86	259.89	127.67	38.8	0	0	0	0	134.34	278.33	412.07	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	433.46	342.1	277.95	136.55	41.49	0	0	0	0	143.68	297.68	440.71	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2113.62 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.4	171.48	180.41	162.17	159.25	142.76	137.54	150.32	149.86	168.14	177.23	189.87

Efficiency of water heater 79.8 (216)

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(217)m=	86.73	86.45	85.79	84.18	81.69	79.8	79.8	79.8	79.8	84.22	86.01	86.83	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	224.14	198.35	210.3	192.64	194.93	178.89	172.36	188.37	187.8	199.64	206.05	218.68	

Total = Sum(219a)$_{1...12}$ = 2372.16 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2113.62	
Water heating fuel used		2372.16	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		319.52	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4880.3	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	456.54	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	512.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =				968.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	165.83	(268)
Total CO2, kg/year		sum of (265)…(271) =			1173.68	(272)

TER = 24.14 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed TF

Address : 2 Bed Corner TF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.81	(1a) x	2.4	(2a) =	169.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			8.41	x	1/[1/(1.2)+ 0.04]	=	9.63			(27)
Windows Type 2			3.64	x	1/[1/(1.2)+ 0.04]	=	4.17			(27)
Walls Type1	50.27	12.05	38.22	x	0.23	=	8.79	93.8	3585.04	(29)
Walls Type2	34.84	2.12	32.72	x	0.23	=	7.39	93.8	3069.14	(29)
Roof	70.81	0	70.81	x	0.09	=	6.37	9	637.29	(30)
Total area of elements, m²			155.92							(31)
Party wall			15.43	x	0	=	0	45	694.35	(32)
Party floor			70.81					40	2832.4	(32a)
Internal wall **			116.33					9	1046.97	(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.1 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11865.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 167.56 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.35 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.46 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	28.15	28.04	28.04	28.04	28.04	28.04	28.04	28.04	28.04	28.04	28.04	28.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	73.61	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	

Average = Sum(39)$_{1...12}$ /12= 73.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	96.81	93.29	89.77	86.25	82.73	79.21	79.21	82.73	86.25	89.77	93.29	96.81	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1056.1 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.57	125.56	129.57	112.96	108.39	93.53	86.67	99.46	100.64	117.29	128.03	139.04	

Total = Sum(45)$_{1...12}$ = 1384.72 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.53	18.83	19.44	16.94	16.26	14.03	13	14.92	15.1	17.59	19.2	20.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 200 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0.54 (48)

Temperature factor from Table 2b 0.8694 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.87 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	26.95	24.34	26.95	26.08	26.95	26.08	26.95	26.95	26.08	26.95	26.08	26.95	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	170.52	149.91	156.52	139.04	135.34	119.61	113.62	126.41	126.73	144.24	154.12	165.99	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	170.52	149.91	156.52	139.04	135.34	119.61	113.62	126.41	126.73	144.24	154.12	165.99	

Output from water heater (annual)$_{1...12}$ | 1702.05 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	47.74	41.75	43.08	37.56	36.04	31.1	28.82	33.07	33.46	39	42.57	46.23	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.88	15.88	12.92	9.78	7.31	6.17	6.67	8.67	11.63	14.77	17.24	18.38	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.18	201.25	196.04	184.95	170.95	157.8	149.01	146.94	152.15	163.24	177.24	190.39	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	(71)

Water heating gains (Table 5)

(72)m=	64.16	62.13	57.91	52.17	48.44	43.19	38.73	44.45	46.48	52.42	59.13	62.14	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.21	336.24	323.85	303.88	283.69	264.15	251.4	257.04	267.25	287.41	310.59	327.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	8.41	x	10.63	x	0.47	x	1.11	=	32.36	(74)
North	0.9x 0.77	x	8.41	x	20.32	x	0.47	x	1.11	=	61.85	(74)

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North	0.9x	0.77	x	8.41	x	34.53	x	0.47	x	1.11	=	105.1	(74)
North	0.9x	0.77	x	8.41	x	55.46	x	0.47	x	1.11	=	168.81	(74)
North	0.9x	0.77	x	8.41	x	74.72	x	0.47	x	1.11	=	227.4	(74)
North	0.9x	0.77	x	8.41	x	79.99	x	0.47	x	1.11	=	243.44	(74)
North	0.9x	0.77	x	8.41	x	74.68	x	0.47	x	1.11	=	227.28	(74)
North	0.9x	0.77	x	8.41	x	59.25	x	0.47	x	1.11	=	180.32	(74)
North	0.9x	0.77	x	8.41	x	41.52	x	0.47	x	1.11	=	126.36	(74)
North	0.9x	0.77	x	8.41	x	24.19	x	0.47	x	1.11	=	73.62	(74)
North	0.9x	0.77	x	8.41	x	13.12	x	0.47	x	1.11	=	39.92	(74)
North	0.9x	0.77	x	8.41	x	8.86	x	0.47	x	1.11	=	26.98	(74)
East	0.9x	0.77	x	3.64	x	19.64	x	0.47	x	1.11	=	25.87	(76)
East	0.9x	0.77	x	3.64	x	38.42	x	0.47	x	1.11	=	50.61	(76)
East	0.9x	0.77	x	3.64	x	63.27	x	0.47	x	1.11	=	83.35	(76)
East	0.9x	0.77	x	3.64	x	92.28	x	0.47	x	1.11	=	121.56	(76)
East	0.9x	0.77	x	3.64	x	113.09	x	0.47	x	1.11	=	148.98	(76)
East	0.9x	0.77	x	3.64	x	115.77	x	0.47	x	1.11	=	152.51	(76)
East	0.9x	0.77	x	3.64	x	110.22	x	0.47	x	1.11	=	145.19	(76)
East	0.9x	0.77	x	3.64	x	94.68	x	0.47	x	1.11	=	124.72	(76)
East	0.9x	0.77	x	3.64	x	73.59	x	0.47	x	1.11	=	96.94	(76)
East	0.9x	0.77	x	3.64	x	45.59	x	0.47	x	1.11	=	60.06	(76)
East	0.9x	0.77	x	3.64	x	24.49	x	0.47	x	1.11	=	32.26	(76)
East	0.9x	0.77	x	3.64	x	16.15	x	0.47	x	1.11	=	21.28	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.24	112.46	188.45	290.37	376.38	395.95	372.48	305.04	223.3	133.68	72.18	48.26	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	396.44	448.7	512.29	594.25	660.07	660.1	623.87	562.08	490.55	421.09	382.77	376.15	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.81	0.65	0.5	0.57	0.81	0.96	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.46	19.63	19.95	20.37	20.73	20.92	20.98	20.96	20.8	20.33	19.81	19.41	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	20.48	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.79	0.61	0.45	0.51	0.78	0.95	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.98	18.24	18.7	19.29	19.77	19.99	20.04	20.03	19.87	19.25	18.5	17.91	(90)

fLA = Living area ÷ (4) = 0.39 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.78	19.19	19.71	20.14	20.35	20.41	20.4	20.23	19.67	19.01	18.5	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.78	19.19	19.71	20.14	20.35	20.41	20.4	20.23	19.67	19.01	18.5	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.9	0.77	0.6	0.44	0.5	0.76	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	391.31	439.06	490	532.84	510.98	393.98	273.38	282.74	374.91	393.5	374.7	372.12	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1049.48	1020.28	932.41	794.67	620.48	422.81	279.79	293.69	450.59	666.67	875.44	1050.88	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	489.68	390.58	329.15	188.52	81.47	0	0	0	0	203.24	360.53	505	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2548.18 (98)

Space heating requirement in kWh/m²/year 35.99 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 100 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	489.68	390.58	329.15	188.52	81.47	0	0	0	0	203.24	360.53	505	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	489.68	390.58	329.15	188.52	81.47	0	0	0	0	203.24	360.53	505	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2548.18 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	170.52	149.91	156.52	139.04	135.34	119.61	113.62	126.41	126.73	144.24	154.12	165.99	

Efficiency of water heater 324.52 (216)

(217)m=	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	324.52	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	52.54	46.19	48.23	42.85	41.71	36.86	35.01	38.95	39.05	44.45	47.49	51.15	

Total = Sum(219a)$_{1...12}$ = 524.48 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2548.18	
Water heating fuel used		524.48	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	32.06		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		32.06	(231)
Electricity for lighting		315.79	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3420.51	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	1322.5	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	272.21	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1594.71	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	16.64	(267)
Electricity for lighting	(232) x		0.519	=	163.89	(268)
Total CO2, kg/year	sum of (265)…(271) =				1775.24	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				25.07	(273)
EI rating (section 14)					79	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: 2 Bed TF

Address : 2 Bed Corner TF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.81	(1a) x	2.4	(2a) =	169.94	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.81	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		169.94	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.18 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.43 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.36 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.46	0.45	0.44	0.4	0.39	0.34	0.34	0.34	0.36	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=

0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=

0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=

0.61	0.6	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.58	0.59

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			8.41	x1/[1/(1.4)+ 0.04]		=	11.15			(27)
Windows Type 2			3.64	x1/[1/(1.4)+ 0.04]		=	4.83			(27)
Walls Type1	50.27	12.05	38.22	x	0.18	=	6.88			(29)
Walls Type2	34.84	2.12	32.72	x	0.18	=	5.89			(29)
Roof	70.81	0	70.81	x	0.13	=	9.21			(30)
Total area of elements, m²			155.92							(31)
Party wall			15.43	x	0	=	0			(32)
Party floor			70.81							(32a)
Internal wall **			116.33							(32c)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.49 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 11865.18 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.87 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 48.36 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

TER WorkSheet: New dwelling design stage

(38)m=	34.03	33.8	33.57	32.5	32.3	31.37	31.37	31.19	31.73	32.3	32.71	33.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	82.39	82.16	81.93	80.86	80.66	79.73	79.73	79.55	80.09	80.66	81.07	81.49	

Average = Sum(39)$_{1...12}$ /12= 80.86 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.16	1.16	1.16	1.14	1.14	1.13	1.13	1.12	1.13	1.14	1.14	1.15	

Average = Sum(40)$_{1...12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.27 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 88.01 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	96.81	93.29	89.77	86.25	82.73	79.21	79.21	82.73	86.25	89.77	93.29	96.81	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1056.1 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	143.57	125.56	129.57	112.96	108.39	93.53	86.67	99.46	100.64	117.29	128.03	139.04	

Total = Sum(45)$_{1...12}$ = 1384.72 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.53	18.83	19.44	16.94	16.26	14.03	13	14.92	15.1	17.59	19.2	20.86	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 1.65 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.89 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0.89 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	27.66	24.99	27.66	26.77	27.66	26.77	27.66	27.66	26.77	27.66	26.77	27.66	(57)

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Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	194.49	171.56	180.5	162.25	159.32	142.82	137.6	150.38	149.93	168.22	177.32	189.96	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	194.49	171.56	180.5	162.25	159.32	142.82	137.6	150.38	149.93	168.22	177.32	189.96	

Output from water heater (annual)$_{1...12}$ | 1984.33 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	88.48	78.55	83.82	76.99	76.78	70.53	69.56	73.81	72.89	79.74	82	86.97	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	113.28	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.88	15.88	12.92	9.78	7.31	6.17	6.67	8.67	11.63	14.77	17.24	18.38	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	199.18	201.25	196.04	184.95	170.95	157.8	149.01	146.94	152.15	163.24	177.24	190.39	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	34.33	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	-90.63	(71)

Water heating gains (Table 5)

(72)m=	118.92	116.89	112.67	106.93	103.2	97.95	93.49	99.21	101.24	107.18	113.89	116.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	395.97	394	381.6	361.64	341.45	321.91	309.16	314.8	325.01	345.17	368.35	385.65	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	8.41	x	10.63	x	0.63	x	0.7	=	27.33	(74)
North	0.9x 0.77	x	8.41	x	20.32	x	0.63	x	0.7	=	52.23	(74)

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North	0.9x	0.77	x	8.41	x	34.53	x	0.63	x	0.7	=	88.75	(74)
North	0.9x	0.77	x	8.41	x	55.46	x	0.63	x	0.7	=	142.56	(74)
North	0.9x	0.77	x	8.41	x	74.72	x	0.63	x	0.7	=	192.03	(74)
North	0.9x	0.77	x	8.41	x	79.99	x	0.63	x	0.7	=	205.58	(74)
North	0.9x	0.77	x	8.41	x	74.68	x	0.63	x	0.7	=	191.93	(74)
North	0.9x	0.77	x	8.41	x	59.25	x	0.63	x	0.7	=	152.28	(74)
North	0.9x	0.77	x	8.41	x	41.52	x	0.63	x	0.7	=	106.71	(74)
North	0.9x	0.77	x	8.41	x	24.19	x	0.63	x	0.7	=	62.17	(74)
North	0.9x	0.77	x	8.41	x	13.12	x	0.63	x	0.7	=	33.72	(74)
North	0.9x	0.77	x	8.41	x	8.86	x	0.63	x	0.7	=	22.78	(74)
East	0.9x	0.77	x	3.64	x	19.64	x	0.63	x	0.7	=	21.85	(76)
East	0.9x	0.77	x	3.64	x	38.42	x	0.63	x	0.7	=	42.74	(76)
East	0.9x	0.77	x	3.64	x	63.27	x	0.63	x	0.7	=	70.39	(76)
East	0.9x	0.77	x	3.64	x	92.28	x	0.63	x	0.7	=	102.66	(76)
East	0.9x	0.77	x	3.64	x	113.09	x	0.63	x	0.7	=	125.81	(76)
East	0.9x	0.77	x	3.64	x	115.77	x	0.63	x	0.7	=	128.79	(76)
East	0.9x	0.77	x	3.64	x	110.22	x	0.63	x	0.7	=	122.61	(76)
East	0.9x	0.77	x	3.64	x	94.68	x	0.63	x	0.7	=	105.32	(76)
East	0.9x	0.77	x	3.64	x	73.59	x	0.63	x	0.7	=	81.86	(76)
East	0.9x	0.77	x	3.64	x	45.59	x	0.63	x	0.7	=	50.71	(76)
East	0.9x	0.77	x	3.64	x	24.49	x	0.63	x	0.7	=	27.24	(76)
East	0.9x	0.77	x	3.64	x	16.15	x	0.63	x	0.7	=	17.97	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	49.18	94.97	159.14	245.21	317.84	334.37	314.54	257.6	188.57	112.89	60.96	40.75	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	445.14	488.97	540.74	606.85	659.29	656.27	623.7	572.4	513.58	458.06	429.3	426.4	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.89	20.13	20.48	20.78	20.95	20.99	20.98	20.86	20.48	20.07	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.95	19.95	19.95	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.96	19.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.95	0.84	0.63	0.43	0.49	0.8	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.31	18.5	18.85	19.35	19.75	19.94	19.98	19.97	19.86	19.36	18.77	18.29	(90)

fLA = Living area ÷ (4) = 0.39 (91)

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Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.88	19.04	19.35	19.79	20.15	20.34	20.37	20.37	20.25	19.8	19.28	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.88	19.04	19.35	19.79	20.15	20.34	20.37	20.37	20.25	19.8	19.28	18.86	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.95	0.85	0.66	0.48	0.54	0.82	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	443.14	485.18	531.18	574.73	559.53	432.72	296.9	308.71	419.95	441.95	425.64	424.85	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1201.24	1161.92	1052.96	880.48	681.63	457.3	300.68	315.61	492.28	741.92	987.04	1194.69	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	564.03	454.77	388.21	220.14	90.84	0	0	0	0	223.17	404.21	572.76	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2918.12 (98)

Space heating requirement in kWh/m²/year 41.21 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	564.03	454.77	388.21	220.14	90.84	0	0	0	0	223.17	404.21	572.76	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	603.24	486.39	415.19	235.45	97.15	0	0	0	0	238.69	432.31	612.58	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3120.99 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	194.49	171.56	180.5	162.25	159.32	142.82	137.6	150.38	149.93	168.22	177.32	189.96	

Efficiency of water heater 79.8 (216)

(217)m=	87.49	87.29	86.81	85.63	83.38	79.8	79.8	79.8	79.8	85.57	86.95	87.58	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.3	196.53	207.93	189.48	191.07	178.97	172.43	188.45	187.88	196.59	203.94	216.91	

Total = Sum(219a)$_{1...12}$ = 2352.48 (219)

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Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3120.99	
Water heating fuel used		2352.48	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		315.79	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5864.25	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	674.13	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	508.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1182.27	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	163.89	(268)
Total CO2, kg/year	sum of (265)…(271) =				1385.09	(272)

TER = 28.74 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: Arkwright DET (ASHP)

Address : Arkwright DET (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.16 (1a)	x	2.38 (2a)	=	164.95	(3a)
First floor	69.16 (1b)	x	2.61 (2b)	=	180.51	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	138.32 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		345.45	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.02	x	1.3	=	2.626			(26)
Doors Type 2			2.03	x	1.3	=	2.639			(26)
Windows Type 1			10.65	x1/[1/(1.2)+ 0.04]		=	12.19			(27)
Windows Type 2			1.32	x1/[1/(1.2)+ 0.04]		=	1.51			(27)
Windows Type 3			1.32	x1/[1/(1.2)+ 0.04]		=	1.51			(27)
Windows Type 4			10.5	x1/[1/(1.2)+ 0.04]		=	12.02			(27)
Floor			69.16	x	0.1	=	6.916	75	5187	(28)
Walls	172.17	27.84	144.33	x	0.25	=	36.08	60	8659.8	(29)
Roof	69.16	0	69.16	x	0.09	=	6.22	9	622.44	(30)
Total area of elements, m²			310.49							(31)
Internal wall **			222.23					9	2000.07	(32c)
Internal wall **			39.15					75	2936.25	(32c)
Internal floor			69.16					18	1244.88	(32d)
Internal ceiling			69.16					9	622.4401	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 81.73 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21272.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.79 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.46 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 90.19 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	57.22	57	57	57	57	57	57	57	57	57	57	57	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	147.41	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	147.19	

Average = Sum(39)$_{1...12}$ /12= 147.21 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	

Average = Sum(40)$_{1...12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.91 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 103.4 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	113.74	109.61	105.47	101.34	97.2	93.06	93.06	97.2	101.34	105.47	109.61	113.74	

Total = Sum(44)$_{1...12}$ = 1240.84 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	168.68	147.53	152.23	132.72	127.35	109.89	101.83	116.85	118.25	137.81	150.43	163.36	

Total = Sum(45)$_{1...12}$ = 1626.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.3	22.13	22.84	19.91	19.1	16.48	15.27	17.53	17.74	20.67	22.56	24.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.89 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)	1.02	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	223.58	197.12	207.14	185.85	182.25	140.51	133.47	148.49	148.87	192.71	203.56	218.26	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	223.58	197.12	207.14	185.85	182.25	0	0	0	0	192.71	203.56	218.26	

Output from water heater (annual)$_{1...12}$	1610.46	(64)

Output immersion

(64)m=	0	0	0	0	0	140.51	133.47	148.49	148.87	0	0	0	

Output from immersion (annual)$_{1...12}$	571.342389147011	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	100.01	88.72	94.54	86.63	86.26	61.03	59.17	64.16	63.81	89.74	92.52	98.24	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.59	24.5	19.93	15.09	11.28	9.52	10.29	13.37	17.95	22.79	26.6	28.36	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	307.49	310.68	302.64	285.53	263.92	243.61	230.04	226.85	234.89	252.01	273.62	293.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	(71)

Water heating gains (Table 5)

(72)m=	134.42	132.03	127.07	120.33	115.95	84.77	79.53	86.24	88.63	120.62	128.5	132.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	536.21	533.92	516.35	487.64	457.85	404.61	386.57	393.17	408.18	462.13	495.43	521.03	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	10.65	x	10.63	x	0.47	x	1.11	=	40.98	(74)
North	0.9x 0.77	x	10.65	x	20.32	x	0.47	x	1.11	=	78.32	(74)
North	0.9x 0.77	x	10.65	x	34.53	x	0.47	x	1.11	=	133.09	(74)
North	0.9x 0.77	x	10.65	x	55.46	x	0.47	x	1.11	=	213.77	(74)
North	0.9x 0.77	x	10.65	x	74.72	x	0.47	x	1.11	=	287.97	(74)
North	0.9x 0.77	x	10.65	x	79.99	x	0.47	x	1.11	=	308.28	(74)
North	0.9x 0.77	x	10.65	x	74.68	x	0.47	x	1.11	=	287.82	(74)
North	0.9x 0.77	x	10.65	x	59.25	x	0.47	x	1.11	=	228.35	(74)
North	0.9x 0.77	x	10.65	x	41.52	x	0.47	x	1.11	=	160.01	(74)
North	0.9x 0.77	x	10.65	x	24.19	x	0.47	x	1.11	=	93.23	(74)
North	0.9x 0.77	x	10.65	x	13.12	x	0.47	x	1.11	=	50.56	(74)
North	0.9x 0.77	x	10.65	x	8.86	x	0.47	x	1.11	=	34.17	(74)
East	0.9x 0.77	x	1.32	x	19.64	x	0.47	x	1.11	=	9.38	(76)
East	0.9x 0.77	x	1.32	x	38.42	x	0.47	x	1.11	=	18.35	(76)
East	0.9x 0.77	x	1.32	x	63.27	x	0.47	x	1.11	=	30.23	(76)
East	0.9x 0.77	x	1.32	x	92.28	x	0.47	x	1.11	=	44.08	(76)
East	0.9x 0.77	x	1.32	x	113.09	x	0.47	x	1.11	=	54.03	(76)
East	0.9x 0.77	x	1.32	x	115.77	x	0.47	x	1.11	=	55.3	(76)
East	0.9x 0.77	x	1.32	x	110.22	x	0.47	x	1.11	=	52.65	(76)
East	0.9x 0.77	x	1.32	x	94.68	x	0.47	x	1.11	=	45.23	(76)
East	0.9x 0.77	x	1.32	x	73.59	x	0.47	x	1.11	=	35.15	(76)
East	0.9x 0.77	x	1.32	x	45.59	x	0.47	x	1.11	=	21.78	(76)
East	0.9x 0.77	x	1.32	x	24.49	x	0.47	x	1.11	=	11.7	(76)
East	0.9x 0.77	x	1.32	x	16.15	x	0.47	x	1.11	=	7.72	(76)
South	0.9x 0.77	x	10.5	x	46.75	x	0.47	x	1.11	=	177.66	(78)
South	0.9x 0.77	x	10.5	x	76.57	x	0.47	x	1.11	=	290.95	(78)
South	0.9x 0.77	x	10.5	x	97.53	x	0.47	x	1.11	=	370.62	(78)
South	0.9x 0.77	x	10.5	x	110.23	x	0.47	x	1.11	=	418.89	(78)
South	0.9x 0.77	x	10.5	x	114.87	x	0.47	x	1.11	=	436.5	(78)
South	0.9x 0.77	x	10.5	x	110.55	x	0.47	x	1.11	=	420.08	(78)
South	0.9x 0.77	x	10.5	x	108.01	x	0.47	x	1.11	=	410.44	(78)
South	0.9x 0.77	x	10.5	x	104.89	x	0.47	x	1.11	=	398.59	(78)
South	0.9x 0.77	x	10.5	x	101.89	x	0.47	x	1.11	=	387.16	(78)
South	0.9x 0.77	x	10.5	x	82.59	x	0.47	x	1.11	=	313.82	(78)
South	0.9x 0.77	x	10.5	x	55.42	x	0.47	x	1.11	=	210.58	(78)
South	0.9x 0.77	x	10.5	x	40.4	x	0.47	x	1.11	=	153.51	(78)

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West	0.9x	0.77	x	1.32	x	19.64	x	0.47	x	1.11	=	9.38	(80)
West	0.9x	0.77	x	1.32	x	38.42	x	0.47	x	1.11	=	18.35	(80)
West	0.9x	0.77	x	1.32	x	63.27	x	0.47	x	1.11	=	30.23	(80)
West	0.9x	0.77	x	1.32	x	92.28	x	0.47	x	1.11	=	44.08	(80)
West	0.9x	0.77	x	1.32	x	113.09	x	0.47	x	1.11	=	54.03	(80)
West	0.9x	0.77	x	1.32	x	115.77	x	0.47	x	1.11	=	55.3	(80)
West	0.9x	0.77	x	1.32	x	110.22	x	0.47	x	1.11	=	52.65	(80)
West	0.9x	0.77	x	1.32	x	94.68	x	0.47	x	1.11	=	45.23	(80)
West	0.9x	0.77	x	1.32	x	73.59	x	0.47	x	1.11	=	35.15	(80)
West	0.9x	0.77	x	1.32	x	45.59	x	0.47	x	1.11	=	21.78	(80)
West	0.9x	0.77	x	1.32	x	24.49	x	0.47	x	1.11	=	11.7	(80)
West	0.9x	0.77	x	1.32	x	16.15	x	0.47	x	1.11	=	7.72	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	237.4	405.98	564.16	720.82	832.53	838.97	803.57	717.4	617.48	450.61	284.54	203.11	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	773.61	939.91	1080.51	1208.47	1290.38	1243.57	1190.13	1110.57	1025.66	912.74	779.96	724.14	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.81	0.67	0.52	0.57	0.78	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.66	19.84	20.11	20.41	20.68	20.84	20.9	20.89	20.76	20.42	19.96	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.98	0.95	0.89	0.77	0.59	0.41	0.46	0.72	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.22	18.49	18.86	19.3	19.66	19.85	19.91	19.9	19.77	19.32	18.67	18.15	(90)

fLA = Living area ÷ (4) = 0.13 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.41	18.66	19.03	19.45	19.8	19.98	20.04	20.03	19.9	19.46	18.84	18.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.41	18.66	19.03	19.45	19.8	19.98	20.04	20.03	19.9	19.46	18.84	18.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.98	0.97	0.94	0.87	0.75	0.59	0.41	0.46	0.71	0.9	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	760.62	909.14	1012.19	1053.98	972.75	729.91	493.51	515.09	727.51	821.87	756.43	714.34	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2079.7	2026.01	1843.82	1552.52	1191.7	792.29	506.3	534.58	854.38	1304.34	1728.21	2082.29	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	981.4	750.54	618.74	358.95	162.9	0	0	0	0	358.96	699.68	1017.75	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4948.92 (98)

Space heating requirement in kWh/m²/year 35.78 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 408.33 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	981.4	750.54	618.74	358.95	162.9	0	0	0	0	358.96	699.68	1017.75	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	240.34	183.81	151.53	87.91	39.89	0	0	0	0	87.91	171.35	249.25	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1211.98 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	223.58	197.12	207.14	185.85	182.25	0	0	0	0	192.71	203.56	218.26	

Efficiency of water heater 282.62 (216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	79.11	69.74	73.29	65.76	64.49	0	0	0	0	68.19	72.02	77.22	

Total = Sum(219a)$_{1...12}$ = 569.82 (219)

Water heating requirement (immersion)

	0	0	0	0	0	140.51	133.47	148.49	148.87	0	0	0	

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	140.51	133.47	148.49	148.87	0	0	0	

Total = Sum(219a)$_{1...12}$ = 571.34 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1211.98

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Water heating fuel used		569.82	
Water heating fuel used (Immersion)		571.34	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	63.43		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	63.43	(231)
Electricity for lighting		487.22	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2332.46	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	629.02	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	295.74	(264)
Water heating (Immersion)	(219) x		0.519	=	296.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1221.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	32.92	(267)
Electricity for lighting	(232) x		0.519	=	252.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			1507.07	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			10.9	(273)
EI rating (section 14)					89	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: Arkwright DET (ASHP)

Address : Arkwright DET (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	69.16 (1a)	x	2.38 (2a)	=	164.95	(3a)
First floor	69.16 (1b)	x	2.61 (2b)	=	180.51	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	138.32 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		345.45	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.31	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.39	0.38	0.34	0.33	0.3	0.3	0.29	0.31	0.33	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.02	x	1.2	=	2.424			(26)
Doors Type 2			2.03	x	1.2	=	2.436			(26)
Windows Type 1			10.65	x1/[1/(1.4)+ 0.04]		=	14.12			(27)
Windows Type 2			1.32	x1/[1/(1.4)+ 0.04]		=	1.75			(27)
Windows Type 3			1.32	x1/[1/(1.4)+ 0.04]		=	1.75			(27)
Windows Type 4			10.5	x1/[1/(1.4)+ 0.04]		=	13.92			(27)
Floor			69.16	x	0.13	=	8.9908			(28)
Walls	172.17	27.84	144.33	x	0.18	=	25.98			(29)
Roof	69.16	0	69.16	x	0.13	=	8.99			(30)
Total area of elements, m²			310.49							(31)
Internal wall **			222.23							(32c)
Internal wall **			39.15							(32c)
Internal floor			69.16							(32d)
Internal ceiling			69.16							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 80.36 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21272.88 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 13.13 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 93.49 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	65.96	65.61	65.27	63.67	63.37	61.97	61.97	61.71	62.51	63.37	63.97	64.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	159.45	159.1	158.76	157.16	156.86	155.46	155.46	155.2	156	156.86	157.46	158.1	

Average = Sum(39)$_{1...12}$ /12= 157.16 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.15	1.14	1.13	1.12	1.12	1.12	1.13	1.13	1.14	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.91 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 103.4 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	113.74	109.61	105.47	101.34	97.2	93.06	93.06	97.2	101.34	105.47	109.61	113.74	

Total = Sum(44)$_{1...12}$ = 1240.84 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	168.68	147.53	152.23	132.72	127.35	109.89	101.83	116.85	118.25	137.81	150.43	163.36	

Total = Sum(45)$_{1...12}$ = 1626.93 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.3	22.13	22.84	19.91	19.1	16.48	15.27	17.53	17.74	20.67	22.56	24.5	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)	0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	215.27	189.61	198.83	177.81	173.94	154.99	148.43	163.45	163.34	184.4	195.52	209.95	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	215.27	189.61	198.83	177.81	173.94	154.99	148.43	163.45	163.34	184.4	195.52	209.95	

Output from water heater (annual)$_{1...12}$ 2175.55 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.36	82.72	87.89	80.2	79.62	72.61	71.14	76.13	75.39	83.1	86.09	91.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	145.69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	27.59	24.5	19.93	15.09	11.28	9.52	10.29	13.37	17.95	22.79	26.6	28.36	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	307.49	310.68	302.64	285.53	263.92	243.61	230.04	226.85	234.89	252.01	273.62	293.93	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	37.57	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	-116.55	(71)

Water heating gains (Table 5)

(72)m=	125.49	123.1	118.14	111.39	107.02	100.85	95.61	102.33	104.71	111.69	119.57	123.11	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	530.28	527.99	510.42	481.71	451.92	423.69	405.65	412.26	427.26	456.2	489.49	515.1	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	10.65	x	10.63	x	0.63	x	0.7	=	34.61	(74)
North	0.9x 0.77	x	10.65	x	20.32	x	0.63	x	0.7	=	66.14	(74)
North	0.9x 0.77	x	10.65	x	34.53	x	0.63	x	0.7	=	112.39	(74)
North	0.9x 0.77	x	10.65	x	55.46	x	0.63	x	0.7	=	180.52	(74)
North	0.9x 0.77	x	10.65	x	74.72	x	0.63	x	0.7	=	243.18	(74)
North	0.9x 0.77	x	10.65	x	79.99	x	0.63	x	0.7	=	260.33	(74)
North	0.9x 0.77	x	10.65	x	74.68	x	0.63	x	0.7	=	243.06	(74)
North	0.9x 0.77	x	10.65	x	59.25	x	0.63	x	0.7	=	192.83	(74)
North	0.9x 0.77	x	10.65	x	41.52	x	0.63	x	0.7	=	135.13	(74)
North	0.9x 0.77	x	10.65	x	24.19	x	0.63	x	0.7	=	78.73	(74)
North	0.9x 0.77	x	10.65	x	13.12	x	0.63	x	0.7	=	42.7	(74)
North	0.9x 0.77	x	10.65	x	8.86	x	0.63	x	0.7	=	28.85	(74)
East	0.9x 0.77	x	1.32	x	19.64	x	0.63	x	0.7	=	7.92	(76)
East	0.9x 0.77	x	1.32	x	38.42	x	0.63	x	0.7	=	15.5	(76)
East	0.9x 0.77	x	1.32	x	63.27	x	0.63	x	0.7	=	25.52	(76)
East	0.9x 0.77	x	1.32	x	92.28	x	0.63	x	0.7	=	37.23	(76)
East	0.9x 0.77	x	1.32	x	113.09	x	0.63	x	0.7	=	45.62	(76)
East	0.9x 0.77	x	1.32	x	115.77	x	0.63	x	0.7	=	46.7	(76)
East	0.9x 0.77	x	1.32	x	110.22	x	0.63	x	0.7	=	44.46	(76)
East	0.9x 0.77	x	1.32	x	94.68	x	0.63	x	0.7	=	38.19	(76)
East	0.9x 0.77	x	1.32	x	73.59	x	0.63	x	0.7	=	29.69	(76)
East	0.9x 0.77	x	1.32	x	45.59	x	0.63	x	0.7	=	18.39	(76)
East	0.9x 0.77	x	1.32	x	24.49	x	0.63	x	0.7	=	9.88	(76)
East	0.9x 0.77	x	1.32	x	16.15	x	0.63	x	0.7	=	6.52	(76)
South	0.9x 0.77	x	10.5	x	46.75	x	0.63	x	0.7	=	150.02	(78)
South	0.9x 0.77	x	10.5	x	76.57	x	0.63	x	0.7	=	245.7	(78)
South	0.9x 0.77	x	10.5	x	97.53	x	0.63	x	0.7	=	312.98	(78)
South	0.9x 0.77	x	10.5	x	110.23	x	0.63	x	0.7	=	353.74	(78)
South	0.9x 0.77	x	10.5	x	114.87	x	0.63	x	0.7	=	368.61	(78)
South	0.9x 0.77	x	10.5	x	110.55	x	0.63	x	0.7	=	354.74	(78)
South	0.9x 0.77	x	10.5	x	108.01	x	0.63	x	0.7	=	346.6	(78)
South	0.9x 0.77	x	10.5	x	104.89	x	0.63	x	0.7	=	336.6	(78)
South	0.9x 0.77	x	10.5	x	101.89	x	0.63	x	0.7	=	326.94	(78)
South	0.9x 0.77	x	10.5	x	82.59	x	0.63	x	0.7	=	265.01	(78)
South	0.9x 0.77	x	10.5	x	55.42	x	0.63	x	0.7	=	177.83	(78)
South	0.9x 0.77	x	10.5	x	40.4	x	0.63	x	0.7	=	129.63	(78)
West	0.9x 0.77	x	1.32	x	19.64	x	0.63	x	0.7	=	7.92	(80)
West	0.9x 0.77	x	1.32	x	38.42	x	0.63	x	0.7	=	15.5	(80)
West	0.9x 0.77	x	1.32	x	63.27	x	0.63	x	0.7	=	25.52	(80)

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West	0.9x	0.77	x	1.32	x	92.28	x	0.63	x	0.7	=	37.23	(80)
West	0.9x	0.77	x	1.32	x	113.09	x	0.63	x	0.7	=	45.62	(80)
West	0.9x	0.77	x	1.32	x	115.77	x	0.63	x	0.7	=	46.7	(80)
West	0.9x	0.77	x	1.32	x	110.22	x	0.63	x	0.7	=	44.46	(80)
West	0.9x	0.77	x	1.32	x	94.68	x	0.63	x	0.7	=	38.19	(80)
West	0.9x	0.77	x	1.32	x	73.59	x	0.63	x	0.7	=	29.69	(80)
West	0.9x	0.77	x	1.32	x	45.59	x	0.63	x	0.7	=	18.39	(80)
West	0.9x	0.77	x	1.32	x	24.49	x	0.63	x	0.7	=	9.88	(80)
West	0.9x	0.77	x	1.32	x	16.15	x	0.63	x	0.7	=	6.52	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	200.48	342.84	476.42	608.71	703.04	708.48	678.59	605.82	521.44	380.53	240.28	171.52	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	730.76	870.83	986.83	1090.43	1154.96	1132.17	1084.23	1018.08	948.7	836.72	729.78	686.61	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.92	0.78	0.61	0.66	0.88	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.85	20.1	20.43	20.73	20.92	20.98	20.97	20.84	20.45	20.01	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.96	19.97	19.97	19.98	19.98	19.98	19.98	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.88	0.69	0.48	0.53	0.82	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.2	18.44	18.81	19.28	19.69	19.93	19.97	19.97	19.84	19.32	18.67	18.17	(90)

fLA = Living area ÷ (4) = 0.13 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.4	18.63	18.98	19.43	19.83	20.06	20.11	20.1	19.97	19.47	18.85	18.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.4	18.63	18.98	19.43	19.83	20.06	20.11	20.1	19.97	19.47	18.85	18.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.96	0.87	0.7	0.5	0.55	0.82	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	728.99	865.65	971.77	1041.87	1009.46	789.89	537.15	561.02	779.11	810.36	725.8	685.4	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2247.88	2183.81	1980.91	1655.6	1275.14	848.48	545.31	574.8	916.11	1391.2	1850.26	2239.31	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1130.05	885.8	750.8	441.89	197.67	0	0	0	0	432.14	809.61	1156.11

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5804.08 (98)

Space heating requirement in kWh/m²/year 41.96 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1130.05	885.8	750.8	441.89	197.67	0	0	0	0	432.14	809.61	1156.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1208.61	947.38	803	472.61	211.41	0	0	0	0	462.19	865.9	1236.48	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6207.57 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	215.27	189.61	198.83	177.81	173.94	154.99	148.43	163.45	163.34	184.4	195.52	209.95

Efficiency of water heater 79.8 (216)

(217)m=	88.6	88.41	88.03	87.15	85.16	79.8	79.8	79.8	79.8	87.01	88.2	88.67

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	242.97	214.47	225.87	204.04	204.27	194.22	186	204.82	204.69	211.93	221.68	236.77

Total = Sum(219a)$_{1...12}$ = 2551.73 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6207.57
Water heating fuel used		2551.73
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		487.22 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9321.52 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	1340.84	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	551.17	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1892.01	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	252.87	(268)
Total CO2, kg/year		sum of (265)…(271) =			2183.8	(272)
TER =					23.31	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Cartographer Semi (ASHP)

Address : HT Cartographer Semi (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.18 (1a)	x	2.4 (2a)	=	120.43	(3a)
First floor	50.18 (1b)	x	2.61 (2b)	=	130.97	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.36 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		251.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			6.08	x1/[1/(1.2)+ 0.04]		=	6.96			(27)
Windows Type 2			1.42	x1/[1/(1.2)+ 0.04]		=	1.63			(27)
Windows Type 3			7.52	x1/[1/(1.2)+ 0.04]		=	8.61			(27)
Floor			50.18	x	0.1	=	5.018	75	3763.5	(28)
Walls	100.82	17.17	83.65	x	0.25	=	20.91	60	5019	(29)
Roof	50.18	0	50.18	x	0.09	=	4.52	9	451.62	(30)
Total area of elements, m²			201.18							(31)
Party wall			45.71	x	0	=	0	45	2056.95	(32)
Internal wall **			190.37					9	1713.33	(32c)
Internal floor			50.18					18	903.24	(32d)
Internal ceiling			50.18					9	451.62	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.44 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14359.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 143.08 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.33 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.77 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.64	41.48	41.48	41.48	41.48	41.48	41.48	41.48	41.48	41.48	41.48	41.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.41	99.25	99.25	99.25	99.25	99.25	99.25	99.25	99.25	99.25	99.25	99.25	

Average = Sum(39)$_{1...12}$ /12= 99.26 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	

Average = Sum(40)$_{1...12}$ /12= 0.99 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.74 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 99.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	109.28	105.3	101.33	97.36	93.38	89.41	89.41	93.38	97.36	101.33	105.3	109.28	

Total = Sum(44)$_{1...12}$ = 1192.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	162.05	141.73	146.26	127.51	122.35	105.58	97.83	112.26	113.61	132.4	144.52	156.94	

Total = Sum(45)$_{1...12}$ = 1563.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.31	21.26	21.94	19.13	18.35	15.84	14.67	16.84	17.04	19.86	21.68	23.54	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.89 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.02	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	216.95	191.32	201.16	180.64	177.25	136.2	129.47	143.9	144.22	187.3	197.65	211.84	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	216.95	191.32	201.16	180.64	177.25	0	0	0	0	187.3	197.65	211.84	

Output from water heater (annual)$_{1...12}$: 1564.11 (64)

Output immersion

(64)m=	0	0	0	0	0	136.2	129.47	143.9	144.22	0	0	0	

Output from immersion (annual)$_{1...12}$: 553.794403158761 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	97.8	86.8	92.55	84.9	84.6	59.6	57.84	62.64	62.27	87.94	90.56	96.1	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.6	20.96	17.04	12.9	9.65	8.14	8.8	11.44	15.35	19.49	22.75	24.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	256.91	259.57	252.86	238.55	220.5	203.53	192.2	189.53	196.25	210.55	228.61	245.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	(71)

Water heating gains (Table 5)

(72)m=	131.46	129.16	124.4	117.92	113.71	82.78	77.74	84.19	86.48	118.2	125.77	129.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	476.1	473.84	458.44	433.52	408	358.59	342.88	349.3	362.23	412.39	441.27	463.14	(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.08	x	10.63	x	0.47	x	1.11	=	23.4	(74)
North	0.9x 0.77	x	6.08	x	20.32	x	0.47	x	1.11	=	44.71	(74)
North	0.9x 0.77	x	6.08	x	34.53	x	0.47	x	1.11	=	75.98	(74)
North	0.9x 0.77	x	6.08	x	55.46	x	0.47	x	1.11	=	122.04	(74)
North	0.9x 0.77	x	6.08	x	74.72	x	0.47	x	1.11	=	164.4	(74)
North	0.9x 0.77	x	6.08	x	79.99	x	0.47	x	1.11	=	176	(74)
North	0.9x 0.77	x	6.08	x	74.68	x	0.47	x	1.11	=	164.31	(74)
North	0.9x 0.77	x	6.08	x	59.25	x	0.47	x	1.11	=	130.36	(74)
North	0.9x 0.77	x	6.08	x	41.52	x	0.47	x	1.11	=	91.35	(74)
North	0.9x 0.77	x	6.08	x	24.19	x	0.47	x	1.11	=	53.23	(74)
North	0.9x 0.77	x	6.08	x	13.12	x	0.47	x	1.11	=	28.86	(74)
North	0.9x 0.77	x	6.08	x	8.86	x	0.47	x	1.11	=	19.51	(74)
East	0.9x 0.77	x	1.42	x	19.64	x	0.47	x	1.11	=	10.09	(76)
East	0.9x 0.77	x	1.42	x	38.42	x	0.47	x	1.11	=	19.74	(76)
East	0.9x 0.77	x	1.42	x	63.27	x	0.47	x	1.11	=	32.52	(76)
East	0.9x 0.77	x	1.42	x	92.28	x	0.47	x	1.11	=	47.42	(76)
East	0.9x 0.77	x	1.42	x	113.09	x	0.47	x	1.11	=	58.12	(76)
East	0.9x 0.77	x	1.42	x	115.77	x	0.47	x	1.11	=	59.49	(76)
East	0.9x 0.77	x	1.42	x	110.22	x	0.47	x	1.11	=	56.64	(76)
East	0.9x 0.77	x	1.42	x	94.68	x	0.47	x	1.11	=	48.65	(76)
East	0.9x 0.77	x	1.42	x	73.59	x	0.47	x	1.11	=	37.82	(76)
East	0.9x 0.77	x	1.42	x	45.59	x	0.47	x	1.11	=	23.43	(76)
East	0.9x 0.77	x	1.42	x	24.49	x	0.47	x	1.11	=	12.58	(76)
East	0.9x 0.77	x	1.42	x	16.15	x	0.47	x	1.11	=	8.3	(76)
South	0.9x 0.77	x	7.52	x	46.75	x	0.47	x	1.11	=	127.24	(78)
South	0.9x 0.77	x	7.52	x	76.57	x	0.47	x	1.11	=	208.38	(78)
South	0.9x 0.77	x	7.52	x	97.53	x	0.47	x	1.11	=	265.44	(78)
South	0.9x 0.77	x	7.52	x	110.23	x	0.47	x	1.11	=	300	(78)
South	0.9x 0.77	x	7.52	x	114.87	x	0.47	x	1.11	=	312.62	(78)
South	0.9x 0.77	x	7.52	x	110.55	x	0.47	x	1.11	=	300.85	(78)
South	0.9x 0.77	x	7.52	x	108.01	x	0.47	x	1.11	=	293.95	(78)
South	0.9x 0.77	x	7.52	x	104.89	x	0.47	x	1.11	=	285.47	(78)
South	0.9x 0.77	x	7.52	x	101.89	x	0.47	x	1.11	=	277.28	(78)
South	0.9x 0.77	x	7.52	x	82.59	x	0.47	x	1.11	=	224.76	(78)
South	0.9x 0.77	x	7.52	x	55.42	x	0.47	x	1.11	=	150.82	(78)
South	0.9x 0.77	x	7.52	x	40.4	x	0.47	x	1.11	=	109.94	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	160.73	272.84	373.93	469.47	535.14	536.34	514.91	464.49	406.45	301.41	192.27	137.75

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	636.83	746.67	832.37	902.98	943.14	894.94	857.79	813.79	768.68	713.8	633.54	600.89

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.98	0.97	0.94	0.88	0.78	0.64	0.49	0.53	0.74	0.9	0.97	0.98

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.95	20.2	20.47	20.72	20.86	20.91	20.9	20.79	20.5	20.07	19.74

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.86	0.73	0.57	0.4	0.44	0.68	0.88	0.96	0.98

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.7	19.05	19.44	19.76	19.92	19.97	19.97	19.86	19.47	18.88	18.38

(90)

fLA = Living area ÷ (4) = 0.31 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.09	19.4	19.76	20.05	20.21	20.26	20.25	20.15	19.79	19.24	18.8

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.09	19.4	19.76	20.05	20.21	20.26	20.25	20.15	19.79	19.24	18.8

(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.97	0.95	0.92	0.85	0.73	0.58	0.41	0.45	0.68	0.87	0.95	0.98

(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	618.98	710.83	763.47	767.32	691.26	515.58	354.19	369.47	523.13	621.51	603.88	586.86

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1447.05	1407.92	1280.45	1077.65	829	556.74	363.22	382.45	600.42	912.02	1205.34	1448.77

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	616.09	468.44	384.64	223.44	102.48	0	0	0	0	216.14	433.05	641.26

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3085.54 (98)

Space heating requirement in kWh/m²/year 30.74 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		258.21 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	616.09	468.44	384.64	223.44	102.48	0	0	0	0	216.14	433.05	641.26	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	238.6	181.42	148.96	86.53	39.69	0	0	0	0	83.71	167.71	248.35	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1194.96 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	216.95	191.32	201.16	180.64	177.25	0	0	0	0	187.3	197.65	211.84	

Efficiency of water heater 282.62 (216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	76.76	67.69	71.17	63.91	62.72	0	0	0	0	66.27	69.93	74.96	

Total = Sum(219a)$_{1...12}$ = 553.42 (219)

Water heating requirement (immersion)

	0	0	0	0	0	136.2	129.47	143.9	144.22	0	0	0	

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	136.2	129.47	143.9	144.22	0	0	0	

Total = Sum(219a)$_{1...12}$ = 553.79 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1194.96
Water heating fuel used		553.42
Water heating fuel used (Immersion)		553.79
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	47.43	(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		47.43 (231)
Electricity for lighting		416.7 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2212.52 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year

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Space heating (main system 1)	(211) x	0.519	=	620.19	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	287.23	(264)
Water heating (Immersion)	(219) x	0.519	=	287.42	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1194.83	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	24.62	(267)
Electricity for lighting	(232) x	0.519	=	216.26	(268)
Total CO2, kg/year	sum of (265)…(271) =			1435.71	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			14.31	(273)
EI rating (section 14)				87	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Cartographer Semi (ASHP)

Address : HT Cartographer Semi (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50.18 (1a)	x	2.4 (2a)	=	120.43	(3a)
First floor	50.18 (1b)	x	2.61 (2b)	=	130.97	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	100.36 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		251.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.16	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.41	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.35	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.44	0.43	0.43	0.38	0.37	0.33	0.33	0.32	0.35	0.37	0.39	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.58	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 2			1.42	x1/[1/(1.4)+ 0.04]		=	1.88			(27)
Windows Type 3			7.52	x1/[1/(1.4)+ 0.04]		=	9.97			(27)
Floor			50.18	x	0.13	=	6.5234			(28)
Walls	100.82	17.17	83.65	x	0.18	=	15.06			(29)
Roof	50.18	0	50.18	x	0.13	=	6.52			(30)
Total area of elements, m²			201.18							(31)
Party wall			45.71	x	0	=	0			(32)
Internal wall **			190.37							(32c)
Internal floor			50.18							(32d)
Internal ceiling			50.18							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.6 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14359.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.4 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 61 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.64	49.32	49.01	47.55	47.28	46.01	46.01	45.77	46.5	47.28	47.83	48.41	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.63	110.32	110	108.55	108.27	107	107	106.77	107.49	108.27	108.83	109.4	

Average = Sum(39)$_{1...12}$ /12= 108.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.1	1.1	1.08	1.08	1.07	1.07	1.06	1.07	1.08	1.08	1.09	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.74 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 99.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	109.28	105.3	101.33	97.36	93.38	89.41	89.41	93.38	97.36	101.33	105.3	109.28	

Total = Sum(44)$_{1...12}$ = 1192.11 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	162.05	141.73	146.26	127.51	122.35	105.58	97.83	112.26	113.61	132.4	144.52	156.94	

Total = Sum(45)$_{1...12}$ = 1563.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.31	21.26	21.94	19.13	18.35	15.84	14.67	16.84	17.04	19.86	21.68	23.54	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	208.65	183.82	192.85	172.6	168.94	150.67	144.43	158.86	158.7	178.99	189.61	203.54	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	208.65	183.82	192.85	172.6	168.94	150.67	144.43	158.86	158.7	178.99	189.61	203.54	

Output from water heater (annual)$_{1...12}$	2111.66	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.16	80.79	85.91	78.47	77.96	71.18	69.81	74.6	73.85	81.3	84.13	89.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	137.14	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.6	20.96	17.04	12.9	9.65	8.14	8.8	11.44	15.35	19.49	22.75	24.25	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	256.91	259.57	252.86	238.55	220.5	203.53	192.2	189.53	196.25	210.55	228.61	245.57	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	36.71	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	-109.71	(71)

Water heating gains (Table 5)

(72)m=	122.53	120.23	115.47	108.99	104.78	98.86	93.82	100.27	102.57	109.27	116.84	120.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	470.17	467.9	452.51	427.59	402.07	377.68	361.96	368.39	381.31	406.46	435.34	457.21	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.08	x	10.63	x	0.63	x	0.7	=	19.76	(74)
North	0.9x 0.77	x	6.08	x	20.32	x	0.63	x	0.7	=	37.76	(74)
North	0.9x 0.77	x	6.08	x	34.53	x	0.63	x	0.7	=	64.16	(74)
North	0.9x 0.77	x	6.08	x	55.46	x	0.63	x	0.7	=	103.06	(74)
North	0.9x 0.77	x	6.08	x	74.72	x	0.63	x	0.7	=	138.83	(74)
North	0.9x 0.77	x	6.08	x	79.99	x	0.63	x	0.7	=	148.62	(74)
North	0.9x 0.77	x	6.08	x	74.68	x	0.63	x	0.7	=	138.76	(74)
North	0.9x 0.77	x	6.08	x	59.25	x	0.63	x	0.7	=	110.09	(74)
North	0.9x 0.77	x	6.08	x	41.52	x	0.63	x	0.7	=	77.14	(74)
North	0.9x 0.77	x	6.08	x	24.19	x	0.63	x	0.7	=	44.95	(74)
North	0.9x 0.77	x	6.08	x	13.12	x	0.63	x	0.7	=	24.37	(74)
North	0.9x 0.77	x	6.08	x	8.86	x	0.63	x	0.7	=	16.47	(74)
East	0.9x 0.77	x	1.42	x	19.64	x	0.63	x	0.7	=	8.52	(76)
East	0.9x 0.77	x	1.42	x	38.42	x	0.63	x	0.7	=	16.67	(76)
East	0.9x 0.77	x	1.42	x	63.27	x	0.63	x	0.7	=	27.46	(76)
East	0.9x 0.77	x	1.42	x	92.28	x	0.63	x	0.7	=	40.05	(76)
East	0.9x 0.77	x	1.42	x	113.09	x	0.63	x	0.7	=	49.08	(76)
East	0.9x 0.77	x	1.42	x	115.77	x	0.63	x	0.7	=	50.24	(76)
East	0.9x 0.77	x	1.42	x	110.22	x	0.63	x	0.7	=	47.83	(76)
East	0.9x 0.77	x	1.42	x	94.68	x	0.63	x	0.7	=	41.09	(76)
East	0.9x 0.77	x	1.42	x	73.59	x	0.63	x	0.7	=	31.94	(76)
East	0.9x 0.77	x	1.42	x	45.59	x	0.63	x	0.7	=	19.78	(76)
East	0.9x 0.77	x	1.42	x	24.49	x	0.63	x	0.7	=	10.63	(76)
East	0.9x 0.77	x	1.42	x	16.15	x	0.63	x	0.7	=	7.01	(76)
South	0.9x 0.77	x	7.52	x	46.75	x	0.63	x	0.7	=	107.45	(78)
South	0.9x 0.77	x	7.52	x	76.57	x	0.63	x	0.7	=	175.97	(78)
South	0.9x 0.77	x	7.52	x	97.53	x	0.63	x	0.7	=	224.15	(78)
South	0.9x 0.77	x	7.52	x	110.23	x	0.63	x	0.7	=	253.34	(78)
South	0.9x 0.77	x	7.52	x	114.87	x	0.63	x	0.7	=	264	(78)
South	0.9x 0.77	x	7.52	x	110.55	x	0.63	x	0.7	=	254.06	(78)
South	0.9x 0.77	x	7.52	x	108.01	x	0.63	x	0.7	=	248.23	(78)
South	0.9x 0.77	x	7.52	x	104.89	x	0.63	x	0.7	=	241.07	(78)
South	0.9x 0.77	x	7.52	x	101.89	x	0.63	x	0.7	=	234.15	(78)
South	0.9x 0.77	x	7.52	x	82.59	x	0.63	x	0.7	=	189.8	(78)
South	0.9x 0.77	x	7.52	x	55.42	x	0.63	x	0.7	=	127.36	(78)
South	0.9x 0.77	x	7.52	x	40.4	x	0.63	x	0.7	=	92.84	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	135.73	230.4	315.77	396.45	451.91	452.93	434.82	392.24	343.23	254.53	162.36	116.32	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	605.9	698.31	768.28	824.04	853.98	830.6	796.79	760.63	724.54	660.99	597.7	573.53	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.9	0.75	0.58	0.62	0.85	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.98	20.21	20.51	20.78	20.94	20.99	20.98	20.88	20.54	20.13	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.02	20.02	20.03	20.03	20.03	20.02	20.02	20.01	20.01	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.86	0.66	0.46	0.5	0.78	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.43	18.66	18.99	19.43	19.79	19.99	20.02	20.02	19.93	19.49	18.89	18.41	(90)

fLA = Living area ÷ (4) = | 0.31 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.86	19.06	19.37	19.76	20.09	20.28	20.32	20.32	20.22	19.81	19.27	18.83	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.86	19.06	19.37	19.76	20.09	20.28	20.32	20.32	20.22	19.81	19.27	18.83	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.87	0.69	0.49	0.54	0.8	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	603.55	692.46	753.52	782.22	739.53	572.25	393.16	410.48	578.64	633.63	592.71	571.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1610.94	1562.4	1415.56	1179.15	908.75	607.95	398.11	418.34	657.95	997.23	1324.4	1601.09	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	749.5	584.6	492.55	285.79	125.89	0	0	0	0	270.51	526.82	765.76	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 3801.43 | (98)

Space heating requirement in kWh/m²/year | 37.88 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = | 1 | (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = | 1 | (204)

Efficiency of main space heating system 1 | 93.5 | (206)

Efficiency of secondary/supplementary heating system, % | 0 | (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	749.5	584.6	492.55	285.79	125.89	0	0	0	0	270.51	526.82	765.76	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	801.6	625.24	526.8	305.66	134.65	0	0	0	0	289.32	563.44	818.99	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													4065.7 (211)
Space heating fuel (secondary), kWh/month													
= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)													
	208.65	183.82	192.85	172.6	168.94	150.67	144.43	158.86	158.7	178.99	189.61	203.54	
Efficiency of water heater													79.8 (216)
(217)m=	87.93	87.69	87.21	86.15	84.04	79.8	79.8	79.8	79.8	85.91	87.4	88.02	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	237.28	209.63	221.13	200.35	201.02	188.81	180.99	199.07	198.87	208.34	216.95	231.23	
Total = Sum(219a)$_{1...12}$ =													2493.68 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4065.7
Water heating fuel used		2493.68
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30 (230c)	
boiler with a fan-assisted flue	45 (230e)	
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75 (231)
Electricity for lighting		416.7 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7051.07 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	878.19	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	538.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1416.83	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	216.26	(268)
Total CO2, kg/year	sum of (265)…(271) =				1672.02	(272)

TER = 24.42 (273)

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DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Hillard Det

Address : HT Hillard Det

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.28 (1a)	x	2.39 (2a)	=	115.39	(3a)
First floor	48.28 (1b)	x	2.61 (2b)	=	126.01	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.56 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		241.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			4.2	x1/[1/(1.2)+ 0.04]		=	4.81			(27)
Windows Type 2			7.47	x1/[1/(1.2)+ 0.04]		=	8.55			(27)
Floor			48.28	x	0.1	=	4.828	75	3621	(28)
Walls	143.63	13.82	129.81	x	0.25	=	32.45	60	7788.6	(29)
Roof	48.28	0	48.28	x	0.09	=	4.35	9	434.52	(30)
Total area of elements, m²			240.19							(31)
Internal wall **			187.41					9	1686.69	(32c)
Internal floor			48.28					18	869.04	(32d)
Internal ceiling			48.28					9	434.52	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 57.78 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14834.37 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 153.63 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.38 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 64.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.99	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	39.83	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	104.15	103.99	103.99	103.99	103.99	103.99	103.99	103.99	103.99	103.99	103.99	103.99	

Average = Sum(39)$_{1...12}$ /12= 104 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 98.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	108.3	104.36	100.42	96.48	92.54	88.61	88.61	92.54	96.48	100.42	104.36	108.3	

Total = Sum(44)$_{1...12}$ = 1181.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.6	140.46	144.94	126.37	121.25	104.63	96.96	111.26	112.59	131.21	143.22	155.53	

Total = Sum(45)$_{1...12}$ = 1549.02 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.09	21.07	21.74	18.95	18.19	15.69	14.54	16.69	16.89	19.68	21.48	23.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	165.66	145.03	150	131.26	126.31	109.53	102.02	116.32	117.48	136.27	148.12	160.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-55.96	-49.24	-50.25	-41.35	-38.39	-31.67	-26.8	-32.45	-33.4	-41.29	-47.83	-54.09	(63) (G10)

Output from water heater

(64)m=	109.7	95.79	99.75	89.92	87.92	77.86	75.21	83.87	84.09	94.98	100.29	106.5	

Output from water heater (annual)$_{1...12}$ 1105.88 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.66	47.85	49.46	43.24	41.58	36.01	33.5	38.26	38.66	44.89	48.85	52.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.86	21.19	17.23	13.05	9.75	8.23	8.9	11.56	15.52	19.71	23	24.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	250.64	253.24	246.69	232.74	215.12	198.57	187.51	184.91	191.46	205.42	223.03	239.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	(71)

Water heating gains (Table 5)

(72)m=	73.47	71.2	66.48	60.06	55.89	50.02	45.03	51.42	53.69	60.34	67.84	71.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	414.55	412.21	396.98	372.42	347.34	323.4	308.02	314.48	327.26	352.04	380.45	401.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	4.2	x	10.63	x	0.47	x	1.11	=	16.16	(74)
North	0.9x 0.77	x	4.2	x	20.32	x	0.47	x	1.11	=	30.89	(74)
North	0.9x 0.77	x	4.2	x	34.53	x	0.47	x	1.11	=	52.49	(74)
North	0.9x 0.77	x	4.2	x	55.46	x	0.47	x	1.11	=	84.3	(74)
North	0.9x 0.77	x	4.2	x	74.72	x	0.47	x	1.11	=	113.57	(74)
North	0.9x 0.77	x	4.2	x	79.99	x	0.47	x	1.11	=	121.58	(74)
North	0.9x 0.77	x	4.2	x	74.68	x	0.47	x	1.11	=	113.51	(74)
North	0.9x 0.77	x	4.2	x	59.25	x	0.47	x	1.11	=	90.05	(74)
North	0.9x 0.77	x	4.2	x	41.52	x	0.47	x	1.11	=	63.1	(74)
North	0.9x 0.77	x	4.2	x	24.19	x	0.47	x	1.11	=	36.77	(74)
North	0.9x 0.77	x	4.2	x	13.12	x	0.47	x	1.11	=	19.94	(74)
North	0.9x 0.77	x	4.2	x	8.86	x	0.47	x	1.11	=	13.47	(74)
South	0.9x 0.77	x	7.47	x	46.75	x	0.47	x	1.11	=	126.39	(78)
South	0.9x 0.77	x	7.47	x	76.57	x	0.47	x	1.11	=	206.99	(78)
South	0.9x 0.77	x	7.47	x	97.53	x	0.47	x	1.11	=	263.67	(78)
South	0.9x 0.77	x	7.47	x	110.23	x	0.47	x	1.11	=	298.01	(78)
South	0.9x 0.77	x	7.47	x	114.87	x	0.47	x	1.11	=	310.54	(78)
South	0.9x 0.77	x	7.47	x	110.55	x	0.47	x	1.11	=	298.85	(78)
South	0.9x 0.77	x	7.47	x	108.01	x	0.47	x	1.11	=	292	(78)
South	0.9x 0.77	x	7.47	x	104.89	x	0.47	x	1.11	=	283.57	(78)
South	0.9x 0.77	x	7.47	x	101.89	x	0.47	x	1.11	=	275.44	(78)
South	0.9x 0.77	x	7.47	x	82.59	x	0.47	x	1.11	=	223.26	(78)
South	0.9x 0.77	x	7.47	x	55.42	x	0.47	x	1.11	=	149.81	(78)
South	0.9x 0.77	x	7.47	x	40.4	x	0.47	x	1.11	=	109.21	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.55	237.88	316.16	382.31	424.11	420.43	405.51	373.62	338.54	260.03	169.75	122.69	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.11	650.09	713.14	754.73	771.45	743.83	713.52	688.1	665.8	612.07	550.21	524.58	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.93	0.86	0.74	0.59	0.63	0.81	0.94	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.31	19.52	19.83	20.21	20.57	20.83	20.95	20.93	20.75	20.28	19.71	19.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.91	0.83	0.67	0.48	0.52	0.75	0.92	0.98	0.99	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.75	18.06	18.51	19.05	19.55	19.88	19.99	19.98	19.78	19.15	18.34	17.67	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.04	18.33	18.75	19.26	19.74	20.05	20.17	20.15	19.96	19.36	18.59	17.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.89	18.18	18.6	19.11	19.59	19.9	20.02	20	19.81	19.21	18.44	17.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.94	0.9	0.81	0.66	0.48	0.52	0.74	0.9	0.97	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	545.58	627.28	671.07	675.54	623.19	487.61	340.61	354.94	491.08	553.65	531.38	515.6	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1415	1381.1	1258.55	1061.89	819.97	551.53	355.26	374.8	593.77	895.63	1179.24	1415.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	646.85	506.57	437.08	278.17	146.4	0	0	0	0	254.44	466.46	669.4	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3405.37 (98)

Space heating requirement in kWh/m²/year 35.27 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	646.85	506.57	437.08	278.17	146.4	0	0	0	0	254.44	466.46	669.4	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	714.75	559.75	482.96	307.37	161.77	0	0	0	0	281.15	515.42	739.67	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3762.84 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	109.7	95.79	99.75	89.92	87.92	77.86	75.21	83.87	84.09	94.98	100.29	106.5

Efficiency of water heater 87.3 (216)

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(217)m=	90.02	89.98	89.89	89.7	89.27	87.3	87.3	87.3	87.3	89.61	89.92	90.05

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	121.86	106.47	110.97	100.24	98.49	89.18	86.16	96.07	96.32	106	111.54	118.28

Total = Sum(219a)$_{1...12}$ = 1241.56 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3762.84	
Water heating fuel used		1241.56	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	44.81		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	119.81	(231)
Electricity for lighting		421.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5545.54	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	812.77	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	268.18	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1080.95	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.18	(267)
Electricity for lighting	(232) x	0.519	=	218.67	(268)
Total CO2, kg/year	sum of (265)…(271) =			1361.8	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			14.1	(273)
EI rating (section 14)				87	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Hillard Det

Address : HT Hillard Det

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.28 (1a)	x	2.39 (2a)	=	115.39	(3a)
First floor	48.28 (1b)	x	2.61 (2b)	=	126.01	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.56 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		241.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 2			7.47	x1/[1/(1.4)+ 0.04]		=	9.9			(27)
Floor			48.28	x	0.13	=	6.2764			(28)
Walls	143.63	13.82	129.81	x	0.18	=	23.37			(29)
Roof	48.28	0	48.28	x	0.13	=	6.28			(30)
Total area of elements, m²			240.19							(31)
Internal wall **			187.41							(32c)
Internal floor			48.28							(32d)
Internal ceiling			48.28							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 53.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14834.37 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.19 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 64.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.38	46.13	45.88	44.71	44.49	43.47	43.47	43.28	43.86	44.49	44.93	45.4	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.55	110.29	110.04	108.87	108.65	107.63	107.63	107.44	108.03	108.65	109.1	109.56	

Average = Sum(39)$_{1...12}$ /12= 108.87 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.14	1.14	1.13	1.13	1.11	1.11	1.11	1.12	1.13	1.13	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 98.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	108.3	104.36	100.42	96.48	92.54	88.61	88.61	92.54	96.48	100.42	104.36	108.3	

Total = Sum(44)$_{1...12}$ = 1181.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.6	140.46	144.94	126.37	121.25	104.63	96.96	111.26	112.59	131.21	143.22	155.53	

Total = Sum(45)$_{1...12}$ = 1549.02 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.09	21.07	21.74	18.95	18.19	15.69	14.54	16.69	16.89	19.68	21.48	23.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0 (51)

If community heating see section 4.3

Volume factor from Table 2a 0 (52)

Temperature factor from Table 2b 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

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Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.96	47.58	47.16	43.7	45.15	47.16	47.58	50.96	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.56	186.49	195.9	173.95	168.41	148.33	142.11	158.42	160.17	182.17	192.54	206.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	211.56	186.49	195.9	173.95	168.41	148.33	142.11	158.42	160.17	182.17	192.54	206.49	

Output from water heater (annual)$_{1...12}$ 2126.53 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	66.14	58.21	60.93	53.91	52.11	45.71	43.53	48.78	49.33	56.37	59.95	64.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.86	21.19	17.23	13.05	9.75	8.23	8.9	11.56	15.52	19.71	23	24.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	250.64	253.24	246.69	232.74	215.12	198.57	187.51	184.91	191.46	205.42	223.03	239.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	(71)

Water heating gains (Table 5)

(72)m=	88.9	86.62	81.9	74.88	70.03	63.49	58.5	65.57	68.51	75.76	83.27	86.63	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	429.98	427.64	412.4	387.24	361.49	336.87	321.49	328.62	342.08	367.47	395.88	417.32	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.2	x	10.63	x	0.63	x	0.7	=	13.65	(74)
North	0.9x	0.77	x	4.2	x	20.32	x	0.63	x	0.7	=	26.08	(74)
North	0.9x	0.77	x	4.2	x	34.53	x	0.63	x	0.7	=	44.32	(74)
North	0.9x	0.77	x	4.2	x	55.46	x	0.63	x	0.7	=	71.19	(74)
North	0.9x	0.77	x	4.2	x	74.72	x	0.63	x	0.7	=	95.9	(74)
North	0.9x	0.77	x	4.2	x	79.99	x	0.63	x	0.7	=	102.67	(74)
North	0.9x	0.77	x	4.2	x	74.68	x	0.63	x	0.7	=	95.85	(74)
North	0.9x	0.77	x	4.2	x	59.25	x	0.63	x	0.7	=	76.05	(74)
North	0.9x	0.77	x	4.2	x	41.52	x	0.63	x	0.7	=	53.29	(74)
North	0.9x	0.77	x	4.2	x	24.19	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	4.2	x	13.12	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	4.2	x	8.86	x	0.63	x	0.7	=	11.38	(74)
South	0.9x	0.77	x	7.47	x	46.75	x	0.63	x	0.7	=	106.73	(78)
South	0.9x	0.77	x	7.47	x	76.57	x	0.63	x	0.7	=	174.8	(78)
South	0.9x	0.77	x	7.47	x	97.53	x	0.63	x	0.7	=	222.66	(78)
South	0.9x	0.77	x	7.47	x	110.23	x	0.63	x	0.7	=	251.66	(78)
South	0.9x	0.77	x	7.47	x	114.87	x	0.63	x	0.7	=	262.24	(78)
South	0.9x	0.77	x	7.47	x	110.55	x	0.63	x	0.7	=	252.37	(78)
South	0.9x	0.77	x	7.47	x	108.01	x	0.63	x	0.7	=	246.58	(78)
South	0.9x	0.77	x	7.47	x	104.89	x	0.63	x	0.7	=	239.47	(78)
South	0.9x	0.77	x	7.47	x	101.89	x	0.63	x	0.7	=	232.6	(78)
South	0.9x	0.77	x	7.47	x	82.59	x	0.63	x	0.7	=	188.54	(78)
South	0.9x	0.77	x	7.47	x	55.42	x	0.63	x	0.7	=	126.51	(78)
South	0.9x	0.77	x	7.47	x	40.4	x	0.63	x	0.7	=	92.23	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	120.38	200.88	266.99	322.85	358.15	355.04	342.44	315.51	285.89	219.59	143.35	103.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	550.36	628.52	679.39	710.09	719.64	691.91	663.93	644.14	627.97	587.05	539.23	520.92	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C): 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.94	0.84	0.67	0.71	0.9	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.74	19.88	20.1	20.39	20.68	20.89	20.97	20.96	20.82	20.46	20.04	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	1	0.99	0.97	0.91	0.76	0.54	0.58	0.84	0.97	1	1	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.28	18.49	18.81	19.24	19.63	19.91	19.98	19.97	19.83	19.34	18.74	18.25	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.55	18.75	19.05	19.45	19.83	20.09	20.16	20.16	20.02	19.55	18.98	18.52	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.55	18.75	19.05	19.45	19.83	20.09	20.16	20.16	20.02	19.55	18.98	18.52	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.91	0.76	0.56	0.6	0.84	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	548.57	624.33	669.75	685.55	654.12	529.29	373.49	389.37	530.21	568.58	535.6	519.63	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1575.13	1527.13	1381.19	1148.95	883.01	590.82	383.39	403.7	639.06	972.13	1295.8	1568.7	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	763.75	606.68	529.31	333.65	170.3	0	0	0	0	300.25	547.34	780.51	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4031.78 (98)

Space heating requirement in kWh/m²/year 41.75 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	763.75	606.68	529.31	333.65	170.3	0	0	0	0	300.25	547.34	780.51	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	817.72	649.55	566.72	357.22	182.33	0	0	0	0	321.46	586.02	835.66	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4316.68 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	211.56	186.49	195.9	173.95	168.41	148.33	142.11	158.42	160.17	182.17	192.54	206.49

Efficiency of water heater 80.3 (216)

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(217)m=	88	87.8	87.43	86.66	85.08	80.3	80.3	80.3	80.3	86.3	87.53	88.08

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	240.41	212.39	224.07	200.71	197.95	184.72	176.97	197.28	199.46	211.08	219.96	234.43

Total = Sum(219a)$_{1...12}$ = 2499.44 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4316.68	
Water heating fuel used		2499.44	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		421.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7312.45	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	932.4	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	539.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1472.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	218.67	(268)
Total CO2, kg/year	sum of (265)…(271) =				1729.88	(272)

TER = 17.92 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Hillard Semi

Address : HT Hillard Semi

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.28 (1a)	x	2.4 (2a)	=	115.87	(3a)
First floor	48.28 (1b)	x	2.61 (2b)	=	126.01	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.56 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		241.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			4.2	x	1/[1/(1.2)+ 0.04]	=	4.81			(27)
Windows Type 2			7.47	x	1/[1/(1.2)+ 0.04]	=	8.55			(27)
Floor			48.28	x	0.1	=	4.828	75	3621	(28)
Walls	98.92	13.82	85.1	x	0.25	=	21.27	60	5106	(29)
Roof	48.28	0	48.28	x	0.09	=	4.35	9	434.52	(30)
Total area of elements, m²			195.48							(31)
Party wall			44.71	x	0	=	0	45	2011.95	(32)
Internal wall **			187.41					9	1686.69	(32c)
Internal floor			48.28					18	869.04	(32d)
Internal ceiling			48.28					9	434.52	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.61 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14163.72 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 146.68 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

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Thermal bridges : S (L x Y) calculated using Appendix K | 6.79 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.39 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.07	39.91	39.91	39.91	39.91	39.91	39.91	39.91	39.91	39.91	39.91	39.91	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.46	93.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3	93.3	

Average = Sum(39)$_{1...12}$ /12= | 93.32 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	

Average = Sum(40)$_{1...12}$ /12= | 0.97 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.71 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 98.45 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	108.3	104.36	100.42	96.48	92.54	88.61	88.61	92.54	96.48	100.42	104.36	108.3	

Total = Sum(44)$_{1...12}$ = | 1181.42 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.6	140.46	144.94	126.37	121.25	104.63	96.96	111.26	112.59	131.21	143.22	155.53	

Total = Sum(45)$_{1...12}$ = | 1549.02 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.09	21.07	21.74	18.95	18.19	15.69	14.54	16.69	16.89	19.68	21.48	23.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	165.66	145.03	150	131.26	126.31	109.53	102.02	116.32	117.48	136.27	148.12	160.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-55.96	-49.24	-50.25	-41.35	-38.39	-31.67	-26.8	-32.45	-33.4	-41.29	-47.83	-54.09	(63) (G10)

Output from water heater

(64)m=	109.7	95.79	99.75	89.92	87.92	77.86	75.21	83.87	84.09	94.98	100.29	106.5	

Output from water heater (annual)$_{1...12}$	1105.88	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.66	47.85	49.46	43.24	41.58	36.01	33.5	38.26	38.66	44.89	48.85	52.98	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.86	21.19	17.23	13.05	9.75	8.23	8.9	11.56	15.52	19.71	23	24.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	250.64	253.24	246.69	232.74	215.12	198.57	187.51	184.91	191.46	205.42	223.03	239.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	(71)

Water heating gains (Table 5)

(72)m=	73.47	71.2	66.48	60.06	55.89	50.02	45.03	51.42	53.69	60.34	67.84	71.21	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	414.55	412.21	396.98	372.42	347.34	323.4	308.02	314.48	327.26	352.04	380.45	401.89	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	4.2	x	10.63	x	0.47	x	1.11	=	16.16	(74)
North	0.9x 0.77	x	4.2	x	20.32	x	0.47	x	1.11	=	30.89	(74)
North	0.9x 0.77	x	4.2	x	34.53	x	0.47	x	1.11	=	52.49	(74)
North	0.9x 0.77	x	4.2	x	55.46	x	0.47	x	1.11	=	84.3	(74)
North	0.9x 0.77	x	4.2	x	74.72	x	0.47	x	1.11	=	113.57	(74)
North	0.9x 0.77	x	4.2	x	79.99	x	0.47	x	1.11	=	121.58	(74)
North	0.9x 0.77	x	4.2	x	74.68	x	0.47	x	1.11	=	113.51	(74)
North	0.9x 0.77	x	4.2	x	59.25	x	0.47	x	1.11	=	90.05	(74)
North	0.9x 0.77	x	4.2	x	41.52	x	0.47	x	1.11	=	63.1	(74)
North	0.9x 0.77	x	4.2	x	24.19	x	0.47	x	1.11	=	36.77	(74)
North	0.9x 0.77	x	4.2	x	13.12	x	0.47	x	1.11	=	19.94	(74)
North	0.9x 0.77	x	4.2	x	8.86	x	0.47	x	1.11	=	13.47	(74)
South	0.9x 0.77	x	7.47	x	46.75	x	0.47	x	1.11	=	126.39	(78)
South	0.9x 0.77	x	7.47	x	76.57	x	0.47	x	1.11	=	206.99	(78)
South	0.9x 0.77	x	7.47	x	97.53	x	0.47	x	1.11	=	263.67	(78)
South	0.9x 0.77	x	7.47	x	110.23	x	0.47	x	1.11	=	298.01	(78)
South	0.9x 0.77	x	7.47	x	114.87	x	0.47	x	1.11	=	310.54	(78)
South	0.9x 0.77	x	7.47	x	110.55	x	0.47	x	1.11	=	298.85	(78)
South	0.9x 0.77	x	7.47	x	108.01	x	0.47	x	1.11	=	292	(78)
South	0.9x 0.77	x	7.47	x	104.89	x	0.47	x	1.11	=	283.57	(78)
South	0.9x 0.77	x	7.47	x	101.89	x	0.47	x	1.11	=	275.44	(78)
South	0.9x 0.77	x	7.47	x	82.59	x	0.47	x	1.11	=	223.26	(78)
South	0.9x 0.77	x	7.47	x	55.42	x	0.47	x	1.11	=	149.81	(78)
South	0.9x 0.77	x	7.47	x	40.4	x	0.47	x	1.11	=	109.21	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	142.55	237.88	316.16	382.31	424.11	420.43	405.51	373.62	338.54	260.03	169.75	122.69	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.11	650.09	713.14	754.73	771.45	743.83	713.52	688.1	665.8	612.07	550.21	524.58	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.92	0.84	0.7	0.54	0.58	0.78	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.46	19.68	19.98	20.34	20.66	20.88	20.97	20.95	20.81	20.39	19.85	19.41	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	20.11	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.97	0.95	0.9	0.8	0.63	0.45	0.48	0.72	0.91	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.04	18.36	18.79	19.29	19.74	20.01	20.09	20.08	19.93	19.38	18.6	17.96	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.31	18.6	19.01	19.49	19.91	20.17	20.25	20.24	20.09	19.56	18.83	18.23	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.16	18.45	18.86	19.34	19.76	20.02	20.1	20.09	19.94	19.41	18.68	18.08	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.93	0.88	0.78	0.62	0.45	0.48	0.71	0.89	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	544.08	624.01	664.77	663.73	603.13	461.56	317.56	331.86	470.49	545.1	528.75	514.48	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1294.98	1264.55	1153.23	973.69	751.8	505.62	326.81	344.66	545.1	822.27	1080.53	1294.83	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	558.67	430.44	363.41	223.17	110.62	0	0	0	0	206.21	397.28	580.58	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2870.38 (98)

Space heating requirement in kWh/m²/year 29.73 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	558.67	430.44	363.41	223.17	110.62	0	0	0	0	206.21	397.28	580.58	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	617.31	475.62	401.56	246.6	122.23	0	0	0	0	227.86	438.98	641.52	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3171.69 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	109.7	95.79	99.75	89.92	87.92	77.86	75.21	83.87	84.09	94.98	100.29	106.5

Efficiency of water heater: 87.3 (216)

(217)m= 89.96 | 89.9 | 89.79 | 89.56 | 89.05 | 87.3 | 87.3 | 87.3 | 87.3 | 89.47 | 89.84 | 89.99 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 121.94 | 106.56 | 111.09 | 100.4 | 98.73 | 89.18 | 86.16 | 96.07 | 96.32 | 106.16 | 111.64 | 118.35

Total = Sum(219a)$_{1...12}$ = 1242.6 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3171.69	
Water heating fuel used		1242.6	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	44.89		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		119.89	(231)
Electricity for lighting		421.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4955.52	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	685.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	268.4	(264)
Space and water heating	(261) + (262) + (263) + (264) =			953.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	62.23	(267)
Electricity for lighting	(232) x	0.519	=	218.67	(268)
Total CO2, kg/year	sum of (265)…(271) =			1234.39	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			12.78	(273)
EI rating (section 14)				88	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Hillard Semi

Address : HT Hillard Semi

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.28 (1a)	x	2.4 (2a)	=	115.87	(3a)
First floor	48.28 (1b)	x	2.61 (2b)	=	126.01	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.56 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		241.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			4.2	x1/[1/(1.4)+ 0.04]		=	5.57			(27)
Windows Type 2			7.47	x1/[1/(1.4)+ 0.04]		=	9.9			(27)
Floor			48.28	x	0.13	=	6.2764			(28)
Walls	98.92	13.82	85.1	x	0.18	=	15.32			(29)
Roof	48.28	0	48.28	x	0.13	=	6.28			(30)
Total area of elements, m²			195.48							(31)
Party wall			44.71	x	0	=	0			(32)
Internal wall **			187.41							(32c)
Internal floor			48.28							(32d)
Internal ceiling			48.28							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.92 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14163.72 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

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Thermal bridges : S (L x Y) calculated using Appendix K — 9.71 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 55.63 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.47	46.21	45.96	44.79	44.57	43.55	43.55	43.36	43.94	44.57	45.02	45.48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	102.1	101.85	101.6	100.43	100.21	99.19	99.19	99	99.58	100.21	100.65	101.11	

Average = Sum(39)$_{1...12}$ /12= 100.42 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.06	1.05	1.05	1.04	1.04	1.03	1.03	1.03	1.03	1.04	1.04	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.71 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 98.45 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	108.3	104.36	100.42	96.48	92.54	88.61	88.61	92.54	96.48	100.42	104.36	108.3	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1181.42 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.6	140.46	144.94	126.37	121.25	104.63	96.96	111.26	112.59	131.21	143.22	155.53	

Total = Sum(45)$_{1...12}$ = 1549.02 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.09	21.07	21.74	18.95	18.19	15.69	14.54	16.69	16.89	19.68	21.48	23.33	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.96	47.58	47.16	43.7	45.15	47.16	47.58	50.96	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.56	186.49	195.9	173.95	168.41	148.33	142.11	158.42	160.17	182.17	192.54	206.49	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	211.56	186.49	195.9	173.95	168.41	148.33	142.11	158.42	160.17	182.17	192.54	206.49	

Output from water heater (annual)$_{1...12}$	2126.53	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	66.14	58.21	60.93	53.91	52.11	45.71	43.53	48.78	49.33	56.37	59.95	64.45	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	135.27	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.86	21.19	17.23	13.05	9.75	8.23	8.9	11.56	15.52	19.71	23	24.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	250.64	253.24	246.69	232.74	215.12	198.57	187.51	184.91	191.46	205.42	223.03	239.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	36.53	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	-108.21	(71)

Water heating gains (Table 5)

(72)m=	88.9	86.62	81.9	74.88	70.03	63.49	58.5	65.57	68.51	75.76	83.27	86.63	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	429.98	427.64	412.4	387.24	361.49	336.87	321.49	328.62	342.08	367.47	395.88	417.32	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	4.2	x	10.63	x	0.63	x	0.7	=	13.65	(74)
North	0.9x	0.77	x	4.2	x	20.32	x	0.63	x	0.7	=	26.08	(74)
North	0.9x	0.77	x	4.2	x	34.53	x	0.63	x	0.7	=	44.32	(74)
North	0.9x	0.77	x	4.2	x	55.46	x	0.63	x	0.7	=	71.19	(74)
North	0.9x	0.77	x	4.2	x	74.72	x	0.63	x	0.7	=	95.9	(74)
North	0.9x	0.77	x	4.2	x	79.99	x	0.63	x	0.7	=	102.67	(74)
North	0.9x	0.77	x	4.2	x	74.68	x	0.63	x	0.7	=	95.85	(74)
North	0.9x	0.77	x	4.2	x	59.25	x	0.63	x	0.7	=	76.05	(74)
North	0.9x	0.77	x	4.2	x	41.52	x	0.63	x	0.7	=	53.29	(74)
North	0.9x	0.77	x	4.2	x	24.19	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	4.2	x	13.12	x	0.63	x	0.7	=	16.84	(74)
North	0.9x	0.77	x	4.2	x	8.86	x	0.63	x	0.7	=	11.38	(74)
South	0.9x	0.77	x	7.47	x	46.75	x	0.63	x	0.7	=	106.73	(78)
South	0.9x	0.77	x	7.47	x	76.57	x	0.63	x	0.7	=	174.8	(78)
South	0.9x	0.77	x	7.47	x	97.53	x	0.63	x	0.7	=	222.66	(78)
South	0.9x	0.77	x	7.47	x	110.23	x	0.63	x	0.7	=	251.66	(78)
South	0.9x	0.77	x	7.47	x	114.87	x	0.63	x	0.7	=	262.24	(78)
South	0.9x	0.77	x	7.47	x	110.55	x	0.63	x	0.7	=	252.37	(78)
South	0.9x	0.77	x	7.47	x	108.01	x	0.63	x	0.7	=	246.58	(78)
South	0.9x	0.77	x	7.47	x	104.89	x	0.63	x	0.7	=	239.47	(78)
South	0.9x	0.77	x	7.47	x	101.89	x	0.63	x	0.7	=	232.6	(78)
South	0.9x	0.77	x	7.47	x	82.59	x	0.63	x	0.7	=	188.54	(78)
South	0.9x	0.77	x	7.47	x	55.42	x	0.63	x	0.7	=	126.51	(78)
South	0.9x	0.77	x	7.47	x	40.4	x	0.63	x	0.7	=	92.23	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	120.38	200.88	266.99	322.85	358.15	355.04	342.44	315.51	285.89	219.59	143.35	103.6	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	550.36	628.52	679.39	710.09	719.64	691.91	663.93	644.14	627.97	587.05	539.23	520.92	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.93	0.81	0.63	0.67	0.88	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	20	20.21	20.48	20.74	20.92	20.98	20.98	20.87	20.54	20.15	19.83	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.05	20.05	20.06	20.06	20.06	20.06	20.05	20.05	20.04	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.9	0.73	0.51	0.55	0.82	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.5	18.71	19.02	19.42	19.78	20	20.05	20.05	19.94	19.5	18.93	18.47	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.75	18.95	19.24	19.62	19.96	20.18	20.23	20.22	20.11	19.69	19.16	18.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.75	18.95	19.24	19.62	19.96	20.18	20.23	20.22	20.11	19.69	19.16	18.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.96	0.9	0.74	0.53	0.57	0.83	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	548.64	624.31	669.29	683.23	645.99	510.86	353.94	369.95	518.21	566.96	535.58	519.7	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1475.79	1430.75	1294.28	1076.33	827.33	552.97	359.68	378.54	598.96	911.34	1213.68	1468.68	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	689.8	541.93	464.99	283.04	134.92	0	0	0	0	256.21	488.23	706.04	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3565.16 (98)

Space heating requirement in kWh/m²/year 36.92 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	689.8	541.93	464.99	283.04	134.92	0	0	0	0	256.21	488.23	706.04	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	738.54	580.22	497.85	303.04	144.46	0	0	0	0	274.32	522.73	755.93	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3817.09 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	211.56	186.49	195.9	173.95	168.41	148.33	142.11	158.42	160.17	182.17	192.54	206.49

Efficiency of water heater: 80.3 (216)

(217)m=	87.81	87.58	87.15	86.27	84.5	80.3	80.3	80.3	80.3	85.91	87.29	87.9

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	240.93	212.94	224.79	201.63	199.3	184.72	176.97	197.28	199.46	212.05	220.56	234.92

Total = Sum(219a)$_{1...12}$ = 2505.55 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3817.09	
Water heating fuel used		2505.55	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		421.34	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6818.98	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	824.49	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	541.2	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1365.69	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	218.67	(268)
Total CO2, kg/year	sum of (265)…(271) =			1623.29	(272)

TER = 16.81 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Saddler

Address : HT Saddler

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	3.63 (1a)	x	2.63 (2a)	=	9.55	(3a)
First floor	65.12 (1b)	x	2.37 (2b)	=	154.33	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	68.75 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		163.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.13	x	1.3	=	2.769			(26)
Windows Type 1			5.25	x	1/[1/(1.2)+ 0.04]	=	6.01			(27)
Windows Type 2			3.04	x	1/[1/(1.2)+ 0.04]	=	3.48			(27)
Floor Type 1			3.63	x	0.1	=	0.363	75	272.25	(28)
Floor Type 2			61.49	x	0.17	=	10.4533	75	4611.75	(28)
Walls Type1	82.21	10.42	71.79	x	0.25	=	17.95	60	4307.4	(29)
Walls Type2	20.51	0	20.51	x	0.25	=	5.13	60	1230.6	(29)
Roof	65.12	0	65.12	x	0.09	=	5.86	9	586.08	(30)
Total area of elements, m²			232.96							(31)
Internal wall **			133.85					9	1204.65	(32c)
Internal floor			3.63					18	65.34	(32d)
Internal ceiling			3.63					9	32.67	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 52.01 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12310.74 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 179.07 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 14.06 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 66.07 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.15	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	27.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	93.22	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	93.11	

Average = Sum(39)$_{1...12}$ /12= 93.12 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.36	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	1.35	

Average = Sum(40)$_{1...12}$ /12= 1.35 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.22 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 86.82 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	95.5	92.02	88.55	85.08	81.61	78.13	78.13	81.61	85.08	88.55	92.02	95.5	

Total = Sum(44)$_{1...12}$ = 1041.79 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	141.62	123.86	127.81	111.43	106.92	92.26	85.5	98.11	99.28	115.7	126.3	137.15	

Total = Sum(45)$_{1...12}$ = 1365.95 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.24	18.58	19.17	16.71	16.04	13.84	12.82	14.72	14.89	17.36	18.94	20.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	146.68	128.43	132.87	116.33	111.98	97.16	90.56	103.17	104.18	120.76	131.19	142.21	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-44.73	-39.36	-40.17	-33.08	-30.72	-25.35	-21.47	-26	-26.75	-33.05	-38.26	-43.23	(63) (G10)

Output from water heater

(64)m=	101.95	89.08	92.7	83.25	81.26	71.81	69.08	77.17	77.43	87.71	92.94	98.98	

Output from water heater (annual)$_{1...12}$	1023.36	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	48.35	42.33	43.76	38.27	36.82	31.9	29.69	33.89	34.23	39.74	43.22	46.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.23	13.2	9.99	7.47	6.31	6.82	8.86	11.89	15.1	17.62	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	194.36	196.38	191.3	180.48	166.82	153.98	145.41	143.39	148.47	159.29	172.95	185.79	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	(71)

Water heating gains (Table 5)

(72)m=	64.99	62.99	58.82	53.16	49.48	44.31	39.91	45.55	47.55	53.41	60.03	62.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	336.86	334.83	322.55	302.86	283	263.83	251.36	257.02	267.14	287.03	309.83	326.8	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	5.25	x	10.63	x	0.47	x	1.11	=	20.2	(74)
North	0.9x 0.77	x	5.25	x	20.32	x	0.47	x	1.11	=	38.61	(74)
North	0.9x 0.77	x	5.25	x	34.53	x	0.47	x	1.11	=	65.61	(74)
North	0.9x 0.77	x	5.25	x	55.46	x	0.47	x	1.11	=	105.38	(74)
North	0.9x 0.77	x	5.25	x	74.72	x	0.47	x	1.11	=	141.96	(74)
North	0.9x 0.77	x	5.25	x	79.99	x	0.47	x	1.11	=	151.97	(74)
North	0.9x 0.77	x	5.25	x	74.68	x	0.47	x	1.11	=	141.88	(74)
North	0.9x 0.77	x	5.25	x	59.25	x	0.47	x	1.11	=	112.57	(74)
North	0.9x 0.77	x	5.25	x	41.52	x	0.47	x	1.11	=	78.88	(74)
North	0.9x 0.77	x	5.25	x	24.19	x	0.47	x	1.11	=	45.96	(74)
North	0.9x 0.77	x	5.25	x	13.12	x	0.47	x	1.11	=	24.92	(74)
North	0.9x 0.77	x	5.25	x	8.86	x	0.47	x	1.11	=	16.84	(74)
South	0.9x 0.77	x	3.04	x	46.75	x	0.47	x	1.11	=	51.44	(78)
South	0.9x 0.77	x	3.04	x	76.57	x	0.47	x	1.11	=	84.24	(78)
South	0.9x 0.77	x	3.04	x	97.53	x	0.47	x	1.11	=	107.3	(78)
South	0.9x 0.77	x	3.04	x	110.23	x	0.47	x	1.11	=	121.28	(78)
South	0.9x 0.77	x	3.04	x	114.87	x	0.47	x	1.11	=	126.38	(78)
South	0.9x 0.77	x	3.04	x	110.55	x	0.47	x	1.11	=	121.62	(78)
South	0.9x 0.77	x	3.04	x	108.01	x	0.47	x	1.11	=	118.83	(78)
South	0.9x 0.77	x	3.04	x	104.89	x	0.47	x	1.11	=	115.4	(78)
South	0.9x 0.77	x	3.04	x	101.89	x	0.47	x	1.11	=	112.09	(78)
South	0.9x 0.77	x	3.04	x	82.59	x	0.47	x	1.11	=	90.86	(78)
South	0.9x 0.77	x	3.04	x	55.42	x	0.47	x	1.11	=	60.97	(78)
South	0.9x 0.77	x	3.04	x	40.4	x	0.47	x	1.11	=	44.45	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	71.64	122.85	172.91	226.66	268.34	273.59	260.72	227.97	190.97	136.82	85.89	61.29	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	408.5	457.68	495.46	529.52	551.34	537.42	512.08	484.99	458.11	423.85	395.72	388.08	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.96	0.91	0.81	0.68	0.72	0.89	0.97	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.07	19.24	19.55	19.96	20.39	20.73	20.9	20.87	20.6	20.06	19.48	19.02	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.95	0.88	0.73	0.54	0.59	0.83	0.95	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.24	17.49	17.94	18.53	19.13	19.58	19.75	19.73	19.43	18.69	17.85	17.17	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.88	18.11	18.5	19.04	19.58	19.98	20.15	20.13	19.84	19.17	18.42	17.82	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.73	17.96	18.35	18.89	19.43	19.83	20	19.98	19.69	19.02	18.27	17.67	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.93	0.87	0.74	0.57	0.61	0.82	0.94	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	402.66	447.73	477.71	493.89	477.16	395.44	290.57	297.95	376.5	398.87	386.85	383.37	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1251.95	1215.8	1103.69	929.72	719.31	487.25	316.69	333.14	520.43	783.83	1040.19	1254.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	631.88	516.15	465.73	313.79	180.16	0	0	0	0	286.42	470.41	647.94	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3512.47 (98)

Space heating requirement in kWh/m²/year 51.09 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year

Space heating requirement (calculated above)

	631.88	516.15	465.73	313.79	180.16	0	0	0	0	286.42	470.41	647.94	

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

	698.21	570.33	514.62	346.73	199.08	0	0	0	0	316.48	519.79	715.95	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3881.18 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	101.95	89.08	92.7	83.25	81.26	71.81	69.08	77.17	77.43	87.71	92.94	98.98

Efficiency of water heater 87.3 (216)

(217)m= 90.04 | 90.01 | 89.95 | 89.81 | 89.48 | 87.3 | 87.3 | 87.3 | 87.3 | 89.73 | 89.96 | 90.06 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 113.22 | 98.96 | 103.06 | 92.7 | 90.81 | 82.25 | 79.13 | 88.4 | 88.69 | 97.76 | 103.32 | 109.9

Total = Sum(219a)$_{1...12}$ = 1148.19 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3881.18	
Water heating fuel used		1148.19	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	31.81		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		106.81	(231)
Electricity for lighting		322.78	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5458.96	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	838.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	248.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1086.34	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	55.43	(267)
Electricity for lighting	(232) x	0.519	=	167.52	(268)
Total CO2, kg/year	sum of (265)…(271) =			1309.3	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			19.04	(273)
EI rating (section 14)				85	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Saddler

Address : HT Saddler

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	3.63 (1a)	x	2.63 (2a)	=	9.55	(3a)
First floor	65.12 (1b)	x	2.37 (2b)	=	154.33	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	68.75 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		163.88	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.12 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.37 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.4	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.13	x	1.2	=	2.556			(26)
Windows Type 1			5.25	x	1/[1/(1.4)+ 0.04]	=	6.96			(27)
Windows Type 2			3.04	x	1/[1/(1.4)+ 0.04]	=	4.03			(27)
Floor Type 1			3.63	x	0.13	=	0.4719			(28)
Floor Type 2			61.49	x	0.13	=	7.9937			(28)
Walls Type1	82.21	10.42	71.79	x	0.18	=	12.92			(29)
Walls Type2	20.51	0	20.51	x	0.18	=	3.69			(29)
Roof	65.12	0	65.12	x	0.13	=	8.47			(30)
Total area of elements, m²			232.96							(31)
Internal wall **			133.85							(32c)
Internal floor			3.63							(32d)
Internal ceiling			3.63							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.09 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12310.74 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 21.32 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 68.41 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.44	31.27	31.1	30.31	30.17	29.48	29.48	29.35	29.74	30.17	30.46	30.77	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.85	99.68	99.51	98.72	98.58	97.89	97.89	97.76	98.15	98.58	98.87	99.18	

Average = Sum(39)$_{1...12}$ /12= 98.72 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.45	1.45	1.45	1.44	1.43	1.42	1.42	1.42	1.43	1.43	1.44	1.44	

Average = Sum(40)$_{1...12}$ /12= 1.44 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.22 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 86.82 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	95.5	92.02	88.55	85.08	81.61	78.13	78.13	81.61	85.08	88.55	92.02	95.5	

Total = Sum(44)$_{1...12}$ = 1041.79 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	141.62	123.86	127.81	111.43	106.92	92.26	85.5	98.11	99.28	115.7	126.3	137.15	

Total = Sum(45)$_{1...12}$ = 1365.95 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.24	18.58	19.17	16.71	16.04	13.84	12.82	14.72	14.89	17.36	18.94	20.57	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	48.66	42.36	45.13	41.96	41.59	38.53	39.82	41.59	41.96	45.13	45.38	48.66	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	190.28	166.22	172.94	153.39	148.51	130.8	125.31	139.69	141.24	160.83	171.68	185.82	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	190.28	166.22	172.94	153.39	148.51	130.8	125.31	139.69	141.24	160.83	171.68	185.82	

Output from water heater (annual)$_{1...12}$	1886.7	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	59.25	51.77	53.78	47.54	45.95	40.31	38.38	43.02	43.5	49.75	53.34	57.77	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	110.77	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.23	13.2	9.99	7.47	6.31	6.82	8.86	11.89	15.1	17.62	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	194.36	196.38	191.3	180.48	166.82	153.98	145.41	143.39	148.47	159.29	172.95	185.79	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	34.08	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	-88.62	(71)

Water heating gains (Table 5)

(72)m=	79.64	77.04	72.28	66.03	61.76	55.99	51.59	57.82	60.42	66.87	74.08	77.65	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	351.51	348.89	336.01	315.73	295.28	275.51	263.04	269.3	280.01	300.49	323.88	341.45	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	5.25	x	10.63	x	0.63	x	0.7	=	17.06	(74)
North	0.9x	0.77	x	5.25	x	20.32	x	0.63	x	0.7	=	32.6	(74)
North	0.9x	0.77	x	5.25	x	34.53	x	0.63	x	0.7	=	55.4	(74)
North	0.9x	0.77	x	5.25	x	55.46	x	0.63	x	0.7	=	88.99	(74)
North	0.9x	0.77	x	5.25	x	74.72	x	0.63	x	0.7	=	119.88	(74)
North	0.9x	0.77	x	5.25	x	79.99	x	0.63	x	0.7	=	128.33	(74)
North	0.9x	0.77	x	5.25	x	74.68	x	0.63	x	0.7	=	119.82	(74)
North	0.9x	0.77	x	5.25	x	59.25	x	0.63	x	0.7	=	95.06	(74)
North	0.9x	0.77	x	5.25	x	41.52	x	0.63	x	0.7	=	66.61	(74)
North	0.9x	0.77	x	5.25	x	24.19	x	0.63	x	0.7	=	38.81	(74)
North	0.9x	0.77	x	5.25	x	13.12	x	0.63	x	0.7	=	21.05	(74)
North	0.9x	0.77	x	5.25	x	8.86	x	0.63	x	0.7	=	14.22	(74)
South	0.9x	0.77	x	3.04	x	46.75	x	0.63	x	0.7	=	43.44	(78)
South	0.9x	0.77	x	3.04	x	76.57	x	0.63	x	0.7	=	71.14	(78)
South	0.9x	0.77	x	3.04	x	97.53	x	0.63	x	0.7	=	90.62	(78)
South	0.9x	0.77	x	3.04	x	110.23	x	0.63	x	0.7	=	102.41	(78)
South	0.9x	0.77	x	3.04	x	114.87	x	0.63	x	0.7	=	106.72	(78)
South	0.9x	0.77	x	3.04	x	110.55	x	0.63	x	0.7	=	102.71	(78)
South	0.9x	0.77	x	3.04	x	108.01	x	0.63	x	0.7	=	100.35	(78)
South	0.9x	0.77	x	3.04	x	104.89	x	0.63	x	0.7	=	97.45	(78)
South	0.9x	0.77	x	3.04	x	101.89	x	0.63	x	0.7	=	94.66	(78)
South	0.9x	0.77	x	3.04	x	82.59	x	0.63	x	0.7	=	76.73	(78)
South	0.9x	0.77	x	3.04	x	55.42	x	0.63	x	0.7	=	51.49	(78)
South	0.9x	0.77	x	3.04	x	40.4	x	0.63	x	0.7	=	37.53	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	60.5	103.74	146.02	191.41	226.6	231.04	220.17	192.51	161.27	115.54	72.53	51.76	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	412.01	452.63	482.03	507.14	521.88	506.55	483.21	461.81	441.28	416.03	396.42	393.2	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.96	0.88	0.76	0.8	0.94	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.37	19.51	19.75	20.1	20.46	20.77	20.92	20.89	20.66	20.2	19.73	19.35	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.72	19.73	19.73	19.74	19.74	19.75	19.75	19.75	19.74	19.74	19.73	19.73	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.81	0.6	0.65	0.89	0.98	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.58	17.78	18.14	18.64	19.16	19.56	19.71	19.7	19.43	18.8	18.11	17.55	(90)

fLA = Living area ÷ (4) = 0.35 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.21	18.38	18.7	19.15	19.61	19.99	20.13	20.12	19.86	19.29	18.68	18.18	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.21	18.38	18.7	19.15	19.61	19.99	20.13	20.12	19.86	19.29	18.68	18.18	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.93	0.83	0.66	0.7	0.89	0.98	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	410.22	449.49	475.97	493.1	485.94	418.16	317.28	324.42	394.82	405.71	393.45	391.8	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1389	1344.01	1214.28	1012.34	780.2	527.36	346	363.42	565.74	856.78	1144.75	1386.74	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	728.21	601.12	549.3	373.85	218.93	0	0	0	0	335.6	540.94	740.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4088.17 (98)

Space heating requirement in kWh/m²/year 59.46 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	728.21	601.12	549.3	373.85	218.93	0	0	0	0	335.6	540.94	740.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	779.67	643.59	588.12	400.26	234.4	0	0	0	0	359.31	579.16	792.54	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4377.06 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	190.28	166.22	172.94	153.39	148.51	130.8	125.31	139.69	141.24	160.83	171.68	185.82

Efficiency of water heater 80.3 (216)

(217)m= 88.1 | 88 | 87.76 | 87.21 | 86.03 | 80.3 | 80.3 | 80.3 | 80.3 | 86.86 | 87.74 | 88.17 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 215.98 | 188.88 | 197.07 | 175.89 | 172.63 | 162.88 | 156.06 | 173.97 | 175.89 | 185.16 | 195.67 | 210.74

Total = Sum(219a)$_{1...12}$ = 2210.79 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4377.06	
Water heating fuel used		2210.79	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		322.78	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6985.63	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	945.44	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	477.53	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1422.98	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	167.52	(268)
Total CO2, kg/year	sum of (265)…(271) =				1629.42	(272)

TER = 23.7 (273)

DER WorkSheet: New dwelling design stage

User Details:

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Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Weaver Det (ASHP)

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1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.21	(1a) x	2.39	(2a) =	184.53	(3a)
First floor	77.21	(1b) x	2.61	(2b) =	201.52	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	154.42	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		386.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.13	x	1.3	=	2.769			(26)
Windows Type 1			11.49	x1/[1/(1.2)+ 0.04]		=	13.16			(27)
Windows Type 2			1.68	x1/[1/(1.2)+ 0.04]		=	1.92			(27)
Windows Type 3			2.87	x1/[1/(1.2)+ 0.04]		=	3.29			(27)
Windows Type 4			15.66	x1/[1/(1.2)+ 0.04]		=	17.93			(27)
Floor			77.21	x	0.1	=	7.721	75	5790.75	(28)
Walls	189.95	33.83	156.12	x	0.25	=	39.03	60	9367.2	(29)
Roof	77.21	0	77.21	x	0.09	=	6.95	9	694.89	(30)
Total area of elements, m²			344.37							(31)
Internal wall **			89.29					75	6696.75	(32c)
Internal wall **			210.38					9	1893.42	(32c)
Internal floor			77.21					18	1389.78	(32d)
Internal ceiling			77.21					9	694.89	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 92.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 26527.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 171.79 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.71 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 101.47 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	63.95	63.7	63.7	63.7	63.7	63.7	63.7	63.7	63.7	63.7	63.7	63.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	165.42	165.17	165.17	165.17	165.17	165.17	165.17	165.17	165.17	165.17	165.17	165.17	

Average = Sum(39)$_{1...12}$ /12= 165.19 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.94 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 104.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	114.45	110.29	106.13	101.97	97.8	93.64	93.64	97.8	101.97	106.13	110.29	114.45	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1248.55 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	169.73	148.44	153.18	133.55	128.14	110.58	102.47	117.58	118.98	138.67	151.36	164.37	

Total = Sum(45)$_{1...12}$ = 1637.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.46	22.27	22.98	20.03	19.22	16.59	15.37	17.64	17.85	20.8	22.7	24.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.89 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 1.02 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.02	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	224.63	198.03	208.08	186.68	183.04	141.19	134.1	149.22	149.6	193.57	204.49	219.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	224.63	198.03	208.08	186.68	183.04	0	0	0	0	193.57	204.49	219.27	

Output from water heater (annual)$_{1...12}$ 1617.8 (64)

Output immersion

(64)m=	0	0	0	0	0	141.19	134.1	149.22	149.6	0	0	0	

Output from immersion (annual)$_{1...12}$ 574.120465524924 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	100.36	89.03	94.85	86.91	86.53	61.26	59.38	64.41	64.06	90.03	92.83	98.57	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	29.01	25.77	20.96	15.87	11.86	10.01	10.82	14.06	18.88	23.97	27.97	29.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	325.29	328.67	320.16	302.05	279.19	257.71	243.36	239.98	248.49	266.59	289.45	310.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	(71)

Water heating gains (Table 5)

(72)m=	134.89	132.48	127.49	120.71	116.3	85.08	79.81	86.57	88.97	121	128.93	132.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	556.3	554.03	535.72	505.74	474.47	419.92	401.1	407.72	423.44	478.68	513.47	540.36	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	11.49	x	10.63	x	0.47	x	1.11	=	44.22	(74)
North	0.9x 0.77	x	11.49	x	20.32	x	0.47	x	1.11	=	84.5	(74)
North	0.9x 0.77	x	11.49	x	34.53	x	0.47	x	1.11	=	143.58	(74)
North	0.9x 0.77	x	11.49	x	55.46	x	0.47	x	1.11	=	230.63	(74)
North	0.9x 0.77	x	11.49	x	74.72	x	0.47	x	1.11	=	310.69	(74)
North	0.9x 0.77	x	11.49	x	79.99	x	0.47	x	1.11	=	332.6	(74)
North	0.9x 0.77	x	11.49	x	74.68	x	0.47	x	1.11	=	310.52	(74)
North	0.9x 0.77	x	11.49	x	59.25	x	0.47	x	1.11	=	246.36	(74)
North	0.9x 0.77	x	11.49	x	41.52	x	0.47	x	1.11	=	172.64	(74)
North	0.9x 0.77	x	11.49	x	24.19	x	0.47	x	1.11	=	100.59	(74)
North	0.9x 0.77	x	11.49	x	13.12	x	0.47	x	1.11	=	54.55	(74)
North	0.9x 0.77	x	11.49	x	8.86	x	0.47	x	1.11	=	36.86	(74)
East	0.9x 0.77	x	1.68	x	19.64	x	0.47	x	1.11	=	11.94	(76)
East	0.9x 0.77	x	1.68	x	38.42	x	0.47	x	1.11	=	23.36	(76)
East	0.9x 0.77	x	1.68	x	63.27	x	0.47	x	1.11	=	38.47	(76)
East	0.9x 0.77	x	1.68	x	92.28	x	0.47	x	1.11	=	56.11	(76)
East	0.9x 0.77	x	1.68	x	113.09	x	0.47	x	1.11	=	68.76	(76)
East	0.9x 0.77	x	1.68	x	115.77	x	0.47	x	1.11	=	70.39	(76)
East	0.9x 0.77	x	1.68	x	110.22	x	0.47	x	1.11	=	67.01	(76)
East	0.9x 0.77	x	1.68	x	94.68	x	0.47	x	1.11	=	57.56	(76)
East	0.9x 0.77	x	1.68	x	73.59	x	0.47	x	1.11	=	44.74	(76)
East	0.9x 0.77	x	1.68	x	45.59	x	0.47	x	1.11	=	27.72	(76)
East	0.9x 0.77	x	1.68	x	24.49	x	0.47	x	1.11	=	14.89	(76)
East	0.9x 0.77	x	1.68	x	16.15	x	0.47	x	1.11	=	9.82	(76)
South	0.9x 0.77	x	15.66	x	46.75	x	0.47	x	1.11	=	264.96	(78)
South	0.9x 0.77	x	15.66	x	76.57	x	0.47	x	1.11	=	433.94	(78)
South	0.9x 0.77	x	15.66	x	97.53	x	0.47	x	1.11	=	552.76	(78)
South	0.9x 0.77	x	15.66	x	110.23	x	0.47	x	1.11	=	624.74	(78)
South	0.9x 0.77	x	15.66	x	114.87	x	0.47	x	1.11	=	651.02	(78)
South	0.9x 0.77	x	15.66	x	110.55	x	0.47	x	1.11	=	626.51	(78)
South	0.9x 0.77	x	15.66	x	108.01	x	0.47	x	1.11	=	612.14	(78)
South	0.9x 0.77	x	15.66	x	104.89	x	0.47	x	1.11	=	594.47	(78)
South	0.9x 0.77	x	15.66	x	101.89	x	0.47	x	1.11	=	577.42	(78)
South	0.9x 0.77	x	15.66	x	82.59	x	0.47	x	1.11	=	468.04	(78)
South	0.9x 0.77	x	15.66	x	55.42	x	0.47	x	1.11	=	314.07	(78)
South	0.9x 0.77	x	15.66	x	40.4	x	0.47	x	1.11	=	228.95	(78)

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West	0.9x	0.77	x	2.87	x	19.64	x	0.47	x	1.11	=	20.4	(80)
West	0.9x	0.77	x	2.87	x	38.42	x	0.47	x	1.11	=	39.91	(80)
West	0.9x	0.77	x	2.87	x	63.27	x	0.47	x	1.11	=	65.72	(80)
West	0.9x	0.77	x	2.87	x	92.28	x	0.47	x	1.11	=	95.85	(80)
West	0.9x	0.77	x	2.87	x	113.09	x	0.47	x	1.11	=	117.46	(80)
West	0.9x	0.77	x	2.87	x	115.77	x	0.47	x	1.11	=	120.25	(80)
West	0.9x	0.77	x	2.87	x	110.22	x	0.47	x	1.11	=	114.48	(80)
West	0.9x	0.77	x	2.87	x	94.68	x	0.47	x	1.11	=	98.34	(80)
West	0.9x	0.77	x	2.87	x	73.59	x	0.47	x	1.11	=	76.43	(80)
West	0.9x	0.77	x	2.87	x	45.59	x	0.47	x	1.11	=	47.35	(80)
West	0.9x	0.77	x	2.87	x	24.49	x	0.47	x	1.11	=	25.44	(80)
West	0.9x	0.77	x	2.87	x	16.15	x	0.47	x	1.11	=	16.78	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	341.52	581.7	800.53	1007.32	1147.92	1149.74	1104.15	996.73	871.23	643.7	408.94	292.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	897.82	1135.73	1336.25	1513.06	1622.39	1569.66	1505.26	1404.46	1294.68	1122.38	922.41	832.77	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.78	0.62	0.47	0.52	0.75	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.78	19.98	20.24	20.53	20.76	20.88	20.92	20.91	20.82	20.51	20.07	19.73	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.02	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.87	0.73	0.54	0.37	0.42	0.68	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.38	18.67	19.05	19.45	19.75	19.89	19.92	19.92	19.83	19.44	18.81	18.31	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.57	18.85	19.21	19.6	19.89	20.03	20.06	20.06	19.97	19.59	18.99	18.51	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.57	18.85	19.21	19.6	19.89	20.03	20.06	20.06	19.97	19.59	18.99	18.51	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.97	0.93	0.86	0.72	0.54	0.37	0.42	0.67	0.89	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	885.74	1100.06	1246.11	1295.03	1169.52	852	563.83	591.55	868.44	1002.42	897.54	824.18	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2360.95	2304.35	2099.79	1767.78	1353.16	896.17	571.44	603.75	969.62	1484.54	1963.42	2363.25	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1097.56	809.28	635.13	340.38	136.63	0	0	0	0	358.69	767.43	1145.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5290.18 (98)

Space heating requirement in kWh/m²/year 34.26 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 444.01 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1097.56	809.28	635.13	340.38	136.63	0	0	0	0	358.69	767.43	1145.07	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	247.19	182.27	143.05	76.66	30.77	0	0	0	0	80.79	172.84	257.89	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1191.46 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	224.63	198.03	208.08	186.68	183.04	0	0	0	0	193.57	204.49	219.27	

Efficiency of water heater 282.62 (216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	79.48	70.07	73.62	66.05	64.77	0	0	0	0	68.49	72.36	77.58	

Total = Sum(219a)$_{1...12}$ = 572.42 (219)

Water heating requirement (immersion)

	0	0	0	0	0	141.19	134.1	149.22	149.6	0	0	0	

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	141.19	134.1	149.22	149.6	0	0	0	

Total = Sum(219a)$_{1...12}$ = 574.12 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1191.46

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Water heating fuel used		572.42	
Water heating fuel used (Immersion)		574.12	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	70.35		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	70.35	(231)
Electricity for lighting		512.4	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2346.62	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.519	=	618.37	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.519	=	297.08	(264)
Water heating (Immersion)	(219) x		0.519	=	297.97	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1213.42	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	36.51	(267)
Electricity for lighting	(232) x		0.519	=	265.93	(268)
Total CO2, kg/year		sum of (265)…(271) =			1515.87	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			9.82	(273)
EI rating (section 14)					90	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: HT Weaver Det (ASHP)

Address : HT Weaver Det (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	77.21 (1a)	x	2.39 (2a)	=	184.53	(3a)
First floor	77.21 (1b)	x	2.61 (2b)	=	201.52	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	154.42 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		386.05	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.1 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.35 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.3 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.38	0.38	0.37	0.33	0.32	0.29	0.29	0.28	0.3	0.32	0.34	0.35

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.57	0.55	0.55	0.54	0.54	0.54	0.55	0.55	0.56	0.56

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.13	x	1.2	=	2.556			(26)
Windows Type 1			11.49	x1/[1/(1.4)+ 0.04]		=	15.23			(27)
Windows Type 2			1.68	x1/[1/(1.4)+ 0.04]		=	2.23			(27)
Windows Type 3			2.87	x1/[1/(1.4)+ 0.04]		=	3.8			(27)
Windows Type 4			15.66	x1/[1/(1.4)+ 0.04]		=	20.76			(27)
Floor			77.21	x	0.13	=	10.0373			(28)
Walls	189.95	33.83	156.12	x	0.18	=	28.1			(29)
Roof	77.21	0	77.21	x	0.13	=	10.04			(30)
Total area of elements, m²			344.37							(31)
Internal wall **			89.29							(32c)
Internal wall **			210.38							(32c)
Internal floor			77.21							(32d)
Internal ceiling			77.21							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 92.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 26527.68 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 14.6 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 107.36 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	73.05	72.69	72.33	70.66	70.35	68.89	68.89	68.62	69.45	70.35	70.98	71.64	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	180.41	180.05	179.69	178.02	177.71	176.25	176.25	175.98	176.81	177.71	178.34	179	

Average = Sum(39)$_{1...12}$ /12= 178.02 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.17	1.17	1.16	1.15	1.15	1.14	1.14	1.14	1.14	1.15	1.15	1.16	

Average = Sum(40)$_{1...12}$ /12= 1.15 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.94 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 104.05 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	114.45	110.29	106.13	101.97	97.8	93.64	93.64	97.8	101.97	106.13	110.29	114.45	

Total = Sum(44)$_{1...12}$ = 1248.55 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	169.73	148.44	153.18	133.55	128.14	110.58	102.47	117.58	118.98	138.67	151.36	164.37	

Total = Sum(45)$_{1...12}$ = 1637.05 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.46	22.27	22.98	20.03	19.22	16.59	15.37	17.64	17.85	20.8	22.7	24.66	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 1.39 (48)

Temperature factor from Table 2b — 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0.75 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0 (54)
Enter (50) or (54) in (55)		0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33 (56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33 (57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26 (59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0 (61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	216.32	190.53	199.78	178.64	174.74	155.67	149.06	164.18	164.08	185.26	196.46	210.97 (62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0 (63)

Output from water heater

(64)m=	216.32	190.53	199.78	178.64	174.74	155.67	149.06	164.18	164.08	185.26	196.46	210.97

Output from water heater (annual)$_{1...12}$: 2185.67 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.71	83.03	88.21	80.48	79.88	72.84	71.35	76.37	75.64	83.38	86.4	91.93 (65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04	147.04 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	29.01	25.77	20.96	15.87	11.86	10.01	10.82	14.06	18.88	23.97	27.97	29.82 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	325.29	328.67	320.16	302.05	279.19	257.71	243.36	239.98	248.49	266.59	289.45	310.94 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7	37.7 (69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3 (70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64	-117.64 (71)

Water heating gains (Table 5)

(72)m=	125.95	123.55	118.56	111.77	107.37	101.17	95.89	102.65	105.05	112.07	120	123.56 (72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	550.37	548.1	529.79	499.81	468.54	439	420.18	426.81	442.53	472.75	507.54	534.43 (73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	11.49	x	10.63	x	0.63	x	0.7	=	37.34	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.63	x	0.7	=	71.36	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.63	x	0.7	=	121.25	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.63	x	0.7	=	194.76	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.63	x	0.7	=	262.36	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.63	x	0.7	=	280.87	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.63	x	0.7	=	262.23	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.63	x	0.7	=	208.04	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.63	x	0.7	=	145.79	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.63	x	0.7	=	84.94	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.63	x	0.7	=	46.06	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.63	x	0.7	=	31.13	(74)
East	0.9x	0.77	x	1.68	x	19.64	x	0.63	x	0.7	=	10.08	(76)
East	0.9x	0.77	x	1.68	x	38.42	x	0.63	x	0.7	=	19.73	(76)
East	0.9x	0.77	x	1.68	x	63.27	x	0.63	x	0.7	=	32.49	(76)
East	0.9x	0.77	x	1.68	x	92.28	x	0.63	x	0.7	=	47.38	(76)
East	0.9x	0.77	x	1.68	x	113.09	x	0.63	x	0.7	=	58.07	(76)
East	0.9x	0.77	x	1.68	x	115.77	x	0.63	x	0.7	=	59.44	(76)
East	0.9x	0.77	x	1.68	x	110.22	x	0.63	x	0.7	=	56.59	(76)
East	0.9x	0.77	x	1.68	x	94.68	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	1.68	x	73.59	x	0.63	x	0.7	=	37.78	(76)
East	0.9x	0.77	x	1.68	x	45.59	x	0.63	x	0.7	=	23.41	(76)
East	0.9x	0.77	x	1.68	x	24.49	x	0.63	x	0.7	=	12.57	(76)
East	0.9x	0.77	x	1.68	x	16.15	x	0.63	x	0.7	=	8.29	(76)
South	0.9x	0.77	x	15.66	x	46.75	x	0.63	x	0.7	=	223.75	(78)
South	0.9x	0.77	x	15.66	x	76.57	x	0.63	x	0.7	=	366.45	(78)
South	0.9x	0.77	x	15.66	x	97.53	x	0.63	x	0.7	=	466.79	(78)
South	0.9x	0.77	x	15.66	x	110.23	x	0.63	x	0.7	=	527.57	(78)
South	0.9x	0.77	x	15.66	x	114.87	x	0.63	x	0.7	=	549.76	(78)
South	0.9x	0.77	x	15.66	x	110.55	x	0.63	x	0.7	=	529.07	(78)
South	0.9x	0.77	x	15.66	x	108.01	x	0.63	x	0.7	=	516.93	(78)
South	0.9x	0.77	x	15.66	x	104.89	x	0.63	x	0.7	=	502.01	(78)
South	0.9x	0.77	x	15.66	x	101.89	x	0.63	x	0.7	=	487.61	(78)
South	0.9x	0.77	x	15.66	x	82.59	x	0.63	x	0.7	=	395.25	(78)
South	0.9x	0.77	x	15.66	x	55.42	x	0.63	x	0.7	=	265.22	(78)
South	0.9x	0.77	x	15.66	x	40.4	x	0.63	x	0.7	=	193.34	(78)
West	0.9x	0.77	x	2.87	x	19.64	x	0.63	x	0.7	=	17.23	(80)
West	0.9x	0.77	x	2.87	x	38.42	x	0.63	x	0.7	=	33.7	(80)
West	0.9x	0.77	x	2.87	x	63.27	x	0.63	x	0.7	=	55.5	(80)

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West	0.9x	0.77	x	2.87	x	92.28	x	0.63	x	0.7	=	80.94	(80)
West	0.9x	0.77	x	2.87	x	113.09	x	0.63	x	0.7	=	99.19	(80)
West	0.9x	0.77	x	2.87	x	115.77	x	0.63	x	0.7	=	101.54	(80)
West	0.9x	0.77	x	2.87	x	110.22	x	0.63	x	0.7	=	96.67	(80)
West	0.9x	0.77	x	2.87	x	94.68	x	0.63	x	0.7	=	83.04	(80)
West	0.9x	0.77	x	2.87	x	73.59	x	0.63	x	0.7	=	64.55	(80)
West	0.9x	0.77	x	2.87	x	45.59	x	0.63	x	0.7	=	39.99	(80)
West	0.9x	0.77	x	2.87	x	24.49	x	0.63	x	0.7	=	21.48	(80)
West	0.9x	0.77	x	2.87	x	16.15	x	0.63	x	0.7	=	14.17	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	288.4	491.23	676.02	850.65	969.38	970.92	932.42	841.71	735.73	543.58	345.34	246.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	838.77	1039.33	1205.81	1350.46	1437.92	1409.92	1352.61	1268.51	1178.25	1016.33	852.88	781.36	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.89	0.73	0.56	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.68	19.87	20.14	20.48	20.77	20.94	20.99	20.98	20.87	20.48	20.01	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.95	19.95	19.95	19.96	19.96	19.97	19.97	19.97	19.96	19.96	19.96	19.95	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.84	0.64	0.43	0.49	0.78	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.18	18.46	18.86	19.34	19.73	19.93	19.96	19.96	19.86	19.35	18.67	18.14	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.39	18.66	19.04	19.5	19.88	20.07	20.11	20.1	20	19.51	18.86	18.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.39	18.66	19.04	19.5	19.88	20.07	20.11	20.1	20	19.51	18.86	18.35	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.45	0.51	0.78	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	836.48	1031.23	1180.25	1267.79	1205.43	914.36	611.55	640.67	918.74	974.16	847.27	779.84	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2542.56	2476.95	2252.72	1887.62	1453.09	963.88	618	651.75	1042.79	1583.43	2097.14	2533.04	(97)

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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1269.33	971.52	797.92	446.28	184.26	0	0	0	0	453.3	899.91	1304.38

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6326.89 (98)

Space heating requirement in kWh/m²/year 40.97 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1269.33	971.52	797.92	446.28	184.26	0	0	0	0	453.3	899.91	1304.38	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1357.57	1039.06	853.39	477.31	197.07	0	0	0	0	484.81	962.47	1395.06	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 6766.73 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	216.32	190.53	199.78	178.64	174.74	155.67	149.06	164.18	164.08	185.26	196.46	210.97

Efficiency of water heater 79.8 (216)

(217)m=	88.77	88.55	88.13	87.16	84.96	79.8	79.8	79.8	79.8	87.11	88.38	88.84

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	243.7	215.16	226.67	204.96	205.68	195.07	186.79	205.73	205.61	212.67	222.29	237.46

Total = Sum(219a)$_{1...12}$ = 2561.8 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		6766.73
Water heating fuel used		2561.8
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		512.4 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		9915.93 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

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	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	1461.61	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	553.35	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2014.96	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	265.93	(268)
Total CO2, kg/year		sum of (265)…(271) =			2319.82	(272)

TER = 22.2 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Baker R1 - ET

Address : The Baker R1 - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.97 (1a)	x	2.38 (2a)	=	95.33	(3a)
First floor	39.97 (1b)	x	2.61 (2b)	=	104.32	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.94 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.3	=	2.795			(26)
Doors Type 2			2.15	x	1.3	=	2.795			(26)
Windows Type 1			3.53	x1/[1/(1.2)+ 0.04]		=	4.04			(27)
Windows Type 2			3.95	x1/[1/(1.2)+ 0.04]		=	4.52			(27)
Floor			39.97	x	0.1	=	3.997	75	2997.75	(28)
Walls	89.58	11.78	77.8	x	0.25	=	19.45	60	4668	(29)
Roof	39.97	0	39.97	x	0.09	=	3.6	9	359.73	(30)
Total area of elements, m²			169.52							(31)
Party wall			48.89	x	0	=	0	45	2200.05	(32)
Internal wall **			115.22					9	1036.98	(32c)
Internal wall **			14.41					75	1080.75	(32c)
Internal floor			39.97					18	719.46	(32d)
Internal ceiling			39.97					9	359.73	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.2 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13422.45 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 167.91 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 6.42 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.62 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.07	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.69	80.56	80.56	80.56	80.56	80.56	80.56	80.56	80.56	80.56	80.56	80.56	

Average = Sum(39)$_{1...12}$ /12= 80.57 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 92.67 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93	

Total = Sum(44)$_{1...12}$ = 1111.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.16	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.39	

Total = Sum(45)$_{1...12}$ = 1458 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.52	20.22	21.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.22	136.78	141.49	123.84	119.19	103.38	96.32	109.78	110.87	128.56	139.7	151.45	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-48.9	-43.02	-43.91	-36.14	-33.56	-27.69	-23.44	-28.38	-29.21	-36.1	-41.8	-47.26	(63) (G10)

Output from water heater

(64)m=	107.32	93.76	97.58	87.7	85.62	75.69	72.87	81.4	81.66	92.46	97.9	104.19	

Output from water heater (annual)$_{1...12}$	1078.15	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.53	45.1	46.63	40.77	39.21	33.97	31.61	36.08	36.46	42.33	46.05	49.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.75	18.43	14.99	11.34	8.48	7.16	7.74	10.06	13.5	17.14	20	21.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.32	221.59	215.86	203.65	188.24	173.75	164.07	161.8	167.53	179.74	195.15	209.64	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	(71)

Water heating gains (Table 5)

(72)m=	69.26	67.12	62.67	56.63	52.7	47.18	42.48	48.5	50.64	56.89	63.96	67.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	372.24	370.06	356.44	334.54	312.35	291.02	277.22	283.28	294.59	316.7	342.04	361.01	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.53	x	10.63	x	0.47	x	1.11	=	13.58	(74)
North	0.9x 0.77	x	3.53	x	20.32	x	0.47	x	1.11	=	25.96	(74)
North	0.9x 0.77	x	3.53	x	34.53	x	0.47	x	1.11	=	44.11	(74)
North	0.9x 0.77	x	3.53	x	55.46	x	0.47	x	1.11	=	70.86	(74)
North	0.9x 0.77	x	3.53	x	74.72	x	0.47	x	1.11	=	95.45	(74)
North	0.9x 0.77	x	3.53	x	79.99	x	0.47	x	1.11	=	102.18	(74)
North	0.9x 0.77	x	3.53	x	74.68	x	0.47	x	1.11	=	95.4	(74)
North	0.9x 0.77	x	3.53	x	59.25	x	0.47	x	1.11	=	75.69	(74)
North	0.9x 0.77	x	3.53	x	41.52	x	0.47	x	1.11	=	53.04	(74)
North	0.9x 0.77	x	3.53	x	24.19	x	0.47	x	1.11	=	30.9	(74)
North	0.9x 0.77	x	3.53	x	13.12	x	0.47	x	1.11	=	16.76	(74)
North	0.9x 0.77	x	3.53	x	8.86	x	0.47	x	1.11	=	11.32	(74)
South	0.9x 0.77	x	3.95	x	46.75	x	0.47	x	1.11	=	66.83	(78)
South	0.9x 0.77	x	3.95	x	76.57	x	0.47	x	1.11	=	109.45	(78)
South	0.9x 0.77	x	3.95	x	97.53	x	0.47	x	1.11	=	139.43	(78)
South	0.9x 0.77	x	3.95	x	110.23	x	0.47	x	1.11	=	157.58	(78)
South	0.9x 0.77	x	3.95	x	114.87	x	0.47	x	1.11	=	164.21	(78)
South	0.9x 0.77	x	3.95	x	110.55	x	0.47	x	1.11	=	158.03	(78)
South	0.9x 0.77	x	3.95	x	108.01	x	0.47	x	1.11	=	154.4	(78)
South	0.9x 0.77	x	3.95	x	104.89	x	0.47	x	1.11	=	149.95	(78)
South	0.9x 0.77	x	3.95	x	101.89	x	0.47	x	1.11	=	145.65	(78)
South	0.9x 0.77	x	3.95	x	82.59	x	0.47	x	1.11	=	118.06	(78)
South	0.9x 0.77	x	3.95	x	55.42	x	0.47	x	1.11	=	79.22	(78)
South	0.9x 0.77	x	3.95	x	40.4	x	0.47	x	1.11	=	57.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	80.42	135.41	183.54	228.44	259.66	260.21	249.8	225.63	198.68	148.96	95.98	69.07	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	452.66	505.47	539.98	562.98	572	551.23	527.02	508.91	493.28	465.66	438.01	430.08	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.95	0.89	0.78	0.62	0.66	0.85	0.96	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.69	19.95	20.28	20.61	20.86	20.96	20.94	20.77	20.36	19.87	19.48	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.97	0.94	0.86	0.71	0.51	0.55	0.79	0.94	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.09	18.33	18.71	19.18	19.64	19.95	20.05	20.04	19.86	19.3	18.6	18.02	(90)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.44	18.66	19.01	19.45	19.88	20.17	20.27	20.26	20.08	19.56	18.91	18.38	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.29	18.51	18.86	19.3	19.73	20.02	20.12	20.11	19.93	19.41	18.76	18.23	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.96	0.93	0.85	0.7	0.52	0.56	0.78	0.93	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	446.09	493.73	518.74	521.04	485.85	386.31	272.95	284.05	386.47	433.19	427.44	424.9	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1129.03	1096.69	995.72	837.92	646.81	436.85	283.87	299.12	470	709.44	939.23	1130.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	508.11	405.19	354.87	228.15	119.76	0	0	0	0	205.53	368.49	524.84	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2714.94 (98)

Space heating requirement in kWh/m²/year 33.96 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	508.11	405.19	354.87	228.15	119.76	0	0	0	0	205.53	368.49	524.84	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	561.45	447.72	392.12	252.1	132.33	0	0	0	0	227.11	407.17	579.93	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2999.93 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	107.32	93.76	97.58	87.7	85.62	75.69	72.87	81.4	81.66	92.46	97.9	104.19

Efficiency of water heater 87.3 (216)

(217)m= 89.93 | 89.88 | 89.79 | 89.59 | 89.14 | 87.3 | 87.3 | 87.3 | 87.3 | 89.48 | 89.81 | 89.95 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 119.35 | 104.31 | 108.67 | 97.89 | 96.06 | 86.7 | 83.48 | 93.24 | 93.54 | 103.33 | 109.01 | 115.83

Total = Sum(219a)$_{1...12}$ = 1211.4 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2999.93	
Water heating fuel used		1211.4	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	37.67		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		112.67	(231)
Electricity for lighting		366.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4690.38	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	647.99	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	261.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			909.65	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	58.48	(267)
Electricity for lighting	(232) x	0.519	=	190.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			1158.27	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			14.49	(273)
EI rating (section 14)				88	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Baker R1 - ET

Address : The Baker R1 - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.97 (1a)	x	2.38 (2a)	=	95.33	(3a)
First floor	39.97 (1b)	x	2.61 (2b)	=	104.32	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.94 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.2	=	2.58			(26)
Doors Type 2			2.15	x	1.2	=	2.58			(26)
Windows Type 1			3.53	x1/[1/(1.4)+ 0.04]		=	4.68			(27)
Windows Type 2			3.95	x1/[1/(1.4)+ 0.04]		=	5.24			(27)
Floor			39.97	x	0.13	=	5.1961			(28)
Walls	89.58	11.78	77.8	x	0.18	=	14			(29)
Roof	39.97	0	39.97	x	0.13	=	5.2			(30)
Total area of elements, m²			169.52							(31)
Party wall			48.89	x	0	=	0			(32)
Internal wall **			115.22							(32c)
Internal wall **			14.41							(32c)
Internal floor			39.97							(32d)
Internal ceiling			39.97							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.47 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13422.45 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 9.14 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 48.61 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.14	38.9	38.66	37.56	37.35	36.38	36.38	36.2	36.76	37.35	37.77	38.21	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	87.75	87.51	87.27	86.17	85.96	84.99	84.99	84.81	85.37	85.96	86.38	86.82	

Average = Sum(39)$_{1...12}$ /12= | 86.16 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.1	1.09	1.09	1.08	1.08	1.06	1.06	1.06	1.07	1.08	1.08	1.09	

Average = Sum(40)$_{1...12}$ /12= | 1.08 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.46 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 92.67 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93	

Total = Sum(44)$_{1...12}$ = | 1111.99 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.16	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.39	

Total = Sum(45)$_{1...12}$ = | 1458 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.52	20.22	21.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	45.21	48.17	44.78	44.39	41.13	42.5	44.39	44.78	48.17	48.44	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35	

Output from water heater (annual)$_{1...12}$	2011.87	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	63	55.26	57.4	50.74	49.04	43.03	40.97	45.92	46.43	53.1	56.93	61.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.75	18.43	14.99	11.34	8.48	7.16	7.74	10.06	13.5	17.14	20	21.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.32	221.59	215.86	203.65	188.24	173.75	164.07	161.8	167.53	179.74	195.15	209.64	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	(71)

Water heating gains (Table 5)

(72)m=	84.68	82.23	77.16	70.48	65.92	59.76	55.06	61.72	64.49	71.38	79.07	82.55	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	387.67	385.18	370.92	348.39	325.56	303.6	289.8	296.49	308.44	331.18	357.16	376.43	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.53	x	10.63	x	0.63	x	0.7	=	11.47	(74)
North	0.9x	0.77	x	3.53	x	20.32	x	0.63	x	0.7	=	21.92	(74)
North	0.9x	0.77	x	3.53	x	34.53	x	0.63	x	0.7	=	37.25	(74)
North	0.9x	0.77	x	3.53	x	55.46	x	0.63	x	0.7	=	59.84	(74)
North	0.9x	0.77	x	3.53	x	74.72	x	0.63	x	0.7	=	80.6	(74)
North	0.9x	0.77	x	3.53	x	79.99	x	0.63	x	0.7	=	86.29	(74)
North	0.9x	0.77	x	3.53	x	74.68	x	0.63	x	0.7	=	80.56	(74)
North	0.9x	0.77	x	3.53	x	59.25	x	0.63	x	0.7	=	63.92	(74)
North	0.9x	0.77	x	3.53	x	41.52	x	0.63	x	0.7	=	44.79	(74)
North	0.9x	0.77	x	3.53	x	24.19	x	0.63	x	0.7	=	26.1	(74)
North	0.9x	0.77	x	3.53	x	13.12	x	0.63	x	0.7	=	14.15	(74)
North	0.9x	0.77	x	3.53	x	8.86	x	0.63	x	0.7	=	9.56	(74)
South	0.9x	0.77	x	3.95	x	46.75	x	0.63	x	0.7	=	56.44	(78)
South	0.9x	0.77	x	3.95	x	76.57	x	0.63	x	0.7	=	92.43	(78)
South	0.9x	0.77	x	3.95	x	97.53	x	0.63	x	0.7	=	117.74	(78)
South	0.9x	0.77	x	3.95	x	110.23	x	0.63	x	0.7	=	133.07	(78)
South	0.9x	0.77	x	3.95	x	114.87	x	0.63	x	0.7	=	138.67	(78)
South	0.9x	0.77	x	3.95	x	110.55	x	0.63	x	0.7	=	133.45	(78)
South	0.9x	0.77	x	3.95	x	108.01	x	0.63	x	0.7	=	130.39	(78)
South	0.9x	0.77	x	3.95	x	104.89	x	0.63	x	0.7	=	126.63	(78)
South	0.9x	0.77	x	3.95	x	101.89	x	0.63	x	0.7	=	122.99	(78)
South	0.9x	0.77	x	3.95	x	82.59	x	0.63	x	0.7	=	99.69	(78)
South	0.9x	0.77	x	3.95	x	55.42	x	0.63	x	0.7	=	66.9	(78)
South	0.9x	0.77	x	3.95	x	40.4	x	0.63	x	0.7	=	48.77	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	67.91	114.35	154.99	192.91	219.27	219.74	210.95	190.54	167.78	125.79	81.05	58.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.58	499.53	525.91	541.3	544.83	523.34	500.75	487.04	476.23	456.97	438.21	434.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.95	0.86	0.7	0.74	0.92	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.8	19.92	20.12	20.39	20.67	20.89	20.97	20.96	20.82	20.47	20.09	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20.01	20.01	20.02	20.02	20.03	20.03	20.03	20.03	20.02	20.02	20.01	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.79	0.57	0.61	0.87	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.4	18.57	18.86	19.27	19.66	19.94	20.02	20.01	19.86	19.39	18.83	18.38	(90)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.74	18.9	19.17	19.55	19.91	20.17	20.25	20.25	20.1	19.65	19.14	18.72	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.74	18.9	19.17	19.55	19.91	20.17	20.25	20.25	20.1	19.65	19.14	18.72	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.93	0.8	0.6	0.64	0.87	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	454.17	496.81	520.25	527.21	505.63	417.55	300.85	312.66	414.8	445.38	435.56	433.71	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1267.33	1225.35	1105.92	917.37	705.35	473.75	310.43	326.29	512.02	778.26	1040.08	1260.76	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	604.99	489.58	435.74	280.92	148.59	0	0	0	0	247.66	435.26	615.32	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3258.07 (98)

Space heating requirement in kWh/m²/year 40.76 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	604.99	489.58	435.74	280.92	148.59	0	0	0	0	247.66	435.26	615.32	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	647.74	524.18	466.53	300.77	159.09	0	0	0	0	265.16	466.01	658.81	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3488.29 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35

Efficiency of water heater 80.3 (216)

(217)m= 87.64 | 87.47 | 87.14 | 86.4 | 84.89 | 80.3 | 80.3 | 80.3 | 80.3 | 85.97 | 87.15 | 87.72 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 230.63 | 202.83 | 211.84 | 189.5 | 186.73 | 173.86 | 166.57 | 185.69 | 187.74 | 199.67 | 210.26 | 224.98

Total = Sum(219a)$_{1...12}$ = 2370.3 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3488.29	
Water heating fuel used		2370.3	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		366.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6299.97	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	753.47	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	511.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1265.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	190.15	(268)
Total CO2, kg/year	sum of (265)…(271) =				1494.53	(272)

TER = 18.7 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Baker R1 - MT

Address : The Baker R1 - MT

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.97 (1a)	x	2.38 (2a)	=	95.33	(3a)
First floor	39.97 (1b)	x	2.61 (2b)	=	104.32	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.94 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.3	=	2.795			(26)
Doors Type 2			2.15	x	1.3	=	2.795			(26)
Windows Type 1			3.53	x1/[1/(1.2)+ 0.04]		=	4.04			(27)
Windows Type 2			3.95	x1/[1/(1.2)+ 0.04]		=	4.52			(27)
Floor			39.97	x	0.1	=	3.997	75	2997.75	(28)
Walls	40.77	11.78	28.99	x	0.25	=	7.25	60	1739.4	(29)
Roof	39.97	0	39.97	x	0.09	=	3.6	9	359.73	(30)
Total area of elements, m²			120.71							(31)
Party wall			97.81	x	0	=	0	45	4401.45	(32)
Internal wall **			115.22					9	1036.98	(32c)
Internal wall **			14.41					75	1080.75	(32c)
Internal floor			39.97					18	719.46	(32d)
Internal ceiling			39.97					9	359.73	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12695.25 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 158.81 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 6.87 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 35.87 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.07	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.94	68.81	68.81	68.81	68.81	68.81	68.81	68.81	68.81	68.81	68.81	68.81	

Average = Sum(39)$_{1...12}$ /12= 68.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	

Average = Sum(40)$_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 92.67 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93	

Total = Sum(44)$_{1...12}$ = 1111.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.16	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.39	

Total = Sum(45)$_{1...12}$ = 1458 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.52	20.22	21.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.22	136.78	141.49	123.84	119.19	103.38	96.32	109.78	110.87	128.56	139.7	151.45	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-48.9	-43.02	-43.91	-36.14	-33.56	-27.69	-23.44	-28.38	-29.21	-36.1	-41.8	-47.26	(63) (G10)

Output from water heater

(64)m=	107.32	93.76	97.58	87.7	85.62	75.69	72.87	81.4	81.66	92.46	97.9	104.19	

Output from water heater (annual)$_{1...12}$	1078.15	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.53	45.1	46.63	40.77	39.21	33.97	31.61	36.08	36.46	42.33	46.05	49.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.75	18.43	14.99	11.34	8.48	7.16	7.74	10.06	13.5	17.14	20	21.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.32	221.59	215.86	203.65	188.24	173.75	164.07	161.8	167.53	179.74	195.15	209.64	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	(71)

Water heating gains (Table 5)

(72)m=	69.26	67.12	62.67	56.63	52.7	47.18	42.48	48.5	50.64	56.89	63.96	67.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	372.24	370.06	356.44	334.54	312.35	291.02	277.22	283.28	294.59	316.7	342.04	361.01	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.53	x	10.63	x	0.47	x	1.11	=	13.58	(74)
North	0.9x	0.77	x	3.53	x	20.32	x	0.47	x	1.11	=	25.96	(74)
North	0.9x	0.77	x	3.53	x	34.53	x	0.47	x	1.11	=	44.11	(74)
North	0.9x	0.77	x	3.53	x	55.46	x	0.47	x	1.11	=	70.86	(74)
North	0.9x	0.77	x	3.53	x	74.72	x	0.47	x	1.11	=	95.45	(74)
North	0.9x	0.77	x	3.53	x	79.99	x	0.47	x	1.11	=	102.18	(74)
North	0.9x	0.77	x	3.53	x	74.68	x	0.47	x	1.11	=	95.4	(74)
North	0.9x	0.77	x	3.53	x	59.25	x	0.47	x	1.11	=	75.69	(74)
North	0.9x	0.77	x	3.53	x	41.52	x	0.47	x	1.11	=	53.04	(74)
North	0.9x	0.77	x	3.53	x	24.19	x	0.47	x	1.11	=	30.9	(74)
North	0.9x	0.77	x	3.53	x	13.12	x	0.47	x	1.11	=	16.76	(74)
North	0.9x	0.77	x	3.53	x	8.86	x	0.47	x	1.11	=	11.32	(74)
South	0.9x	0.77	x	3.95	x	46.75	x	0.47	x	1.11	=	66.83	(78)
South	0.9x	0.77	x	3.95	x	76.57	x	0.47	x	1.11	=	109.45	(78)
South	0.9x	0.77	x	3.95	x	97.53	x	0.47	x	1.11	=	139.43	(78)
South	0.9x	0.77	x	3.95	x	110.23	x	0.47	x	1.11	=	157.58	(78)
South	0.9x	0.77	x	3.95	x	114.87	x	0.47	x	1.11	=	164.21	(78)
South	0.9x	0.77	x	3.95	x	110.55	x	0.47	x	1.11	=	158.03	(78)
South	0.9x	0.77	x	3.95	x	108.01	x	0.47	x	1.11	=	154.4	(78)
South	0.9x	0.77	x	3.95	x	104.89	x	0.47	x	1.11	=	149.95	(78)
South	0.9x	0.77	x	3.95	x	101.89	x	0.47	x	1.11	=	145.65	(78)
South	0.9x	0.77	x	3.95	x	82.59	x	0.47	x	1.11	=	118.06	(78)
South	0.9x	0.77	x	3.95	x	55.42	x	0.47	x	1.11	=	79.22	(78)
South	0.9x	0.77	x	3.95	x	40.4	x	0.47	x	1.11	=	57.75	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	80.42	135.41	183.54	228.44	259.66	260.21	249.8	225.63	198.68	148.96	95.98	69.07	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	452.66	505.47	539.98	562.98	572	551.23	527.02	508.91	493.28	465.66	438.01	430.08	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.93	0.86	0.71	0.55	0.59	0.8	0.94	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.75	19.91	20.15	20.45	20.73	20.92	20.98	20.97	20.86	20.51	20.06	19.7	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.92	0.82	0.65	0.46	0.5	0.74	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.51	18.74	19.1	19.52	19.9	20.13	20.19	20.18	20.06	19.6	18.97	18.44	(90)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.81	19.03	19.35	19.75	20.11	20.32	20.38	20.38	20.26	19.82	19.23	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.66	18.88	19.2	19.6	19.96	20.17	20.23	20.23	20.11	19.67	19.08	18.6	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.95	0.91	0.81	0.65	0.46	0.5	0.74	0.91	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	444.75	491.04	513.44	510.13	464.85	356.07	244.97	256.16	363.58	424.92	425.03	423.91	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	989.96	961.95	874.18	736.3	568.23	383.36	249.93	263.28	413.39	624.32	824.64	990.66	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	405.63	316.45	268.39	162.84	76.91	0	0	0	0	148.35	287.72	421.66	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2087.95 (98)

Space heating requirement in kWh/m²/year 26.12 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	405.63	316.45	268.39	162.84	76.91	0	0	0	0	148.35	287.72	421.66	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	448.21	349.66	296.56	179.94	84.98	0	0	0	0	163.93	317.92	465.92	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2307.13 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	107.32	93.76	97.58	87.7	85.62	75.69	72.87	81.4	81.66	92.46	97.9	104.19

Efficiency of water heater 87.3 (216)

(217)m= 89.81 | 89.75 | 89.62 | 89.35 | 88.79 | 87.3 | 87.3 | 87.3 | 87.3 | 89.24 | 89.67 | 89.85 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 119.5 | 104.47 | 108.87 | 98.15 | 96.44 | 86.7 | 83.48 | 93.24 | 93.54 | 103.6 | 109.19 | 115.97

Total = Sum(219a)$_{1...12}$ = 1213.13 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2307.13	
Water heating fuel used		1213.13	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	37.67		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		112.67	(231)
Electricity for lighting		366.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		3999.31	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	498.34	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	262.04	(264)
Space and water heating	(261) + (262) + (263) + (264) =			760.38	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	58.48	(267)
Electricity for lighting	(232) x	0.519	=	190.15	(268)
Total CO2, kg/year	sum of (265)…(271) =			1009	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			12.62	(273)
EI rating (section 14)				89	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Baker R1 - MT

Address : The Baker R1 - MT

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.97 (1a)	x	2.38 (2a)	=	95.33	(3a)
First floor	39.97 (1b)	x	2.61 (2b)	=	104.32	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.94 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.2	=	2.58			(26)
Doors Type 2			2.15	x	1.2	=	2.58			(26)
Windows Type 1			3.53	x1/[1/(1.4)+ 0.04]		=	4.68			(27)
Windows Type 2			3.95	x1/[1/(1.4)+ 0.04]		=	5.24			(27)
Floor			39.97	x	0.13	=	5.1961			(28)
Walls	40.77	11.78	28.99	x	0.18	=	5.22			(29)
Roof	39.97	0	39.97	x	0.13	=	5.2			(30)
Total area of elements, m²			120.71							(31)
Party wall			97.81	x	0	=	0			(32)
Internal wall **			115.22							(32c)
Internal wall **			14.41							(32c)
Internal floor			39.97							(32d)
Internal ceiling			39.97							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 30.69 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 12695.25 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.65 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 39.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.14	38.9	38.66	37.56	37.35	36.38	36.38	36.2	36.76	37.35	37.77	38.21	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	78.48	78.24	78	76.89	76.69	75.72	75.72	75.54	76.09	76.69	77.11	77.54	

Average = Sum(39)$_{1...12}$ /12= 76.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.96	0.96	0.95	0.95	0.94	0.95	0.96	0.96	0.97	

Average = Sum(40)$_{1...12}$ /12= 0.96 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 92.67 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93	

Total = Sum(44)$_{1...12}$ = 1111.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.16	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.39	

Total = Sum(45)$_{1...12}$ = 1458 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.52	20.22	21.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	45.21	48.17	44.78	44.39	41.13	42.5	44.39	44.78	48.17	48.44	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35	

Output from water heater (annual)$_{1...12}$	2011.87	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	63	55.26	57.4	50.74	49.04	43.03	40.97	45.92	46.43	53.1	56.93	61.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.75	18.43	14.99	11.34	8.48	7.16	7.74	10.06	13.5	17.14	20	21.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.32	221.59	215.86	203.65	188.24	173.75	164.07	161.8	167.53	179.74	195.15	209.64	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	(71)

Water heating gains (Table 5)

(72)m=	84.68	82.23	77.16	70.48	65.92	59.76	55.06	61.72	64.49	71.38	79.07	82.55	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	387.67	385.18	370.92	348.39	325.56	303.6	289.8	296.49	308.44	331.18	357.16	376.43	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.53	x	10.63	x	0.63	x	0.7	=	11.47	(74)
North	0.9x	0.77	x	3.53	x	20.32	x	0.63	x	0.7	=	21.92	(74)
North	0.9x	0.77	x	3.53	x	34.53	x	0.63	x	0.7	=	37.25	(74)
North	0.9x	0.77	x	3.53	x	55.46	x	0.63	x	0.7	=	59.84	(74)
North	0.9x	0.77	x	3.53	x	74.72	x	0.63	x	0.7	=	80.6	(74)
North	0.9x	0.77	x	3.53	x	79.99	x	0.63	x	0.7	=	86.29	(74)
North	0.9x	0.77	x	3.53	x	74.68	x	0.63	x	0.7	=	80.56	(74)
North	0.9x	0.77	x	3.53	x	59.25	x	0.63	x	0.7	=	63.92	(74)
North	0.9x	0.77	x	3.53	x	41.52	x	0.63	x	0.7	=	44.79	(74)
North	0.9x	0.77	x	3.53	x	24.19	x	0.63	x	0.7	=	26.1	(74)
North	0.9x	0.77	x	3.53	x	13.12	x	0.63	x	0.7	=	14.15	(74)
North	0.9x	0.77	x	3.53	x	8.86	x	0.63	x	0.7	=	9.56	(74)
South	0.9x	0.77	x	3.95	x	46.75	x	0.63	x	0.7	=	56.44	(78)
South	0.9x	0.77	x	3.95	x	76.57	x	0.63	x	0.7	=	92.43	(78)
South	0.9x	0.77	x	3.95	x	97.53	x	0.63	x	0.7	=	117.74	(78)
South	0.9x	0.77	x	3.95	x	110.23	x	0.63	x	0.7	=	133.07	(78)
South	0.9x	0.77	x	3.95	x	114.87	x	0.63	x	0.7	=	138.67	(78)
South	0.9x	0.77	x	3.95	x	110.55	x	0.63	x	0.7	=	133.45	(78)
South	0.9x	0.77	x	3.95	x	108.01	x	0.63	x	0.7	=	130.39	(78)
South	0.9x	0.77	x	3.95	x	104.89	x	0.63	x	0.7	=	126.63	(78)
South	0.9x	0.77	x	3.95	x	101.89	x	0.63	x	0.7	=	122.99	(78)
South	0.9x	0.77	x	3.95	x	82.59	x	0.63	x	0.7	=	99.69	(78)
South	0.9x	0.77	x	3.95	x	55.42	x	0.63	x	0.7	=	66.9	(78)
South	0.9x	0.77	x	3.95	x	40.4	x	0.63	x	0.7	=	48.77	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	67.91	114.35	154.99	192.91	219.27	219.74	210.95	190.54	167.78	125.79	81.05	58.33	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	455.58	499.53	525.91	541.3	544.83	523.34	500.75	487.04	476.23	456.97	438.21	434.76	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.94	0.82	0.64	0.68	0.89	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.08	20.26	20.51	20.76	20.93	20.99	20.98	20.88	20.58	20.23	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.12	20.12	20.13	20.13	20.13	20.12	20.12	20.11	20.11	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.92	0.75	0.53	0.57	0.84	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.7	18.87	19.14	19.52	19.86	20.08	20.12	20.12	20.02	19.61	19.1	18.69	(90)

fLA = Living area ÷ (4) = 0.25 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.01	19.17	19.42	19.76	20.08	20.29	20.33	20.33	20.23	19.85	19.38	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.01	19.17	19.42	19.76	20.08	20.29	20.33	20.33	20.23	19.85	19.38	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.99	0.97	0.91	0.76	0.56	0.6	0.85	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	454.22	496.77	519.84	525.16	497.88	397.83	278.4	290.53	402.49	443.75	435.49	433.77	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1154.65	1116.25	1007.61	835.24	642.35	430.56	282.73	297.01	466.32	709.1	946.74	1147.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.12	416.29	362.91	223.26	107.48	0	0	0	0	197.42	368.1	530.81	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2727.39 (98)

Space heating requirement in kWh/m²/year 34.12 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	521.12	416.29	362.91	223.26	107.48	0	0	0	0	197.42	368.1	530.81	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	557.95	445.71	388.55	239.03	115.08	0	0	0	0	211.37	394.11	568.32	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2920.12 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35

Efficiency of water heater 80.3 (216)

(217)m=	87.33	87.13	86.72	85.83	84.1	80.3	80.3	80.3	80.3	85.4	86.77	87.42

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	231.45	203.64	212.85	190.75	188.49	173.86	166.57	185.69	187.74	201	211.18	225.75

Total = Sum(219a)$_{1...12}$ = 2378.98 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2920.12	
Water heating fuel used		2378.98	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		366.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5740.48	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	630.75	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	513.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1144.61	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	190.15	(268)
Total CO2, kg/year	sum of (265)…(271) =				1373.68	(272)

TER = 17.18 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Blenmere - ET

Address : The Blenmere - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.85 (1a)	x	2.38 (2a)	=	111.74	(3a)
First floor	46.85 (1b)	x	2.61 (2b)	=	122.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.7 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		234.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			7.8	x1/[1/(1.2)+ 0.04]		=	8.93			(27)
Windows Type 2			4.75	x1/[1/(1.2)+ 0.04]		=	5.44			(27)
Windows Type 3			1.5	x1/[1/(1.2)+ 0.04]		=	1.72			(27)
Windows Type 4			4.64	x1/[1/(1.2)+ 0.04]		=	5.31			(27)
Floor			46.85	x	0.1	=	4.685	75	3513.75	(28)
Walls	96.66	20.84	75.82	x	0.25	=	18.96	60	4549.2	(29)
Roof	46.85	0	46.85	x	0.09	=	4.22	9	421.65	(30)
Total area of elements, m²			190.36							(31)
Party wall			48.89	x	0	=	0	45	2200.05	(32)
Internal wall **			158.34					9	1425.06	(32c)
Internal wall **			22.8					75	1710	(32c)
Internal floor			46.85					18	843.3	(32d)
Internal ceiling			46.85					9	421.65	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 52.05 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15084.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 160.99 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.64 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 59.69 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.76	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	98.45	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	

Average = Sum(39)$_{1...12}$ /12= 98.31 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.45	103.55	99.64	95.73	91.82	87.92	87.92	91.82	95.73	99.64	103.55	107.45	

Total = Sum(44)$_{1...12}$ = 1172.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.35	139.37	143.82	125.38	120.31	103.82	96.2	110.39	111.71	130.19	142.11	154.32	

Total = Sum(45)$_{1...12}$ = 1536.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.9	20.91	21.57	18.81	18.05	15.57	14.43	16.56	16.76	19.53	21.32	23.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.41	143.94	148.88	130.28	125.37	108.71	101.26	115.45	116.61	135.25	147.01	159.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-55.39	-48.73	-49.74	-40.92	-38	-31.35	-26.53	-32.12	-33.06	-40.87	-47.34	-53.53	(63) (G10)

Output from water heater

(64)m=	109.02	95.21	99.14	89.36	87.37	77.37	74.73	83.33	83.55	94.38	99.67	105.85	

Output from water heater (annual)$_{1...12}$ 1098.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.25	47.48	49.08	42.91	41.27	35.74	33.25	37.97	38.37	44.55	48.48	52.58	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.72	248.27	241.85	228.17	210.9	194.67	183.83	181.28	187.71	201.38	218.65	234.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	(71)

Water heating gains (Table 5)

(72)m=	72.92	70.66	65.97	59.6	55.47	49.64	44.69	51.04	53.29	59.88	67.33	70.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.64	404.48	389.74	365.85	341.42	317.97	302.79	309.03	321.34	345.46	373.2	394.16	(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	7.8	x	10.63	x	0.47	x	1.11	=	30.02	(74)
North	0.9x 0.77	x	7.8	x	20.32	x	0.47	x	1.11	=	57.36	(74)
North	0.9x 0.77	x	7.8	x	34.53	x	0.47	x	1.11	=	97.47	(74)
North	0.9x 0.77	x	7.8	x	55.46	x	0.47	x	1.11	=	156.57	(74)
North	0.9x 0.77	x	7.8	x	74.72	x	0.47	x	1.11	=	210.91	(74)
North	0.9x 0.77	x	7.8	x	79.99	x	0.47	x	1.11	=	225.78	(74)
North	0.9x 0.77	x	7.8	x	74.68	x	0.47	x	1.11	=	210.8	(74)
North	0.9x 0.77	x	7.8	x	59.25	x	0.47	x	1.11	=	167.24	(74)
North	0.9x 0.77	x	7.8	x	41.52	x	0.47	x	1.11	=	117.19	(74)
North	0.9x 0.77	x	7.8	x	24.19	x	0.47	x	1.11	=	68.28	(74)
North	0.9x 0.77	x	7.8	x	13.12	x	0.47	x	1.11	=	37.03	(74)
North	0.9x 0.77	x	7.8	x	8.86	x	0.47	x	1.11	=	25.02	(74)
East	0.9x 0.77	x	4.75	x	19.64	x	0.47	x	1.11	=	33.76	(76)
East	0.9x 0.77	x	4.75	x	38.42	x	0.47	x	1.11	=	66.05	(76)
East	0.9x 0.77	x	4.75	x	63.27	x	0.47	x	1.11	=	108.77	(76)
East	0.9x 0.77	x	4.75	x	92.28	x	0.47	x	1.11	=	158.63	(76)
East	0.9x 0.77	x	4.75	x	113.09	x	0.47	x	1.11	=	194.41	(76)
East	0.9x 0.77	x	4.75	x	115.77	x	0.47	x	1.11	=	199.01	(76)
East	0.9x 0.77	x	4.75	x	110.22	x	0.47	x	1.11	=	189.47	(76)
East	0.9x 0.77	x	4.75	x	94.68	x	0.47	x	1.11	=	162.75	(76)
East	0.9x 0.77	x	4.75	x	73.59	x	0.47	x	1.11	=	126.5	(76)
East	0.9x 0.77	x	4.75	x	45.59	x	0.47	x	1.11	=	78.37	(76)
East	0.9x 0.77	x	4.75	x	24.49	x	0.47	x	1.11	=	42.1	(76)
East	0.9x 0.77	x	4.75	x	16.15	x	0.47	x	1.11	=	27.76	(76)
South	0.9x 0.77	x	4.64	x	46.75	x	0.47	x	1.11	=	78.51	(78)
South	0.9x 0.77	x	4.64	x	76.57	x	0.47	x	1.11	=	128.57	(78)
South	0.9x 0.77	x	4.64	x	97.53	x	0.47	x	1.11	=	163.78	(78)
South	0.9x 0.77	x	4.64	x	110.23	x	0.47	x	1.11	=	185.11	(78)
South	0.9x 0.77	x	4.64	x	114.87	x	0.47	x	1.11	=	192.89	(78)
South	0.9x 0.77	x	4.64	x	110.55	x	0.47	x	1.11	=	185.63	(78)
South	0.9x 0.77	x	4.64	x	108.01	x	0.47	x	1.11	=	181.38	(78)
South	0.9x 0.77	x	4.64	x	104.89	x	0.47	x	1.11	=	176.14	(78)
South	0.9x 0.77	x	4.64	x	101.89	x	0.47	x	1.11	=	171.09	(78)
South	0.9x 0.77	x	4.64	x	82.59	x	0.47	x	1.11	=	138.68	(78)
South	0.9x 0.77	x	4.64	x	55.42	x	0.47	x	1.11	=	93.06	(78)
South	0.9x 0.77	x	4.64	x	40.4	x	0.47	x	1.11	=	67.84	(78)

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West	0.9x	0.77	x	1.5	x	19.64	x	0.47	x	1.11	=	10.66	(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.47	x	1.11	=	20.86	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.47	x	1.11	=	34.35	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.47	x	1.11	=	50.09	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.47	x	1.11	=	61.39	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.47	x	1.11	=	62.85	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.47	x	1.11	=	59.83	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.47	x	1.11	=	51.39	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.47	x	1.11	=	39.95	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.47	x	1.11	=	24.75	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.47	x	1.11	=	13.29	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.47	x	1.11	=	8.77	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	152.95	272.84	404.37	550.4	659.6	673.28	641.47	557.53	454.73	310.08	185.48	129.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	559.59	677.32	794.11	916.25	1001.02	991.25	944.26	866.56	776.07	655.54	558.67	523.55	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.76	0.59	0.45	0.5	0.74	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.44	19.68	20.04	20.45	20.77	20.94	20.98	20.97	20.85	20.41	19.83	19.38	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.86	0.71	0.52	0.35	0.4	0.67	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.95	18.3	18.82	19.39	19.81	19.99	20.03	20.03	19.91	19.34	18.52	17.86	(90)

fLA = Living area ÷ (4) = 0.16 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.19	18.52	19.01	19.56	19.96	20.14	20.19	20.18	20.06	19.51	18.73	18.11	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.04	18.37	18.86	19.41	19.81	19.99	20.04	20.03	19.91	19.36	18.58	17.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.92	0.84	0.7	0.51	0.35	0.4	0.66	0.89	0.96	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	548.34	651.14	732.59	768.11	696.09	506.73	333.54	349.72	510.92	580.7	539.07	515.09	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1352.7	1324.55	1215.2	1033.52	797.61	530.14	337.75	356.76	570.87	861.25	1128.31	1352.31	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	598.45	452.53	359.06	191.1	75.53	0	0	0	0	208.73	424.25	622.89	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2932.53 (98)

Space heating requirement in kWh/m²/year 31.3 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	598.45	452.53	359.06	191.1	75.53	0	0	0	0	208.73	424.25	622.89	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	661.27	500.03	396.75	211.16	83.46	0	0	0	0	230.64	468.78	688.28	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3240.37 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	109.02	95.21	99.14	89.36	87.37	77.37	74.73	83.33	83.55	94.38	99.67	105.85	

Efficiency of water heater 87.3 (216)

(217)m=	89.99	89.93	89.79	89.46	88.76	87.3	87.3	87.3	87.3	89.48	89.87	90.02	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	121.15	105.87	110.41	99.89	98.44	88.62	85.6	95.45	95.7	105.48	110.9	117.58	

Total = Sum(219a)$_{1...12}$ = 1235.11 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3240.37
Water heating fuel used		1235.11
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	43.43	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)

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Total electricity for the above, kWh/year	sum of (230a)…(230g) =	118.43	(231)
Electricity for lighting		386.89	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4980.8	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	699.92	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	266.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =				966.7	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	61.47	(267)
Electricity for lighting	(232) x		0.519	=	200.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1228.97	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			13.12	(273)
EI rating (section 14)					88	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Blenmere - ET

Address : The Blenmere - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.85 (1a)	x	2.38 (2a)	=	111.74	(3a)
First floor	46.85 (1b)	x	2.61 (2b)	=	122.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.7 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	234.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			7.8	x1/[1/(1.4)+ 0.04]		=	10.34			(27)
Windows Type 2			4.75	x1/[1/(1.4)+ 0.04]		=	6.3			(27)
Windows Type 3			1.5	x1/[1/(1.4)+ 0.04]		=	1.99			(27)
Windows Type 4			4.64	x1/[1/(1.4)+ 0.04]		=	6.15			(27)
Floor			46.85	x	0.13	=	6.090499			(28)
Walls	96.66	20.84	75.82	x	0.18	=	13.65			(29)
Roof	46.85	0	46.85	x	0.13	=	6.09			(30)
Total area of elements, m²			190.36							(31)
Party wall			48.89	x	0	=	0			(32)
Internal wall **			158.34							(32c)
Internal wall **			22.8							(32c)
Internal floor			46.85							(32d)
Internal ceiling			46.85							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 53.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15084.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.72 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 63.9 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.1	44.85	44.6	43.44	43.22	42.21	42.21	42.03	42.6	43.22	43.66	44.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(39)m=	109	108.75	108.5	107.35	107.13	106.12	106.12	105.93	106.51	107.13	107.57	108.03	

Average = Sum(39)$_{1...12}$ /12= 107.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.16	1.16	1.16	1.15	1.14	1.13	1.13	1.13	1.14	1.14	1.15	1.15	

Average = Sum(40)$_{1...12}$ /12= 1.15 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.45	103.55	99.64	95.73	91.82	87.92	87.92	91.82	95.73	99.64	103.55	107.45	

Total = Sum(44)$_{1...12}$ = 1172.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.35	139.37	143.82	125.38	120.31	103.82	96.2	110.39	111.71	130.19	142.11	154.32	

Total = Sum(45)$_{1...12}$ = 1536.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.9	20.91	21.57	18.81	18.05	15.57	14.43	16.56	16.76	19.53	21.32	23.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.77	47.21	46.79	43.36	44.8	46.79	47.21	50.77	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.31	185.4	194.59	172.59	167.1	147.17	141	157.18	158.92	180.96	191.43	205.28	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	210.31	185.4	194.59	172.59	167.1	147.17	141	157.18	158.92	180.96	191.43	205.28	

Output from water heater (annual)$_{1...12}$ 2111.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.72	57.85	60.51	53.49	51.7	45.36	43.19	48.4	48.95	55.98	59.58	64.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.91	19.46	15.82	11.98	8.96	7.56	8.17	10.62	14.25	18.1	21.12	22.52	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.72	248.27	241.85	228.17	210.9	194.67	183.83	181.28	187.71	201.38	218.65	234.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	(71)

Water heating gains (Table 5)

(72)m=	88.34	86.08	81.33	74.29	69.49	63	58.05	65.06	67.98	75.24	82.75	86.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	422.06	419.91	405.1	380.54	355.44	331.32	316.14	323.05	336.03	360.82	388.62	409.58	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	7.8	x	10.63	x	0.63	x	0.7	=	25.35	(74)
North	0.9x 0.77	x	7.8	x	20.32	x	0.63	x	0.7	=	48.44	(74)
North	0.9x 0.77	x	7.8	x	34.53	x	0.63	x	0.7	=	82.31	(74)
North	0.9x 0.77	x	7.8	x	55.46	x	0.63	x	0.7	=	132.22	(74)
North	0.9x 0.77	x	7.8	x	74.72	x	0.63	x	0.7	=	178.11	(74)
North	0.9x 0.77	x	7.8	x	79.99	x	0.63	x	0.7	=	190.67	(74)
North	0.9x 0.77	x	7.8	x	74.68	x	0.63	x	0.7	=	178.01	(74)
North	0.9x 0.77	x	7.8	x	59.25	x	0.63	x	0.7	=	141.23	(74)
North	0.9x 0.77	x	7.8	x	41.52	x	0.63	x	0.7	=	98.97	(74)
North	0.9x 0.77	x	7.8	x	24.19	x	0.63	x	0.7	=	57.66	(74)
North	0.9x 0.77	x	7.8	x	13.12	x	0.63	x	0.7	=	31.27	(74)
North	0.9x 0.77	x	7.8	x	8.86	x	0.63	x	0.7	=	21.13	(74)
East	0.9x 0.77	x	4.75	x	19.64	x	0.63	x	0.7	=	28.51	(76)
East	0.9x 0.77	x	4.75	x	38.42	x	0.63	x	0.7	=	55.77	(76)
East	0.9x 0.77	x	4.75	x	63.27	x	0.63	x	0.7	=	91.85	(76)
East	0.9x 0.77	x	4.75	x	92.28	x	0.63	x	0.7	=	133.96	(76)
East	0.9x 0.77	x	4.75	x	113.09	x	0.63	x	0.7	=	164.17	(76)
East	0.9x 0.77	x	4.75	x	115.77	x	0.63	x	0.7	=	168.06	(76)
East	0.9x 0.77	x	4.75	x	110.22	x	0.63	x	0.7	=	160	(76)
East	0.9x 0.77	x	4.75	x	94.68	x	0.63	x	0.7	=	137.44	(76)
East	0.9x 0.77	x	4.75	x	73.59	x	0.63	x	0.7	=	106.83	(76)
East	0.9x 0.77	x	4.75	x	45.59	x	0.63	x	0.7	=	66.18	(76)
East	0.9x 0.77	x	4.75	x	24.49	x	0.63	x	0.7	=	35.55	(76)
East	0.9x 0.77	x	4.75	x	16.15	x	0.63	x	0.7	=	23.45	(76)
South	0.9x 0.77	x	4.64	x	46.75	x	0.63	x	0.7	=	66.3	(78)
South	0.9x 0.77	x	4.64	x	76.57	x	0.63	x	0.7	=	108.58	(78)
South	0.9x 0.77	x	4.64	x	97.53	x	0.63	x	0.7	=	138.31	(78)
South	0.9x 0.77	x	4.64	x	110.23	x	0.63	x	0.7	=	156.32	(78)
South	0.9x 0.77	x	4.64	x	114.87	x	0.63	x	0.7	=	162.89	(78)
South	0.9x 0.77	x	4.64	x	110.55	x	0.63	x	0.7	=	156.76	(78)
South	0.9x 0.77	x	4.64	x	108.01	x	0.63	x	0.7	=	153.17	(78)
South	0.9x 0.77	x	4.64	x	104.89	x	0.63	x	0.7	=	148.75	(78)
South	0.9x 0.77	x	4.64	x	101.89	x	0.63	x	0.7	=	144.48	(78)
South	0.9x 0.77	x	4.64	x	82.59	x	0.63	x	0.7	=	117.11	(78)
South	0.9x 0.77	x	4.64	x	55.42	x	0.63	x	0.7	=	78.58	(78)
South	0.9x 0.77	x	4.64	x	40.4	x	0.63	x	0.7	=	57.29	(78)

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West	0.9x	0.77	x	1.5	x	19.64	x	0.63	x	0.7	=	9	(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.63	x	0.7	=	17.61	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.63	x	0.7	=	29.01	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.63	x	0.7	=	42.3	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.63	x	0.7	=	51.84	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.63	x	0.7	=	53.07	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.63	x	0.7	=	50.53	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.63	x	0.7	=	43.4	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.63	x	0.7	=	33.73	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.63	x	0.7	=	20.9	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.63	x	0.7	=	11.23	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.63	x	0.7	=	7.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.16	230.4	341.48	464.79	557.01	568.56	541.7	470.81	384.01	261.85	156.63	109.27	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.22	650.31	746.58	845.33	912.46	899.89	857.85	793.87	720.04	622.67	545.25	518.85	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.87	0.7	0.53	0.59	0.84	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.73	19.9	20.16	20.51	20.8	20.95	20.99	20.98	20.87	20.49	20.05	19.7	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.95	19.95	19.95	19.96	19.97	19.97	19.97	19.98	19.97	19.97	19.96	19.96	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.61	0.41	0.47	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.26	18.5	18.89	19.39	19.77	19.94	19.97	19.97	19.87	19.37	18.73	18.22	(90)

fLA = Living area ÷ (4) = 0.16 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.49	18.72	19.09	19.57	19.93	20.1	20.13	20.13	20.03	19.55	18.94	18.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.49	18.72	19.09	19.57	19.93	20.1	20.13	20.13	20.03	19.55	18.94	18.46	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.93	0.82	0.62	0.43	0.49	0.78	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.14	644.63	729.62	788.29	748.32	559.57	371.88	389.54	558.83	596.06	540.86	517.38	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1547.06	1503.39	1366.44	1145.01	881.82	584.06	375.03	395.31	631.49	959.05	1273.35	1540.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	742.45	577.08	473.8	256.84	99.32	0	0	0	0	270.07	527.4	760.96	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3707.93 (98)

Space heating requirement in kWh/m²/year 39.57 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	742.45	577.08	473.8	256.84	99.32	0	0	0	0	270.07	527.4	760.96	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	794.92	617.86	507.28	274.99	106.34	0	0	0	0	289.15	564.66	814.74	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3969.94 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	210.31	185.4	194.59	172.59	167.1	147.17	141	157.18	158.92	180.96	191.43	205.28	

Efficiency of water heater 80.3 (216)

(217)m=	87.96	87.72	87.21	86.05	83.79	80.3	80.3	80.3	80.3	86.06	87.47	88.05	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.1	211.36	223.14	200.57	199.43	183.28	175.59	195.75	197.91	210.28	218.85	233.15	

Total = Sum(219a)$_{1...12}$ = 2488.4 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3969.94
Water heating fuel used		2488.4
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)

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Electricity for lighting				386.89	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =				6920.24	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	857.51	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	537.49	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1395	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	200.8	(268)
Total CO2, kg/year		sum of (265)…(271) =			1634.72	(272)

TER = 17.45 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Coiner - ET

Address : The Coiner - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.97 (1a)	x	2.38 (2a)	=	95.33	(3a)
First floor	39.97 (1b)	x	2.61 (2b)	=	104.32	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.94 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			3.53	x1/[1/(1.2)+ 0.04]		=	4.04			(27)
Windows Type 2			2.17	x1/[1/(1.2)+ 0.04]		=	2.48			(27)
Windows Type 3			4.51	x1/[1/(1.2)+ 0.04]		=	5.16			(27)
Floor			39.97	x	0.1	=	3.997	75	2997.75	(28)
Walls	89.59	12.36	77.23	x	0.25	=	19.31	60	4633.8	(29)
Roof	39.97	0	39.97	x	0.09	=	3.6	9	359.73	(30)
Total area of elements, m²			169.53							(31)
Party wall			48.89	x	0	=	0	45	2200.05	(32)
Internal wall **			130.05					9	1170.45	(32c)
Internal wall **			14.29					75	1071.75	(32c)
Internal floor			39.97					18	719.46	(32d)
Internal ceiling			39.97					9	359.73	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.39 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13512.72 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 169.04 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 6.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.65 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	33.07	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	32.94	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.72	80.59	80.59	80.59	80.59	80.59	80.59	80.59	80.59	80.59	80.59	80.59	

Average = Sum(39)$_{1...12}$ /12= 80.6 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 92.67 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93	

Total = Sum(44)$_{1...12}$ = 1111.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.16	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.39	

Total = Sum(45)$_{1...12}$ = 1458 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.52	20.22	21.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	156.22	136.78	141.49	123.84	119.19	103.38	96.32	109.78	110.87	128.56	139.7	151.45	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-51.61	-45.41	-46.35	-38.15	-35.43	-29.23	-24.75	-29.96	-30.83	-38.1	-44.13	-49.88	(63) (G10)

Output from water heater

(64)m=	104.61	91.37	95.14	85.69	83.76	74.15	71.57	79.82	80.04	90.46	95.58	101.57	

Output from water heater (annual)$_{1...12}$	1053.74	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	51.53	45.1	46.63	40.77	39.21	33.97	31.61	36.08	36.46	42.33	46.05	49.94	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.54	18.24	14.84	11.23	8.4	7.09	7.66	9.96	13.36	16.97	19.8	21.11	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.32	221.59	215.86	203.65	188.24	173.75	164.07	161.8	167.53	179.74	195.15	209.64	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	(71)

Water heating gains (Table 5)

(72)m=	69.26	67.12	62.67	56.63	52.7	47.18	42.48	48.5	50.64	56.89	63.96	67.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	372.04	369.87	356.29	334.43	312.26	290.94	277.14	283.18	294.46	316.53	341.84	360.8	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.53	x	10.63	x	0.47	x	1.11	=	13.58	(74)
North	0.9x 0.77	x	3.53	x	20.32	x	0.47	x	1.11	=	25.96	(74)
North	0.9x 0.77	x	3.53	x	34.53	x	0.47	x	1.11	=	44.11	(74)
North	0.9x 0.77	x	3.53	x	55.46	x	0.47	x	1.11	=	70.86	(74)
North	0.9x 0.77	x	3.53	x	74.72	x	0.47	x	1.11	=	95.45	(74)
North	0.9x 0.77	x	3.53	x	79.99	x	0.47	x	1.11	=	102.18	(74)
North	0.9x 0.77	x	3.53	x	74.68	x	0.47	x	1.11	=	95.4	(74)
North	0.9x 0.77	x	3.53	x	59.25	x	0.47	x	1.11	=	75.69	(74)
North	0.9x 0.77	x	3.53	x	41.52	x	0.47	x	1.11	=	53.04	(74)
North	0.9x 0.77	x	3.53	x	24.19	x	0.47	x	1.11	=	30.9	(74)
North	0.9x 0.77	x	3.53	x	13.12	x	0.47	x	1.11	=	16.76	(74)
North	0.9x 0.77	x	3.53	x	8.86	x	0.47	x	1.11	=	11.32	(74)
South	0.9x 0.77	x	2.17	x	46.75	x	0.47	x	1.11	=	36.72	(78)
South	0.9x 0.77	x	4.51	x	46.75	x	0.47	x	1.11	=	76.31	(78)
South	0.9x 0.77	x	2.17	x	76.57	x	0.47	x	1.11	=	60.13	(78)
South	0.9x 0.77	x	4.51	x	76.57	x	0.47	x	1.11	=	124.97	(78)
South	0.9x 0.77	x	2.17	x	97.53	x	0.47	x	1.11	=	76.6	(78)
South	0.9x 0.77	x	4.51	x	97.53	x	0.47	x	1.11	=	159.19	(78)
South	0.9x 0.77	x	2.17	x	110.23	x	0.47	x	1.11	=	86.57	(78)
South	0.9x 0.77	x	4.51	x	110.23	x	0.47	x	1.11	=	179.92	(78)
South	0.9x 0.77	x	2.17	x	114.87	x	0.47	x	1.11	=	90.21	(78)
South	0.9x 0.77	x	4.51	x	114.87	x	0.47	x	1.11	=	187.49	(78)
South	0.9x 0.77	x	2.17	x	110.55	x	0.47	x	1.11	=	86.82	(78)
South	0.9x 0.77	x	4.51	x	110.55	x	0.47	x	1.11	=	180.43	(78)
South	0.9x 0.77	x	2.17	x	108.01	x	0.47	x	1.11	=	84.82	(78)
South	0.9x 0.77	x	4.51	x	108.01	x	0.47	x	1.11	=	176.29	(78)
South	0.9x 0.77	x	2.17	x	104.89	x	0.47	x	1.11	=	82.38	(78)
South	0.9x 0.77	x	4.51	x	104.89	x	0.47	x	1.11	=	171.21	(78)
South	0.9x 0.77	x	2.17	x	101.89	x	0.47	x	1.11	=	80.01	(78)
South	0.9x 0.77	x	4.51	x	101.89	x	0.47	x	1.11	=	166.29	(78)
South	0.9x 0.77	x	2.17	x	82.59	x	0.47	x	1.11	=	64.86	(78)
South	0.9x 0.77	x	4.51	x	82.59	x	0.47	x	1.11	=	134.79	(78)
South	0.9x 0.77	x	2.17	x	55.42	x	0.47	x	1.11	=	43.52	(78)
South	0.9x 0.77	x	4.51	x	55.42	x	0.47	x	1.11	=	90.45	(78)
South	0.9x 0.77	x	2.17	x	40.4	x	0.47	x	1.11	=	31.73	(78)
South	0.9x 0.77	x	4.51	x	40.4	x	0.47	x	1.11	=	65.94	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	126.61	211.06	279.9	337.35	373.15	369.43	356.52	329.27	299.35	230.55	150.73	108.99

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	498.64	580.94	636.19	671.78	685.41	660.37	633.66	612.45	593.8	547.08	492.57	469.79

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	0.99	0.98	0.96	0.92	0.84	0.69	0.54	0.57	0.78	0.93	0.98	0.99

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.6	19.81	20.09	20.42	20.71	20.91	20.98	20.97	20.84	20.46	19.96	19.55

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08	20.08

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.95	0.9	0.8	0.62	0.43	0.47	0.71	0.91	0.98	0.99

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.2	18.5	18.91	19.37	19.77	20	20.06	20.06	19.94	19.44	18.72	18.12

(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.54	18.81	19.19	19.62	19.99	20.22	20.28	20.27	20.15	19.68	19.02	18.46

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.39	18.66	19.04	19.47	19.84	20.07	20.13	20.12	20	19.53	18.87	18.31

(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.94	0.89	0.79	0.62	0.44	0.48	0.71	0.9	0.97	0.98

(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	488.96	560.74	597.23	595.49	538.94	408.6	278.53	291.68	419.49	490.65	475.89	462.39

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1137.05	1109.16	1010.34	851.73	656.32	440.44	284.48	300.09	475.64	720.04	948.19	1137.35

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	482.17	368.54	307.35	184.49	87.33	0	0	0	0	170.67	340.06	502.17

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 2442.78 (98)

Space heating requirement in kWh/m²/year 30.56 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)													kWh/year
	482.17	368.54	307.35	184.49	87.33	0	0	0	0	170.67	340.06	502.17	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	532.79	407.22	339.61	203.85	96.5	0	0	0	0	188.58	375.76	554.88	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2699.2 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater (calculated above)	104.61	91.37	95.14	85.69	83.76	74.15	71.57	79.82	80.04	90.46	95.58	101.57
Efficiency of water heater												87.3 (216)
(217)m=	89.91	89.85	89.72	89.46	88.9	87.3	87.3	87.3	87.3	89.37	89.78	89.95 (217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m												
(219)m=	116.34	101.69	106.03	95.78	94.21	84.94	81.98	91.43	91.68	101.22	106.46	112.92

Total = Sum(219a)$_{1...12}$ = 1184.7 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2699.2
Water heating fuel used		1184.7
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	37.06	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	112.06 (231)
Electricity for lighting		362.73 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4358.69 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	583.03 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	255.9 (264)
Space and water heating	(261) + (262) + (263) + (264) =			838.92 (265)

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Electricity for pumps, fans and electric keep-hot	(231)	x		0.519	=	58.16	(267)
Electricity for lighting	(232)	x		0.519	=	188.26	(268)
Total CO2, kg/year			sum of (265)…(271) =			1085.34	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =			13.58	(273)
EI rating (section 14)						88	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Coiner - ET

Address : The Coiner - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.97 (1a)	x	2.38 (2a)	=	95.33	(3a)
First floor	39.97 (1b)	x	2.61 (2b)	=	104.32	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	79.94 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		199.65	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.4 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.34 (21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.43	0.43	0.42	0.37	0.37	0.32	0.32	0.31	0.34	0.37	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			3.53	x1/[1/(1.4)+ 0.04]		=	4.68			(27)
Windows Type 2			2.17	x1/[1/(1.4)+ 0.04]		=	2.88			(27)
Windows Type 3			4.51	x1/[1/(1.4)+ 0.04]		=	5.98			(27)
Floor			39.97	x	0.13	=	5.1961			(28)
Walls	89.59	12.36	77.23	x	0.18	=	13.9			(29)
Roof	39.97	0	39.97	x	0.13	=	5.2			(30)
Total area of elements, m²			169.53							(31)
Party wall			48.89	x	0	=	0			(32)
Internal wall **			130.05							(32c)
Internal wall **			14.29							(32c)
Internal floor			39.97							(32d)
Internal ceiling			39.97							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.41 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 13512.72 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 8.93 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 49.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.14	38.9	38.66	37.56	37.35	36.38	36.38	36.2	36.76	37.35	37.77	38.21	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	88.48	88.24	88	86.89	86.68	85.72	85.72	85.54	86.09	86.68	87.1	87.54	

Average = Sum(39)$_{1...12}$ /12= 86.89 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.1	1.1	1.09	1.08	1.07	1.07	1.07	1.08	1.08	1.09	1.1	

Average = Sum(40)$_{1...12}$ /12= 1.09 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.46 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 92.67 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.93	98.23	94.52	90.81	87.11	83.4	83.4	87.11	90.81	94.52	98.23	101.93	

Total = Sum(44)$_{1...12}$ = 1111.99 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.16	132.21	136.43	118.94	114.13	98.48	91.26	104.72	105.97	123.5	134.81	146.39	

Total = Sum(45)$_{1...12}$ = 1458 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.67	19.83	20.46	17.84	17.12	14.77	13.69	15.71	15.9	18.52	20.22	21.96	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	45.21	48.17	44.78	44.39	41.13	42.5	44.39	44.78	48.17	48.44	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35	

Output from water heater (annual)$_{1...12}$	2011.87	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	63	55.26	57.4	50.74	49.04	43.03	40.97	45.92	46.43	53.1	56.93	61.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	123.09	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	20.54	18.24	14.84	11.23	8.4	7.09	7.66	9.96	13.36	16.97	19.8	21.11	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	219.32	221.59	215.86	203.65	188.24	173.75	164.07	161.8	167.53	179.74	195.15	209.64	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	35.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	-98.47	(71)

Water heating gains (Table 5)

(72)m=	84.68	82.23	77.16	70.48	65.92	59.76	55.06	61.72	64.49	71.38	79.07	82.55	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	387.46	384.99	370.77	348.28	325.48	303.52	289.72	296.39	308.31	331.01	356.96	376.22	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.53	x	10.63	x	0.63	x	0.7	=	11.47	(74)
North	0.9x	0.77	x	3.53	x	20.32	x	0.63	x	0.7	=	21.92	(74)
North	0.9x	0.77	x	3.53	x	34.53	x	0.63	x	0.7	=	37.25	(74)
North	0.9x	0.77	x	3.53	x	55.46	x	0.63	x	0.7	=	59.84	(74)
North	0.9x	0.77	x	3.53	x	74.72	x	0.63	x	0.7	=	80.6	(74)
North	0.9x	0.77	x	3.53	x	79.99	x	0.63	x	0.7	=	86.29	(74)
North	0.9x	0.77	x	3.53	x	74.68	x	0.63	x	0.7	=	80.56	(74)
North	0.9x	0.77	x	3.53	x	59.25	x	0.63	x	0.7	=	63.92	(74)
North	0.9x	0.77	x	3.53	x	41.52	x	0.63	x	0.7	=	44.79	(74)
North	0.9x	0.77	x	3.53	x	24.19	x	0.63	x	0.7	=	26.1	(74)
North	0.9x	0.77	x	3.53	x	13.12	x	0.63	x	0.7	=	14.15	(74)
North	0.9x	0.77	x	3.53	x	8.86	x	0.63	x	0.7	=	9.56	(74)
South	0.9x	0.77	x	2.17	x	46.75	x	0.63	x	0.7	=	31.01	(78)
South	0.9x	0.77	x	4.51	x	46.75	x	0.63	x	0.7	=	64.44	(78)
South	0.9x	0.77	x	2.17	x	76.57	x	0.63	x	0.7	=	50.78	(78)
South	0.9x	0.77	x	4.51	x	76.57	x	0.63	x	0.7	=	105.53	(78)
South	0.9x	0.77	x	2.17	x	97.53	x	0.63	x	0.7	=	64.68	(78)
South	0.9x	0.77	x	4.51	x	97.53	x	0.63	x	0.7	=	134.43	(78)
South	0.9x	0.77	x	2.17	x	110.23	x	0.63	x	0.7	=	73.11	(78)
South	0.9x	0.77	x	4.51	x	110.23	x	0.63	x	0.7	=	151.94	(78)
South	0.9x	0.77	x	2.17	x	114.87	x	0.63	x	0.7	=	76.18	(78)
South	0.9x	0.77	x	4.51	x	114.87	x	0.63	x	0.7	=	158.33	(78)
South	0.9x	0.77	x	2.17	x	110.55	x	0.63	x	0.7	=	73.31	(78)
South	0.9x	0.77	x	4.51	x	110.55	x	0.63	x	0.7	=	152.37	(78)
South	0.9x	0.77	x	2.17	x	108.01	x	0.63	x	0.7	=	71.63	(78)
South	0.9x	0.77	x	4.51	x	108.01	x	0.63	x	0.7	=	148.87	(78)
South	0.9x	0.77	x	2.17	x	104.89	x	0.63	x	0.7	=	69.56	(78)
South	0.9x	0.77	x	4.51	x	104.89	x	0.63	x	0.7	=	144.58	(78)
South	0.9x	0.77	x	2.17	x	101.89	x	0.63	x	0.7	=	67.57	(78)
South	0.9x	0.77	x	4.51	x	101.89	x	0.63	x	0.7	=	140.43	(78)
South	0.9x	0.77	x	2.17	x	82.59	x	0.63	x	0.7	=	54.77	(78)
South	0.9x	0.77	x	4.51	x	82.59	x	0.63	x	0.7	=	113.83	(78)
South	0.9x	0.77	x	2.17	x	55.42	x	0.63	x	0.7	=	36.75	(78)
South	0.9x	0.77	x	4.51	x	55.42	x	0.63	x	0.7	=	76.38	(78)
South	0.9x	0.77	x	2.17	x	40.4	x	0.63	x	0.7	=	26.79	(78)
South	0.9x	0.77	x	4.51	x	40.4	x	0.63	x	0.7	=	55.68	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	106.92	178.24	236.37	284.88	315.11	311.97	301.07	278.06	252.79	194.69	127.29	92.04

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.37	563.23	607.14	633.16	640.59	615.5	590.79	574.45	561.1	525.71	484.24	468.26

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	1	0.99	0.97	0.92	0.79	0.62	0.65	0.86	0.97	1	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.98	20.2	20.48	20.74	20.93	20.98	20.98	20.87	20.54	20.13	19.81

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20	20	20	20.01	20.01	20.02	20.02	20.03	20.02	20.01	20.01	20

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.96	0.89	0.71	0.49	0.53	0.8	0.96	0.99	1

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.44	18.66	18.98	19.39	19.75	19.97	20.02	20.02	19.91	19.47	18.89	18.41

(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	18.97	19.27	19.65	19.98	20.2	20.25	20.24	20.14	19.73	19.19	18.74

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	18.97	19.27	19.65	19.98	20.2	20.25	20.24	20.14	19.73	19.19	18.74

(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.88	0.72	0.52	0.56	0.81	0.96	0.99	1

(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	492.18	558.12	595.55	604.22	566.49	444.28	307.54	321.44	453.12	503.53	479.77	466.67

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1280.49	1241.62	1123.45	933.94	718.02	479.76	312.62	328.87	519.96	791.13	1052.69	1273.23

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	586.5	459.31	392.76	237.4	112.74	0	0	0	0	213.98	412.5	600.08

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3015.26 (98)

Space heating requirement in kWh/m²/year 37.72 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	586.5	459.31	392.76	237.4	112.74	0	0	0	0	213.98	412.5	600.08	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	627.95	491.77	420.51	254.17	120.7	0	0	0	0	229.1	441.65	642.48	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3228.33 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater (calculated above)	202.12	177.42	184.59	163.72	158.51	139.61	133.76	149.11	150.75	171.66	183.25	197.35

Efficiency of water heater 80.3 (216)

(217)m=	87.58	87.34	86.91	85.99	84.21	80.3	80.3	80.3	80.3	85.61	87.03	87.67

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	230.79	203.14	212.41	190.41	188.24	173.86	166.57	185.69	187.74	200.53	210.55	225.11

Total = Sum(219a)$_{1...12}$ = 2375.03 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3228.33	
Water heating fuel used		2375.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		362.73	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6041.09	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	697.32	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	513.01	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1210.33	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)

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Electricity for lighting	(232)	x	0.519	=	188.26	(268)
Total CO2, kg/year			sum of (265)…(271) =		1437.51	(272)
TER =					17.98	(273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Framer Det

Address : The Framer Det

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.19 (1a)	x	2.38 (2a)	=	114.93	(3a)
First floor	48.19 (1b)	x	2.61 (2b)	=	125.78	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.38 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		240.71	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.14	x	1.3	=	2.782			(26)
Doors Type 2			2.14	x	1.3	=	2.782			(26)
Windows Type 1			9.11	x	1/[1/(1.2)+ 0.04]	=	10.43			(27)
Windows Type 2			5.33	x	1/[1/(1.2)+ 0.04]	=	6.1			(27)
Windows Type 3			12.86	x	1/[1/(1.2)+ 0.04]	=	14.73			(27)
Floor			48.19	x	0.1	=	4.819	75	3614.25	(28)
Walls	156.49	31.58	124.91	x	0.25	=	31.23	60	7494.6	(29)
Roof	48.19	0	48.19	x	0.09	=	4.34	9	433.71	(30)
Total area of elements, m²			252.87							(31)
Internal wall **			23.13					75	1734.75	(32c)
Internal wall **			161.34					9	1452.06	(32c)
Internal floor			48.19					18	867.42	(32d)
Internal ceiling			48.19					9	433.71	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 77.21 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16030.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 166.33 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.74 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 84.95 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.87	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	39.72	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	124.82	124.66	124.66	124.66	124.66	124.66	124.66	124.66	124.66	124.66	124.66	124.66	

Average = Sum(39)$_{1...12}$ /12= 124.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	1.29	

Average = Sum(40)$_{1...12}$ /12= 1.29 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 98.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	108.25	104.31	100.37	96.44	92.5	88.57	88.57	92.5	96.44	100.37	104.31	108.25	

Total = Sum(44)$_{1...12}$ = 1180.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.53	140.4	144.88	126.31	121.19	104.58	96.91	111.21	112.53	131.15	143.16	155.46	

Total = Sum(45)$_{1...12}$ = 1548.3 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.08	21.06	21.73	18.95	18.18	15.69	14.54	16.68	16.88	19.67	21.47	23.32	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	165.59	144.97	149.94	131.2	126.25	109.48	101.97	116.27	117.43	136.21	148.05	160.52	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-55.93	-49.21	-50.22	-41.32	-38.37	-31.65	-26.79	-32.43	-33.38	-41.26	-47.8	-54.06	(63) (G10)

Output from water heater

(64)m=	109.66	95.76	99.71	89.88	87.89	77.83	75.18	83.83	84.05	94.95	100.26	106.46	

Output from water heater (annual)$_{1...12}$	1105.47	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.64	47.82	49.44	43.22	41.56	36	33.49	38.24	38.64	44.87	48.82	52.96	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.32	19.82	16.12	12.2	9.12	7.7	8.32	10.82	14.52	18.44	21.52	22.94	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	250.34	252.94	246.39	232.45	214.86	198.33	187.28	184.69	191.23	205.17	222.76	239.29	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	(71)

Water heating gains (Table 5)

(72)m=	73.44	71.17	66.45	60.03	55.86	50	45.01	51.4	53.67	60.31	67.81	71.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	412.65	410.48	395.51	371.24	346.4	322.58	307.17	313.45	325.97	350.47	378.64	399.96	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	9.11	x	10.63	x	0.47	x	1.11	=	35.06	(74)
North	0.9x 0.77	x	9.11	x	20.32	x	0.47	x	1.11	=	67	(74)
North	0.9x 0.77	x	9.11	x	34.53	x	0.47	x	1.11	=	113.84	(74)
North	0.9x 0.77	x	9.11	x	55.46	x	0.47	x	1.11	=	182.86	(74)
North	0.9x 0.77	x	9.11	x	74.72	x	0.47	x	1.11	=	246.33	(74)
North	0.9x 0.77	x	9.11	x	79.99	x	0.47	x	1.11	=	263.7	(74)
North	0.9x 0.77	x	9.11	x	74.68	x	0.47	x	1.11	=	246.2	(74)
North	0.9x 0.77	x	9.11	x	59.25	x	0.47	x	1.11	=	195.33	(74)
North	0.9x 0.77	x	9.11	x	41.52	x	0.47	x	1.11	=	136.88	(74)
North	0.9x 0.77	x	9.11	x	24.19	x	0.47	x	1.11	=	79.75	(74)
North	0.9x 0.77	x	9.11	x	13.12	x	0.47	x	1.11	=	43.25	(74)
North	0.9x 0.77	x	9.11	x	8.86	x	0.47	x	1.11	=	29.23	(74)
East	0.9x 0.77	x	5.33	x	19.64	x	0.47	x	1.11	=	37.88	(76)
East	0.9x 0.77	x	5.33	x	38.42	x	0.47	x	1.11	=	74.11	(76)
East	0.9x 0.77	x	5.33	x	63.27	x	0.47	x	1.11	=	122.05	(76)
East	0.9x 0.77	x	5.33	x	92.28	x	0.47	x	1.11	=	178	(76)
East	0.9x 0.77	x	5.33	x	113.09	x	0.47	x	1.11	=	218.15	(76)
East	0.9x 0.77	x	5.33	x	115.77	x	0.47	x	1.11	=	223.31	(76)
East	0.9x 0.77	x	5.33	x	110.22	x	0.47	x	1.11	=	212.6	(76)
East	0.9x 0.77	x	5.33	x	94.68	x	0.47	x	1.11	=	182.62	(76)
East	0.9x 0.77	x	5.33	x	73.59	x	0.47	x	1.11	=	141.95	(76)
East	0.9x 0.77	x	5.33	x	45.59	x	0.47	x	1.11	=	87.94	(76)
East	0.9x 0.77	x	5.33	x	24.49	x	0.47	x	1.11	=	47.24	(76)
East	0.9x 0.77	x	5.33	x	16.15	x	0.47	x	1.11	=	31.15	(76)
South	0.9x 0.77	x	12.86	x	46.75	x	0.47	x	1.11	=	217.59	(78)
South	0.9x 0.77	x	12.86	x	76.57	x	0.47	x	1.11	=	356.35	(78)
South	0.9x 0.77	x	12.86	x	97.53	x	0.47	x	1.11	=	453.93	(78)
South	0.9x 0.77	x	12.86	x	110.23	x	0.47	x	1.11	=	513.03	(78)
South	0.9x 0.77	x	12.86	x	114.87	x	0.47	x	1.11	=	534.61	(78)
South	0.9x 0.77	x	12.86	x	110.55	x	0.47	x	1.11	=	514.49	(78)
South	0.9x 0.77	x	12.86	x	108.01	x	0.47	x	1.11	=	502.69	(78)
South	0.9x 0.77	x	12.86	x	104.89	x	0.47	x	1.11	=	488.18	(78)
South	0.9x 0.77	x	12.86	x	101.89	x	0.47	x	1.11	=	474.18	(78)
South	0.9x 0.77	x	12.86	x	82.59	x	0.47	x	1.11	=	384.36	(78)
South	0.9x 0.77	x	12.86	x	55.42	x	0.47	x	1.11	=	257.91	(78)
South	0.9x 0.77	x	12.86	x	40.4	x	0.47	x	1.11	=	188.01	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	290.53	497.46	689.82	873.9	999.09	1001.51	961.5	866.14	753	552.04	348.4	248.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	703.18	907.93	1085.33	1245.14	1345.49	1324.09	1268.66	1179.59	1078.98	902.51	727.04	648.35	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.92	0.84	0.71	0.55	0.42	0.46	0.68	0.89	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.22	19.55	19.97	20.41	20.74	20.92	20.98	20.97	20.84	20.37	19.68	19.14	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.85	19.85	19.85	19.85	19.85	19.85	19.85	19.85	19.85	19.85	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.95	0.9	0.81	0.65	0.47	0.31	0.36	0.6	0.86	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.5	17.98	18.56	19.17	19.59	19.79	19.84	19.83	19.71	19.13	18.18	17.39	(90)

fLA = Living area ÷ (4) = 0.16 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	17.78	18.23	18.79	19.37	19.78	19.97	20.02	20.01	19.89	19.33	18.42	17.67	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.63	18.08	18.64	19.22	19.63	19.82	19.87	19.86	19.74	19.18	18.27	17.52	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.93	0.88	0.78	0.64	0.47	0.32	0.36	0.59	0.83	0.94	0.97	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	680.51	848.86	955.3	976.38	863.53	619.24	401.54	422.36	635.29	751.34	686.06	631.64	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1663.42	1642.95	1513.48	1286.34	988.19	650.57	407.53	431.61	703.33	1069.85	1392.41	1660.33	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	731.28	533.63	415.29	223.17	92.75	0	0	0	0	236.98	508.57	765.34	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3507.02 (98)

Space heating requirement in kWh/m²/year 36.39 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	731.28	533.63	415.29	223.17	92.75	0	0	0	0	236.98	508.57	765.34	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	808.05	589.64	458.88	246.6	102.49	0	0	0	0	261.85	561.96	845.68	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3875.15 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater (calculated above)	109.66	95.76	99.71	89.88	87.89	77.83	75.18	83.83	84.05	94.95	100.26	106.46
Efficiency of water heater												87.3 (216)
(217)m=	90.07	90	89.86	89.56	88.91	87.3	87.3	87.3	87.3	89.56	89.96	90.1 (217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(219)m=	121.75	106.4	110.96	100.36	98.85	89.15	86.12	96.03	96.28	106.01	111.45	118.17

Total = Sum(219a)$_{1...12}$ = 1241.53 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3875.15
Water heating fuel used		1241.53
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	44.2	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	119.2 (231)
Electricity for lighting		394.14 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5630.03 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216	=	837.03 (261)
Space heating (secondary)	(215) x	0.519	=	0 (263)
Water heating	(219) x	0.216	=	268.17 (264)
Space and water heating	(261) + (262) + (263) + (264) =			1105.2 (265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	61.86	(267)
Electricity for lighting	(232)	x	0.519	=	204.56	(268)
Total CO2, kg/year			sum of (265)…(271) =		1371.63	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		14.23	(273)
EI rating (section 14)					87	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Framer Det

Address : The Framer Det

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	48.19 (1a)	x	2.38 (2a)	=	114.93	(3a)
First floor	48.19 (1b)	x	2.61 (2b)	=	125.78	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	96.38 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		240.71	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.12	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.37	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.34	0.3	0.3	0.29	0.32	0.34	0.36	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.56	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.14	x	1.2	=	2.568			(26)
Doors Type 2			2.14	x	1.2	=	2.568			(26)
Windows Type 1			6.61	x	1/[1/(1.4)+ 0.04]	=	8.76			(27)
Windows Type 2			3.87	x	1/[1/(1.4)+ 0.04]	=	5.13			(27)
Windows Type 3			9.33	x	1/[1/(1.4)+ 0.04]	=	12.37			(27)
Floor			48.19	x	0.13	=	6.264699			(28)
Walls	156.49	24.09	132.4	x	0.18	=	23.83			(29)
Roof	48.19	0	48.19	x	0.13	=	6.26			(30)
Total area of elements, m²			252.87							(31)
Internal wall **			23.13							(32c)
Internal wall **			161.34							(32c)
Internal floor			48.19							(32d)
Internal ceiling			48.19							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 67.76 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16479.9 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 12.94 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 80.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	46.26	46.01	45.76	44.59	44.37	43.35	43.35	43.16	43.74	44.37	44.81	45.28	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	126.96	126.71	126.46	125.29	125.07	124.05	124.05	123.86	124.44	125.07	125.51	125.97	

Average = Sum(39)$_{1...12}$ /12= 125.29 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.32	1.31	1.31	1.3	1.3	1.29	1.29	1.29	1.29	1.3	1.3	1.31	

Average = Sum(40)$_{1...12}$ /12= 1.3 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 98.41 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	108.25	104.31	100.37	96.44	92.5	88.57	88.57	92.5	96.44	100.37	104.31	108.25	

Total = Sum(44)$_{1...12}$ = 1180.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	160.53	140.4	144.88	126.31	121.19	104.58	96.91	111.21	112.53	131.15	143.16	155.46	

Total = Sum(45)$_{1...12}$ = 1548.3 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.08	21.06	21.73	18.95	18.18	15.69	14.54	16.68	16.88	19.67	21.47	23.32	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.96	47.56	47.14	43.68	45.13	47.14	47.56	50.96	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	211.48	186.42	195.84	173.87	168.33	148.26	142.04	158.34	160.09	182.11	192.47	206.42	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	211.48	186.42	195.84	173.87	168.33	148.26	142.04	158.34	160.09	182.11	192.47	206.42	

Output from water heater (annual)$_{1...12}$	2125.68	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	66.11	58.19	60.91	53.89	52.08	45.69	43.51	48.76	49.31	56.35	59.93	64.43	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	135.17	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.32	19.82	16.12	12.2	9.12	7.7	8.32	10.82	14.52	18.44	21.52	22.94	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	250.34	252.94	246.39	232.45	214.86	198.33	187.28	184.69	191.23	205.17	222.76	239.29	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	36.52	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	-108.14	(71)

Water heating gains (Table 5)

(72)m=	88.86	86.59	81.87	74.84	70	63.46	58.48	65.54	68.48	75.73	83.23	86.6	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	428.07	425.9	410.93	386.05	360.54	336.04	320.63	327.59	340.78	365.89	394.06	415.38	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.61	x	10.63	x	0.63	x	0.7	=	21.48	(74)
North	0.9x 0.77	x	6.61	x	20.32	x	0.63	x	0.7	=	41.05	(74)
North	0.9x 0.77	x	6.61	x	34.53	x	0.63	x	0.7	=	69.75	(74)
North	0.9x 0.77	x	6.61	x	55.46	x	0.63	x	0.7	=	112.04	(74)
North	0.9x 0.77	x	6.61	x	74.72	x	0.63	x	0.7	=	150.93	(74)
North	0.9x 0.77	x	6.61	x	79.99	x	0.63	x	0.7	=	161.58	(74)
North	0.9x 0.77	x	6.61	x	74.68	x	0.63	x	0.7	=	150.85	(74)
North	0.9x 0.77	x	6.61	x	59.25	x	0.63	x	0.7	=	119.68	(74)
North	0.9x 0.77	x	6.61	x	41.52	x	0.63	x	0.7	=	83.87	(74)
North	0.9x 0.77	x	6.61	x	24.19	x	0.63	x	0.7	=	48.87	(74)
North	0.9x 0.77	x	6.61	x	13.12	x	0.63	x	0.7	=	26.5	(74)
North	0.9x 0.77	x	6.61	x	8.86	x	0.63	x	0.7	=	17.91	(74)
East	0.9x 0.77	x	3.87	x	19.64	x	0.63	x	0.7	=	23.23	(76)
East	0.9x 0.77	x	3.87	x	38.42	x	0.63	x	0.7	=	45.44	(76)
East	0.9x 0.77	x	3.87	x	63.27	x	0.63	x	0.7	=	74.83	(76)
East	0.9x 0.77	x	3.87	x	92.28	x	0.63	x	0.7	=	109.14	(76)
East	0.9x 0.77	x	3.87	x	113.09	x	0.63	x	0.7	=	133.76	(76)
East	0.9x 0.77	x	3.87	x	115.77	x	0.63	x	0.7	=	136.92	(76)
East	0.9x 0.77	x	3.87	x	110.22	x	0.63	x	0.7	=	130.36	(76)
East	0.9x 0.77	x	3.87	x	94.68	x	0.63	x	0.7	=	111.98	(76)
East	0.9x 0.77	x	3.87	x	73.59	x	0.63	x	0.7	=	87.04	(76)
East	0.9x 0.77	x	3.87	x	45.59	x	0.63	x	0.7	=	53.92	(76)
East	0.9x 0.77	x	3.87	x	24.49	x	0.63	x	0.7	=	28.96	(76)
East	0.9x 0.77	x	3.87	x	16.15	x	0.63	x	0.7	=	19.1	(76)
South	0.9x 0.77	x	9.33	x	46.75	x	0.63	x	0.7	=	133.31	(78)
South	0.9x 0.77	x	9.33	x	76.57	x	0.63	x	0.7	=	218.32	(78)
South	0.9x 0.77	x	9.33	x	97.53	x	0.63	x	0.7	=	278.11	(78)
South	0.9x 0.77	x	9.33	x	110.23	x	0.63	x	0.7	=	314.32	(78)
South	0.9x 0.77	x	9.33	x	114.87	x	0.63	x	0.7	=	327.54	(78)
South	0.9x 0.77	x	9.33	x	110.55	x	0.63	x	0.7	=	315.21	(78)
South	0.9x 0.77	x	9.33	x	108.01	x	0.63	x	0.7	=	307.98	(78)
South	0.9x 0.77	x	9.33	x	104.89	x	0.63	x	0.7	=	299.09	(78)
South	0.9x 0.77	x	9.33	x	101.89	x	0.63	x	0.7	=	290.51	(78)
South	0.9x 0.77	x	9.33	x	82.59	x	0.63	x	0.7	=	235.48	(78)
South	0.9x 0.77	x	9.33	x	55.42	x	0.63	x	0.7	=	158.01	(78)
South	0.9x 0.77	x	9.33	x	40.4	x	0.63	x	0.7	=	115.19	(78)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	178.02	304.81	422.69	535.5	612.23	613.72	589.19	530.75	461.42	338.27	213.48	152.2

(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	606.09	730.72	833.63	921.56	972.77	949.76	909.83	858.34	802.2	704.16	607.54	567.58

(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(86)m=	1	0.99	0.98	0.96	0.89	0.74	0.58	0.63	0.85	0.97	0.99	1

(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.76	20.04	20.4	20.71	20.91	20.98	20.97	20.83	20.41	19.92	19.53

(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.83	19.83	19.83	19.84	19.84	19.85	19.85	19.85	19.85	19.84	19.84	19.84

(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.64	0.44	0.49	0.77	0.96	0.99	1

(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.93	18.21	18.63	19.14	19.56	19.79	19.84	19.84	19.71	19.17	18.46	17.89

(90)

fLA = Living area ÷ (4) = 0.16 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.2	18.46	18.85	19.34	19.75	19.97	20.03	20.02	19.89	19.37	18.69	18.15

(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.2	18.46	18.85	19.34	19.75	19.97	20.03	20.02	19.89	19.37	18.69	18.15

(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.46	0.51	0.77	0.95	0.99	1

(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	602.88	721.84	810.28	857.33	811.34	621.37	418.11	437.54	621.32	667.81	600.86	565.31

(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2

(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1764.35	1718.3	1562.21	1308.33	1006.41	666.68	425.06	448.64	720.91	1097.17	1454.9	1757.71

(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	864.13	669.62	559.43	324.72	145.13	0	0	0	0	319.44	614.91	887.14

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 4384.53 (98)

Space heating requirement in kWh/m²/year 45.49 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.4 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)													kWh/year
	864.13	669.62	559.43	324.72	145.13	0	0	0	0	319.44	614.91	887.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	925.2	716.94	598.96	347.67	155.39	0	0	0	0	342.02	658.36	949.83	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4694.36 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	211.48	186.42	195.84	173.87	168.33	148.26	142.04	158.34	160.09	182.11	192.47	206.42	

Efficiency of water heater 80.3 (216)

(217)m=	88.22	87.99	87.54	86.6	84.68	80.3	80.3	80.3	80.3	86.45	87.77	88.3	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(219)m=	239.73	211.87	223.7	200.76	198.79	184.63	176.89	197.19	199.37	210.65	219.3	233.76	

Total = Sum(219a)$_{1...12}$ = 2496.63 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4694.36	
Water heating fuel used		2496.63	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		394.14	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7660.13	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	1013.98	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	539.27	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1553.25	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)

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Electricity for lighting	(232)	x	0.519	=	204.56	(268)
Total CO2, kg/year			sum of (265)…(271) =		1796.74	(272)
TER =					18.64	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Harper - ET

Address : The Harper - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.76 (1a)	x	2.38 (2a)	=	111.52	(3a)
First floor	46.76 (1b)	x	2.61 (2b)	=	122.04	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.52 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			2.89	x1/[1/(1.2)+ 0.04]		=	3.31			(27)
Windows Type 2			2.58	x1/[1/(1.2)+ 0.04]		=	2.95			(27)
Windows Type 3			2.99	x1/[1/(1.2)+ 0.04]		=	3.42			(27)
Windows Type 4			4.83	x1/[1/(1.2)+ 0.04]		=	5.53			(27)
Floor			46.76	x	0.1	=	4.676	75	3507	(28)
Walls	96.57	15.44	81.13	x	0.25	=	20.28	60	4867.8	(29)
Roof	46.76	0	46.76	x	0.09	=	4.21	9	420.84	(30)
Total area of elements, m²			190.09							(31)
Party wall			48.86	x	0	=	0	45	2198.7	(32)
Internal wall **			153.86					9	1384.74	(32c)
Internal wall **			22.8					75	1710	(32c)
Internal floor			46.76					18	841.68	(32d)
Internal ceiling			46.76					9	420.84	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 47.18 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15351.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 164.15 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 6.88 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 54.06 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.69	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	92.75	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	92.6	

Average = Sum(39)$_{1...12}$ /12= 92.61 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	

Average = Sum(40)$_{1...12}$ /12= 0.99 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.4	103.49	99.59	95.68	91.78	87.87	87.87	91.78	95.68	99.59	103.49	107.4	

Total = Sum(44)$_{1...12}$ = 1171.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.27	139.3	143.74	125.32	120.24	103.76	96.15	110.33	111.65	130.12	142.04	154.24	

Total = Sum(45)$_{1...12}$ = 1536.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.8	18.04	15.56	14.42	16.55	16.75	19.52	21.31	23.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.33	143.87	148.8	130.21	125.3	108.66	101.21	115.39	116.55	135.18	146.93	159.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-55.35	-48.7	-49.7	-40.89	-37.97	-31.32	-26.51	-32.1	-33.04	-40.84	-47.3	-53.5	(63) (G10)

Output from water heater

(64)m=	108.98	95.17	99.1	89.32	87.33	77.33	74.7	83.3	83.51	94.34	99.63	105.81	

Output from water heater (annual)$_{1...12}$	1098.51	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.22	47.46	49.06	42.89	41.25	35.72	33.23	37.95	38.35	44.53	48.45	52.55	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.69	20.15	16.39	12.41	9.27	7.83	8.46	11	14.76	18.74	21.87	23.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.41	247.95	241.54	227.87	210.63	194.42	183.59	181.05	187.46	201.13	218.37	234.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	(71)

Water heating gains (Table 5)

(72)m=	72.88	70.62	65.94	59.57	55.44	49.62	44.67	51.01	53.26	59.85	67.29	70.63	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.04	404.79	389.93	365.92	341.41	317.93	302.79	309.12	321.55	345.78	373.6	394.59	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.47	x	1.11	=	11.12	(74)
North	0.9x 0.77	x	2.58	x	10.63	x	0.47	x	1.11	=	9.93	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.47	x	1.11	=	21.25	(74)
North	0.9x 0.77	x	2.58	x	20.32	x	0.47	x	1.11	=	18.97	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.47	x	1.11	=	36.11	(74)
North	0.9x 0.77	x	2.58	x	34.53	x	0.47	x	1.11	=	32.24	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.47	x	1.11	=	58.01	(74)
North	0.9x 0.77	x	2.58	x	55.46	x	0.47	x	1.11	=	51.79	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.47	x	1.11	=	78.14	(74)
North	0.9x 0.77	x	2.58	x	74.72	x	0.47	x	1.11	=	69.76	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.47	x	1.11	=	83.66	(74)
North	0.9x 0.77	x	2.58	x	79.99	x	0.47	x	1.11	=	74.68	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.47	x	1.11	=	78.1	(74)
North	0.9x 0.77	x	2.58	x	74.68	x	0.47	x	1.11	=	69.73	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.47	x	1.11	=	61.97	(74)
North	0.9x 0.77	x	2.58	x	59.25	x	0.47	x	1.11	=	55.32	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.47	x	1.11	=	43.42	(74)
North	0.9x 0.77	x	2.58	x	41.52	x	0.47	x	1.11	=	38.76	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.47	x	1.11	=	25.3	(74)
North	0.9x 0.77	x	2.58	x	24.19	x	0.47	x	1.11	=	22.59	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.47	x	1.11	=	13.72	(74)
North	0.9x 0.77	x	2.58	x	13.12	x	0.47	x	1.11	=	12.25	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.47	x	1.11	=	9.27	(74)
North	0.9x 0.77	x	2.58	x	8.86	x	0.47	x	1.11	=	8.28	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.47	x	1.11	=	50.59	(78)
South	0.9x 0.77	x	4.83	x	46.75	x	0.47	x	1.11	=	81.72	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.47	x	1.11	=	82.85	(78)
South	0.9x 0.77	x	4.83	x	76.57	x	0.47	x	1.11	=	133.84	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.47	x	1.11	=	105.54	(78)
South	0.9x 0.77	x	4.83	x	97.53	x	0.47	x	1.11	=	170.49	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.47	x	1.11	=	119.28	(78)
South	0.9x 0.77	x	4.83	x	110.23	x	0.47	x	1.11	=	192.69	(78)
South	0.9x 0.77	x	2.99	x	114.87	x	0.47	x	1.11	=	124.3	(78)
South	0.9x 0.77	x	4.83	x	114.87	x	0.47	x	1.11	=	200.79	(78)
South	0.9x 0.77	x	2.99	x	110.55	x	0.47	x	1.11	=	119.62	(78)
South	0.9x 0.77	x	4.83	x	110.55	x	0.47	x	1.11	=	193.24	(78)

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South	0.9x	0.77	x	2.99	x	108.01	x	0.47	x	1.11	=	116.88	(78)
South	0.9x	0.77	x	4.83	x	108.01	x	0.47	x	1.11	=	188.8	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.47	x	1.11	=	113.5	(78)
South	0.9x	0.77	x	4.83	x	104.89	x	0.47	x	1.11	=	183.35	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.47	x	1.11	=	110.25	(78)
South	0.9x	0.77	x	4.83	x	101.89	x	0.47	x	1.11	=	178.09	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.47	x	1.11	=	89.36	(78)
South	0.9x	0.77	x	4.83	x	82.59	x	0.47	x	1.11	=	144.36	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.47	x	1.11	=	59.97	(78)
South	0.9x	0.77	x	4.83	x	55.42	x	0.47	x	1.11	=	96.87	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.47	x	1.11	=	43.71	(78)
South	0.9x	0.77	x	4.83	x	40.4	x	0.47	x	1.11	=	70.61	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	153.36	256.92	344.38	421.77	473	471.2	453.51	414.14	370.53	281.61	182.8	131.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	560.4	661.71	734.31	787.68	814.4	789.13	756.3	723.26	692.08	627.39	556.4	526.47	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C): 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.91	0.82	0.67	0.52	0.56	0.77	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.57	19.79	20.08	20.43	20.73	20.91	20.98	20.97	20.85	20.46	19.94	19.52	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	20.09	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.99	0.97	0.95	0.9	0.78	0.6	0.42	0.46	0.71	0.91	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.17	18.49	18.91	19.4	19.8	20.02	20.08	20.07	19.95	19.45	18.7	18.09	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.37	18.67	19.08	19.54	19.93	20.15	20.21	20.2	20.08	19.59	18.88	18.3	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.22	18.52	18.93	19.39	19.78	20	20.06	20.05	19.93	19.44	18.73	18.15	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.98	0.96	0.94	0.88	0.77	0.59	0.42	0.46	0.69	0.89	0.97	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	549.59	638.05	686.75	690.75	624.97	468.08	314.43	329.69	479.47	560.34	537.43	518.29	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1291.37	1261.57	1150.84	971.5	748.28	499.76	320.08	338.01	539.75	818.48	1076.79	1291.28	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	551.89	419.01	345.29	202.14	91.74	0	0	0	0	192.06	388.34	575.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2765.56 (98)

Space heating requirement in kWh/m²/year 29.57 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	551.89	419.01	345.29	202.14	91.74	0	0	0	0	192.06	388.34	575.11	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	609.82	462.99	381.53	223.36	101.37	0	0	0	0	212.22	429.1	635.48	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3055.87 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	108.98	95.17	99.1	89.32	87.33	77.33	74.7	83.3	83.51	94.34	99.63	105.81	

Efficiency of water heater 87.3 (216)

(217)m=	89.96	89.89	89.77	89.49	88.91	87.3	87.3	87.3	87.3	89.42	89.83	89.99	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	121.15	105.87	110.4	99.8	98.23	88.58	85.57	95.41	95.66	105.5	110.91	117.58	

Total = Sum(219a)$_{1...12}$ = 1234.66 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3055.87
Water heating fuel used		1234.66
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	43.35	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)

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Total electricity for the above, kWh/year	sum of (230a)…(230g) =	118.35	(231)
Electricity for lighting		400.66	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4809.54	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	660.07	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	266.69	(264)
Space and water heating	(261) + (262) + (263) + (264) =				926.75	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	61.42	(267)
Electricity for lighting	(232) x		0.519	=	207.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1196.12	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			12.79	(273)
EI rating (section 14)					88	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Harper - ET

Address : The Harper - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.76 (1a)	x	2.38 (2a)	=	111.52	(3a)
First floor	46.76 (1b)	x	2.61 (2b)	=	122.04	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.52 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

	0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			2.89	x1/[1/(1.4)+ 0.04]		=	3.83			(27)
Windows Type 2			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 3			2.99	x1/[1/(1.4)+ 0.04]		=	3.96			(27)
Windows Type 4			4.83	x1/[1/(1.4)+ 0.04]		=	6.4			(27)
Floor			46.76	x	0.13	=	6.0788			(28)
Walls	96.57	15.44	81.13	x	0.18	=	14.6			(29)
Roof	46.76	0	46.76	x	0.13	=	6.08			(30)
Total area of elements, m²			190.09							(31)
Party wall			48.86	x	0	=	0			(32)
Internal wall **			153.86							(32c)
Internal wall **			22.8							(32c)
Internal floor			46.76							(32d)
Internal ceiling			46.76							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.96 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 15351.6 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 9.79 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 56.75 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.02	44.77	44.52	43.36	43.15	42.14	42.14	41.95	42.53	43.15	43.59	44.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	101.77	101.52	101.27	100.12	99.9	98.89	98.89	98.7	99.28	99.9	100.34	100.8	

Average = Sum(39)$_{1...12}$ /12= 100.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.09	1.08	1.07	1.07	1.06	1.06	1.06	1.06	1.07	1.07	1.08	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	107.4	103.49	99.59	95.68	91.78	87.87	87.87	91.78	95.68	99.59	103.49	107.4	

Total = Sum(44)$_{1...12}$ = 1171.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.27	139.3	143.74	125.32	120.24	103.76	96.15	110.33	111.65	130.12	142.04	154.24	

Total = Sum(45)$_{1...12}$ = 1536.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.8	18.04	15.56	14.42	16.55	16.75	19.52	21.31	23.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.75	47.19	46.77	43.33	44.78	46.77	47.19	50.75	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.23	185.32	194.49	172.5	167.01	147.1	140.93	157.1	158.84	180.87	191.35	205.2	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	210.23	185.32	194.49	172.5	167.01	147.1	140.93	157.1	158.84	180.87	191.35	205.2	

Output from water heater (annual)$_{1...12}$	2110.94	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.7	57.82	60.48	53.46	51.67	45.33	43.16	48.38	48.92	55.95	59.56	64.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.69	20.15	16.39	12.41	9.27	7.83	8.46	11	14.76	18.74	21.87	23.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.41	247.95	241.54	227.87	210.63	194.42	183.59	181.05	187.46	201.13	218.37	234.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	(71)

Water heating gains (Table 5)

(72)m=	88.3	86.05	81.29	74.26	69.45	62.96	58.02	65.02	67.95	75.2	82.72	86.06	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	422.46	420.21	405.28	380.6	355.42	331.28	316.13	323.13	336.23	361.13	389.02	410.01	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x 0.77	x	2.58	x	10.63	x	0.63	x	0.7	=	8.38	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x 0.77	x	2.58	x	20.32	x	0.63	x	0.7	=	16.02	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x 0.77	x	2.58	x	34.53	x	0.63	x	0.7	=	27.23	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x 0.77	x	2.58	x	55.46	x	0.63	x	0.7	=	43.73	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x 0.77	x	2.58	x	74.72	x	0.63	x	0.7	=	58.91	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x 0.77	x	2.58	x	79.99	x	0.63	x	0.7	=	63.07	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x 0.77	x	2.58	x	74.68	x	0.63	x	0.7	=	58.88	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x 0.77	x	2.58	x	59.25	x	0.63	x	0.7	=	46.71	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x 0.77	x	2.58	x	41.52	x	0.63	x	0.7	=	32.74	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x 0.77	x	2.58	x	24.19	x	0.63	x	0.7	=	19.07	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x 0.77	x	2.58	x	13.12	x	0.63	x	0.7	=	10.34	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
North	0.9x 0.77	x	2.58	x	8.86	x	0.63	x	0.7	=	6.99	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.63	x	0.7	=	42.72	(78)
South	0.9x 0.77	x	4.83	x	46.75	x	0.63	x	0.7	=	69.01	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.63	x	0.7	=	69.97	(78)
South	0.9x 0.77	x	4.83	x	76.57	x	0.63	x	0.7	=	113.02	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.63	x	0.7	=	89.12	(78)
South	0.9x 0.77	x	4.83	x	97.53	x	0.63	x	0.7	=	143.97	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.63	x	0.7	=	100.73	(78)
South	0.9x 0.77	x	4.83	x	110.23	x	0.63	x	0.7	=	162.72	(78)
South	0.9x 0.77	x	2.99	x	114.87	x	0.63	x	0.7	=	104.97	(78)
South	0.9x 0.77	x	4.83	x	114.87	x	0.63	x	0.7	=	169.56	(78)
South	0.9x 0.77	x	2.99	x	110.55	x	0.63	x	0.7	=	101.02	(78)
South	0.9x 0.77	x	4.83	x	110.55	x	0.63	x	0.7	=	163.18	(78)

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South	0.9x	0.77	x	2.99	x	108.01	x	0.63	x	0.7	=	98.7	(78)
South	0.9x	0.77	x	4.83	x	108.01	x	0.63	x	0.7	=	159.44	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.63	x	0.7	=	95.85	(78)
South	0.9x	0.77	x	4.83	x	104.89	x	0.63	x	0.7	=	154.84	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.63	x	0.7	=	93.1	(78)
South	0.9x	0.77	x	4.83	x	101.89	x	0.63	x	0.7	=	150.39	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.63	x	0.7	=	75.47	(78)
South	0.9x	0.77	x	4.83	x	82.59	x	0.63	x	0.7	=	121.91	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.63	x	0.7	=	50.64	(78)
South	0.9x	0.77	x	4.83	x	55.42	x	0.63	x	0.7	=	81.8	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.63	x	0.7	=	36.92	(78)
South	0.9x	0.77	x	4.83	x	40.4	x	0.63	x	0.7	=	59.63	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.51	216.96	290.82	356.17	399.43	397.91	382.97	349.73	312.9	237.81	154.37	111.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.97	637.17	696.1	736.77	754.85	729.19	699.11	672.86	649.13	598.94	543.39	521.38	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.92	0.78	0.6	0.65	0.86	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.83	19.98	20.21	20.49	20.76	20.93	20.99	20.98	20.87	20.54	20.13	19.81	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.01	20.01	20.02	20.03	20.04	20.04	20.04	20.03	20.03	20.02	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.96	0.88	0.69	0.48	0.52	0.8	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.67	19	19.42	19.78	19.99	20.03	20.03	19.93	19.48	18.89	18.42	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.65	18.86	19.17	19.57	19.92	20.12	20.17	20.16	20.06	19.63	19.07	18.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.65	18.86	19.17	19.57	19.92	20.12	20.17	20.16	20.06	19.63	19.07	18.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.88	0.7	0.5	0.54	0.8	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.89	631.92	683.18	701.81	660.6	511.69	348.18	364.56	520.24	574.5	538.97	519.91	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1460.16	1417.06	1283.17	1068.3	820.76	546.08	352.64	371.5	591.87	902.45	1201.05	1453	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	677.24	527.61	446.4	263.87	119.15	0	0	0	0	244	476.7	694.22	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3449.2 (98)

Space heating requirement in kWh/m²/year 36.88 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	677.24	527.61	446.4	263.87	119.15	0	0	0	0	244	476.7	694.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	725.1	564.9	477.94	282.52	127.57	0	0	0	0	261.24	510.38	743.28	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3692.93 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	210.23	185.32	194.49	172.5	167.01	147.1	140.93	157.1	158.84	180.87	191.35	205.2	

Efficiency of water heater 80.3 (216)

(217)m=	87.78	87.54	87.08	86.12	84.22	80.3	80.3	80.3	80.3	85.81	87.26	87.88	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.48	211.71	223.35	200.31	198.31	183.18	175.5	195.64	197.8	210.79	219.3	233.51	

Total = Sum(219a)$_{1...12}$ = 2488.88 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3692.93
Water heating fuel used		2488.88
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)

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Electricity for lighting	400.66	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	6657.47	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	797.67	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	537.6	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1335.27	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	207.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1582.14	(272)

TER = 16.92 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Harper - MT

Address : The Harper - MT

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.76 (1a)	x	2.38 (2a)	=	111.52	(3a)
First floor	46.76 (1b)	x	2.61 (2b)	=	122.04	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.52 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			2.89	x1/[1/(1.2)+ 0.04]		=	3.31			(27)
Windows Type 2			2.58	x1/[1/(1.2)+ 0.04]		=	2.95			(27)
Windows Type 3			2.99	x1/[1/(1.2)+ 0.04]		=	3.42			(27)
Windows Type 4			4.83	x1/[1/(1.2)+ 0.04]		=	5.53			(27)
Floor			46.76	x	0.1	=	4.676	75	3507	(28)
Walls	47.71	15.44	32.27	x	0.25	=	8.07	60	1936.2	(29)
Roof	46.76	0	46.76	x	0.09	=	4.21	9	420.84	(30)
Total area of elements, m²			141.23							(31)
Party wall			97.73	x	0	=	0	45	4397.85	(32)
Internal wall **			153.86					9	1384.74	(32c)
Internal wall **			22.8					75	1710	(32c)
Internal floor			46.76					18	841.68	(32d)
Internal ceiling			46.76					9	420.84	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.96 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14619.15 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.32 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.32 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 42.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.69	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	38.54	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	80.98	80.82	80.82	80.82	80.82	80.82	80.82	80.82	80.82	80.82	80.82	80.82	

Average = Sum(39)$_{1...12}$ /12= 80.84 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	

Average = Sum(40)$_{1...12}$ /12= 0.86 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.4	103.49	99.59	95.68	91.78	87.87	87.87	91.78	95.68	99.59	103.49	107.4	

Total = Sum(44)$_{1...12}$ = 1171.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.27	139.3	143.74	125.32	120.24	103.76	96.15	110.33	111.65	130.12	142.04	154.24	

Total = Sum(45)$_{1...12}$ = 1536.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.8	18.04	15.56	14.42	16.55	16.75	19.52	21.31	23.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.33	143.87	148.8	130.21	125.3	108.66	101.21	115.39	116.55	135.18	146.93	159.3	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-55.35	-48.7	-49.7	-40.89	-37.97	-31.32	-26.51	-32.1	-33.04	-40.84	-47.3	-53.5	(63) (G10)

Output from water heater

(64)m=	108.98	95.17	99.1	89.32	87.33	77.33	74.7	83.3	83.51	94.34	99.63	105.81	

Output from water heater (annual)$_{1...12}$	1098.51	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.22	47.46	49.06	42.89	41.25	35.72	33.23	37.95	38.35	44.53	48.45	52.55	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.69	20.15	16.39	12.41	9.27	7.83	8.46	11	14.76	18.74	21.87	23.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.41	247.95	241.54	227.87	210.63	194.42	183.59	181.05	187.46	201.13	218.37	234.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	(71)

Water heating gains (Table 5)

(72)m=	72.88	70.62	65.94	59.57	55.44	49.62	44.67	51.01	53.26	59.85	67.29	70.63	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.04	404.79	389.93	365.92	341.41	317.93	302.79	309.12	321.55	345.78	373.6	394.59	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.47	x	1.11	=	11.12	(74)
North	0.9x 0.77	x	2.58	x	10.63	x	0.47	x	1.11	=	9.93	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.47	x	1.11	=	21.25	(74)
North	0.9x 0.77	x	2.58	x	20.32	x	0.47	x	1.11	=	18.97	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.47	x	1.11	=	36.11	(74)
North	0.9x 0.77	x	2.58	x	34.53	x	0.47	x	1.11	=	32.24	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.47	x	1.11	=	58.01	(74)
North	0.9x 0.77	x	2.58	x	55.46	x	0.47	x	1.11	=	51.79	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.47	x	1.11	=	78.14	(74)
North	0.9x 0.77	x	2.58	x	74.72	x	0.47	x	1.11	=	69.76	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.47	x	1.11	=	83.66	(74)
North	0.9x 0.77	x	2.58	x	79.99	x	0.47	x	1.11	=	74.68	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.47	x	1.11	=	78.1	(74)
North	0.9x 0.77	x	2.58	x	74.68	x	0.47	x	1.11	=	69.73	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.47	x	1.11	=	61.97	(74)
North	0.9x 0.77	x	2.58	x	59.25	x	0.47	x	1.11	=	55.32	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.47	x	1.11	=	43.42	(74)
North	0.9x 0.77	x	2.58	x	41.52	x	0.47	x	1.11	=	38.76	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.47	x	1.11	=	25.3	(74)
North	0.9x 0.77	x	2.58	x	24.19	x	0.47	x	1.11	=	22.59	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.47	x	1.11	=	13.72	(74)
North	0.9x 0.77	x	2.58	x	13.12	x	0.47	x	1.11	=	12.25	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.47	x	1.11	=	9.27	(74)
North	0.9x 0.77	x	2.58	x	8.86	x	0.47	x	1.11	=	8.28	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.47	x	1.11	=	50.59	(78)
South	0.9x 0.77	x	4.83	x	46.75	x	0.47	x	1.11	=	81.72	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.47	x	1.11	=	82.85	(78)
South	0.9x 0.77	x	4.83	x	76.57	x	0.47	x	1.11	=	133.84	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.47	x	1.11	=	105.54	(78)
South	0.9x 0.77	x	4.83	x	97.53	x	0.47	x	1.11	=	170.49	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.47	x	1.11	=	119.28	(78)
South	0.9x 0.77	x	4.83	x	110.23	x	0.47	x	1.11	=	192.69	(78)
South	0.9x 0.77	x	2.99	x	114.87	x	0.47	x	1.11	=	124.3	(78)
South	0.9x 0.77	x	4.83	x	114.87	x	0.47	x	1.11	=	200.79	(78)
South	0.9x 0.77	x	2.99	x	110.55	x	0.47	x	1.11	=	119.62	(78)
South	0.9x 0.77	x	4.83	x	110.55	x	0.47	x	1.11	=	193.24	(78)

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South	0.9x	0.77	x	2.99	x	108.01	x	0.47	x	1.11	=	116.88	(78)
South	0.9x	0.77	x	4.83	x	108.01	x	0.47	x	1.11	=	188.8	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.47	x	1.11	=	113.5	(78)
South	0.9x	0.77	x	4.83	x	104.89	x	0.47	x	1.11	=	183.35	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.47	x	1.11	=	110.25	(78)
South	0.9x	0.77	x	4.83	x	101.89	x	0.47	x	1.11	=	178.09	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.47	x	1.11	=	89.36	(78)
South	0.9x	0.77	x	4.83	x	82.59	x	0.47	x	1.11	=	144.36	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.47	x	1.11	=	59.97	(78)
South	0.9x	0.77	x	4.83	x	55.42	x	0.47	x	1.11	=	96.87	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.47	x	1.11	=	43.71	(78)
South	0.9x	0.77	x	4.83	x	40.4	x	0.47	x	1.11	=	70.61	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	153.36	256.92	344.38	421.77	473	471.2	453.51	414.14	370.53	281.61	182.8	131.88	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	560.4	661.71	734.31	787.68	814.4	789.13	756.3	723.26	692.08	627.39	556.4	526.47	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C): 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.95	0.89	0.78	0.62	0.46	0.5	0.72	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.77	19.99	20.27	20.57	20.82	20.95	20.99	20.98	20.9	20.58	20.11	19.71	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	0.98	0.97	0.94	0.87	0.74	0.55	0.38	0.42	0.66	0.89	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(90)m=	18.54	18.85	19.25	19.68	20	20.16	20.19	20.19	20.11	19.7	19.03	18.45	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(92)m=	18.71	19.01	19.4	19.81	20.12	20.27	20.3	20.3	20.22	19.83	19.18	18.63	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.56	18.86	19.25	19.66	19.97	20.12	20.15	20.15	20.07	19.68	19.03	18.48	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.98	0.96	0.92	0.85	0.73	0.54	0.38	0.41	0.65	0.87	0.96	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(95)m=	547.65	633.24	676.48	670.2	590.65	429.1	284.66	299.14	447.11	546.3	533.67	516.91	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1154.9	1128.66	1030.12	869.39	668.43	446.14	287.32	303.2	482.79	733.85	964.24	1154.34	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	451.8	332.92	263.11	143.41	57.87	0	0	0	0	139.54	310.01	474.25	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2172.91 (98)

Space heating requirement in kWh/m²/year 23.23 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	451.8	332.92	263.11	143.41	57.87	0	0	0	0	139.54	310.01	474.25	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	499.22	367.87	290.73	158.47	63.94	0	0	0	0	154.19	342.55	524.03	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2401 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	108.98	95.17	99.1	89.32	87.33	77.33	74.7	83.3	83.51	94.34	99.63	105.81	

Efficiency of water heater 87.3 (216)

(217)m=	89.86	89.77	89.6	89.24	88.55	87.3	87.3	87.3	87.3	89.18	89.7	89.9	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	121.28	106.01	110.6	100.08	98.63	88.58	85.57	95.41	95.66	105.79	111.07	117.69	

Total = Sum(219a)$_{1...12}$ = 1236.37 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2401
Water heating fuel used		1236.37
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	43.35	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)

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Total electricity for the above, kWh/year	sum of (230a)…(230g) =	118.35	(231)
Electricity for lighting		400.66	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4156.38	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	518.62	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	267.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				785.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	61.42	(267)
Electricity for lighting	(232) x		0.519	=	207.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1055.04	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			11.28	(273)
EI rating (section 14)					90	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Harper - MT

Address : The Harper - MT

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.76 (1a)	x	2.38 (2a)	=	111.52	(3a)
First floor	46.76 (1b)	x	2.61 (2b)	=	122.04	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.52 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.57	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			2.89	x1/[1/(1.4)+ 0.04]		=	3.83			(27)
Windows Type 2			2.58	x1/[1/(1.4)+ 0.04]		=	3.42			(27)
Windows Type 3			2.99	x1/[1/(1.4)+ 0.04]		=	3.96			(27)
Windows Type 4			4.83	x1/[1/(1.4)+ 0.04]		=	6.4			(27)
Floor			46.76	x	0.13	=	6.0788			(28)
Walls	47.71	15.44	32.27	x	0.18	=	5.81			(29)
Roof	46.76	0	46.76	x	0.13	=	6.08			(30)
Total area of elements, m²			141.23							(31)
Party wall			97.73	x	0	=	0			(32)
Internal wall **			153.86							(32c)
Internal wall **			22.8							(32c)
Internal floor			46.76							(32d)
Internal ceiling			46.76							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.17 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14619.15 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 9.3 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 47.46 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.02	44.77	44.52	43.36	43.15	42.14	42.14	41.95	42.53	43.15	43.59	44.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	92.48	92.23	91.98	90.83	90.61	89.6	89.6	89.41	89.99	90.61	91.05	91.51	

Average = Sum(39)$_{1...12}$ /12= 90.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.99	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.97	0.97	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.63 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.4	103.49	99.59	95.68	91.78	87.87	87.87	91.78	95.68	99.59	103.49	107.4	

Total = Sum(44)$_{1...12}$ = 1171.61 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.27	139.3	143.74	125.32	120.24	103.76	96.15	110.33	111.65	130.12	142.04	154.24	

Total = Sum(45)$_{1...12}$ = 1536.16 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.8	18.04	15.56	14.42	16.55	16.75	19.52	21.31	23.14	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.75	47.19	46.77	43.33	44.78	46.77	47.19	50.75	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.23	185.32	194.49	172.5	167.01	147.1	140.93	157.1	158.84	180.87	191.35	205.2	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	210.23	185.32	194.49	172.5	167.01	147.1	140.93	157.1	158.84	180.87	191.35	205.2	

Output from water heater (annual)$_{1...12}$	2110.94	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.7	57.82	60.48	53.46	51.67	45.33	43.16	48.38	48.92	55.95	59.56	64.03	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	133.55	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	22.69	20.15	16.39	12.41	9.27	7.83	8.46	11	14.76	18.74	21.87	23.32	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.41	247.95	241.54	227.87	210.63	194.42	183.59	181.05	187.46	201.13	218.37	234.58	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	-106.84	(71)

Water heating gains (Table 5)

(72)m=	88.3	86.05	81.29	74.26	69.45	62.96	58.02	65.02	67.95	75.2	82.72	86.06	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	422.46	420.21	405.28	380.6	355.42	331.28	316.13	323.13	336.23	361.13	389.02	410.01	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x 0.77	x	2.58	x	10.63	x	0.63	x	0.7	=	8.38	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x 0.77	x	2.58	x	20.32	x	0.63	x	0.7	=	16.02	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x 0.77	x	2.58	x	34.53	x	0.63	x	0.7	=	27.23	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x 0.77	x	2.58	x	55.46	x	0.63	x	0.7	=	43.73	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x 0.77	x	2.58	x	74.72	x	0.63	x	0.7	=	58.91	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x 0.77	x	2.58	x	79.99	x	0.63	x	0.7	=	63.07	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x 0.77	x	2.58	x	74.68	x	0.63	x	0.7	=	58.88	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x 0.77	x	2.58	x	59.25	x	0.63	x	0.7	=	46.71	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x 0.77	x	2.58	x	41.52	x	0.63	x	0.7	=	32.74	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x 0.77	x	2.58	x	24.19	x	0.63	x	0.7	=	19.07	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x 0.77	x	2.58	x	13.12	x	0.63	x	0.7	=	10.34	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
North	0.9x 0.77	x	2.58	x	8.86	x	0.63	x	0.7	=	6.99	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.63	x	0.7	=	42.72	(78)
South	0.9x 0.77	x	4.83	x	46.75	x	0.63	x	0.7	=	69.01	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.63	x	0.7	=	69.97	(78)
South	0.9x 0.77	x	4.83	x	76.57	x	0.63	x	0.7	=	113.02	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.63	x	0.7	=	89.12	(78)
South	0.9x 0.77	x	4.83	x	97.53	x	0.63	x	0.7	=	143.97	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.63	x	0.7	=	100.73	(78)
South	0.9x 0.77	x	4.83	x	110.23	x	0.63	x	0.7	=	162.72	(78)
South	0.9x 0.77	x	2.99	x	114.87	x	0.63	x	0.7	=	104.97	(78)
South	0.9x 0.77	x	4.83	x	114.87	x	0.63	x	0.7	=	169.56	(78)
South	0.9x 0.77	x	2.99	x	110.55	x	0.63	x	0.7	=	101.02	(78)
South	0.9x 0.77	x	4.83	x	110.55	x	0.63	x	0.7	=	163.18	(78)

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South	0.9x	0.77	x	2.99	x	108.01	x	0.63	x	0.7	=	98.7	(78)
South	0.9x	0.77	x	4.83	x	108.01	x	0.63	x	0.7	=	159.44	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.63	x	0.7	=	95.85	(78)
South	0.9x	0.77	x	4.83	x	104.89	x	0.63	x	0.7	=	154.84	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.63	x	0.7	=	93.1	(78)
South	0.9x	0.77	x	4.83	x	101.89	x	0.63	x	0.7	=	150.39	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.63	x	0.7	=	75.47	(78)
South	0.9x	0.77	x	4.83	x	82.59	x	0.63	x	0.7	=	121.91	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.63	x	0.7	=	50.64	(78)
South	0.9x	0.77	x	4.83	x	55.42	x	0.63	x	0.7	=	81.8	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.63	x	0.7	=	36.92	(78)
South	0.9x	0.77	x	4.83	x	40.4	x	0.63	x	0.7	=	59.63	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	129.51	216.96	290.82	356.17	399.43	397.91	382.97	349.73	312.9	237.81	154.37	111.37	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	551.97	637.17	696.1	736.77	754.85	729.19	699.11	672.86	649.13	598.94	543.39	521.38	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.9	0.74	0.56	0.6	0.83	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.12	20.33	20.6	20.83	20.96	20.99	20.99	20.92	20.63	20.25	19.95	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.09	20.09	20.1	20.11	20.11	20.12	20.12	20.12	20.11	20.11	20.11	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.86	0.65	0.45	0.49	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.71	18.93	19.24	19.63	19.93	20.09	20.12	20.12	20.05	19.67	19.13	18.68	(90)

fLA = Living area ÷ (4) = 0.14 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.89	19.1	19.39	19.76	20.06	20.21	20.24	20.24	20.17	19.81	19.29	18.86	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.89	19.1	19.39	19.76	20.06	20.21	20.24	20.24	20.17	19.81	19.29	18.86	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.95	0.85	0.66	0.46	0.51	0.77	0.95	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	549.93	631.72	681.96	696.58	644.63	483.64	324.14	340.01	500.36	571.11	538.8	519.96	(95)

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Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1349.55	1309.6	1186.05	986.72	757.54	503.09	326.19	343.35	546.34	834.33	1109.5	1341.64	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	594.92	455.54	375.04	208.9	84	0	0	0	0	195.84	410.9	611.33	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2936.47 (98)

Space heating requirement in kWh/m²/year 31.4 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	594.92	455.54	375.04	208.9	84	0	0	0	0	195.84	410.9	611.33	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	636.96	487.73	401.54	223.66	89.94	0	0	0	0	209.68	439.94	654.53	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3143.97 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	210.23	185.32	194.49	172.5	167.01	147.1	140.93	157.1	158.84	180.87	191.35	205.2	

Efficiency of water heater 80.3 (216)

(217)m=	87.53	87.23	86.68	85.53	83.42	80.3	80.3	80.3	80.3	85.25	86.93	87.63	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	240.19	212.46	224.38	201.68	200.21	183.18	175.5	195.64	197.8	212.16	220.13	234.17	

Total = Sum(219a)$_{1...12}$ = 2497.51 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3143.97
Water heating fuel used		2497.51
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)

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Electricity for lighting	400.66	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	6117.14	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	679.1	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	539.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1218.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	207.94	(268)
Total CO2, kg/year		sum of (265)…(271) =			1465.43	(272)

TER = 15.67 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Lacemaker Semi

Address : The Lacemaker Semi

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.01 (1a)	x	2.5 (2a)	=	107.52	(3a)
First floor	41.1 (1b)	x	2.7 (2b)	=	110.97	(3b)
Second floor	27.72 (1c)	x	2.61 (2c)	=	72.43	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	111.83	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	290.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.3	=	2.756			(26)
Windows Type 1			3.37	x1/[1/(1.2)+ 0.04]		=	3.86			(27)
Windows Type 2			1.51	x1/[1/(1.2)+ 0.04]		=	1.73			(27)
Windows Type 3			0.84	x1/[1/(1.2)+ 0.04]		=	0.96			(27)
Windows Type 4			8.24	x1/[1/(1.2)+ 0.04]		=	9.44			(27)
Windows Type 5			1.44	x1/[1/(1.2)+ 0.04]		=	1.65			(27)
Rooflights			1.48	x1/[1/(1.3) + 0.04]		=	1.924			(27b)
Floor			43.01	x	0.1	=	4.301	75	3225.75	(28)
Walls Type1	113.39	16.08	97.31	x	0.25	=	24.33	60	5838.6	(29)
Walls Type2	22.1	0	22.1	x	0.22	=	4.91	9	198.9	(29)
Walls Type3	4.32	1.44	2.88	x	0.25	=	0.72	9	25.92	(29)
Roof Type1	18.77	0	18.77	x	0.09	=	1.69	9	168.93	(30)
Roof Type2	2.09	0	2.09	x	0.09	=	0.19	9	18.81	(30)
Roof Type3	13.33	0	13.33	x	0.09	=	1.2	9	119.97	(30)
Roof Type4	9.72	1.48	8.24	x	0.13	=	1.07	9	74.16	(30)
Roof Type5	2.16	0	2.16	x	0.13	=	0.28	9	19.44	(30)
Total area of elements, m²			228.89							(31)

DER WorkSheet: New dwelling design stage

Party wall	58.2	x	0	=	0	45	2619 (32)
Internal wall **	185.91					9	1673.19 (32c)
Internal wall **	6.4					75	480 (32c)
Internal floor	68.82					18	1238.76 (32d)
Internal ceiling	68.82					9	619.38 (32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 60.91 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16320.81 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 145.94 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.27 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 71.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	48.19	48	48	48	48	48	48	48	48	48	48	48	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	119.37	119.18	119.18	119.18	119.18	119.18	119.18	119.18	119.18	119.18	119.18	119.18	

Average = Sum(39)$_{1...12}$ /12= 119.2 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	

Average = Sum(40)$_{1...12}$ /12= 1.07 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.83 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	111.43	107.38	103.33	99.28	95.22	91.17	91.17	95.22	99.28	103.33	107.38	111.43	

Total = Sum(44)$_{1...12}$ = 1215.63 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	165.25	144.53	149.14	130.03	124.76	107.66	99.76	114.48	115.85	135.01	147.37	160.04	

Total = Sum(45)$_{1...12}$ = 1593.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.79	21.68	22.37	19.5	18.71	16.15	14.96	17.17	17.38	20.25	22.11	24.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 210 (47)

DER WorkSheet: New dwelling design stage

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.48	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.8	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.8	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	24.78	22.38	24.78	23.98	24.78	23.98	24.78	24.78	23.98	24.78	23.98	24.78	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	24.78	22.38	24.78	23.98	24.78	23.98	24.78	24.78	23.98	24.78	23.98	24.78	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.29	187.92	197.18	176.51	172.8	154.15	147.8	162.52	162.34	183.05	193.86	208.08	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	29.29	25.02	25.04	21.69	16.98	9.65	9.29	10.43	10.47	22.66	25.66	28.81	(63) (G2)
WWHRS	-59.12	-52.02	-53.09	-43.68	-40.55	-33.45	-28.3	-34.27	-35.27	-43.61	-50.52	-57.15	(63) (G10)

Output from water heater

(64)m=	128.65	114.07	122.16	113.74	117.62	112.86	111.73	119.91	118.8	119.6	120.95	125.69	

Output from water heater (annual)$_{1...12}$ 1425.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	93.38	82.77	88.02	80.42	79.91	72.99	71.6	76.49	75.71	83.32	86.19	91.64	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.14	22.33	18.16	13.75	10.28	8.68	9.37	12.19	16.36	20.77	24.24	25.84	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	274.16	277	269.84	254.57	235.31	217.2	205.1	202.26	209.43	224.69	243.96	262.06	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	(71)

Water heating gains (Table 5)

(72)m=	125.51	123.17	118.31	111.7	107.41	101.37	96.24	102.82	105.15	111.99	119.71	123.18	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	493.19	490.88	474.68	448.4	421.38	395.63	379.1	385.64	399.32	425.83	456.29	479.46	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.37	x	10.63	x	0.47	x	1.11	=	12.97	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.47	x	1.11	=	5.54	(74)
North	0.9x 0.77	x	3.37	x	20.32	x	0.47	x	1.11	=	24.78	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.47	x	1.11	=	10.59	(74)
North	0.9x 0.77	x	3.37	x	34.53	x	0.47	x	1.11	=	42.11	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.47	x	1.11	=	17.99	(74)
North	0.9x 0.77	x	3.37	x	55.46	x	0.47	x	1.11	=	67.64	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.47	x	1.11	=	28.9	(74)
North	0.9x 0.77	x	3.37	x	74.72	x	0.47	x	1.11	=	91.12	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.47	x	1.11	=	38.94	(74)
North	0.9x 0.77	x	3.37	x	79.99	x	0.47	x	1.11	=	97.55	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.47	x	1.11	=	41.68	(74)
North	0.9x 0.77	x	3.37	x	74.68	x	0.47	x	1.11	=	91.08	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.47	x	1.11	=	38.92	(74)
North	0.9x 0.77	x	3.37	x	59.25	x	0.47	x	1.11	=	72.26	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.47	x	1.11	=	30.88	(74)
North	0.9x 0.77	x	3.37	x	41.52	x	0.47	x	1.11	=	50.63	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.47	x	1.11	=	21.64	(74)
North	0.9x 0.77	x	3.37	x	24.19	x	0.47	x	1.11	=	29.5	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.47	x	1.11	=	12.61	(74)
North	0.9x 0.77	x	3.37	x	13.12	x	0.47	x	1.11	=	16	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.47	x	1.11	=	6.84	(74)
North	0.9x 0.77	x	3.37	x	8.86	x	0.47	x	1.11	=	10.81	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.47	x	1.11	=	4.62	(74)
East	0.9x 0.77	x	1.51	x	19.64	x	0.47	x	1.11	=	10.73	(76)
East	0.9x 0.77	x	1.51	x	38.42	x	0.47	x	1.11	=	21	(76)

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East	0.9x	0.77	x	1.51	x	63.27	x	0.47	x	1.11	=	34.58	(76)
East	0.9x	0.77	x	1.51	x	92.28	x	0.47	x	1.11	=	50.43	(76)
East	0.9x	0.77	x	1.51	x	113.09	x	0.47	x	1.11	=	61.8	(76)
East	0.9x	0.77	x	1.51	x	115.77	x	0.47	x	1.11	=	63.27	(76)
East	0.9x	0.77	x	1.51	x	110.22	x	0.47	x	1.11	=	60.23	(76)
East	0.9x	0.77	x	1.51	x	94.68	x	0.47	x	1.11	=	51.74	(76)
East	0.9x	0.77	x	1.51	x	73.59	x	0.47	x	1.11	=	40.21	(76)
East	0.9x	0.77	x	1.51	x	45.59	x	0.47	x	1.11	=	24.91	(76)
East	0.9x	0.77	x	1.51	x	24.49	x	0.47	x	1.11	=	13.38	(76)
East	0.9x	0.77	x	1.51	x	16.15	x	0.47	x	1.11	=	8.83	(76)
South	0.9x	0.77	x	8.24	x	46.75	x	0.47	x	1.11	=	139.42	(78)
South	0.9x	0.77	x	8.24	x	76.57	x	0.47	x	1.11	=	228.33	(78)
South	0.9x	0.77	x	8.24	x	97.53	x	0.47	x	1.11	=	290.85	(78)
South	0.9x	0.77	x	8.24	x	110.23	x	0.47	x	1.11	=	328.73	(78)
South	0.9x	0.77	x	8.24	x	114.87	x	0.47	x	1.11	=	342.55	(78)
South	0.9x	0.77	x	8.24	x	110.55	x	0.47	x	1.11	=	329.66	(78)
South	0.9x	0.77	x	8.24	x	108.01	x	0.47	x	1.11	=	322.1	(78)
South	0.9x	0.77	x	8.24	x	104.89	x	0.47	x	1.11	=	312.8	(78)
South	0.9x	0.77	x	8.24	x	101.89	x	0.47	x	1.11	=	303.83	(78)
South	0.9x	0.77	x	8.24	x	82.59	x	0.47	x	1.11	=	246.27	(78)
South	0.9x	0.77	x	8.24	x	55.42	x	0.47	x	1.11	=	165.26	(78)
South	0.9x	0.77	x	8.24	x	40.4	x	0.47	x	1.11	=	120.47	(78)
West	0.9x	0.77	x	0.84	x	19.64	x	0.47	x	1.11	=	5.97	(80)
West	0.9x	0.77	x	0.84	x	38.42	x	0.47	x	1.11	=	11.68	(80)
West	0.9x	0.77	x	0.84	x	63.27	x	0.47	x	1.11	=	19.23	(80)
West	0.9x	0.77	x	0.84	x	92.28	x	0.47	x	1.11	=	28.05	(80)
West	0.9x	0.77	x	0.84	x	113.09	x	0.47	x	1.11	=	34.38	(80)
West	0.9x	0.77	x	0.84	x	115.77	x	0.47	x	1.11	=	35.19	(80)
West	0.9x	0.77	x	0.84	x	110.22	x	0.47	x	1.11	=	33.51	(80)
West	0.9x	0.77	x	0.84	x	94.68	x	0.47	x	1.11	=	28.78	(80)
West	0.9x	0.77	x	0.84	x	73.59	x	0.47	x	1.11	=	22.37	(80)
West	0.9x	0.77	x	0.84	x	45.59	x	0.47	x	1.11	=	13.86	(80)
West	0.9x	0.77	x	0.84	x	24.49	x	0.47	x	1.11	=	7.44	(80)
West	0.9x	0.77	x	0.84	x	16.15	x	0.47	x	1.11	=	4.91	(80)
Rooflights	0.9x	1	x	1.48	x	47.01	x	0.63	x	0.7	=	27.62	(82)
Rooflights	0.9x	1	x	1.48	x	83.9	x	0.63	x	0.7	=	49.28	(82)
Rooflights	0.9x	1	x	1.48	x	122.73	x	0.63	x	0.7	=	72.09	(82)
Rooflights	0.9x	1	x	1.48	x	161.74	x	0.63	x	0.7	=	95.01	(82)
Rooflights	0.9x	1	x	1.48	x	187.38	x	0.63	x	0.7	=	110.07	(82)
Rooflights	0.9x	1	x	1.48	x	188.06	x	0.63	x	0.7	=	110.47	(82)
Rooflights	0.9x	1	x	1.48	x	180.51	x	0.63	x	0.7	=	106.04	(82)

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Rooflights 0.9x	1	x	1.48	x	161.54	x	0.63	x	0.7	=	94.89	(82)
Rooflights 0.9x	1	x	1.48	x	136.5	x	0.63	x	0.7	=	80.18	(82)
Rooflights 0.9x	1	x	1.48	x	95.08	x	0.63	x	0.7	=	55.85	(82)
Rooflights 0.9x	1	x	1.48	x	57.06	x	0.63	x	0.7	=	33.52	(82)
Rooflights 0.9x	1	x	1.48	x	39.72	x	0.63	x	0.7	=	23.33	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	202.25	345.66	476.86	598.76	678.86	677.82	651.86	591.34	518.87	383	242.44	172.97	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	695.43	836.54	951.54	1047.16	1100.24	1073.45	1030.96	976.98	918.18	808.83	698.72	652.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.97	0.94	0.88	0.78	0.63	0.48	0.53	0.73	0.91	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.32	19.58	19.93	20.34	20.68	20.89	20.97	20.96	20.81	20.36	19.75	19.26	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	20.03	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.96	0.93	0.86	0.74	0.56	0.39	0.43	0.67	0.89	0.97	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.79	18.16	18.66	19.23	19.69	19.94	20.01	20	19.85	19.27	18.4	17.69	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.13	18.48	18.95	19.48	19.91	20.15	20.23	20.22	20.07	19.51	18.71	18.05	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	17.98	18.33	18.8	19.33	19.76	20	20.08	20.07	19.92	19.36	18.56	17.9	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.97	0.95	0.91	0.84	0.72	0.56	0.39	0.43	0.66	0.87	0.95	0.98	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	675.44	794.01	867.22	880.73	796.63	597.05	404.24	422.61	606.16	701.11	665.18	636.88	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1633.14	1600.3	1465.85	1243.18	960.9	643.98	414.26	437.04	693.56	1044.14	1365.3	1632.32	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	712.53	541.82	445.38	260.96	122.22	0	0	0	0	255.21	504.08	740.6	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 3582.82 (98)

Space heating requirement in kWh/m²/year 32.04 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.6 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	712.53	541.82	445.38	260.96	122.22	0	0	0	0	255.21	504.08	740.6	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	786.46	598.04	491.59	288.03	134.9	0	0	0	0	281.69	556.38	817.44	

Total (kWh/year) =Sum(211)$_{1..5,10...12}$= 3954.54 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1..5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)	128.65	114.07	122.16	113.74	117.62	112.86	111.73	119.91	118.8	119.6	120.95	125.69	
Efficiency of water heater													79.9 (216)
(217)m=	88.78	88.54	88.06	87.06	85.02	79.9	79.9	79.9	79.9	86.89	88.31	88.87	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	144.91	128.84	138.73	130.65	138.35	141.25	139.84	150.08	148.69	137.65	136.96	141.42	

Total = Sum(219a)$_{1...12}$ = 1677.35 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3954.54
Water heating fuel used		1677.35
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	53.42	(230a)
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		128.42 (231)
Electricity for lighting		443.98 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6204.29 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	854.18 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)

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Water heating	(219) x	0.216	=	362.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1216.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	66.65	(267)
Electricity for lighting	(232) x	0.519	=	230.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1513.56	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			13.53	(273)
EI rating (section 14)				87	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Lacemaker Semi

Address : The Lacemaker Semi

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	43.01 (1a)	x	2.5 (2a)	=	107.52	(3a)
First floor	41.1 (1b)	x	2.7 (2b)	=	110.97	(3b)
Second floor	27.72 (1c)	x	2.61 (2c)	=	72.43	(3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	111.83	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	290.93	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.14 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.39 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.12	x	1.2	=	2.544			(26)
Windows Type 1			3.37	x1/[1/(1.4)+ 0.04]		=	4.47			(27)
Windows Type 2			1.51	x1/[1/(1.4)+ 0.04]		=	2			(27)
Windows Type 3			0.84	x1/[1/(1.4)+ 0.04]		=	1.11			(27)
Windows Type 4			8.24	x1/[1/(1.4)+ 0.04]		=	10.92			(27)
Windows Type 5			1.44	x1/[1/(1.4)+ 0.04]		=	1.91			(27)
Rooflights			1.48	x1/[1/(1.7) + 0.04]		=	2.516			(27b)
Floor			43.01	x	0.13	=	5.5913			(28)
Walls Type1	113.39	16.08	97.31	x	0.18	=	17.52			(29)
Walls Type2	22.1	0	22.1	x	0.18	=	3.98			(29)
Walls Type3	4.32	1.44	2.88	x	0.18	=	0.52			(29)
Roof Type1	18.77	0	18.77	x	0.13	=	2.44			(30)
Roof Type2	2.09	0	2.09	x	0.13	=	0.27			(30)
Roof Type3	13.33	0	13.33	x	0.13	=	1.73			(30)
Roof Type4	9.72	1.48	8.24	x	0.13	=	1.07			(30)
Roof Type5	2.16	0	2.16	x	0.13	=	0.28			(30)
Total area of elements, m²			228.89							(31)

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Party wall	58.2	x	0	=	0		(32)
Internal wall **	185.91						(32c)
Internal wall **	6.4						(32c)
Internal floor	68.82						(32d)
Internal ceiling	68.82						(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 58.72 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16320.81 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 12.9 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 71.61 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	56.47	56.14	55.82	54.3	54.02	52.7	52.7	52.46	53.21	54.02	54.59	55.19	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	128.08	127.75	127.43	125.92	125.64	124.32	124.32	124.07	124.82	125.64	126.21	126.81	

Average = Sum(39)$_{1...12}$ /12= 125.92 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.14	1.14	1.13	1.12	1.11	1.11	1.11	1.12	1.12	1.13	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.83 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 101.3 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	111.43	107.38	103.33	99.28	95.22	91.17	91.17	95.22	99.28	103.33	107.38	111.43	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1215.63 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	165.25	144.53	149.14	130.03	124.76	107.66	99.76	114.48	115.85	135.01	147.37	160.04	

Total = Sum(45)$_{1...12}$ = 1593.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	24.79	21.68	22.37	19.5	18.71	16.15	14.96	17.17	17.38	20.25	22.11	24.01	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

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If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day):		1.7	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.92	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.92	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	28.48	25.73	28.48	27.57	28.48	27.57	28.48	28.48	27.57	28.48	27.57	28.48

(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217	191.27	200.89	180.1	176.51	157.74	151.51	166.23	165.92	186.76	197.45	211.78

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)
(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0
FHRS	0	0	0	0	0	0	0	0	0	0	0	0
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0

(63) (63) (G2) (63) (G10)

Output from water heater

(64)m=	217	191.27	200.89	180.1	176.51	157.74	151.51	166.23	165.92	186.76	197.45	211.78

Output from water heater (annual)$_{1...12}$ 2203.16 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	96.34	85.45	90.99	83.3	82.88	75.86	74.57	79.46	78.58	86.29	89.06	94.61

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27	141.27

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.14	22.33	18.16	13.75	10.28	8.68	9.37	12.19	16.36	20.77	24.24	25.84

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	274.16	277	269.84	254.57	235.31	217.2	205.1	202.26	209.43	224.69	243.96	262.06

(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	37.13	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	-113.02	(71)

Water heating gains (Table 5)

(72)m=	129.49	127.15	122.29	115.69	111.4	105.36	100.23	106.8	109.14	115.98	123.7	127.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	497.17	494.87	478.67	452.39	425.36	399.62	383.09	389.63	403.3	429.82	460.27	483.45	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.37	x	10.63	x	0.63	x	0.7	=	10.95	(74)
North	0.9x 0.77	x	1.44	x	10.63	x	0.63	x	0.7	=	4.68	(74)
North	0.9x 0.77	x	3.37	x	20.32	x	0.63	x	0.7	=	20.93	(74)
North	0.9x 0.77	x	1.44	x	20.32	x	0.63	x	0.7	=	8.94	(74)
North	0.9x 0.77	x	3.37	x	34.53	x	0.63	x	0.7	=	35.56	(74)
North	0.9x 0.77	x	1.44	x	34.53	x	0.63	x	0.7	=	15.2	(74)
North	0.9x 0.77	x	3.37	x	55.46	x	0.63	x	0.7	=	57.12	(74)
North	0.9x 0.77	x	1.44	x	55.46	x	0.63	x	0.7	=	24.41	(74)
North	0.9x 0.77	x	3.37	x	74.72	x	0.63	x	0.7	=	76.95	(74)
North	0.9x 0.77	x	1.44	x	74.72	x	0.63	x	0.7	=	32.88	(74)
North	0.9x 0.77	x	3.37	x	79.99	x	0.63	x	0.7	=	82.38	(74)
North	0.9x 0.77	x	1.44	x	79.99	x	0.63	x	0.7	=	35.2	(74)
North	0.9x 0.77	x	3.37	x	74.68	x	0.63	x	0.7	=	76.91	(74)
North	0.9x 0.77	x	1.44	x	74.68	x	0.63	x	0.7	=	32.86	(74)
North	0.9x 0.77	x	3.37	x	59.25	x	0.63	x	0.7	=	61.02	(74)
North	0.9x 0.77	x	1.44	x	59.25	x	0.63	x	0.7	=	26.07	(74)
North	0.9x 0.77	x	3.37	x	41.52	x	0.63	x	0.7	=	42.76	(74)
North	0.9x 0.77	x	1.44	x	41.52	x	0.63	x	0.7	=	18.27	(74)
North	0.9x 0.77	x	3.37	x	24.19	x	0.63	x	0.7	=	24.91	(74)
North	0.9x 0.77	x	1.44	x	24.19	x	0.63	x	0.7	=	10.65	(74)
North	0.9x 0.77	x	3.37	x	13.12	x	0.63	x	0.7	=	13.51	(74)
North	0.9x 0.77	x	1.44	x	13.12	x	0.63	x	0.7	=	5.77	(74)
North	0.9x 0.77	x	3.37	x	8.86	x	0.63	x	0.7	=	9.13	(74)
North	0.9x 0.77	x	1.44	x	8.86	x	0.63	x	0.7	=	3.9	(74)
East	0.9x 0.77	x	1.51	x	19.64	x	0.63	x	0.7	=	9.06	(76)
East	0.9x 0.77	x	1.51	x	38.42	x	0.63	x	0.7	=	17.73	(76)

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East	0.9x	0.77	x	1.51	x	63.27	x	0.63	x	0.7	=	29.2	(76)
East	0.9x	0.77	x	1.51	x	92.28	x	0.63	x	0.7	=	42.59	(76)
East	0.9x	0.77	x	1.51	x	113.09	x	0.63	x	0.7	=	52.19	(76)
East	0.9x	0.77	x	1.51	x	115.77	x	0.63	x	0.7	=	53.43	(76)
East	0.9x	0.77	x	1.51	x	110.22	x	0.63	x	0.7	=	50.86	(76)
East	0.9x	0.77	x	1.51	x	94.68	x	0.63	x	0.7	=	43.69	(76)
East	0.9x	0.77	x	1.51	x	73.59	x	0.63	x	0.7	=	33.96	(76)
East	0.9x	0.77	x	1.51	x	45.59	x	0.63	x	0.7	=	21.04	(76)
East	0.9x	0.77	x	1.51	x	24.49	x	0.63	x	0.7	=	11.3	(76)
East	0.9x	0.77	x	1.51	x	16.15	x	0.63	x	0.7	=	7.45	(76)
South	0.9x	0.77	x	8.24	x	46.75	x	0.63	x	0.7	=	117.73	(78)
South	0.9x	0.77	x	8.24	x	76.57	x	0.63	x	0.7	=	192.82	(78)
South	0.9x	0.77	x	8.24	x	97.53	x	0.63	x	0.7	=	245.61	(78)
South	0.9x	0.77	x	8.24	x	110.23	x	0.63	x	0.7	=	277.6	(78)
South	0.9x	0.77	x	8.24	x	114.87	x	0.63	x	0.7	=	289.27	(78)
South	0.9x	0.77	x	8.24	x	110.55	x	0.63	x	0.7	=	278.39	(78)
South	0.9x	0.77	x	8.24	x	108.01	x	0.63	x	0.7	=	272	(78)
South	0.9x	0.77	x	8.24	x	104.89	x	0.63	x	0.7	=	264.15	(78)
South	0.9x	0.77	x	8.24	x	101.89	x	0.63	x	0.7	=	256.57	(78)
South	0.9x	0.77	x	8.24	x	82.59	x	0.63	x	0.7	=	207.97	(78)
South	0.9x	0.77	x	8.24	x	55.42	x	0.63	x	0.7	=	139.55	(78)
South	0.9x	0.77	x	8.24	x	40.4	x	0.63	x	0.7	=	101.73	(78)
West	0.9x	0.77	x	0.84	x	19.64	x	0.63	x	0.7	=	5.04	(80)
West	0.9x	0.77	x	0.84	x	38.42	x	0.63	x	0.7	=	9.86	(80)
West	0.9x	0.77	x	0.84	x	63.27	x	0.63	x	0.7	=	16.24	(80)
West	0.9x	0.77	x	0.84	x	92.28	x	0.63	x	0.7	=	23.69	(80)
West	0.9x	0.77	x	0.84	x	113.09	x	0.63	x	0.7	=	29.03	(80)
West	0.9x	0.77	x	0.84	x	115.77	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	0.84	x	110.22	x	0.63	x	0.7	=	28.29	(80)
West	0.9x	0.77	x	0.84	x	94.68	x	0.63	x	0.7	=	24.3	(80)
West	0.9x	0.77	x	0.84	x	73.59	x	0.63	x	0.7	=	18.89	(80)
West	0.9x	0.77	x	0.84	x	45.59	x	0.63	x	0.7	=	11.7	(80)
West	0.9x	0.77	x	0.84	x	24.49	x	0.63	x	0.7	=	6.29	(80)
West	0.9x	0.77	x	0.84	x	16.15	x	0.63	x	0.7	=	4.15	(80)
Rooflights	0.9x	1	x	1.48	x	47.01	x	0.63	x	0.7	=	27.62	(82)
Rooflights	0.9x	1	x	1.48	x	83.9	x	0.63	x	0.7	=	49.28	(82)
Rooflights	0.9x	1	x	1.48	x	122.73	x	0.63	x	0.7	=	72.09	(82)
Rooflights	0.9x	1	x	1.48	x	161.74	x	0.63	x	0.7	=	95.01	(82)
Rooflights	0.9x	1	x	1.48	x	187.38	x	0.63	x	0.7	=	110.07	(82)
Rooflights	0.9x	1	x	1.48	x	188.06	x	0.63	x	0.7	=	110.47	(82)
Rooflights	0.9x	1	x	1.48	x	180.51	x	0.63	x	0.7	=	106.04	(82)

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Rooflights 0.9x	1	x	1.48	x	161.54	x	0.63	x	0.7	=	94.89	(82)
Rooflights 0.9x	1	x	1.48	x	136.5	x	0.63	x	0.7	=	80.18	(82)
Rooflights 0.9x	1	x	1.48	x	95.08	x	0.63	x	0.7	=	55.85	(82)
Rooflights 0.9x	1	x	1.48	x	57.06	x	0.63	x	0.7	=	33.52	(82)
Rooflights 0.9x	1	x	1.48	x	39.72	x	0.63	x	0.7	=	23.33	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.09	299.57	413.91	520.41	590.4	589.58	566.97	514.13	450.64	332.12	209.94	149.69	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	672.26	794.43	892.58	972.8	1015.76	989.2	950.05	903.76	853.94	761.94	670.22	633.14	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.89	0.74	0.56	0.61	0.84	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.93	20.19	20.5	20.78	20.94	20.99	20.98	20.88	20.52	20.08	19.74	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.97	19.97	19.98	19.98	19.99	19.99	19.99	19.99	19.98	19.98	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.95	0.85	0.65	0.44	0.49	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.32	18.57	18.93	19.39	19.76	19.95	19.99	19.99	19.89	19.43	18.79	18.29	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.64	18.87	19.21	19.64	19.99	20.17	20.21	20.21	20.11	19.67	19.08	18.61	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.64	18.87	19.21	19.64	19.99	20.17	20.21	20.21	20.11	19.67	19.08	18.61	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.85	0.66	0.47	0.51	0.78	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	669.57	787	872.44	914.35	860.11	655.79	444	464.61	665.13	726.86	664.3	631.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1837.22	1785.27	1620.28	1352.65	1041.11	692.95	448.98	472.64	750.48	1140	1512.28	1827.44	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	868.73	670.83	556.39	315.58	134.67	0	0	0	0	307.38	610.54	889.97	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4354.09 (98)

Space heating requirement in kWh/m²/year 38.93 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0 (201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	868.73	670.83	556.39	315.58	134.67	0	0	0	0	307.38	610.54	889.97	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	929.12	717.47	595.07	337.51	144.03	0	0	0	0	328.74	652.99	951.84	

Total (kWh/year) =Sum(211)$_{1..5,10...12}$= 4656.78 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1..5,10...12}$= 0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Output from water heater (calculated above)	217	191.27	200.89	180.1	176.51	157.74	151.51	166.23	165.92	186.76	197.45	211.78

Efficiency of water heater 79.8 (216)

(217)m=	88.14	87.89	87.39	86.3	84.1	79.8	79.8	79.8	79.8	86.13	87.63	88.23

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	246.2	217.63	229.87	208.7	209.87	197.67	189.86	208.3	207.93	216.82	225.33	240.05

Total = Sum(219a)$_{1...12}$ = 2598.24 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4656.78
Water heating fuel used		2598.24
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)
boiler with a fan-assisted flue	45	(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		443.98 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7773.99 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year
Space heating (main system 1)	(211)	x	0.216	=	1005.86 (261)
Space heating (secondary)	(215)	x	0.519	=	0 (263)
Water heating	(219)	x	0.216	=	561.22 (264)

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Space and water heating	(261) + (262) + (263) + (264) =			1567.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	230.42	(268)
Total CO2, kg/year	sum of (265)…(271) =			1836.43	(272)

TER = 16.42 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Pargeter (ASHP)

Address : The Pargeter (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	63.01 (1a)	x	2.38 (2a)	=	150.28	(3a)
First floor	60.97 (1b)	x	2.61 (2b)	=	159.13	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	123.98 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		309.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.78	x	1.3	=	2.314			(26)
Windows Type 1			6.44	x1/[1/(1.2)+ 0.04]		=	7.37			(27)
Windows Type 2			3	x1/[1/(1.2)+ 0.04]		=	3.44			(27)
Windows Type 3			5.73	x1/[1/(1.2)+ 0.04]		=	6.56			(27)
Windows Type 4			3.09	x1/[1/(1.2)+ 0.04]		=	3.54			(27)
Windows Type 5			4.43	x1/[1/(1.2)+ 0.04]		=	5.07			(27)
Windows Type 6			3	x1/[1/(1.2)+ 0.04]		=	3.44			(27)
Windows Type 7			1.5	x1/[1/(1.2)+ 0.04]		=	1.72			(27)
Windows Type 8			1.5	x1/[1/(1.2)+ 0.04]		=	1.72			(27)
Floor			63.01	x	0.1	=	6.301	75	4725.75	(28)
Walls Type1	79.36	20.04	59.32	x	0.25	=	14.83	60	3559.2	(29)
Walls Type2	82.83	10.43	72.4	x	0.25	=	18.1	60	4344	(29)
Roof Type1	60.97	0	60.97	x	0.09	=	5.49	9	548.73	(30)
Roof Type2	2.09	0	2.09	x	0.09	=	0.19	9	18.81	(30)
Total area of elements, m²			288.26							(31)
Internal wall **			174.61					9	1571.49	(32c)
Internal wall **			62.27					75	4670.25	(32c)

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Internal floor	60.97	18	1097.46	(32d)
Internal ceiling	60.97	9	548.73	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 80.07 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21084.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 170.06 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.41 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 89.48 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	51.25	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	140.73	140.53	140.53	140.53	140.53	140.53	140.53	140.53	140.53	140.53	140.53	140.53	

Average = Sum(39)$_{1...12}$ /12= 140.55 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.14	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.88 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.54 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.79	108.69	104.59	100.49	96.39	92.29	92.29	96.39	100.49	104.59	108.69	112.79	

Total = Sum(44)$_{1...12}$ = 1230.48 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.27	146.3	150.96	131.61	126.29	108.98	100.98	115.88	117.26	136.66	149.17	161.99	

Total = Sum(45)$_{1...12}$ = 1613.35 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.09	21.94	22.64	19.74	18.94	16.35	15.15	17.38	17.59	20.5	22.38	24.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)
Water storage loss:

DER WorkSheet: New dwelling design stage

a) If manufacturer's declared loss factor is known (kWh/day):		1.89	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	1.02	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.02	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	222.17	195.88	205.86	184.74	181.19	139.59	132.62	147.52	147.88	191.56	202.3	216.89	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	222.17	195.88	205.86	184.74	181.19	0	0	0	0	191.56	202.3	216.89	

Output from water heater (annual)$_{1...12}$ 1600.61 (64)

Output immersion

(64)m=	0	0	0	0	0	139.59	132.62	147.52	147.88	0	0	0	

Output from immersion (annual)$_{1...12}$ 567.611767623672 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.54	88.31	94.12	86.27	85.91	60.73	58.89	63.84	63.48	89.36	92.1	97.78	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.88	22.99	18.69	14.15	10.58	8.93	9.65	12.54	16.84	21.38	24.95	26.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	290.31	293.32	285.73	269.57	249.17	229.99	217.18	214.17	221.76	237.92	258.33	277.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

DER WorkSheet: New dwelling design stage

(69)m=	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	(71)

Water heating gains (Table 5)

(72)m=	133.79	131.42	126.5	119.81	115.47	84.35	79.15	85.81	88.17	120.11	127.92	131.43	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	516.14	513.89	497.09	469.7	441.38	389.43	372.15	378.69	392.94	445.57	477.36	501.69	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.44	x	10.63	x	0.47	x	1.11	=	24.78	(74)
North	0.9x 0.77	x	4.43	x	10.63	x	0.47	x	1.11	=	17.05	(74)
North	0.9x 0.77	x	6.44	x	20.32	x	0.47	x	1.11	=	47.36	(74)
North	0.9x 0.77	x	4.43	x	20.32	x	0.47	x	1.11	=	32.58	(74)
North	0.9x 0.77	x	6.44	x	34.53	x	0.47	x	1.11	=	80.48	(74)
North	0.9x 0.77	x	4.43	x	34.53	x	0.47	x	1.11	=	55.36	(74)
North	0.9x 0.77	x	6.44	x	55.46	x	0.47	x	1.11	=	129.27	(74)
North	0.9x 0.77	x	4.43	x	55.46	x	0.47	x	1.11	=	88.92	(74)
North	0.9x 0.77	x	6.44	x	74.72	x	0.47	x	1.11	=	174.14	(74)
North	0.9x 0.77	x	4.43	x	74.72	x	0.47	x	1.11	=	119.79	(74)
North	0.9x 0.77	x	6.44	x	79.99	x	0.47	x	1.11	=	186.42	(74)
North	0.9x 0.77	x	4.43	x	79.99	x	0.47	x	1.11	=	128.23	(74)
North	0.9x 0.77	x	6.44	x	74.68	x	0.47	x	1.11	=	174.04	(74)
North	0.9x 0.77	x	4.43	x	74.68	x	0.47	x	1.11	=	119.72	(74)
North	0.9x 0.77	x	6.44	x	59.25	x	0.47	x	1.11	=	138.08	(74)
North	0.9x 0.77	x	4.43	x	59.25	x	0.47	x	1.11	=	94.98	(74)
North	0.9x 0.77	x	6.44	x	41.52	x	0.47	x	1.11	=	96.76	(74)
North	0.9x 0.77	x	4.43	x	41.52	x	0.47	x	1.11	=	66.56	(74)
North	0.9x 0.77	x	6.44	x	24.19	x	0.47	x	1.11	=	56.38	(74)
North	0.9x 0.77	x	4.43	x	24.19	x	0.47	x	1.11	=	38.78	(74)
North	0.9x 0.77	x	6.44	x	13.12	x	0.47	x	1.11	=	30.57	(74)
North	0.9x 0.77	x	4.43	x	13.12	x	0.47	x	1.11	=	21.03	(74)
North	0.9x 0.77	x	6.44	x	8.86	x	0.47	x	1.11	=	20.66	(74)
North	0.9x 0.77	x	4.43	x	8.86	x	0.47	x	1.11	=	14.21	(74)
East	0.9x 0.77	x	3	x	19.64	x	0.47	x	1.11	=	21.32	(76)
East	0.9x 0.77	x	3	x	19.64	x	0.47	x	1.11	=	21.32	(76)
East	0.9x 0.77	x	3	x	38.42	x	0.47	x	1.11	=	41.71	(76)
East	0.9x 0.77	x	3	x	38.42	x	0.47	x	1.11	=	41.71	(76)

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East	0.9x	0.77	x	3	x	63.27	x	0.47	x	1.11	=	68.7	(76)
East	0.9x	0.77	x	3	x	63.27	x	0.47	x	1.11	=	68.7	(76)
East	0.9x	0.77	x	3	x	92.28	x	0.47	x	1.11	=	100.19	(76)
East	0.9x	0.77	x	3	x	92.28	x	0.47	x	1.11	=	100.19	(76)
East	0.9x	0.77	x	3	x	113.09	x	0.47	x	1.11	=	122.78	(76)
East	0.9x	0.77	x	3	x	113.09	x	0.47	x	1.11	=	122.78	(76)
East	0.9x	0.77	x	3	x	115.77	x	0.47	x	1.11	=	125.69	(76)
East	0.9x	0.77	x	3	x	115.77	x	0.47	x	1.11	=	125.69	(76)
East	0.9x	0.77	x	3	x	110.22	x	0.47	x	1.11	=	119.66	(76)
East	0.9x	0.77	x	3	x	110.22	x	0.47	x	1.11	=	119.66	(76)
East	0.9x	0.77	x	3	x	94.68	x	0.47	x	1.11	=	102.79	(76)
East	0.9x	0.77	x	3	x	94.68	x	0.47	x	1.11	=	102.79	(76)
East	0.9x	0.77	x	3	x	73.59	x	0.47	x	1.11	=	79.9	(76)
East	0.9x	0.77	x	3	x	73.59	x	0.47	x	1.11	=	79.9	(76)
East	0.9x	0.77	x	3	x	45.59	x	0.47	x	1.11	=	49.5	(76)
East	0.9x	0.77	x	3	x	45.59	x	0.47	x	1.11	=	49.5	(76)
East	0.9x	0.77	x	3	x	24.49	x	0.47	x	1.11	=	26.59	(76)
East	0.9x	0.77	x	3	x	24.49	x	0.47	x	1.11	=	26.59	(76)
East	0.9x	0.77	x	3	x	16.15	x	0.47	x	1.11	=	17.54	(76)
East	0.9x	0.77	x	3	x	16.15	x	0.47	x	1.11	=	17.54	(76)
South	0.9x	0.77	x	3.09	x	46.75	x	0.47	x	1.11	=	52.28	(78)
South	0.9x	0.77	x	1.5	x	46.75	x	0.47	x	1.11	=	25.38	(78)
South	0.9x	0.77	x	3.09	x	76.57	x	0.47	x	1.11	=	85.62	(78)
South	0.9x	0.77	x	1.5	x	76.57	x	0.47	x	1.11	=	41.56	(78)
South	0.9x	0.77	x	3.09	x	97.53	x	0.47	x	1.11	=	109.07	(78)
South	0.9x	0.77	x	1.5	x	97.53	x	0.47	x	1.11	=	52.95	(78)
South	0.9x	0.77	x	3.09	x	110.23	x	0.47	x	1.11	=	123.27	(78)
South	0.9x	0.77	x	1.5	x	110.23	x	0.47	x	1.11	=	59.84	(78)
South	0.9x	0.77	x	3.09	x	114.87	x	0.47	x	1.11	=	128.46	(78)
South	0.9x	0.77	x	1.5	x	114.87	x	0.47	x	1.11	=	62.36	(78)
South	0.9x	0.77	x	3.09	x	110.55	x	0.47	x	1.11	=	123.62	(78)
South	0.9x	0.77	x	1.5	x	110.55	x	0.47	x	1.11	=	60.01	(78)
South	0.9x	0.77	x	3.09	x	108.01	x	0.47	x	1.11	=	120.79	(78)
South	0.9x	0.77	x	1.5	x	108.01	x	0.47	x	1.11	=	58.63	(78)
South	0.9x	0.77	x	3.09	x	104.89	x	0.47	x	1.11	=	117.3	(78)
South	0.9x	0.77	x	1.5	x	104.89	x	0.47	x	1.11	=	56.94	(78)
South	0.9x	0.77	x	3.09	x	101.89	x	0.47	x	1.11	=	113.94	(78)
South	0.9x	0.77	x	1.5	x	101.89	x	0.47	x	1.11	=	55.31	(78)
South	0.9x	0.77	x	3.09	x	82.59	x	0.47	x	1.11	=	92.35	(78)
South	0.9x	0.77	x	1.5	x	82.59	x	0.47	x	1.11	=	44.83	(78)
South	0.9x	0.77	x	3.09	x	55.42	x	0.47	x	1.11	=	61.97	(78)

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South	0.9x	0.77	x	1.5	x	55.42	x	0.47	x	1.11	=	30.08	(78)
South	0.9x	0.77	x	3.09	x	40.4	x	0.47	x	1.11	=	45.18	(78)
South	0.9x	0.77	x	1.5	x	40.4	x	0.47	x	1.11	=	21.93	(78)
West	0.9x	0.77	x	5.73	x	19.64	x	0.47	x	1.11	=	40.73	(80)
West	0.9x	0.77	x	1.5	x	19.64	x	0.47	x	1.11	=	10.66	(80)
West	0.9x	0.77	x	5.73	x	38.42	x	0.47	x	1.11	=	79.67	(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.47	x	1.11	=	20.86	(80)
West	0.9x	0.77	x	5.73	x	63.27	x	0.47	x	1.11	=	131.21	(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.47	x	1.11	=	34.35	(80)
West	0.9x	0.77	x	5.73	x	92.28	x	0.47	x	1.11	=	191.36	(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.47	x	1.11	=	50.09	(80)
West	0.9x	0.77	x	5.73	x	113.09	x	0.47	x	1.11	=	234.52	(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.47	x	1.11	=	61.39	(80)
West	0.9x	0.77	x	5.73	x	115.77	x	0.47	x	1.11	=	240.07	(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.47	x	1.11	=	62.85	(80)
West	0.9x	0.77	x	5.73	x	110.22	x	0.47	x	1.11	=	228.56	(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.47	x	1.11	=	59.83	(80)
West	0.9x	0.77	x	5.73	x	94.68	x	0.47	x	1.11	=	196.33	(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.47	x	1.11	=	51.39	(80)
West	0.9x	0.77	x	5.73	x	73.59	x	0.47	x	1.11	=	152.6	(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.47	x	1.11	=	39.95	(80)
West	0.9x	0.77	x	5.73	x	45.59	x	0.47	x	1.11	=	94.54	(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.47	x	1.11	=	24.75	(80)
West	0.9x	0.77	x	5.73	x	24.49	x	0.47	x	1.11	=	50.78	(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.47	x	1.11	=	13.29	(80)
West	0.9x	0.77	x	5.73	x	16.15	x	0.47	x	1.11	=	33.49	(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.47	x	1.11	=	8.77	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	213.53	391.08	600.8	843.13	1026.22	1052.59	1000.91	860.61	684.91	450.62	260.91	179.31	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	729.67	904.97	1097.89	1312.83	1467.6	1442.02	1373.05	1239.3	1077.84	896.19	738.27	681	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.88	0.74	0.58	0.44	0.5	0.75	0.93	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.88	20.17	20.51	20.76	20.88	20.92	20.91	20.8	20.45	19.98	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.85	0.69	0.5	0.34	0.4	0.67	0.91	0.98	0.99	(89)

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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.21	18.49	18.91	19.38	19.7	19.83	19.86	19.86	19.76	19.31	18.65	18.15	(90)

fLA = Living area ÷ (4) = 0.18 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.48	18.74	19.14	19.58	19.89	20.02	20.05	20.05	19.95	19.51	18.89	18.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.48	18.74	19.14	19.58	19.89	20.02	20.05	20.05	19.95	19.51	18.89	18.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.93	0.84	0.69	0.5	0.35	0.4	0.67	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	719.19	877.38	1022.14	1102.99	1006.83	727.89	478.84	501.53	725.21	806.04	718.57	673.26	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1994.86	1944.64	1775.62	1501.12	1151.27	761.72	485.03	512.37	821.57	1252.71	1657.25	1997.59	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	949.1	717.2	560.59	286.65	107.46	0	0	0	0	332.32	675.85	985.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4614.48 (98)

Space heating requirement in kWh/m²/year 37.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 386.3 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	949.1	717.2	560.59	286.65	107.46	0	0	0	0	332.32	675.85	985.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	245.69	185.66	145.12	74.21	27.82	0	0	0	0	86.03	174.96	255.06	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1194.54 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	222.17	195.88	205.86	184.74	181.19	0	0	0	0	191.56	202.3	216.89	

Efficiency of water heater 282.62 (216)

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(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	78.61	69.31	72.84	65.37	64.11	0	0	0	0	67.78	71.58	76.74	

Total = Sum(219a)$_{1...12}$ = 566.34 (219)

Water heating requirement (immersion)

	0	0	0	0	0	139.59	132.62	147.52	147.88	0	0	0

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	139.59	132.62	147.52	147.88	0	0	0	

Total = Sum(219a)$_{1...12}$ = 567.61 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1194.54	
Water heating fuel used		566.34	
Water heating fuel used (Immersion)		567.61	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	56.82		(230a)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	56.82	(231)
Electricity for lighting		457.07	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2274.76	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.519	=	619.97	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	293.93	(264)
Water heating (Immersion)	(219) x	0.519	=	294.59	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1208.49	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	29.49	(267)
Electricity for lighting	(232) x	0.519	=	237.22	(268)
Total CO2, kg/year	sum of (265)…(271) =			1475.19	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			11.9	(273)
EI rating (section 14)				88	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Pargeter (ASHP)

Address : The Pargeter (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	63.01 (1a)	x	2.38 (2a)	=	150.28	(3a)
First floor	60.97 (1b)	x	2.61 (2b)	=	159.13	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	123.98 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		309.41	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.78	x	1.2	=	2.136			(26)
Windows Type 1			6.44	x1/[1/(1.4)+ 0.04]		=	8.54			(27)
Windows Type 2			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 3			5.73	x1/[1/(1.4)+ 0.04]		=	7.6			(27)
Windows Type 4			3.09	x1/[1/(1.4)+ 0.04]		=	4.1			(27)
Windows Type 5			4.43	x1/[1/(1.4)+ 0.04]		=	5.87			(27)
Windows Type 6			3	x1/[1/(1.4)+ 0.04]		=	3.98			(27)
Windows Type 7			1.5	x1/[1/(1.4)+ 0.04]		=	1.99			(27)
Windows Type 8			1.5	x1/[1/(1.4)+ 0.04]		=	1.99			(27)
Floor			63.01	x	0.13	=	8.191299			(28)
Walls Type1	79.36	20.04	59.32	x	0.18	=	10.68			(29)
Walls Type2	82.83	10.43	72.4	x	0.18	=	13.03			(29)
Roof Type1	60.97	0	60.97	x	0.13	=	7.93			(30)
Roof Type2	2.09	0	2.09	x	0.13	=	0.27			(30)
Total area of elements, m²			288.26							(31)
Internal wall **			174.61							(32c)
Internal wall **			62.27							(32c)

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Internal floor	60.97			(32d)
Internal ceiling	60.97			(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 80.27 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21084.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 14.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 94.5 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	59.68	59.34	59.02	57.47	57.18	55.84	55.84	55.59	56.36	57.18	57.77	58.38	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	154.18	153.84	153.51	151.97	151.68	150.34	150.34	150.09	150.86	151.68	152.27	152.88	

Average = Sum(39)$_{1...12}$ /12= 151.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.24	1.24	1.24	1.23	1.22	1.21	1.21	1.21	1.22	1.22	1.23	1.23	

Average = Sum(40)$_{1...12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.88 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.54 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.79	108.69	104.59	100.49	96.39	92.29	92.29	96.39	100.49	104.59	108.69	112.79	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1230.48 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	167.27	146.3	150.96	131.61	126.29	108.98	100.98	115.88	117.26	136.66	149.17	161.99	

Total = Sum(45)$_{1...12}$ = 1613.35 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.09	21.94	22.64	19.74	18.94	16.35	15.15	17.38	17.59	20.5	22.38	24.3	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

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a) If manufacturer's declared loss factor is known (kWh/day):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(50)
b) If manufacturer's declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.86	188.38	197.56	176.71	172.88	154.07	147.58	162.47	162.35	183.25	194.26	208.59	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.86	188.38	197.56	176.71	172.88	154.07	147.58	162.47	162.35	183.25	194.26	208.59	

Output from water heater (annual)$_{1...12}$: 2161.97 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.89	82.31	87.47	79.84	79.27	72.31	70.85	75.81	75.06	82.71	85.67	91.14	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	143.87	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.88	22.99	18.69	14.15	10.58	8.93	9.65	12.54	16.84	21.38	24.95	26.6	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	290.31	293.32	285.73	269.57	249.17	229.99	217.18	214.17	221.76	237.92	258.33	277.5	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	37.39	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	-115.1	(71)

Water heating gains (Table 5)

(72)m=	124.86	122.49	117.57	110.88	106.54	100.43	95.23	101.89	104.25	111.18	118.99	122.5	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	510.21	507.96	491.15	463.77	435.45	408.52	391.23	397.77	412.02	439.64	471.43	495.76	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	6.44	x	10.63	x	0.63	x	0.7	=	20.93	(74)
North	0.9x 0.77	x	4.43	x	10.63	x	0.63	x	0.7	=	14.4	(74)
North	0.9x 0.77	x	6.44	x	20.32	x	0.63	x	0.7	=	39.99	(74)
North	0.9x 0.77	x	4.43	x	20.32	x	0.63	x	0.7	=	27.51	(74)
North	0.9x 0.77	x	6.44	x	34.53	x	0.63	x	0.7	=	67.96	(74)
North	0.9x 0.77	x	4.43	x	34.53	x	0.63	x	0.7	=	46.75	(74)
North	0.9x 0.77	x	6.44	x	55.46	x	0.63	x	0.7	=	109.16	(74)
North	0.9x 0.77	x	4.43	x	55.46	x	0.63	x	0.7	=	75.09	(74)
North	0.9x 0.77	x	6.44	x	74.72	x	0.63	x	0.7	=	147.05	(74)
North	0.9x 0.77	x	4.43	x	74.72	x	0.63	x	0.7	=	101.15	(74)
North	0.9x 0.77	x	6.44	x	79.99	x	0.63	x	0.7	=	157.42	(74)
North	0.9x 0.77	x	4.43	x	79.99	x	0.63	x	0.7	=	108.29	(74)
North	0.9x 0.77	x	6.44	x	74.68	x	0.63	x	0.7	=	146.97	(74)
North	0.9x 0.77	x	4.43	x	74.68	x	0.63	x	0.7	=	101.1	(74)
North	0.9x 0.77	x	6.44	x	59.25	x	0.63	x	0.7	=	116.61	(74)
North	0.9x 0.77	x	4.43	x	59.25	x	0.63	x	0.7	=	80.21	(74)
North	0.9x 0.77	x	6.44	x	41.52	x	0.63	x	0.7	=	81.71	(74)
North	0.9x 0.77	x	4.43	x	41.52	x	0.63	x	0.7	=	56.21	(74)
North	0.9x 0.77	x	6.44	x	24.19	x	0.63	x	0.7	=	47.61	(74)
North	0.9x 0.77	x	4.43	x	24.19	x	0.63	x	0.7	=	32.75	(74)
North	0.9x 0.77	x	6.44	x	13.12	x	0.63	x	0.7	=	25.82	(74)
North	0.9x 0.77	x	4.43	x	13.12	x	0.63	x	0.7	=	17.76	(74)
North	0.9x 0.77	x	6.44	x	8.86	x	0.63	x	0.7	=	17.45	(74)
North	0.9x 0.77	x	4.43	x	8.86	x	0.63	x	0.7	=	12	(74)
East	0.9x 0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(76)
East	0.9x 0.77	x	3	x	19.64	x	0.63	x	0.7	=	18.01	(76)
East	0.9x 0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(76)
East	0.9x 0.77	x	3	x	38.42	x	0.63	x	0.7	=	35.23	(76)
East	0.9x 0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(76)
East	0.9x 0.77	x	3	x	63.27	x	0.63	x	0.7	=	58.01	(76)

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East	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(76)
East	0.9x	0.77	x	3	x	92.28	x	0.63	x	0.7	=	84.61	(76)
East	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(76)
East	0.9x	0.77	x	3	x	113.09	x	0.63	x	0.7	=	103.69	(76)
East	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(76)
East	0.9x	0.77	x	3	x	115.77	x	0.63	x	0.7	=	106.14	(76)
East	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(76)
East	0.9x	0.77	x	3	x	110.22	x	0.63	x	0.7	=	101.05	(76)
East	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(76)
East	0.9x	0.77	x	3	x	94.68	x	0.63	x	0.7	=	86.8	(76)
East	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(76)
East	0.9x	0.77	x	3	x	73.59	x	0.63	x	0.7	=	67.47	(76)
East	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(76)
East	0.9x	0.77	x	3	x	45.59	x	0.63	x	0.7	=	41.8	(76)
East	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(76)
East	0.9x	0.77	x	3	x	24.49	x	0.63	x	0.7	=	22.45	(76)
East	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(76)
East	0.9x	0.77	x	3	x	16.15	x	0.63	x	0.7	=	14.81	(76)
South	0.9x	0.77	x	3.09	x	46.75	x	0.63	x	0.7	=	44.15	(78)
South	0.9x	0.77	x	1.5	x	46.75	x	0.63	x	0.7	=	21.43	(78)
South	0.9x	0.77	x	3.09	x	76.57	x	0.63	x	0.7	=	72.31	(78)
South	0.9x	0.77	x	1.5	x	76.57	x	0.63	x	0.7	=	35.1	(78)
South	0.9x	0.77	x	3.09	x	97.53	x	0.63	x	0.7	=	92.11	(78)
South	0.9x	0.77	x	1.5	x	97.53	x	0.63	x	0.7	=	44.71	(78)
South	0.9x	0.77	x	3.09	x	110.23	x	0.63	x	0.7	=	104.1	(78)
South	0.9x	0.77	x	1.5	x	110.23	x	0.63	x	0.7	=	50.53	(78)
South	0.9x	0.77	x	3.09	x	114.87	x	0.63	x	0.7	=	108.48	(78)
South	0.9x	0.77	x	1.5	x	114.87	x	0.63	x	0.7	=	52.66	(78)
South	0.9x	0.77	x	3.09	x	110.55	x	0.63	x	0.7	=	104.4	(78)
South	0.9x	0.77	x	1.5	x	110.55	x	0.63	x	0.7	=	50.68	(78)
South	0.9x	0.77	x	3.09	x	108.01	x	0.63	x	0.7	=	102	(78)
South	0.9x	0.77	x	1.5	x	108.01	x	0.63	x	0.7	=	49.51	(78)
South	0.9x	0.77	x	3.09	x	104.89	x	0.63	x	0.7	=	99.06	(78)
South	0.9x	0.77	x	1.5	x	104.89	x	0.63	x	0.7	=	48.09	(78)
South	0.9x	0.77	x	3.09	x	101.89	x	0.63	x	0.7	=	96.22	(78)
South	0.9x	0.77	x	1.5	x	101.89	x	0.63	x	0.7	=	46.71	(78)
South	0.9x	0.77	x	3.09	x	82.59	x	0.63	x	0.7	=	77.99	(78)
South	0.9x	0.77	x	1.5	x	82.59	x	0.63	x	0.7	=	37.86	(78)
South	0.9x	0.77	x	3.09	x	55.42	x	0.63	x	0.7	=	52.33	(78)
South	0.9x	0.77	x	1.5	x	55.42	x	0.63	x	0.7	=	25.4	(78)
South	0.9x	0.77	x	3.09	x	40.4	x	0.63	x	0.7	=	38.15	(78)

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South	0.9x	0.77	x	1.5	x	40.4	x	0.63	x	0.7	=	18.52		(78)
West	0.9x	0.77	x	5.73	x	19.64	x	0.63	x	0.7	=	34.39		(80)
West	0.9x	0.77	x	1.5	x	19.64	x	0.63	x	0.7	=	9		(80)
West	0.9x	0.77	x	5.73	x	38.42	x	0.63	x	0.7	=	67.28		(80)
West	0.9x	0.77	x	1.5	x	38.42	x	0.63	x	0.7	=	17.61		(80)
West	0.9x	0.77	x	5.73	x	63.27	x	0.63	x	0.7	=	110.8		(80)
West	0.9x	0.77	x	1.5	x	63.27	x	0.63	x	0.7	=	29.01		(80)
West	0.9x	0.77	x	5.73	x	92.28	x	0.63	x	0.7	=	161.6		(80)
West	0.9x	0.77	x	1.5	x	92.28	x	0.63	x	0.7	=	42.3		(80)
West	0.9x	0.77	x	5.73	x	113.09	x	0.63	x	0.7	=	198.04		(80)
West	0.9x	0.77	x	1.5	x	113.09	x	0.63	x	0.7	=	51.84		(80)
West	0.9x	0.77	x	5.73	x	115.77	x	0.63	x	0.7	=	202.73		(80)
West	0.9x	0.77	x	1.5	x	115.77	x	0.63	x	0.7	=	53.07		(80)
West	0.9x	0.77	x	5.73	x	110.22	x	0.63	x	0.7	=	193.01		(80)
West	0.9x	0.77	x	1.5	x	110.22	x	0.63	x	0.7	=	50.53		(80)
West	0.9x	0.77	x	5.73	x	94.68	x	0.63	x	0.7	=	165.79		(80)
West	0.9x	0.77	x	1.5	x	94.68	x	0.63	x	0.7	=	43.4		(80)
West	0.9x	0.77	x	5.73	x	73.59	x	0.63	x	0.7	=	128.87		(80)
West	0.9x	0.77	x	1.5	x	73.59	x	0.63	x	0.7	=	33.73		(80)
West	0.9x	0.77	x	5.73	x	45.59	x	0.63	x	0.7	=	79.83		(80)
West	0.9x	0.77	x	1.5	x	45.59	x	0.63	x	0.7	=	20.9		(80)
West	0.9x	0.77	x	5.73	x	24.49	x	0.63	x	0.7	=	42.88		(80)
West	0.9x	0.77	x	1.5	x	24.49	x	0.63	x	0.7	=	11.23		(80)
West	0.9x	0.77	x	5.73	x	16.15	x	0.63	x	0.7	=	28.28		(80)
West	0.9x	0.77	x	1.5	x	16.15	x	0.63	x	0.7	=	7.4		(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m ...(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	180.32	330.26	507.36	712	866.61	888.88	845.23	726.76	578.38	380.53	220.33	151.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	690.52	838.21	998.51	1175.76	1302.06	1297.39	1236.46	1124.53	990.4	820.18	691.76	647.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.95	0.86	0.69	0.52	0.59	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.6	19.78	20.08	20.46	20.78	20.95	20.99	20.98	20.85	20.42	19.93	19.57	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.89	19.89	19.89	19.9	19.9	19.91	19.91	19.91	19.91	19.9	19.9	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(89)m=	1	0.99	0.98	0.94	0.81	0.59	0.4	0.46	0.77	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.02	18.28	18.72	19.28	19.69	19.88	19.91	19.9	19.79	19.23	18.52	17.98	(90)

fLA = Living area ÷ (4) = 0.18 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.3	18.55	18.96	19.49	19.89	20.07	20.1	20.1	19.98	19.44	18.77	18.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.3	18.55	18.96	19.49	19.89	20.07	20.1	20.1	19.98	19.44	18.77	18.26	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.61	0.42	0.48	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	688.36	831.65	976.05	1091.23	1050.66	786.05	521.23	545.36	771.43	787.97	687.05	645.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	2158.35	2099.81	1912.86	1609.12	1241.72	821.99	526.19	554.82	886.54	1340.83	1777.4	2149.85	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1093.67	852.21	696.98	372.88	142.15	0	0	0	0	411.33	785.05	1119.1	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 5473.37 (98)

Space heating requirement in kWh/m²/year 44.15 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	1093.67	852.21	696.98	372.88	142.15	0	0	0	0	411.33	785.05	1119.1	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1169.7	911.45	745.44	398.8	152.03	0	0	0	0	439.92	839.63	1196.9	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 5853.87 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	213.86	188.38	197.56	176.71	172.88	154.07	147.58	162.47	162.35	183.25	194.26	208.59

Efficiency of water heater 79.8 (216)

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(217)m=	88.56	88.36	87.9	86.76	84.3	79.8	79.8	79.8	79.8	86.91	88.16	88.63

(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	241.5	213.21	224.76	203.67	205.09	193.07	184.93	203.6	203.45	210.86	220.37	235.34

Total = Sum(219a)$_{1...12}$ = 2539.84 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		5853.87
Water heating fuel used		2539.84
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30 (230c)	
boiler with a fan-assisted flue	45 (230e)	
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75 (231)
Electricity for lighting		457.07 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		8925.78 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.216 =	1264.44 (261)
Space heating (secondary)	(215) x	0.519 =	0 (263)
Water heating	(219) x	0.216 =	548.61 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1813.04 (265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93 (267)
Electricity for lighting	(232) x	0.519 =	237.22 (268)
Total CO2, kg/year	sum of (265)…(271) =		2089.19 (272)

TER = 24.89 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Ploughwright - ET

Address : The Ploughwright - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.85 (1a)	x	2.38 (2a)	=	111.74	(3a)
First floor	46.85 (1b)	x	2.61 (2b)	=	122.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.7 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		234.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) =	0	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)			
Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.65000009536743	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.23	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.3	=	2.795			(26)
Doors Type 2			2.15	x	1.3	=	2.795			(26)
Windows Type 1			8.28	x1/[1/(1.2)+ 0.04]		=	9.48			(27)
Windows Type 2			4.07	x1/[1/(1.2)+ 0.04]		=	4.66			(27)
Windows Type 3			3.27	x1/[1/(1.2)+ 0.04]		=	3.74			(27)
Floor			46.85	x	0.1	=	4.685	75	3513.75	(28)
Walls	96.69	19.92	76.77	x	0.25	=	19.19	60	4606.2	(29)
Roof	46.85	0	46.85	x	0.09	=	4.22	9	421.65	(30)
Total area of elements, m²			190.39							(31)
Party wall			48.91	x	0	=	0	45	2200.95	(32)
Internal wall **			146.93					9	1322.37	(32c)
Internal wall **			17.57					75	1317.75	(32c)
Internal floor			46.85					18	843.3	(32d)
Internal ceiling			46.85					9	421.65	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 51.57 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14647.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 156.32 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 7.59 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 59.16 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.76	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	38.61	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.92	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77	97.77	

Average = Sum(39)$_{1...12}$ /12= 97.78 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04	

Average = Sum(40)$_{1...12}$ /12= 1.04 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	107.45	103.55	99.64	95.73	91.82	87.92	87.92	91.82	95.73	99.64	103.55	107.45	

Total = Sum(44)$_{1...12}$ = 1172.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.35	139.37	143.82	125.38	120.31	103.82	96.2	110.39	111.71	130.19	142.11	154.32	

Total = Sum(45)$_{1...12}$ = 1536.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.9	20.91	21.57	18.81	18.05	15.57	14.43	16.56	16.76	19.53	21.32	23.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.41	143.94	148.88	130.28	125.37	108.71	101.26	115.45	116.61	135.25	147.01	159.38	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-52.47	-46.17	-47.12	-38.77	-36	-29.7	-25.13	-30.43	-31.32	-38.71	-44.85	-50.71	(63) (G10)

Output from water heater

(64)m=	111.94	97.77	101.76	91.51	89.37	79.02	76.13	85.02	85.29	96.53	102.16	108.67	

Output from water heater (annual)$_{1...12}$	1125.16	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.25	47.48	49.08	42.91	41.27	35.74	33.25	37.97	38.37	44.55	48.48	52.58	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.95	19.49	15.85	12	8.97	7.57	8.18	10.64	14.28	18.13	21.16	22.56	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.72	248.27	241.85	228.17	210.9	194.67	183.83	181.28	187.71	201.38	218.65	234.88	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	(71)

Water heating gains (Table 5)

(72)m=	72.92	70.66	65.97	59.6	55.47	49.64	44.69	51.04	53.29	59.88	67.33	70.67	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.68	404.52	389.77	365.87	341.43	317.98	302.8	309.05	321.37	345.49	373.24	394.2	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	8.28	x	10.63	x	0.47	x	1.11	=	31.86	(74)
North	0.9x 0.77	x	8.28	x	20.32	x	0.47	x	1.11	=	60.89	(74)
North	0.9x 0.77	x	8.28	x	34.53	x	0.47	x	1.11	=	103.47	(74)
North	0.9x 0.77	x	8.28	x	55.46	x	0.47	x	1.11	=	166.2	(74)
North	0.9x 0.77	x	8.28	x	74.72	x	0.47	x	1.11	=	223.89	(74)
North	0.9x 0.77	x	8.28	x	79.99	x	0.47	x	1.11	=	239.68	(74)
North	0.9x 0.77	x	8.28	x	74.68	x	0.47	x	1.11	=	223.77	(74)
North	0.9x 0.77	x	8.28	x	59.25	x	0.47	x	1.11	=	177.53	(74)
North	0.9x 0.77	x	8.28	x	41.52	x	0.47	x	1.11	=	124.41	(74)
North	0.9x 0.77	x	8.28	x	24.19	x	0.47	x	1.11	=	72.48	(74)
North	0.9x 0.77	x	8.28	x	13.12	x	0.47	x	1.11	=	39.31	(74)
North	0.9x 0.77	x	8.28	x	8.86	x	0.47	x	1.11	=	26.56	(74)
East	0.9x 0.77	x	4.07	x	19.64	x	0.47	x	1.11	=	28.93	(76)
East	0.9x 0.77	x	4.07	x	38.42	x	0.47	x	1.11	=	56.59	(76)
East	0.9x 0.77	x	4.07	x	63.27	x	0.47	x	1.11	=	93.2	(76)
East	0.9x 0.77	x	4.07	x	92.28	x	0.47	x	1.11	=	135.92	(76)
East	0.9x 0.77	x	4.07	x	113.09	x	0.47	x	1.11	=	166.58	(76)
East	0.9x 0.77	x	4.07	x	115.77	x	0.47	x	1.11	=	170.52	(76)
East	0.9x 0.77	x	4.07	x	110.22	x	0.47	x	1.11	=	162.34	(76)
East	0.9x 0.77	x	4.07	x	94.68	x	0.47	x	1.11	=	139.45	(76)
East	0.9x 0.77	x	4.07	x	73.59	x	0.47	x	1.11	=	108.39	(76)
East	0.9x 0.77	x	4.07	x	45.59	x	0.47	x	1.11	=	67.15	(76)
East	0.9x 0.77	x	4.07	x	24.49	x	0.47	x	1.11	=	36.07	(76)
East	0.9x 0.77	x	4.07	x	16.15	x	0.47	x	1.11	=	23.79	(76)
West	0.9x 0.77	x	3.27	x	19.64	x	0.47	x	1.11	=	23.24	(80)
West	0.9x 0.77	x	3.27	x	38.42	x	0.47	x	1.11	=	45.47	(80)
West	0.9x 0.77	x	3.27	x	63.27	x	0.47	x	1.11	=	74.88	(80)
West	0.9x 0.77	x	3.27	x	92.28	x	0.47	x	1.11	=	109.21	(80)
West	0.9x 0.77	x	3.27	x	113.09	x	0.47	x	1.11	=	133.84	(80)
West	0.9x 0.77	x	3.27	x	115.77	x	0.47	x	1.11	=	137	(80)
West	0.9x 0.77	x	3.27	x	110.22	x	0.47	x	1.11	=	130.43	(80)
West	0.9x 0.77	x	3.27	x	94.68	x	0.47	x	1.11	=	112.04	(80)
West	0.9x 0.77	x	3.27	x	73.59	x	0.47	x	1.11	=	87.09	(80)
West	0.9x 0.77	x	3.27	x	45.59	x	0.47	x	1.11	=	53.95	(80)
West	0.9x 0.77	x	3.27	x	24.49	x	0.47	x	1.11	=	28.98	(80)
West	0.9x 0.77	x	3.27	x	16.15	x	0.47	x	1.11	=	19.11	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.03	162.95	271.55	411.33	524.3	547.21	516.55	429.03	319.88	193.59	104.36	69.47	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	490.72	567.47	661.32	777.2	865.74	865.19	819.35	738.07	641.25	539.08	477.6	463.67	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.81	0.65	0.5	0.57	0.81	0.95	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.32	19.51	19.86	20.31	20.69	20.91	20.97	20.96	20.77	20.26	19.7	19.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	20.05	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.9	0.77	0.57	0.4	0.47	0.75	0.94	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.78	18.07	18.57	19.21	19.72	19.97	20.03	20.02	19.83	19.15	18.34	17.71	(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.15	18.42	18.88	19.48	19.96	20.19	20.26	20.25	20.06	19.42	18.67	18.09	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18	18.27	18.73	19.33	19.81	20.04	20.11	20.1	19.91	19.27	18.52	17.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.88	0.75	0.57	0.41	0.47	0.74	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	483.64	553.43	627.74	685.84	652.97	496	335.46	348.51	474.58	498.92	466.31	458.15	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1341.78	1306.78	1195.93	1019.31	792.42	532.32	343.04	361.39	567.9	847.81	1116.31	1342.99	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	638.45	506.25	422.73	240.1	103.75	0	0	0	0	259.58	468	658.32	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3297.19 (98)

Space heating requirement in kWh/m²/year 35.19 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		90.5 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)													kWh/year
	638.45	506.25	422.73	240.1	103.75	0	0	0	0	259.58	468	658.32	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	705.47	559.4	467.11	265.3	114.64	0	0	0	0	286.83	517.12	727.43	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3643.31 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	111.94	97.77	101.76	91.51	89.37	79.02	76.13	85.02	85.29	96.53	102.16	108.67	

Efficiency of water heater 87.3 (216)

(217)m=	90.01	89.97	89.86	89.59	88.99	87.3	87.3	87.3	87.3	89.61	89.91	90.03	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	124.37	108.68	113.24	102.14	100.43	90.51	87.2	97.39	97.7	107.73	113.63	120.7	

Total = Sum(219a)$_{1...12}$ = 1263.69 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3643.31	
Water heating fuel used		1263.69	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	44.15		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	119.15	(231)
Electricity for lighting		387.62	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5413.78	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	786.95	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	272.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1059.91	(265)

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Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	61.84	(267)
Electricity for lighting	(232)	x	0.519	=	201.18	(268)
Total CO2, kg/year			sum of (265)…(271) =		1322.93	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		14.12	(273)
EI rating (section 14)					87	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Ploughwright - ET

Address : The Ploughwright - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.85 (1a)	x	2.38 (2a)	=	111.74	(3a)
First floor	46.85 (1b)	x	2.61 (2b)	=	122.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.7 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		234.02	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

TER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.2	=	2.58			(26)
Doors Type 2			2.15	x	1.2	=	2.58			(26)
Windows Type 1			8.28	x	1/[1/(1.4)+ 0.04]	=	10.98			(27)
Windows Type 2			4.07	x	1/[1/(1.4)+ 0.04]	=	5.4			(27)
Windows Type 3			3.27	x	1/[1/(1.4)+ 0.04]	=	4.34			(27)
Floor			46.85	x	0.13	=	6.090499			(28)
Walls	96.69	19.92	76.77	x	0.18	=	13.82			(29)
Roof	46.85	0	46.85	x	0.13	=	6.09			(30)
Total area of elements, m²			190.39							(31)
Party wall			48.91	x	0	=	0			(32)
Internal wall **			146.93							(32c)
Internal wall **			17.57							(32c)
Internal floor			46.85							(32d)
Internal ceiling			46.85							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 51.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14647.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.66 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = — 62.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45.1	44.85	44.6	43.44	43.22	42.21	42.21	42.03	42.6	43.22	43.66	44.12	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	107.63	107.37	107.13	105.97	105.75	104.74	104.74	104.55	105.13	105.75	106.19	106.65	

Average = Sum(39)$_{1...12}$ /12= 105.97 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.15	1.15	1.14	1.13	1.13	1.12	1.12	1.12	1.12	1.13	1.13	1.14	

Average = Sum(40)$_{1...12}$ /12= 1.13 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.69 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	107.45	103.55	99.64	95.73	91.82	87.92	87.92	91.82	95.73	99.64	103.55	107.45	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1172.22 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.35	139.37	143.82	125.38	120.31	103.82	96.2	110.39	111.71	130.19	142.11	154.32	

Total = Sum(45)$_{1...12}$ = 1536.97 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.9	20.91	21.57	18.81	18.05	15.57	14.43	16.56	16.76	19.53	21.32	23.15	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.77	47.21	46.79	43.36	44.8	46.79	47.21	50.77	49.32	50.96

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.31	185.4	194.59	172.59	167.1	147.17	141	157.18	158.92	180.96	191.43	205.28

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

FHRS	0	0	0	0	0	0	0	0	0	0	0	0

(63) (G2)

WWHRS	0	0	0	0	0	0	0	0	0	0	0	0

(63) (G10)

Output from water heater

(64)m=	210.31	185.4	194.59	172.59	167.1	147.17	141	157.18	158.92	180.96	191.43	205.28

Output from water heater (annual)$_{1...12}$ 2111.94 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.72	57.85	60.51	53.49	51.7	45.36	43.19	48.4	48.95	55.98	59.58	64.05

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65	133.65

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.95	19.49	15.85	12	8.97	7.57	8.18	10.64	14.28	18.13	21.16	22.56

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.72	248.27	241.85	228.17	210.9	194.67	183.83	181.28	187.71	201.38	218.65	234.88

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37	36.37

(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92	-106.92

(71)

Water heating gains (Table 5)

(72)m=	88.34	86.08	81.33	74.29	69.49	63	58.05	65.06	67.98	75.24	82.75	86.09

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	422.11	419.94	405.13	380.56	355.46	331.34	316.16	323.07	336.06	360.85	388.66	409.63

(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	8.28	x	10.63	x	0.63	x	0.7	=	26.91	(74)
North	0.9x 0.77	x	8.28	x	20.32	x	0.63	x	0.7	=	51.42	(74)
North	0.9x 0.77	x	8.28	x	34.53	x	0.63	x	0.7	=	87.38	(74)
North	0.9x 0.77	x	8.28	x	55.46	x	0.63	x	0.7	=	140.35	(74)
North	0.9x 0.77	x	8.28	x	74.72	x	0.63	x	0.7	=	189.07	(74)
North	0.9x 0.77	x	8.28	x	79.99	x	0.63	x	0.7	=	202.4	(74)
North	0.9x 0.77	x	8.28	x	74.68	x	0.63	x	0.7	=	188.97	(74)
North	0.9x 0.77	x	8.28	x	59.25	x	0.63	x	0.7	=	149.92	(74)
North	0.9x 0.77	x	8.28	x	41.52	x	0.63	x	0.7	=	105.06	(74)
North	0.9x 0.77	x	8.28	x	24.19	x	0.63	x	0.7	=	61.21	(74)
North	0.9x 0.77	x	8.28	x	13.12	x	0.63	x	0.7	=	33.19	(74)
North	0.9x 0.77	x	8.28	x	8.86	x	0.63	x	0.7	=	22.43	(74)
East	0.9x 0.77	x	4.07	x	19.64	x	0.63	x	0.7	=	24.43	(76)
East	0.9x 0.77	x	4.07	x	38.42	x	0.63	x	0.7	=	47.79	(76)
East	0.9x 0.77	x	4.07	x	63.27	x	0.63	x	0.7	=	78.7	(76)
East	0.9x 0.77	x	4.07	x	92.28	x	0.63	x	0.7	=	114.78	(76)
East	0.9x 0.77	x	4.07	x	113.09	x	0.63	x	0.7	=	140.67	(76)
East	0.9x 0.77	x	4.07	x	115.77	x	0.63	x	0.7	=	144	(76)
East	0.9x 0.77	x	4.07	x	110.22	x	0.63	x	0.7	=	137.09	(76)
East	0.9x 0.77	x	4.07	x	94.68	x	0.63	x	0.7	=	117.76	(76)
East	0.9x 0.77	x	4.07	x	73.59	x	0.63	x	0.7	=	91.53	(76)
East	0.9x 0.77	x	4.07	x	45.59	x	0.63	x	0.7	=	56.71	(76)
East	0.9x 0.77	x	4.07	x	24.49	x	0.63	x	0.7	=	30.46	(76)
East	0.9x 0.77	x	4.07	x	16.15	x	0.63	x	0.7	=	20.09	(76)
West	0.9x 0.77	x	3.27	x	19.64	x	0.63	x	0.7	=	19.63	(80)
West	0.9x 0.77	x	3.27	x	38.42	x	0.63	x	0.7	=	38.4	(80)
West	0.9x 0.77	x	3.27	x	63.27	x	0.63	x	0.7	=	63.23	(80)
West	0.9x 0.77	x	3.27	x	92.28	x	0.63	x	0.7	=	92.22	(80)
West	0.9x 0.77	x	3.27	x	113.09	x	0.63	x	0.7	=	113.02	(80)
West	0.9x 0.77	x	3.27	x	115.77	x	0.63	x	0.7	=	115.7	(80)
West	0.9x 0.77	x	3.27	x	110.22	x	0.63	x	0.7	=	110.15	(80)
West	0.9x 0.77	x	3.27	x	94.68	x	0.63	x	0.7	=	94.61	(80)
West	0.9x 0.77	x	3.27	x	73.59	x	0.63	x	0.7	=	73.54	(80)
West	0.9x 0.77	x	3.27	x	45.59	x	0.63	x	0.7	=	45.56	(80)
West	0.9x 0.77	x	3.27	x	24.49	x	0.63	x	0.7	=	24.47	(80)
West	0.9x 0.77	x	3.27	x	16.15	x	0.63	x	0.7	=	16.14	(80)

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Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	70.96	137.61	229.31	347.35	442.76	462.1	436.21	362.3	270.13	163.48	88.13	58.66	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	493.07	557.55	634.44	727.92	798.21	793.44	752.37	685.37	606.19	524.33	476.79	468.29	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.91	0.76	0.59	0.66	0.9	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.82	20.07	20.42	20.74	20.93	20.98	20.97	20.82	20.41	19.99	19.67	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.96	19.96	19.97	19.98	19.98	19.99	19.99	19.99	19.98	19.98	19.97	19.97	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.87	0.67	0.47	0.54	0.85	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.21	18.4	18.77	19.28	19.71	19.94	19.98	19.98	19.83	19.27	18.66	18.18	(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.57	18.75	19.08	19.56	19.96	20.18	20.22	20.22	20.07	19.55	18.98	18.54	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.57	18.75	19.08	19.56	19.96	20.18	20.22	20.22	20.07	19.55	18.98	18.54	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.96	0.87	0.69	0.5	0.57	0.85	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.96	555.06	626.89	698.24	695.57	546.55	373.76	388.37	515.66	512.52	474.68	467.48	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1535.43	1486.7	1348.06	1129.25	873.61	584.24	379.41	399.04	627.16	946.37	1261.74	1529.53	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	776.34	626.06	536.55	310.33	132.46	0	0	0	0	322.78	566.68	790.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4061.36 (98)

Space heating requirement in kWh/m²/year 43.34 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

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Fraction of space heat from main system(s)	(202) = 1 – (201) =	1 (202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1 (204)
Efficiency of main space heating system 1		93.4 (206)
Efficiency of secondary/supplementary heating system, %		0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement (calculated above)													kWh/year
	776.34	626.06	536.55	310.33	132.46	0	0	0	0	322.78	566.68	790.16	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	831.2	670.3	574.46	332.25	141.82	0	0	0	0	345.59	606.73	846	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4348.35 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	210.31	185.4	194.59	172.59	167.1	147.17	141	157.18	158.92	180.96	191.43	205.28

Efficiency of water heater 80.3 (216)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(217)m=	88.04	87.87	87.47	86.51	84.47	80.3	80.3	80.3	80.3	86.49	87.62	88.11	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(219)m=	238.88	210.98	222.46	199.5	197.81	183.28	175.59	195.75	197.91	209.22	218.48	232.97	

Total = Sum(219a)$_{1...12}$ = 2482.84 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4348.35	
Water heating fuel used		2482.84	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		387.62	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		7293.82	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	939.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	536.29	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1475.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)

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Electricity for lighting	(232)	x	0.519	=	201.18 (268)
Total CO2, kg/year			sum of (265)…(271) =		1715.64 (272)

TER = 18.31 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Reedmaker - DET (ASHP)

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1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	59.86 (1a)	x	2.38 (2a)	=	142.77	(3a)
First floor	59.86 (1b)	x	2.61 (2b)	=	156.23	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	119.72 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		299	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.3	=	2.795			(26)
Windows Type 1			3.67	x1/[1/(1.2)+ 0.04]		=	4.2			(27)
Windows Type 2			0.72	x1/[1/(1.2)+ 0.04]		=	0.82			(27)
Windows Type 3			0.72	x1/[1/(1.2)+ 0.04]		=	0.82			(27)
Windows Type 4			2.99	x1/[1/(1.2)+ 0.04]		=	3.42			(27)
Windows Type 5			3.3	x1/[1/(1.2)+ 0.04]		=	3.78			(27)
Windows Type 6			6.29	x1/[1/(1.2)+ 0.04]		=	7.2			(27)
Floor			59.86	x	0.1	=	5.986	75	4489.5	(28)
Walls	157.7	19.84	137.86	x	0.25	=	34.46	60	8271.6	(29)
Roof	59.86	0	59.86	x	0.09	=	5.39	9	538.74	(30)
Total area of elements, m²			277.42							(31)
Internal wall **			200.44					9	1803.96	(32c)
Internal wall **			53.75					75	4031.25	(32c)
Internal floor			59.86					18	1077.48	(32d)
Internal ceiling			59.86					9	538.74	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 68.89 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 20751.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 173.33 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.23 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 76.12 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	49.53	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	49.34	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	125.65	125.46	125.46	125.46	125.46	125.46	125.46	125.46	125.46	125.46	125.46	125.46	

Average = Sum(39)$_{1...12}$ /12= 125.47 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.18 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.4	108.31	104.22	100.13	96.05	91.96	91.96	96.05	100.13	104.22	108.31	112.4	

Total = Sum(44)$_{1...12}$ = 1226.13 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.68	145.78	150.43	131.15	125.84	108.59	100.63	115.47	116.85	136.18	148.65	161.42	

Total = Sum(45)$_{1...12}$ = 1607.66 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25	21.87	22.56	19.67	18.88	16.29	15.09	17.32	17.53	20.43	22.3	24.21	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.89 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.02 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.02	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	221.58	195.37	205.33	184.28	180.74	139.21	132.26	147.11	147.47	191.08	201.78	216.32	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	221.58	195.37	205.33	184.28	180.74	0	0	0	0	191.08	201.78	216.32	

Output from water heater (annual)$_{1...12}$ 1596.47 (64)

Output immersion

(64)m=	0	0	0	0	0	139.21	132.26	147.11	147.47	0	0	0	

Output from immersion (annual)$_{1...12}$ 566.047577326378 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	99.34	88.14	93.94	86.11	85.76	60.6	58.77	63.7	63.35	89.2	91.93	97.59	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.31	23.37	19.01	14.39	10.76	9.08	9.81	12.75	17.12	21.74	25.37	27.05	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	284.85	287.8	280.36	264.5	244.48	225.67	213.1	210.14	217.59	233.45	253.47	272.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	(71)

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Water heating gains (Table 5)

(72)m=	133.52	131.16	126.26	119.6	115.27	84.17	78.99	85.62	87.98	119.89	127.68	131.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	510.62	508.27	491.56	464.42	436.44	384.85	367.84	374.46	388.63	441.01	472.45	496.43	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.67	x	10.63	x	0.47	x	1.11	=	14.12	(74)
North	0.9x 0.77	x	3.3	x	10.63	x	0.47	x	1.11	=	12.7	(74)
North	0.9x 0.77	x	3.67	x	20.32	x	0.47	x	1.11	=	26.99	(74)
North	0.9x 0.77	x	3.3	x	20.32	x	0.47	x	1.11	=	24.27	(74)
North	0.9x 0.77	x	3.67	x	34.53	x	0.47	x	1.11	=	45.86	(74)
North	0.9x 0.77	x	3.3	x	34.53	x	0.47	x	1.11	=	41.24	(74)
North	0.9x 0.77	x	3.67	x	55.46	x	0.47	x	1.11	=	73.67	(74)
North	0.9x 0.77	x	3.3	x	55.46	x	0.47	x	1.11	=	66.24	(74)
North	0.9x 0.77	x	3.67	x	74.72	x	0.47	x	1.11	=	99.24	(74)
North	0.9x 0.77	x	3.3	x	74.72	x	0.47	x	1.11	=	89.23	(74)
North	0.9x 0.77	x	3.67	x	79.99	x	0.47	x	1.11	=	106.23	(74)
North	0.9x 0.77	x	3.3	x	79.99	x	0.47	x	1.11	=	95.52	(74)
North	0.9x 0.77	x	3.67	x	74.68	x	0.47	x	1.11	=	99.18	(74)
North	0.9x 0.77	x	3.3	x	74.68	x	0.47	x	1.11	=	89.18	(74)
North	0.9x 0.77	x	3.67	x	59.25	x	0.47	x	1.11	=	78.69	(74)
North	0.9x 0.77	x	3.3	x	59.25	x	0.47	x	1.11	=	70.76	(74)
North	0.9x 0.77	x	3.67	x	41.52	x	0.47	x	1.11	=	55.14	(74)
North	0.9x 0.77	x	3.3	x	41.52	x	0.47	x	1.11	=	49.58	(74)
North	0.9x 0.77	x	3.67	x	24.19	x	0.47	x	1.11	=	32.13	(74)
North	0.9x 0.77	x	3.3	x	24.19	x	0.47	x	1.11	=	28.89	(74)
North	0.9x 0.77	x	3.67	x	13.12	x	0.47	x	1.11	=	17.42	(74)
North	0.9x 0.77	x	3.3	x	13.12	x	0.47	x	1.11	=	15.67	(74)
North	0.9x 0.77	x	3.67	x	8.86	x	0.47	x	1.11	=	11.77	(74)
North	0.9x 0.77	x	3.3	x	8.86	x	0.47	x	1.11	=	10.59	(74)
East	0.9x 0.77	x	0.72	x	19.64	x	0.47	x	1.11	=	5.12	(76)
East	0.9x 0.77	x	0.72	x	38.42	x	0.47	x	1.11	=	10.01	(76)
East	0.9x 0.77	x	0.72	x	63.27	x	0.47	x	1.11	=	16.49	(76)
East	0.9x 0.77	x	0.72	x	92.28	x	0.47	x	1.11	=	24.05	(76)
East	0.9x 0.77	x	0.72	x	113.09	x	0.47	x	1.11	=	29.47	(76)
East	0.9x 0.77	x	0.72	x	115.77	x	0.47	x	1.11	=	30.17	(76)
East	0.9x 0.77	x	0.72	x	110.22	x	0.47	x	1.11	=	28.72	(76)
East	0.9x 0.77	x	0.72	x	94.68	x	0.47	x	1.11	=	24.67	(76)

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East	0.9x	0.77	x	0.72	x	73.59	x	0.47	x	1.11	=	19.18	(76)
East	0.9x	0.77	x	0.72	x	45.59	x	0.47	x	1.11	=	11.88	(76)
East	0.9x	0.77	x	0.72	x	24.49	x	0.47	x	1.11	=	6.38	(76)
East	0.9x	0.77	x	0.72	x	16.15	x	0.47	x	1.11	=	4.21	(76)
South	0.9x	0.77	x	2.99	x	46.75	x	0.47	x	1.11	=	50.59	(78)
South	0.9x	0.77	x	6.29	x	46.75	x	0.47	x	1.11	=	106.42	(78)
South	0.9x	0.77	x	2.99	x	76.57	x	0.47	x	1.11	=	82.85	(78)
South	0.9x	0.77	x	6.29	x	76.57	x	0.47	x	1.11	=	174.3	(78)
South	0.9x	0.77	x	2.99	x	97.53	x	0.47	x	1.11	=	105.54	(78)
South	0.9x	0.77	x	6.29	x	97.53	x	0.47	x	1.11	=	222.02	(78)
South	0.9x	0.77	x	2.99	x	110.23	x	0.47	x	1.11	=	119.28	(78)
South	0.9x	0.77	x	6.29	x	110.23	x	0.47	x	1.11	=	250.93	(78)
South	0.9x	0.77	x	2.99	x	114.87	x	0.47	x	1.11	=	124.3	(78)
South	0.9x	0.77	x	6.29	x	114.87	x	0.47	x	1.11	=	261.49	(78)
South	0.9x	0.77	x	2.99	x	110.55	x	0.47	x	1.11	=	119.62	(78)
South	0.9x	0.77	x	6.29	x	110.55	x	0.47	x	1.11	=	251.65	(78)
South	0.9x	0.77	x	2.99	x	108.01	x	0.47	x	1.11	=	116.88	(78)
South	0.9x	0.77	x	6.29	x	108.01	x	0.47	x	1.11	=	245.87	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.47	x	1.11	=	113.5	(78)
South	0.9x	0.77	x	6.29	x	104.89	x	0.47	x	1.11	=	238.78	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.47	x	1.11	=	110.25	(78)
South	0.9x	0.77	x	6.29	x	101.89	x	0.47	x	1.11	=	231.93	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.47	x	1.11	=	89.36	(78)
South	0.9x	0.77	x	6.29	x	82.59	x	0.47	x	1.11	=	187.99	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.47	x	1.11	=	59.97	(78)
South	0.9x	0.77	x	6.29	x	55.42	x	0.47	x	1.11	=	126.15	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.47	x	1.11	=	43.71	(78)
South	0.9x	0.77	x	6.29	x	40.4	x	0.47	x	1.11	=	91.96	(78)
West	0.9x	0.77	x	0.72	x	19.64	x	0.47	x	1.11	=	5.12	(80)
West	0.9x	0.77	x	0.72	x	38.42	x	0.47	x	1.11	=	10.01	(80)
West	0.9x	0.77	x	0.72	x	63.27	x	0.47	x	1.11	=	16.49	(80)
West	0.9x	0.77	x	0.72	x	92.28	x	0.47	x	1.11	=	24.05	(80)
West	0.9x	0.77	x	0.72	x	113.09	x	0.47	x	1.11	=	29.47	(80)
West	0.9x	0.77	x	0.72	x	115.77	x	0.47	x	1.11	=	30.17	(80)
West	0.9x	0.77	x	0.72	x	110.22	x	0.47	x	1.11	=	28.72	(80)
West	0.9x	0.77	x	0.72	x	94.68	x	0.47	x	1.11	=	24.67	(80)
West	0.9x	0.77	x	0.72	x	73.59	x	0.47	x	1.11	=	19.18	(80)
West	0.9x	0.77	x	0.72	x	45.59	x	0.47	x	1.11	=	11.88	(80)
West	0.9x	0.77	x	0.72	x	24.49	x	0.47	x	1.11	=	6.38	(80)
West	0.9x	0.77	x	0.72	x	16.15	x	0.47	x	1.11	=	4.21	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	194.07	328.43	447.64	558.21	633.19	633.36	608.56	551.07	485.25	362.13	231.97	166.45	(83)

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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	704.69	836.7	939.19	1022.63	1069.63	1018.21	976.39	925.52	873.88	803.14	704.42	662.88	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) — 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.92	0.84	0.7	0.54	0.59	0.8	0.94	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.98	20.21	20.47	20.72	20.86	20.91	20.91	20.8	20.5	20.09	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.91	0.79	0.62	0.43	0.48	0.73	0.92	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.69	19.01	19.4	19.72	19.89	19.94	19.93	19.82	19.43	18.86	18.4	(90)

fLA = Living area ÷ (4) = 0.13 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.64	18.86	19.17	19.54	19.85	20.02	20.07	20.06	19.96	19.57	19.02	18.58	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.64	18.86	19.17	19.54	19.85	20.02	20.07	20.06	19.96	19.57	19.02	18.58	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.95	0.89	0.78	0.62	0.44	0.48	0.73	0.91	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	695.1	814.45	890.54	913.22	838.59	629.42	425.78	445.5	635.73	731.86	686.54	655.67	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1801.38	1751.42	1590.06	1334.85	1022.47	679.64	434.96	459.33	734.62	1125.65	1495.87	1804.27	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	823.08	629.64	520.44	303.57	136.81	0	0	0	0	292.98	582.72	854.56	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4143.8 (98)

Space heating requirement in kWh/m²/year — 34.61 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system — 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = — 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = — 1 (204)

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Efficiency of main space heating system 1	337.89	(206)
Efficiency of secondary/supplementary heating system, %	0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	823.08	629.64	520.44	303.57	136.81	0	0	0	0	292.98	582.72	854.56	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	243.6	186.35	154.03	89.85	40.49	0	0	0	0	86.71	172.46	252.91	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1226.39 (211)

Space heating fuel (secondary), kWh/month													
= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	221.58	195.37	205.33	184.28	180.74	0	0	0	0	191.08	201.78	216.32	

Efficiency of water heater	282.62	(216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	78.4	69.13	72.65	65.2	63.95	0	0	0	0	67.61	71.39	76.54	

Total = Sum(219a)$_{1...12}$ = 564.87 (219)

Water heating requirement (immersion)													
	0	0	0	0	0	139.21	132.26	147.11	147.47	0	0	0	

Efficiency of water heater (Immersion)	100	(216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)
Fuel for water heating (Immersion), kWh/month													
(219)m = [(64)m + (218) m] x 100 ÷ (217)m													
(219)m=	0	0	0	0	0	139.21	132.26	147.11	147.47	0	0	0	

Total = Sum(219a)$_{1...12}$ = 566.05 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		1226.39
Water heating fuel used		564.87
Water heating fuel used (Immersion)		566.05
Electricity for pumps, fans and electric keep-hot		
mechanical ventilation - balanced, extract or positive input from outside	54.9	(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		54.9 (231)
Electricity for lighting		464.72 (232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2310.89 (338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year
Space heating (main system 1)	(211) x	0.519 =	636.5 (261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	293.17	(264)
Water heating (Immersion)	(219) x	0.519	=	293.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1223.44	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	28.49	(267)
Electricity for lighting	(232) x	0.519	=	241.19	(268)
Total CO2, kg/year	sum of (265)…(271) =			1493.13	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =			12.47	(273)
EI rating (section 14)				88	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Reedmaker - DET (ASHP)

Address : The Reedmaker - DET (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	59.86 (1a)	x	2.38 (2a)	=	142.77	(3a)
First floor	59.86 (1b)	x	2.61 (2b)	=	156.23	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	119.72 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		299	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.13	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.38	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.33	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.15	x	1.2	=	2.58			(26)
Windows Type 1			3.67	x1/[1/(1.4)+ 0.04]		=	4.87			(27)
Windows Type 2			0.72	x1/[1/(1.4)+ 0.04]		=	0.95			(27)
Windows Type 3			0.72	x1/[1/(1.4)+ 0.04]		=	0.95			(27)
Windows Type 4			2.99	x1/[1/(1.4)+ 0.04]		=	3.96			(27)
Windows Type 5			3.3	x1/[1/(1.4)+ 0.04]		=	4.37			(27)
Windows Type 6			6.29	x1/[1/(1.4)+ 0.04]		=	8.34			(27)
Floor			59.86	x	0.13	=	7.7818			(28)
Walls	157.7	19.84	137.86	x	0.18	=	24.81			(29)
Roof	59.86	0	59.86	x	0.13	=	7.78			(30)
Total area of elements, m²			277.42							(31)
Internal wall **			200.44							(32c)
Internal wall **			53.75							(32c)
Internal floor			59.86							(32d)
Internal ceiling			59.86							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 66.41 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 20751.27 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 11.43 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 77.84 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	57.87	57.54	57.21	55.69	55.4	54.07	54.07	53.83	54.59	55.4	55.98	56.58	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	135.71	135.38	135.05	133.53	133.24	131.91	131.91	131.67	132.43	133.24	133.82	134.42	

Average = Sum(39)$_{1...12}$ /12= 133.53 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.12	1.11	1.1	1.1	1.1	1.11	1.11	1.12	1.12	

Average = Sum(40)$_{1...12}$ /12= 1.12 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.86 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 102.18 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	112.4	108.31	104.22	100.13	96.05	91.96	91.96	96.05	100.13	104.22	108.31	112.4	

Total = Sum(44)$_{1...12}$ = 1226.13 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	166.68	145.78	150.43	131.15	125.84	108.59	100.63	115.47	116.85	136.18	148.65	161.42	

Total = Sum(45)$_{1...12}$ = 1607.66 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25	21.87	22.56	19.67	18.88	16.29	15.09	17.32	17.53	20.43	22.3	24.21	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	213.27	187.86	197.03	176.24	172.44	153.68	147.22	162.06	161.94	182.77	193.74	208.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	213.27	187.86	197.03	176.24	172.44	153.68	147.22	162.06	161.94	182.77	193.74	208.02	

Output from water heater (annual)$_{1...12}$ 2156.27 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.7	82.14	87.29	79.68	79.12	72.18	70.73	75.67	74.93	82.55	85.5	90.95	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	143.11	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	26.31	23.37	19.01	14.39	10.76	9.08	9.81	12.75	17.12	21.74	25.37	27.05	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	284.85	287.8	280.36	264.5	244.48	225.67	213.1	210.14	217.59	233.45	253.47	272.28	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	37.31	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	-114.49	(71)

Water heating gains (Table 5)

(72)m=	124.59	122.23	117.33	110.67	106.34	100.25	95.07	101.71	104.06	110.96	118.75	122.24	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	504.69	502.34	485.63	458.49	430.51	403.93	386.92	393.54	407.71	435.08	466.52	490.5	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	3.67	x	10.63	x	0.63	x	0.7	=	11.93	(74)
North	0.9x 0.77	x	3.3	x	10.63	x	0.63	x	0.7	=	10.72	(74)
North	0.9x 0.77	x	3.67	x	20.32	x	0.63	x	0.7	=	22.79	(74)
North	0.9x 0.77	x	3.3	x	20.32	x	0.63	x	0.7	=	20.49	(74)
North	0.9x 0.77	x	3.67	x	34.53	x	0.63	x	0.7	=	38.73	(74)
North	0.9x 0.77	x	3.3	x	34.53	x	0.63	x	0.7	=	34.82	(74)
North	0.9x 0.77	x	3.67	x	55.46	x	0.63	x	0.7	=	62.21	(74)
North	0.9x 0.77	x	3.3	x	55.46	x	0.63	x	0.7	=	55.94	(74)
North	0.9x 0.77	x	3.67	x	74.72	x	0.63	x	0.7	=	83.8	(74)
North	0.9x 0.77	x	3.3	x	74.72	x	0.63	x	0.7	=	75.35	(74)
North	0.9x 0.77	x	3.67	x	79.99	x	0.63	x	0.7	=	89.71	(74)
North	0.9x 0.77	x	3.3	x	79.99	x	0.63	x	0.7	=	80.67	(74)
North	0.9x 0.77	x	3.67	x	74.68	x	0.63	x	0.7	=	83.76	(74)
North	0.9x 0.77	x	3.3	x	74.68	x	0.63	x	0.7	=	75.31	(74)
North	0.9x 0.77	x	3.67	x	59.25	x	0.63	x	0.7	=	66.45	(74)
North	0.9x 0.77	x	3.3	x	59.25	x	0.63	x	0.7	=	59.75	(74)
North	0.9x 0.77	x	3.67	x	41.52	x	0.63	x	0.7	=	46.56	(74)
North	0.9x 0.77	x	3.3	x	41.52	x	0.63	x	0.7	=	41.87	(74)
North	0.9x 0.77	x	3.67	x	24.19	x	0.63	x	0.7	=	27.13	(74)
North	0.9x 0.77	x	3.3	x	24.19	x	0.63	x	0.7	=	24.4	(74)
North	0.9x 0.77	x	3.67	x	13.12	x	0.63	x	0.7	=	14.71	(74)
North	0.9x 0.77	x	3.3	x	13.12	x	0.63	x	0.7	=	13.23	(74)
North	0.9x 0.77	x	3.67	x	8.86	x	0.63	x	0.7	=	9.94	(74)
North	0.9x 0.77	x	3.3	x	8.86	x	0.63	x	0.7	=	8.94	(74)
East	0.9x 0.77	x	0.72	x	19.64	x	0.63	x	0.7	=	4.32	(76)
East	0.9x 0.77	x	0.72	x	38.42	x	0.63	x	0.7	=	8.45	(76)
East	0.9x 0.77	x	0.72	x	63.27	x	0.63	x	0.7	=	13.92	(76)
East	0.9x 0.77	x	0.72	x	92.28	x	0.63	x	0.7	=	20.31	(76)
East	0.9x 0.77	x	0.72	x	113.09	x	0.63	x	0.7	=	24.89	(76)
East	0.9x 0.77	x	0.72	x	115.77	x	0.63	x	0.7	=	25.47	(76)
East	0.9x 0.77	x	0.72	x	110.22	x	0.63	x	0.7	=	24.25	(76)
East	0.9x 0.77	x	0.72	x	94.68	x	0.63	x	0.7	=	20.83	(76)
East	0.9x 0.77	x	0.72	x	73.59	x	0.63	x	0.7	=	16.19	(76)
East	0.9x 0.77	x	0.72	x	45.59	x	0.63	x	0.7	=	10.03	(76)

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East	0.9x	0.77	x	0.72	x	24.49	x	0.63	x	0.7	=	5.39	(76)
East	0.9x	0.77	x	0.72	x	16.15	x	0.63	x	0.7	=	3.55	(76)
South	0.9x	0.77	x	2.99	x	46.75	x	0.63	x	0.7	=	42.72	(78)
South	0.9x	0.77	x	6.29	x	46.75	x	0.63	x	0.7	=	89.87	(78)
South	0.9x	0.77	x	2.99	x	76.57	x	0.63	x	0.7	=	69.97	(78)
South	0.9x	0.77	x	6.29	x	76.57	x	0.63	x	0.7	=	147.19	(78)
South	0.9x	0.77	x	2.99	x	97.53	x	0.63	x	0.7	=	89.12	(78)
South	0.9x	0.77	x	6.29	x	97.53	x	0.63	x	0.7	=	187.49	(78)
South	0.9x	0.77	x	2.99	x	110.23	x	0.63	x	0.7	=	100.73	(78)
South	0.9x	0.77	x	6.29	x	110.23	x	0.63	x	0.7	=	211.9	(78)
South	0.9x	0.77	x	2.99	x	114.87	x	0.63	x	0.7	=	104.97	(78)
South	0.9x	0.77	x	6.29	x	114.87	x	0.63	x	0.7	=	220.82	(78)
South	0.9x	0.77	x	2.99	x	110.55	x	0.63	x	0.7	=	101.02	(78)
South	0.9x	0.77	x	6.29	x	110.55	x	0.63	x	0.7	=	212.51	(78)
South	0.9x	0.77	x	2.99	x	108.01	x	0.63	x	0.7	=	98.7	(78)
South	0.9x	0.77	x	6.29	x	108.01	x	0.63	x	0.7	=	207.63	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.63	x	0.7	=	95.85	(78)
South	0.9x	0.77	x	6.29	x	104.89	x	0.63	x	0.7	=	201.64	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.63	x	0.7	=	93.1	(78)
South	0.9x	0.77	x	6.29	x	101.89	x	0.63	x	0.7	=	195.86	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.63	x	0.7	=	75.47	(78)
South	0.9x	0.77	x	6.29	x	82.59	x	0.63	x	0.7	=	158.75	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.63	x	0.7	=	50.64	(78)
South	0.9x	0.77	x	6.29	x	55.42	x	0.63	x	0.7	=	106.53	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.63	x	0.7	=	36.92	(78)
South	0.9x	0.77	x	6.29	x	40.4	x	0.63	x	0.7	=	77.66	(78)
West	0.9x	0.77	x	0.72	x	19.64	x	0.63	x	0.7	=	4.32	(80)
West	0.9x	0.77	x	0.72	x	38.42	x	0.63	x	0.7	=	8.45	(80)
West	0.9x	0.77	x	0.72	x	63.27	x	0.63	x	0.7	=	13.92	(80)
West	0.9x	0.77	x	0.72	x	92.28	x	0.63	x	0.7	=	20.31	(80)
West	0.9x	0.77	x	0.72	x	113.09	x	0.63	x	0.7	=	24.89	(80)
West	0.9x	0.77	x	0.72	x	115.77	x	0.63	x	0.7	=	25.47	(80)
West	0.9x	0.77	x	0.72	x	110.22	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	0.72	x	94.68	x	0.63	x	0.7	=	20.83	(80)
West	0.9x	0.77	x	0.72	x	73.59	x	0.63	x	0.7	=	16.19	(80)
West	0.9x	0.77	x	0.72	x	45.59	x	0.63	x	0.7	=	10.03	(80)
West	0.9x	0.77	x	0.72	x	24.49	x	0.63	x	0.7	=	5.39	(80)
West	0.9x	0.77	x	0.72	x	16.15	x	0.63	x	0.7	=	3.55	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	163.89	277.35	378.01	471.39	534.71	534.85	513.91	465.36	409.78	305.81	195.89	140.56	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	668.58	779.69	863.64	929.88	965.22	938.78	900.83	858.9	817.49	740.89	662.41	631.06	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.97	0.92	0.79	0.62	0.67	0.88	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.74	19.9	20.13	20.44	20.72	20.92	20.98	20.97	20.85	20.48	20.05	19.72	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.98	19.98	19.99	19.99	20	20	20	20	19.99	19.99	19.98	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.96	0.89	0.71	0.49	0.54	0.82	0.97	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.29	18.52	18.86	19.31	19.7	19.94	19.99	19.99	19.87	19.38	18.76	18.26	(90)

fLA = Living area ÷ (4) = | 0.13 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.49	18.7	19.03	19.46	19.84	20.07	20.13	20.12	20	19.52	18.93	18.46	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.49	18.7	19.03	19.46	19.84	20.07	20.13	20.12	20	19.52	18.93	18.46	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.96	0.88	0.71	0.51	0.56	0.82	0.97	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	666.56	774.37	849.77	889.75	851.69	669.03	457.69	478.37	669.23	715.18	658.02	629.63	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1925.2	1868.57	1692.65	1410.63	1084.8	721.95	465.03	490.04	781.07	1189.05	1583.06	1916.33	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	936.43	735.3	627.1	375.04	173.44	0	0	0	0	352.56	666.03	957.3	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 4823.2 | (98)

Space heating requirement in kWh/m²/year | 40.29 | (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system | 0 | (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = | 1 | (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = | 1 | (204)

Efficiency of main space heating system 1 | 93.5 | (206)

Efficiency of secondary/supplementary heating system, % | 0 | (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	936.43	735.3	627.1	375.04	173.44	0	0	0	0	352.56	666.03	957.3	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	1001.53	786.42	670.7	401.11	185.49	0	0	0	0	377.07	712.33	1023.85	
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													5158.5 (211)
Space heating fuel (secondary), kWh/month													
= {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0 (215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from water heater (calculated above)	213.27	187.86	197.03	176.24	172.44	153.68	147.22	162.06	161.94	182.77	193.74	208.02	
Efficiency of water heater													79.8 (216)
(217)m=	88.3	88.1	87.69	86.78	84.83	79.8	79.8	79.8	79.8	86.54	87.85	88.38	(217)
Fuel for water heating, kWh/month													
(219)m = (64)m x 100 ÷ (217)m													
(219)m=	241.52	213.25	224.69	203.09	203.27	192.59	184.49	203.09	202.93	211.2	220.54	235.35	
Total = Sum(219a)$_{1...12}$ =													2536.01 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		5158.5	
Water heating fuel used		2536.01	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		464.72	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		8234.24	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	1114.24	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	547.78	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1662.02	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	38.93	(267)
Electricity for lighting	(232) x		0.519	=	241.19	(268)
Total CO2, kg/year	sum of (265)…(271) =				1942.13	(272)

TER = 23.86 (273)

TER WorkSheet: New dwelling design stage

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Tenterer Det

Address : The Tenterer Det

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	45.81	(1a) x	2.38	(2a) =	109.26	(3a)
First floor	45.81	(1b) x	2.61	(2b) =	119.56	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.62	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		228.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.14	x	1.3	=	2.782			(26)
Windows Type 1			7.11	x1/[1/(1.2)+ 0.04]		=	8.14			(27)
Windows Type 2			10.78	x1/[1/(1.2)+ 0.04]		=	12.34			(27)
Floor			45.18	x	0.1	=	4.518	75	3388.5	(28)
Walls	130.22	20.03	110.19	x	0.25	=	27.55	60	6611.4	(29)
Roof	45.18	0	45.18	x	0.09	=	4.07	9	406.62	(30)
Total area of elements, m²			220.58							(31)
Internal wall **			53.81					75	4035.75	(32c)
Internal wall **			131.34					9	1182.06	(32c)
Internal floor			45.18					18	813.24	(32d)
Internal ceiling			45.18					9	406.62	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 59.4 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16844.19 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 183.85 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

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Thermal bridges : S (L x Y) calculated using Appendix K | 6.46 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 65.86 | (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	37.9	37.76	37.76	37.76	37.76	37.76	37.76	37.76	37.76	37.76	37.76	37.76	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	103.76	103.61	103.61	103.61	103.61	103.61	103.61	103.61	103.61	103.61	103.61	103.61	

Average = Sum(39)$_{1...12}$ /12= | 103.62 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	

Average = Sum(40)$_{1...12}$ /12= | 1.13 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.65 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 97.07 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	106.78	102.9	99.01	95.13	91.25	87.36	87.36	91.25	95.13	99.01	102.9	106.78	

Total = Sum(44)$_{1...12}$ = | 1164.87 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.35	138.49	142.91	124.6	119.55	103.16	95.6	109.7	111.01	129.37	141.22	153.35	

Total = Sum(45)$_{1...12}$ = | 1527.32 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.75	20.77	21.44	18.69	17.93	15.47	14.34	16.45	16.65	19.41	21.18	23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	163.41	143.06	147.97	129.49	124.61	108.06	100.66	114.76	115.91	134.43	146.11	158.41	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-54.92	-48.33	-49.32	-40.58	-37.68	-31.09	-26.31	-31.86	-32.79	-40.53	-46.95	-53.09	(63) (G10)

Output from water heater

(64)m=	108.49	94.74	98.65	88.91	86.93	76.97	74.35	82.9	83.12	93.9	99.17	105.33	

Output from water heater (annual)$_{1...12}$	1093.45	(64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.92	47.19	48.78	42.65	41.02	35.53	33.05	37.74	38.13	44.28	48.18	52.26	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.59	19.18	15.59	11.81	8.83	7.45	8.05	10.46	14.05	17.83	20.81	22.19	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	242.03	244.54	238.21	224.74	207.73	191.74	181.06	178.55	184.88	198.36	215.36	231.35	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	(71)

Water heating gains (Table 5)

(72)m=	72.47	70.23	65.57	59.24	55.13	49.34	44.42	50.73	52.96	59.52	66.92	70.24	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	401.79	399.65	385.08	361.49	337.39	314.24	299.25	305.45	317.6	341.41	368.8	389.48	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	7.11	x	10.63	x	0.47	x	1.11	=	27.36	(74)
North	0.9x	0.77	x	7.11	x	20.32	x	0.47	x	1.11	=	52.29	(74)
North	0.9x	0.77	x	7.11	x	34.53	x	0.47	x	1.11	=	88.85	(74)
North	0.9x	0.77	x	7.11	x	55.46	x	0.47	x	1.11	=	142.72	(74)
North	0.9x	0.77	x	7.11	x	74.72	x	0.47	x	1.11	=	192.25	(74)
North	0.9x	0.77	x	7.11	x	79.99	x	0.47	x	1.11	=	205.81	(74)
North	0.9x	0.77	x	7.11	x	74.68	x	0.47	x	1.11	=	192.15	(74)
North	0.9x	0.77	x	7.11	x	59.25	x	0.47	x	1.11	=	152.45	(74)
North	0.9x	0.77	x	7.11	x	41.52	x	0.47	x	1.11	=	106.83	(74)
North	0.9x	0.77	x	7.11	x	24.19	x	0.47	x	1.11	=	62.24	(74)
North	0.9x	0.77	x	7.11	x	13.12	x	0.47	x	1.11	=	33.75	(74)
North	0.9x	0.77	x	7.11	x	8.86	x	0.47	x	1.11	=	22.81	(74)
South	0.9x	0.77	x	10.78	x	46.75	x	0.47	x	1.11	=	182.39	(78)
South	0.9x	0.77	x	10.78	x	76.57	x	0.47	x	1.11	=	298.71	(78)
South	0.9x	0.77	x	10.78	x	97.53	x	0.47	x	1.11	=	380.51	(78)
South	0.9x	0.77	x	10.78	x	110.23	x	0.47	x	1.11	=	430.06	(78)
South	0.9x	0.77	x	10.78	x	114.87	x	0.47	x	1.11	=	448.14	(78)
South	0.9x	0.77	x	10.78	x	110.55	x	0.47	x	1.11	=	431.28	(78)
South	0.9x	0.77	x	10.78	x	108.01	x	0.47	x	1.11	=	421.38	(78)
South	0.9x	0.77	x	10.78	x	104.89	x	0.47	x	1.11	=	409.22	(78)
South	0.9x	0.77	x	10.78	x	101.89	x	0.47	x	1.11	=	397.48	(78)
South	0.9x	0.77	x	10.78	x	82.59	x	0.47	x	1.11	=	322.19	(78)
South	0.9x	0.77	x	10.78	x	55.42	x	0.47	x	1.11	=	216.2	(78)
South	0.9x	0.77	x	10.78	x	40.4	x	0.47	x	1.11	=	157.6	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	209.75	351	469.36	572.77	640.4	637.09	613.54	561.67	504.31	384.43	249.95	180.41	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	611.55	750.65	854.44	934.26	977.79	951.33	912.78	867.12	821.91	725.85	618.75	569.89	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.9	0.79	0.64	0.48	0.53	0.74	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.53	19.78	20.1	20.46	20.76	20.93	20.98	20.97	20.86	20.47	19.91	19.47	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.97	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	19.98	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.87	0.74	0.56	0.38	0.42	0.67	0.9	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.03	18.39	18.85	19.34	19.73	19.92	19.97	19.96	19.86	19.37	18.58	17.94	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.3	18.65	19.08	19.55	19.92	20.11	20.15	20.15	20.05	19.57	18.83	18.22	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.15	18.5	18.93	19.4	19.77	19.96	20	20	19.9	19.42	18.68	18.07	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	0.98	0.96	0.93	0.86	0.73	0.55	0.38	0.42	0.66	0.88	0.96	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	599.94	721.32	790.81	800.01	717.13	526.46	347.93	365.62	542.5	639.25	596.91	561.39	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1437.54	1408.74	1287.77	1087.93	836.09	555.01	352.75	372.93	600.45	913.85	1199.69	1437.02	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	623.18	461.95	369.74	207.3	88.5	0	0	0	0	204.3	434	651.47	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3040.44 (98)

Space heating requirement in kWh/m²/year 33.19 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year

Space heating requirement (calculated above)

	623.18	461.95	369.74	207.3	88.5	0	0	0	0	204.3	434	651.47	

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

	688.59	510.44	408.55	229.06	97.79	0	0	0	0	225.75	479.56	719.85	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3359.6 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	108.49	94.74	98.65	88.91	86.93	76.97	74.35	82.9	83.12	93.9	99.17	105.33

Efficiency of water heater: 87.3 (216)

(217)m= 90.01 | 89.94 | 89.81 | 89.52 | 88.89 | 87.3 | 87.3 | 87.3 | 87.3 | 89.47 | 89.89 | 90.04 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m= 120.52 | 105.34 | 109.85 | 99.32 | 97.8 | 88.17 | 85.16 | 94.96 | 95.21 | 104.96 | 110.33 | 116.98

Total = Sum(219a)$_{1...12}$ = 1228.6 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3359.6	
Water heating fuel used		1228.6	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	42.02		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		117.02	(231)
Electricity for lighting		381.27	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5086.48	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	725.67	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	265.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =		991.05	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	60.73	(267)
Electricity for lighting	(232) x	0.519 =	197.88	(268)
Total CO2, kg/year	sum of (265)…(271) =		1249.66	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =		13.64	(273)
EI rating (section 14)			88	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Tenterer Det

Address : The Tenterer Det

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	45.81 (1a)	x	2.38 (2a)	=	109.26	(3a)
First floor	45.81 (1b)	x	2.61 (2b)	=	119.56	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.62 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		228.82	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.4	0.36	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.14	x	1.2	=	2.568			(26)
Windows Type 1			7.11	x1/[1/(1.4)+ 0.04]		=	9.43			(27)
Windows Type 2			10.78	x1/[1/(1.4)+ 0.04]		=	14.29			(27)
Floor			45.18	x	0.13	=	5.8734			(28)
Walls	130.22	20.03	110.19	x	0.18	=	19.83			(29)
Roof	45.18	0	45.18	x	0.13	=	5.87			(30)
Total area of elements, m²			220.58							(31)
Internal wall **			53.81							(32c)
Internal wall **			131.34							(32c)
Internal floor			45.18							(32d)
Internal ceiling			45.18							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 57.87 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 16844.19 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

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Thermal bridges : S (L x Y) calculated using Appendix K — 10.83 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 68.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	44.2	43.95	43.7	42.55	42.33	41.33	41.33	41.15	41.72	42.33	42.77	43.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	112.9	112.65	112.4	111.25	111.04	110.03	110.03	109.85	110.42	111.04	111.47	111.93	

Average = Sum(39)$_{1...12}$ /12= 111.25 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.23	1.23	1.21	1.21	1.2	1.2	1.2	1.21	1.21	1.22	1.22	

Average = Sum(40)$_{1...12}$ /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.65 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 97.07 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	106.78	102.9	99.01	95.13	91.25	87.36	87.36	91.25	95.13	99.01	102.9	106.78	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

Total = Sum(44)$_{1...12}$ = 1164.87 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.35	138.49	142.91	124.6	119.55	103.16	95.6	109.7	111.01	129.37	141.22	153.35	

Total = Sum(45)$_{1...12}$ = 1527.32 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.75	20.77	21.44	18.69	17.93	15.47	14.34	16.45	16.65	19.41	21.18	23	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = — 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0

(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0

(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0

(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.46	46.91	46.5	43.08	44.52	46.5	46.91	50.46	49.32	50.96

(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	209.31	184.52	193.37	171.51	166.05	146.25	140.12	156.2	157.92	179.83	190.53	204.31

(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0

(63)

FHRS	0	0	0	0	0	0	0	0	0	0	0	0

(63) (G2)

WWHRS	0	0	0	0	0	0	0	0	0	0	0	0

(63) (G10)

Output from water heater

(64)m=	209.31	184.52	193.37	171.51	166.05	146.25	140.12	156.2	157.92	179.83	190.53	204.31

Output from water heater (annual)$_{1...12}$ 2099.93 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.39	57.56	60.13	53.16	51.38	45.07	42.92	48.1	48.64	55.63	59.28	63.73

(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m=	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36	132.36

(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	21.59	19.18	15.59	11.81	8.83	7.45	8.05	10.46	14.05	17.83	20.81	22.19

(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	242.03	244.54	238.21	224.74	207.73	191.74	181.06	178.55	184.88	198.36	215.36	231.35

(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24	36.24

(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3

(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89	-105.89

(71)

Water heating gains (Table 5)

(72)m=	87.89	85.65	80.82	73.83	69.05	62.6	57.68	64.65	67.55	74.77	82.34	85.66

(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	417.22	415.07	400.34	376.08	351.32	327.5	312.51	319.38	332.19	356.67	384.23	404.9

(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	7.11	x	10.63	x	0.63	x	0.7	=	23.11	(74)
North	0.9x	0.77	x	7.11	x	20.32	x	0.63	x	0.7	=	44.16	(74)
North	0.9x	0.77	x	7.11	x	34.53	x	0.63	x	0.7	=	75.03	(74)
North	0.9x	0.77	x	7.11	x	55.46	x	0.63	x	0.7	=	120.52	(74)
North	0.9x	0.77	x	7.11	x	74.72	x	0.63	x	0.7	=	162.35	(74)
North	0.9x	0.77	x	7.11	x	79.99	x	0.63	x	0.7	=	173.8	(74)
North	0.9x	0.77	x	7.11	x	74.68	x	0.63	x	0.7	=	162.27	(74)
North	0.9x	0.77	x	7.11	x	59.25	x	0.63	x	0.7	=	128.74	(74)
North	0.9x	0.77	x	7.11	x	41.52	x	0.63	x	0.7	=	90.21	(74)
North	0.9x	0.77	x	7.11	x	24.19	x	0.63	x	0.7	=	52.56	(74)
North	0.9x	0.77	x	7.11	x	13.12	x	0.63	x	0.7	=	28.5	(74)
North	0.9x	0.77	x	7.11	x	8.86	x	0.63	x	0.7	=	19.26	(74)
South	0.9x	0.77	x	10.78	x	46.75	x	0.63	x	0.7	=	154.03	(78)
South	0.9x	0.77	x	10.78	x	76.57	x	0.63	x	0.7	=	252.25	(78)
South	0.9x	0.77	x	10.78	x	97.53	x	0.63	x	0.7	=	321.33	(78)
South	0.9x	0.77	x	10.78	x	110.23	x	0.63	x	0.7	=	363.17	(78)
South	0.9x	0.77	x	10.78	x	114.87	x	0.63	x	0.7	=	378.44	(78)
South	0.9x	0.77	x	10.78	x	110.55	x	0.63	x	0.7	=	364.2	(78)
South	0.9x	0.77	x	10.78	x	108.01	x	0.63	x	0.7	=	355.85	(78)
South	0.9x	0.77	x	10.78	x	104.89	x	0.63	x	0.7	=	345.58	(78)
South	0.9x	0.77	x	10.78	x	101.89	x	0.63	x	0.7	=	335.66	(78)
South	0.9x	0.77	x	10.78	x	82.59	x	0.63	x	0.7	=	272.08	(78)
South	0.9x	0.77	x	10.78	x	55.42	x	0.63	x	0.7	=	182.57	(78)
South	0.9x	0.77	x	10.78	x	40.4	x	0.63	x	0.7	=	133.09	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(83)m=	177.13	296.41	396.36	483.69	540.79	538	518.11	474.31	425.87	324.64	211.08	152.35	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(84)m=	594.35	711.48	796.69	859.77	892.11	865.51	830.62	793.69	758.06	681.31	595.3	557.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C): 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.88	0.73	0.56	0.61	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(87)m=	19.69	19.88	20.14	20.47	20.75	20.93	20.98	20.98	20.87	20.5	20.03	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.89	19.9	19.9	19.91	19.91	19.92	19.92	19.92	19.92	19.91	19.91	19.9	(88)

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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.64	0.44	0.48	0.75	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.17	18.44	18.82	19.29	19.67	19.87	19.91	19.91	19.81	19.34	18.66	18.12	(90)

fLA = Living area ÷ (4) = 0.19 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.45	18.71	19.07	19.51	19.87	20.07	20.11	20.11	20.01	19.55	18.92	18.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.45	18.71	19.07	19.51	19.87	20.07	20.11	20.11	20.01	19.55	18.92	18.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.93	0.83	0.65	0.46	0.5	0.76	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	590.95	702.09	773.26	799.32	744.79	566.04	381.32	399.52	576.95	642.26	588.05	554.87	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1597.37	1555.24	1412.44	1179.93	906.78	601.67	386.41	407.43	652.12	993.9	1317.27	1590.07	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	748.77	573.32	475.55	274.04	120.52	0	0	0	0	261.62	525.04	770.19	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3749.06 (98)

Space heating requirement in kWh/m²/year 40.92 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	748.77	573.32	475.55	274.04	120.52	0	0	0	0	261.62	525.04	770.19	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	801.68	613.83	509.15	293.41	129.04	0	0	0	0	280.11	562.14	824.61	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 4013.98 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	209.31	184.52	193.37	171.51	166.05	146.25	140.12	156.2	157.92	179.83	190.53	204.31

Efficiency of water heater 80.3 (216)

(217)m=	87.98	87.71	87.23	86.23	84.26	80.3	80.3	80.3	80.3	85.99	87.47	88.08

(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	237.9	210.37	221.68	198.91	197.07	182.13	174.49	194.52	196.67	209.12	217.83	231.97

Total = Sum(219a)$_{1...12}$ = 2472.65 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		4013.98	
Water heating fuel used		2472.65	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		381.27	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6942.9	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh	**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	867.02	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	534.09	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1401.11	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	197.88	(268)
Total CO2, kg/year	sum of (265)…(271) =		1637.92	(272)

TER = 17.88 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Tillman - ET

Address : The Tillman - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.73	(1a) x	2.38	(2a) =	111.45	(3a)
First floor	46.73	(1b) x	2.61	(2b) =	121.97	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.46	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.42	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)				0 (9)
Additional infiltration			[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction				0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0				0 (12)
If no draught lobby, enter 0.05, else enter 0				0 (13)
Percentage of windows and doors draught stripped				0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =			0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =			0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area				4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered				2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =			0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.3	=	2.795			(26)
Doors Type 2			2.15	x	1.3	=	2.795			(26)
Windows Type 1			2.89	x1/[1/(1.2)+ 0.04]		=	3.31			(27)
Windows Type 2			1.9	x1/[1/(1.2)+ 0.04]		=	2.18			(27)
Windows Type 3			2.99	x1/[1/(1.2)+ 0.04]		=	3.42			(27)
Windows Type 4			1.78	x1/[1/(1.2)+ 0.04]		=	2.04			(27)
Floor			46.73	x	0.1	=	4.673	75	3504.75	(28)
Walls	96.67	13.86	82.81	x	0.25	=	20.7	60	4968.6	(29)
Roof	46.73	0	46.73	x	0.09	=	4.21	9	420.57	(30)
Total area of elements, m²			190.13							(31)
Party wall			48.9	x	0	=	0	45	2200.5	(32)
Internal wall **			144.8					9	1303.2	(32c)
Internal wall **			17.41					75	1305.75	(32c)
Internal floor			46.73					18	841.14	(32d)
Internal ceiling			46.73					9	420.57	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.12 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14965.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 160.12 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 6.84 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 52.96 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.67	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	91.63	91.47	91.47	91.47	91.47	91.47	91.47	91.47	91.47	91.47	91.47	91.47	

Average = Sum(39)$_{1...12}$ /12= 91.49 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	

Average = Sum(40)$_{1...12}$ /12= 0.98 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	107.38	103.47	99.57	95.66	91.76	87.86	87.86	91.76	95.66	99.57	103.47	107.38	

Total = Sum(44)$_{1...12}$ = 1171.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.24	139.27	143.72	125.29	120.22	103.74	96.13	110.31	111.63	130.1	142.01	154.21	

Total = Sum(45)$_{1...12}$ = 1535.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.79	18.03	15.56	14.42	16.55	16.74	19.51	21.3	23.13	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

DER WorkSheet: New dwelling design stage

Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.3	143.84	148.78	130.19	125.28	108.64	101.19	115.37	116.53	135.16	146.91	159.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-52.42	-46.12	-47.08	-38.73	-35.96	-29.67	-25.11	-30.4	-31.29	-38.68	-44.8	-50.67	(63) (G10)

Output from water heater

(64)m=	111.88	97.72	101.7	91.46	89.32	78.97	76.08	84.97	85.24	96.48	102.1	108.61	

Output from water heater (annual)$_{1...12}$ 1124.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.21	47.45	49.05	42.88	41.24	35.72	33.23	37.94	38.34	44.52	48.44	52.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.17	20.58	16.74	12.67	9.47	8	8.64	11.23	15.08	19.14	22.34	23.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.3	247.85	241.43	227.78	210.54	194.34	183.51	180.97	187.38	201.04	218.28	234.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	(71)

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Water heating gains (Table 5)

(72)m=	72.87	70.61	65.93	59.56	55.43	49.61	44.66	51	53.25	59.84	67.28	70.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.39	405.09	390.15	366.06	341.49	318	302.87	309.25	321.76	346.08	373.95	394.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.47	x	1.11	=	11.12	(74)
North	0.9x 0.77	x	1.9	x	10.63	x	0.47	x	1.11	=	7.31	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.47	x	1.11	=	21.25	(74)
North	0.9x 0.77	x	1.9	x	20.32	x	0.47	x	1.11	=	13.97	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.47	x	1.11	=	36.11	(74)
North	0.9x 0.77	x	1.9	x	34.53	x	0.47	x	1.11	=	23.74	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.47	x	1.11	=	58.01	(74)
North	0.9x 0.77	x	1.9	x	55.46	x	0.47	x	1.11	=	38.14	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.47	x	1.11	=	78.14	(74)
North	0.9x 0.77	x	1.9	x	74.72	x	0.47	x	1.11	=	51.38	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.47	x	1.11	=	83.66	(74)
North	0.9x 0.77	x	1.9	x	79.99	x	0.47	x	1.11	=	55	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.47	x	1.11	=	78.1	(74)
North	0.9x 0.77	x	1.9	x	74.68	x	0.47	x	1.11	=	51.35	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.47	x	1.11	=	61.97	(74)
North	0.9x 0.77	x	1.9	x	59.25	x	0.47	x	1.11	=	40.74	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.47	x	1.11	=	43.42	(74)
North	0.9x 0.77	x	1.9	x	41.52	x	0.47	x	1.11	=	28.55	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.47	x	1.11	=	25.3	(74)
North	0.9x 0.77	x	1.9	x	24.19	x	0.47	x	1.11	=	16.63	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.47	x	1.11	=	13.72	(74)
North	0.9x 0.77	x	1.9	x	13.12	x	0.47	x	1.11	=	9.02	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.47	x	1.11	=	9.27	(74)
North	0.9x 0.77	x	1.9	x	8.86	x	0.47	x	1.11	=	6.1	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.47	x	1.11	=	50.59	(78)
South	0.9x 0.77	x	1.78	x	46.75	x	0.47	x	1.11	=	30.12	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.47	x	1.11	=	82.85	(78)
South	0.9x 0.77	x	1.78	x	76.57	x	0.47	x	1.11	=	49.32	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.47	x	1.11	=	105.54	(78)
South	0.9x 0.77	x	1.78	x	97.53	x	0.47	x	1.11	=	62.83	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.47	x	1.11	=	119.28	(78)
South	0.9x 0.77	x	1.78	x	110.23	x	0.47	x	1.11	=	71.01	(78)

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South	0.9x	0.77	x	2.99	x	114.87	x	0.47	x	1.11	=	124.3		(78)
South	0.9x	0.77	x	1.78	x	114.87	x	0.47	x	1.11	=	74		(78)
South	0.9x	0.77	x	2.99	x	110.55	x	0.47	x	1.11	=	119.62		(78)
South	0.9x	0.77	x	1.78	x	110.55	x	0.47	x	1.11	=	71.21		(78)
South	0.9x	0.77	x	2.99	x	108.01	x	0.47	x	1.11	=	116.88		(78)
South	0.9x	0.77	x	1.78	x	108.01	x	0.47	x	1.11	=	69.58		(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.47	x	1.11	=	113.5		(78)
South	0.9x	0.77	x	1.78	x	104.89	x	0.47	x	1.11	=	67.57		(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.47	x	1.11	=	110.25		(78)
South	0.9x	0.77	x	1.78	x	101.89	x	0.47	x	1.11	=	65.63		(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.47	x	1.11	=	89.36		(78)
South	0.9x	0.77	x	1.78	x	82.59	x	0.47	x	1.11	=	53.2		(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.47	x	1.11	=	59.97		(78)
South	0.9x	0.77	x	1.78	x	55.42	x	0.47	x	1.11	=	35.7		(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.47	x	1.11	=	43.71		(78)
South	0.9x	0.77	x	1.78	x	40.4	x	0.47	x	1.11	=	26.02		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.14	167.4	228.23	286.44	327.82	329.49	315.91	283.78	247.85	184.5	118.4	85.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	506.53	572.49	618.38	652.5	669.31	647.49	618.78	593.03	569.61	530.57	492.36	480.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.95	0.88	0.76	0.61	0.65	0.84	0.96	0.99	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.49	19.67	19.94	20.28	20.62	20.86	20.96	20.95	20.78	20.35	19.85	19.44	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.97	0.93	0.85	0.69	0.5	0.54	0.79	0.94	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.07	18.32	18.71	19.21	19.68	19.98	20.08	20.07	19.88	19.31	18.58	18	(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.41	18.65	19.01	19.47	19.9	20.19	20.29	20.28	20.1	19.56	18.89	18.35	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.26	18.5	18.86	19.32	19.75	20.04	20.14	20.13	19.95	19.41	18.74	18.2	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.96	0.92	0.84	0.68	0.5	0.55	0.78	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	499.11	558.66	592.51	599.97	560.63	443.44	311.98	324.43	441.63	492.23	480.28	474.27	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1279.18	1243.73	1130.6	952.98	736.67	497.85	323.78	341.06	535.02	805.71	1064.7	1280.37	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	580.37	460.37	400.34	254.16	130.97	0	0	0	0	233.23	420.78	599.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3079.97 (98)

Space heating requirement in kWh/m²/year 32.95 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	580.37	460.37	400.34	254.16	130.97	0	0	0	0	233.23	420.78	599.74	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	641.29	508.69	442.36	280.84	144.72	0	0	0	0	257.71	464.95	662.7	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3403.28 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	111.88	97.72	101.7	91.46	89.32	78.97	76.08	84.97	85.24	96.48	102.1	108.61	

Efficiency of water heater 87.3 (216)

(217)m=	89.97	89.92	89.83	89.63	89.17	87.3	87.3	87.3	87.3	89.54	89.86	89.99	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	124.35	108.67	113.21	102.04	100.16	90.46	87.15	97.33	97.64	107.75	113.63	120.68	

Total = Sum(219a)$_{1...12}$ = 1263.07 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3403.28
Water heating fuel used		1263.07
Electricity for pumps, fans and electric keep-hot		

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mechanical ventilation - balanced, extract or positive input from outside	44.04		(230a)
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	119.04	(231)
Electricity for lighting		409.24	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5194.63	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	735.11	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	272.82	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1007.93	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	61.78	(267)
Electricity for lighting	(232) x		0.519	=	212.4	(268)
Total CO2, kg/year		sum of (265)…(271) =			1282.11	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			13.72	(273)
EI rating (section 14)					88	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Tillman - ET

Address : The Tillman - ET

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.73	(1a) x	2.38	(2a) =	111.45	(3a)
First floor	46.73	(1b) x	2.61	(2b) =	121.97	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.46	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.42	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.2	=	2.58			(26)
Doors Type 2			2.15	x	1.2	=	2.58			(26)
Windows Type 1			2.89	x	1/[1/(1.4)+ 0.04]	=	3.83			(27)
Windows Type 2			1.9	x	1/[1/(1.4)+ 0.04]	=	2.52			(27)
Windows Type 3			2.99	x	1/[1/(1.4)+ 0.04]	=	3.96			(27)
Windows Type 4			1.78	x	1/[1/(1.4)+ 0.04]	=	2.36			(27)
Floor			46.73	x	0.13	=	6.0749			(28)
Walls	96.67	13.86	82.81	x	0.18	=	14.91			(29)
Roof	46.73	0	46.73	x	0.13	=	6.07			(30)
Total area of elements, m²			190.13							(31)
Party wall			48.9	x	0	=	0			(32)
Internal wall **			144.8							(32c)
Internal wall **			17.41							(32c)
Internal floor			46.73							(32d)
Internal ceiling			46.73							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.89 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14965.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.75 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 54.64 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45	44.74	44.5	43.34	43.12	42.11	42.11	41.93	42.5	43.12	43.56	44.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	99.64	99.39	99.14	97.98	97.76	96.75	96.75	96.57	97.14	97.76	98.2	98.66	

Average = Sum(39)$_{1...12}$ /12= 97.98 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.07	1.06	1.06	1.05	1.05	1.04	1.04	1.03	1.04	1.05	1.05	1.06	

Average = Sum(40)$_{1...12}$ /12= 1.05 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	107.38	103.47	99.57	95.66	91.76	87.86	87.86	91.76	95.66	99.57	103.47	107.38	

Total = Sum(44)$_{1...12}$ = 1171.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.24	139.27	143.72	125.29	120.22	103.74	96.13	110.31	111.63	130.1	142.01	154.21	

Total = Sum(45)$_{1...12}$ = 1535.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.79	18.03	15.56	14.42	16.55	16.74	19.51	21.3	23.13	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.74	47.18	46.76	43.33	44.77	46.76	47.18	50.74	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.2	185.3	194.46	172.47	166.98	147.07	140.9	157.07	158.81	180.84	191.33	205.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	210.2	185.3	194.46	172.47	166.98	147.07	140.9	157.07	158.81	180.84	191.33	205.17	

Output from water heater (annual)$_{1...12}$ 2110.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.69	57.81	60.47	53.45	51.66	45.33	43.16	48.37	48.91	55.94	59.55	64.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.17	20.58	16.74	12.67	9.47	8	8.64	11.23	15.08	19.14	22.34	23.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.3	247.85	241.43	227.78	210.54	194.34	183.51	180.97	187.38	201.04	218.28	234.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	(71)

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Water heating gains (Table 5)

(72)m=	88.29	86.03	81.28	74.24	69.44	62.95	58.01	65.01	67.93	75.19	82.7	86.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	422.82	420.52	405.5	380.74	355.51	331.34	316.21	323.27	336.45	361.42	389.38	410.39	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x 0.77	x	1.9	x	10.63	x	0.63	x	0.7	=	6.17	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x 0.77	x	1.9	x	20.32	x	0.63	x	0.7	=	11.8	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x 0.77	x	1.9	x	34.53	x	0.63	x	0.7	=	20.05	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x 0.77	x	1.9	x	55.46	x	0.63	x	0.7	=	32.21	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x 0.77	x	1.9	x	74.72	x	0.63	x	0.7	=	43.38	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x 0.77	x	1.9	x	79.99	x	0.63	x	0.7	=	46.44	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x 0.77	x	1.9	x	74.68	x	0.63	x	0.7	=	43.36	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x 0.77	x	1.9	x	59.25	x	0.63	x	0.7	=	34.4	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x 0.77	x	1.9	x	41.52	x	0.63	x	0.7	=	24.11	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x 0.77	x	1.9	x	24.19	x	0.63	x	0.7	=	14.05	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x 0.77	x	1.9	x	13.12	x	0.63	x	0.7	=	7.62	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
North	0.9x 0.77	x	1.9	x	8.86	x	0.63	x	0.7	=	5.15	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.63	x	0.7	=	42.72	(78)
South	0.9x 0.77	x	1.78	x	46.75	x	0.63	x	0.7	=	25.43	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.63	x	0.7	=	69.97	(78)
South	0.9x 0.77	x	1.78	x	76.57	x	0.63	x	0.7	=	41.65	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.63	x	0.7	=	89.12	(78)
South	0.9x 0.77	x	1.78	x	97.53	x	0.63	x	0.7	=	53.06	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.63	x	0.7	=	100.73	(78)
South	0.9x 0.77	x	1.78	x	110.23	x	0.63	x	0.7	=	59.97	(78)

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South	0.9x	0.77	x	2.99	x	114.87	x	0.63	x	0.7	=	104.97		(78)
South	0.9x	0.77	x	1.78	x	114.87	x	0.63	x	0.7	=	62.49		(78)
South	0.9x	0.77	x	2.99	x	110.55	x	0.63	x	0.7	=	101.02		(78)
South	0.9x	0.77	x	1.78	x	110.55	x	0.63	x	0.7	=	60.14		(78)
South	0.9x	0.77	x	2.99	x	108.01	x	0.63	x	0.7	=	98.7		(78)
South	0.9x	0.77	x	1.78	x	108.01	x	0.63	x	0.7	=	58.76		(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.63	x	0.7	=	95.85		(78)
South	0.9x	0.77	x	1.78	x	104.89	x	0.63	x	0.7	=	57.06		(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.63	x	0.7	=	93.1		(78)
South	0.9x	0.77	x	1.78	x	101.89	x	0.63	x	0.7	=	55.42		(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.63	x	0.7	=	75.47		(78)
South	0.9x	0.77	x	1.78	x	82.59	x	0.63	x	0.7	=	44.93		(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.63	x	0.7	=	50.64		(78)
South	0.9x	0.77	x	1.78	x	55.42	x	0.63	x	0.7	=	30.15		(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.63	x	0.7	=	36.92		(78)
South	0.9x	0.77	x	1.78	x	40.4	x	0.63	x	0.7	=	21.98		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.72	141.37	192.73	241.89	276.83	278.24	266.77	239.64	209.3	155.8	99.99	71.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	506.54	561.88	598.23	622.63	632.34	609.58	582.99	562.91	545.75	517.23	489.36	482.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.99	0.95	0.85	0.69	0.73	0.92	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	19.94	20.14	20.41	20.69	20.9	20.98	20.97	20.83	20.48	20.1	19.8	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.03	20.03	20.03	20.04	20.05	20.05	20.05	20.06	20.05	20.05	20.04	20.04	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.93	0.78	0.56	0.61	0.87	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.44	18.62	18.91	19.32	19.7	19.97	20.04	20.04	19.89	19.42	18.87	18.42	(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	18.94	19.21	19.58	19.94	20.2	20.27	20.26	20.12	19.68	19.17	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	18.94	19.21	19.58	19.94	20.2	20.27	20.26	20.12	19.68	19.17	18.75	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.97	0.93	0.79	0.59	0.64	0.87	0.98	1	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	505.31	559.3	592.4	606.94	586.02	482.43	345.37	358.88	476.24	505.32	486.94	481.36	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1442.17	1395.17	1260.05	1046.83	805.62	541.54	354.94	373.06	584.71	887.37	1184.85	1435.66	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	697.03	561.71	496.73	316.71	163.38	0	0	0	0	284.25	502.49	710	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3732.3 (98)

Space heating requirement in kWh/m²/year 39.93 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	697.03	561.71	496.73	316.71	163.38	0	0	0	0	284.25	502.49	710	
(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)	746.28	601.4	531.83	339.09	174.93	0	0	0	0	304.33	538	760.17	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3996.03 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	210.2	185.3	194.46	172.47	166.98	147.07	140.9	157.07	158.81	180.84	191.33	205.17	

Efficiency of water heater 80.3 (216)

(217)m=	87.84	87.66	87.31	86.56	85	80.3	80.3	80.3	80.3	86.19	87.37	87.92	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.3	211.37	222.72	199.25	196.46	183.15	175.47	195.61	197.77	209.82	218.98	233.36	

Total = Sum(219a)$_{1...12}$ = 2483.26 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3996.03
Water heating fuel used		2483.26
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		409.24	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6963.54	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	863.14	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	536.38	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1399.53	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	212.4	(268)
Total CO2, kg/year	sum of (265)…(271) =				1650.85	(272)

TER = 17.66 (273)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Tillman - MT

Address : The Tillman - MT

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.73	(1a) x	2.38	(2a) =	111.45	(3a)
First floor	46.73	(1b) x	2.61	(2b) =	121.97	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.46	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.42	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.3	=	2.795			(26)
Doors Type 2			2.15	x	1.3	=	2.795			(26)
Windows Type 1			2.89	x1/[1/(1.2)+ 0.04]		=	3.31			(27)
Windows Type 2			1.9	x1/[1/(1.2)+ 0.04]		=	2.18			(27)
Windows Type 3			2.99	x1/[1/(1.2)+ 0.04]		=	3.42			(27)
Windows Type 4			1.78	x1/[1/(1.2)+ 0.04]		=	2.04			(27)
Floor			46.73	x	0.1	=	4.673	75	3504.75	(28)
Walls	47.77	13.86	33.91	x	0.25	=	8.48	60	2034.6	(29)
Roof	46.73	0	46.73	x	0.09	=	4.21	9	420.57	(30)
Total area of elements, m²			141.23							(31)
Party wall			97.79	x	0	=	0	45	4400.55	(32)
Internal wall **			144.8					9	1303.2	(32c)
Internal wall **			17.41					75	1305.75	(32c)
Internal floor			46.73					18	841.14	(32d)
Internal ceiling			46.73					9	420.57	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.89 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14231.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 152.27 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.28 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 41.18 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	38.67	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	38.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.84	79.69	79.69	79.69	79.69	79.69	79.69	79.69	79.69	79.69	79.69	79.69	

Average = Sum(39)$_{1...12}$ /12= 79.7 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	

Average = Sum(40)$_{1...12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.38	103.47	99.57	95.66	91.76	87.86	87.86	91.76	95.66	99.57	103.47	107.38	

Total = Sum(44)$_{1...12}$ = 1171.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.24	139.27	143.72	125.29	120.22	103.74	96.13	110.31	111.63	130.1	142.01	154.21	

Total = Sum(45)$_{1...12}$ = 1535.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.79	18.03	15.56	14.42	16.55	16.74	19.51	21.3	23.13	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	5.06	4.57	5.06	4.9	5.06	4.9	5.06	5.06	4.9	5.06	4.9	5.06	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.3	143.84	148.78	130.19	125.28	108.64	101.19	115.37	116.53	135.16	146.91	159.27	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	-52.42	-46.12	-47.08	-38.73	-35.96	-29.67	-25.11	-30.4	-31.29	-38.68	-44.8	-50.67	(63) (G10)

Output from water heater

(64)m=	111.88	97.72	101.7	91.46	89.32	78.97	76.08	84.97	85.24	96.48	102.1	108.61	

Output from water heater (annual)$_{1...12}$ 1124.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	54.21	47.45	49.05	42.88	41.24	35.72	33.23	37.94	38.34	44.52	48.44	52.54	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.17	20.58	16.74	12.67	9.47	8	8.64	11.23	15.08	19.14	22.34	23.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.3	247.85	241.43	227.78	210.54	194.34	183.51	180.97	187.38	201.04	218.28	234.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	(71)

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Water heating gains (Table 5)

(72)m=	72.87	70.61	65.93	59.56	55.43	49.61	44.66	51	53.25	59.84	67.28	70.62	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	407.39	405.09	390.15	366.06	341.49	318	302.87	309.25	321.76	346.08	373.95	394.97	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.47	x	1.11	=	11.12	(74)
North	0.9x 0.77	x	1.9	x	10.63	x	0.47	x	1.11	=	7.31	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.47	x	1.11	=	21.25	(74)
North	0.9x 0.77	x	1.9	x	20.32	x	0.47	x	1.11	=	13.97	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.47	x	1.11	=	36.11	(74)
North	0.9x 0.77	x	1.9	x	34.53	x	0.47	x	1.11	=	23.74	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.47	x	1.11	=	58.01	(74)
North	0.9x 0.77	x	1.9	x	55.46	x	0.47	x	1.11	=	38.14	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.47	x	1.11	=	78.14	(74)
North	0.9x 0.77	x	1.9	x	74.72	x	0.47	x	1.11	=	51.38	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.47	x	1.11	=	83.66	(74)
North	0.9x 0.77	x	1.9	x	79.99	x	0.47	x	1.11	=	55	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.47	x	1.11	=	78.1	(74)
North	0.9x 0.77	x	1.9	x	74.68	x	0.47	x	1.11	=	51.35	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.47	x	1.11	=	61.97	(74)
North	0.9x 0.77	x	1.9	x	59.25	x	0.47	x	1.11	=	40.74	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.47	x	1.11	=	43.42	(74)
North	0.9x 0.77	x	1.9	x	41.52	x	0.47	x	1.11	=	28.55	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.47	x	1.11	=	25.3	(74)
North	0.9x 0.77	x	1.9	x	24.19	x	0.47	x	1.11	=	16.63	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.47	x	1.11	=	13.72	(74)
North	0.9x 0.77	x	1.9	x	13.12	x	0.47	x	1.11	=	9.02	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.47	x	1.11	=	9.27	(74)
North	0.9x 0.77	x	1.9	x	8.86	x	0.47	x	1.11	=	6.1	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.47	x	1.11	=	50.59	(78)
South	0.9x 0.77	x	1.78	x	46.75	x	0.47	x	1.11	=	30.12	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.47	x	1.11	=	82.85	(78)
South	0.9x 0.77	x	1.78	x	76.57	x	0.47	x	1.11	=	49.32	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.47	x	1.11	=	105.54	(78)
South	0.9x 0.77	x	1.78	x	97.53	x	0.47	x	1.11	=	62.83	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.47	x	1.11	=	119.28	(78)
South	0.9x 0.77	x	1.78	x	110.23	x	0.47	x	1.11	=	71.01	(78)

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South	0.9x	0.77	x	2.99	x	114.87	x	0.47	x	1.11	=	124.3		(78)
South	0.9x	0.77	x	1.78	x	114.87	x	0.47	x	1.11	=	74		(78)
South	0.9x	0.77	x	2.99	x	110.55	x	0.47	x	1.11	=	119.62		(78)
South	0.9x	0.77	x	1.78	x	110.55	x	0.47	x	1.11	=	71.21		(78)
South	0.9x	0.77	x	2.99	x	108.01	x	0.47	x	1.11	=	116.88		(78)
South	0.9x	0.77	x	1.78	x	108.01	x	0.47	x	1.11	=	69.58		(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.47	x	1.11	=	113.5		(78)
South	0.9x	0.77	x	1.78	x	104.89	x	0.47	x	1.11	=	67.57		(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.47	x	1.11	=	110.25		(78)
South	0.9x	0.77	x	1.78	x	101.89	x	0.47	x	1.11	=	65.63		(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.47	x	1.11	=	89.36		(78)
South	0.9x	0.77	x	1.78	x	82.59	x	0.47	x	1.11	=	53.2		(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.47	x	1.11	=	59.97		(78)
South	0.9x	0.77	x	1.78	x	55.42	x	0.47	x	1.11	=	35.7		(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.47	x	1.11	=	43.71		(78)
South	0.9x	0.77	x	1.78	x	40.4	x	0.47	x	1.11	=	26.02		(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	99.14	167.4	228.23	286.44	327.82	329.49	315.91	283.78	247.85	184.5	118.4	85.1	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	506.53	572.49	618.38	652.5	669.31	647.49	618.78	593.03	569.61	530.57	492.36	480.07	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.97	0.93	0.85	0.7	0.54	0.59	0.8	0.94	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.86	20.12	20.44	20.73	20.91	20.98	20.97	20.85	20.48	20.02	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	20.21	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.92	0.82	0.64	0.46	0.5	0.74	0.93	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.43	18.68	19.06	19.51	19.9	20.13	20.19	20.19	20.06	19.57	18.91	18.36	(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.73	18.97	19.31	19.73	20.1	20.32	20.38	20.38	20.25	19.79	19.17	18.67	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.58	18.82	19.16	19.58	19.95	20.17	20.23	20.23	20.1	19.64	19.02	18.52	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.98	0.97	0.95	0.9	0.8	0.64	0.46	0.5	0.73	0.91	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	497.83	555.95	587	588.39	538.4	412.22	283.61	296.26	418.48	483.96	477.95	473.32	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1140.39	1109.19	1009.13	851.21	657.71	443.99	289.57	304.96	478.23	720.63	950.31	1140.99	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	478.07	371.77	314.07	189.23	88.77	0	0	0	0	176.08	340.1	496.75	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2454.84 (98)

Space heating requirement in kWh/m²/year 26.27 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 90.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	478.07	371.77	314.07	189.23	88.77	0	0	0	0	176.08	340.1	496.75	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	528.25	410.8	347.03	209.09	98.09	0	0	0	0	194.57	375.81	548.89	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2712.53 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	111.88	97.72	101.7	91.46	89.32	78.97	76.08	84.97	85.24	96.48	102.1	108.61	

Efficiency of water heater 87.3 (216)

(217)m=	89.88	89.81	89.7	89.43	88.87	87.3	87.3	87.3	87.3	89.34	89.74	89.91	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	124.48	108.8	113.38	102.27	100.51	90.46	87.15	97.33	97.64	107.99	113.78	120.8	

Total = Sum(219a)$_{1...12}$ = 1264.58 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2712.53
Water heating fuel used		1264.58
Electricity for pumps, fans and electric keep-hot		

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mechanical ventilation - balanced, extract or positive input from outside		44.04	(230a)
central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	119.04	(231)
Electricity for lighting		409.24	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4505.39	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x		0.216	=	585.91	(261)
Space heating (secondary)	(215) x		0.519	=	0	(263)
Water heating	(219) x		0.216	=	273.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =				859.06	(265)
Electricity for pumps, fans and electric keep-hot	(231) x		0.519	=	61.78	(267)
Electricity for lighting	(232) x		0.519	=	212.4	(268)
Total CO2, kg/year		sum of (265)…(271) =			1133.23	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =			12.13	(273)
EI rating (section 14)					89	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Tillman - MT

Address : The Tillman - MT

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	46.73 (1a)	x	2.38 (2a)	=	111.45	(3a)
First floor	46.73 (1b)	x	2.61 (2b)	=	121.97	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	93.46 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		233.42	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.13 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.38 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.32 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.15	x	1.2	=	2.58			(26)
Doors Type 2			2.15	x	1.2	=	2.58			(26)
Windows Type 1			2.89	x	1/[1/(1.4)+ 0.04]	=	3.83			(27)
Windows Type 2			1.9	x	1/[1/(1.4)+ 0.04]	=	2.52			(27)
Windows Type 3			2.99	x	1/[1/(1.4)+ 0.04]	=	3.96			(27)
Windows Type 4			1.78	x	1/[1/(1.4)+ 0.04]	=	2.36			(27)
Floor			46.73	x	0.13	=	6.0749			(28)
Walls	47.77	13.86	33.91	x	0.18	=	6.1			(29)
Roof	46.73	0	46.73	x	0.13	=	6.07			(30)
Total area of elements, m²			141.23							(31)
Party wall			97.79	x	0	=	0			(32)
Internal wall **			144.8							(32c)
Internal wall **			17.41							(32c)
Internal floor			46.73							(32d)
Internal ceiling			46.73							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 36.09 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 14231.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 9.26 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 45.34 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	45	44.74	44.5	43.34	43.12	42.11	42.11	41.93	42.5	43.12	43.56	44.02	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	90.34	90.09	89.84	88.68	88.47	87.46	87.46	87.27	87.85	88.47	88.9	89.36	

Average = Sum(39)$_{1...12}$ /12= 88.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.67 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 97.62 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	107.38	103.47	99.57	95.66	91.76	87.86	87.86	91.76	95.66	99.57	103.47	107.38	

Total = Sum(44)$_{1...12}$ = 1171.4 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	159.24	139.27	143.72	125.29	120.22	103.74	96.13	110.31	111.63	130.1	142.01	154.21	

Total = Sum(45)$_{1...12}$ = 1535.89 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	23.89	20.89	21.56	18.79	18.03	15.56	14.42	16.55	16.74	19.51	21.3	23.13	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	46.03	50.74	47.18	46.76	43.33	44.77	46.76	47.18	50.74	49.32	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	210.2	185.3	194.46	172.47	166.98	147.07	140.9	157.07	158.81	180.84	191.33	205.17	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)
WWHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G10)

Output from water heater

(64)m=	210.2	185.3	194.46	172.47	166.98	147.07	140.9	157.07	158.81	180.84	191.33	205.17	

Output from water heater (annual)$_{1...12}$ 2110.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	65.69	57.81	60.47	53.45	51.66	45.33	43.16	48.37	48.91	55.94	59.55	64.02	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	133.51	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	23.17	20.58	16.74	12.67	9.47	8	8.64	11.23	15.08	19.14	22.34	23.82	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	245.3	247.85	241.43	227.78	210.54	194.34	183.51	180.97	187.38	201.04	218.28	234.48	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	36.35	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	-106.81	(71)

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Water heating gains (Table 5)

(72)m=	88.29	86.03	81.28	74.24	69.44	62.95	58.01	65.01	67.93	75.19	82.7	86.04	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	422.82	420.52	405.5	380.74	355.51	331.34	316.21	323.27	336.45	361.42	389.38	410.39	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	2.89	x	10.63	x	0.63	x	0.7	=	9.39	(74)
North	0.9x 0.77	x	1.9	x	10.63	x	0.63	x	0.7	=	6.17	(74)
North	0.9x 0.77	x	2.89	x	20.32	x	0.63	x	0.7	=	17.95	(74)
North	0.9x 0.77	x	1.9	x	20.32	x	0.63	x	0.7	=	11.8	(74)
North	0.9x 0.77	x	2.89	x	34.53	x	0.63	x	0.7	=	30.5	(74)
North	0.9x 0.77	x	1.9	x	34.53	x	0.63	x	0.7	=	20.05	(74)
North	0.9x 0.77	x	2.89	x	55.46	x	0.63	x	0.7	=	48.99	(74)
North	0.9x 0.77	x	1.9	x	55.46	x	0.63	x	0.7	=	32.21	(74)
North	0.9x 0.77	x	2.89	x	74.72	x	0.63	x	0.7	=	65.99	(74)
North	0.9x 0.77	x	1.9	x	74.72	x	0.63	x	0.7	=	43.38	(74)
North	0.9x 0.77	x	2.89	x	79.99	x	0.63	x	0.7	=	70.64	(74)
North	0.9x 0.77	x	1.9	x	79.99	x	0.63	x	0.7	=	46.44	(74)
North	0.9x 0.77	x	2.89	x	74.68	x	0.63	x	0.7	=	65.96	(74)
North	0.9x 0.77	x	1.9	x	74.68	x	0.63	x	0.7	=	43.36	(74)
North	0.9x 0.77	x	2.89	x	59.25	x	0.63	x	0.7	=	52.33	(74)
North	0.9x 0.77	x	1.9	x	59.25	x	0.63	x	0.7	=	34.4	(74)
North	0.9x 0.77	x	2.89	x	41.52	x	0.63	x	0.7	=	36.67	(74)
North	0.9x 0.77	x	1.9	x	41.52	x	0.63	x	0.7	=	24.11	(74)
North	0.9x 0.77	x	2.89	x	24.19	x	0.63	x	0.7	=	21.36	(74)
North	0.9x 0.77	x	1.9	x	24.19	x	0.63	x	0.7	=	14.05	(74)
North	0.9x 0.77	x	2.89	x	13.12	x	0.63	x	0.7	=	11.59	(74)
North	0.9x 0.77	x	1.9	x	13.12	x	0.63	x	0.7	=	7.62	(74)
North	0.9x 0.77	x	2.89	x	8.86	x	0.63	x	0.7	=	7.83	(74)
North	0.9x 0.77	x	1.9	x	8.86	x	0.63	x	0.7	=	5.15	(74)
South	0.9x 0.77	x	2.99	x	46.75	x	0.63	x	0.7	=	42.72	(78)
South	0.9x 0.77	x	1.78	x	46.75	x	0.63	x	0.7	=	25.43	(78)
South	0.9x 0.77	x	2.99	x	76.57	x	0.63	x	0.7	=	69.97	(78)
South	0.9x 0.77	x	1.78	x	76.57	x	0.63	x	0.7	=	41.65	(78)
South	0.9x 0.77	x	2.99	x	97.53	x	0.63	x	0.7	=	89.12	(78)
South	0.9x 0.77	x	1.78	x	97.53	x	0.63	x	0.7	=	53.06	(78)
South	0.9x 0.77	x	2.99	x	110.23	x	0.63	x	0.7	=	100.73	(78)
South	0.9x 0.77	x	1.78	x	110.23	x	0.63	x	0.7	=	59.97	(78)

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South	0.9x	0.77	x	2.99	x	114.87	x	0.63	x	0.7	=	104.97	(78)
South	0.9x	0.77	x	1.78	x	114.87	x	0.63	x	0.7	=	62.49	(78)
South	0.9x	0.77	x	2.99	x	110.55	x	0.63	x	0.7	=	101.02	(78)
South	0.9x	0.77	x	1.78	x	110.55	x	0.63	x	0.7	=	60.14	(78)
South	0.9x	0.77	x	2.99	x	108.01	x	0.63	x	0.7	=	98.7	(78)
South	0.9x	0.77	x	1.78	x	108.01	x	0.63	x	0.7	=	58.76	(78)
South	0.9x	0.77	x	2.99	x	104.89	x	0.63	x	0.7	=	95.85	(78)
South	0.9x	0.77	x	1.78	x	104.89	x	0.63	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	2.99	x	101.89	x	0.63	x	0.7	=	93.1	(78)
South	0.9x	0.77	x	1.78	x	101.89	x	0.63	x	0.7	=	55.42	(78)
South	0.9x	0.77	x	2.99	x	82.59	x	0.63	x	0.7	=	75.47	(78)
South	0.9x	0.77	x	1.78	x	82.59	x	0.63	x	0.7	=	44.93	(78)
South	0.9x	0.77	x	2.99	x	55.42	x	0.63	x	0.7	=	50.64	(78)
South	0.9x	0.77	x	1.78	x	55.42	x	0.63	x	0.7	=	30.15	(78)
South	0.9x	0.77	x	2.99	x	40.4	x	0.63	x	0.7	=	36.92	(78)
South	0.9x	0.77	x	1.78	x	40.4	x	0.63	x	0.7	=	21.98	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	83.72	141.37	192.73	241.89	276.83	278.24	266.77	239.64	209.3	155.8	99.99	71.87	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	506.54	561.88	598.23	622.63	632.34	609.58	582.99	562.91	545.75	517.23	489.36	482.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.94	0.82	0.64	0.68	0.9	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.96	20.07	20.26	20.52	20.76	20.94	20.99	20.98	20.88	20.57	20.22	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.12	20.13	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.98	0.92	0.74	0.52	0.57	0.84	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.71	18.88	19.16	19.53	19.87	20.09	20.13	20.13	20.03	19.61	19.1	18.68	(90)

fLA = Living area ÷ (4) = 0.24 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.01	19.17	19.42	19.77	20.09	20.29	20.34	20.34	20.23	19.84	19.37	18.99	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.01	19.17	19.42	19.77	20.09	20.29	20.34	20.34	20.23	19.84	19.37	18.99	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.97	0.91	0.76	0.55	0.6	0.85	0.97	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	505.36	559.27	592.03	604.88	577.79	461.63	322.27	336.21	463.86	503.87	486.91	481.41	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1328.74	1285.3	1161.02	964.05	742.02	497.89	326.96	343.5	538.66	817.77	1090.92	1321.4	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	612.6	487.89	423.32	258.6	122.19	0	0	0	0	233.54	434.89	624.95	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3197.99 (98)

Space heating requirement in kWh/m²/year 34.22 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.4 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	612.6	487.89	423.32	258.6	122.19	0	0	0	0	233.54	434.89	624.95	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	655.89	522.37	453.24	276.87	130.82	0	0	0	0	250.05	465.62	669.12	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 3423.97 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	210.2	185.3	194.46	172.47	166.98	147.07	140.9	157.07	158.81	180.84	191.33	205.17	

Efficiency of water heater 80.3 (216)

(217)m=	87.59	87.37	86.96	86.07	84.28	80.3	80.3	80.3	80.3	85.7	87.05	87.67	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	239.99	212.07	223.62	200.39	198.13	183.15	175.47	195.61	197.77	211.02	219.78	234.02	

Total = Sum(219a)$_{1...12}$ = 2491.02 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3423.97
Water heating fuel used		2491.02
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30	(230c)
boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		409.24	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6399.23	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	739.58	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	538.06	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1277.64	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	212.4	(268)
Total CO2, kg/year	sum of (265)…(271) =				1528.96	(272)

TER = 16.36 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Watchmaker Det (ASHP)

Address : The Watchmaker Det (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4 (1a)	x	2.38 (2a)	=	206.06	(3a)
First floor	88.33 (1b)	x	2.61 (2b)	=	230.54	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	174.73 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		436.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	0	÷ (5) =	0 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)			0 (9)
Additional infiltration		[(9)-1]x0.1 =	0 (10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0 (11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0 (12)
If no draught lobby, enter 0.05, else enter 0			0 (13)
Percentage of windows and doors draught stripped			0 (14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0 (15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0 (16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4.65000009536743 (17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.23 (18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.85 (20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.2 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.25	0.25	0.24	0.22	0.21	0.19	0.19	0.18	0.2	0.21	0.22	0.23

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	0	0	0	0	0	0	0	0	0	0	0

(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.02	x	1.3	=	2.626			(26)
Doors Type 2			1.97	x	1.3	=	2.561			(26)
Windows Type 1			12.58	x	1/[1/(1.2)+ 0.04]	=	14.4			(27)
Windows Type 2			0.67	x	1/[1/(1.2)+ 0.04]	=	0.77			(27)
Windows Type 3			0.67	x	1/[1/(1.2)+ 0.04]	=	0.77			(27)
Windows Type 4			15.98	x	1/[1/(1.2)+ 0.04]	=	18.3			(27)
Floor Type 1			86.4	x	0.12	=	10.368	75	6480	(28)
Floor Type 2			1.97	x	0.17	=	0.3349	20	39.4	(28)
Walls	190.31	33.89	156.42	x	0.24	=	37.54	60	9385.2	(29)
Roof	88.33	0	88.33	x	0.09	=	7.95	9	794.97	(30)
Total area of elements, m²			367.01							(31)
Internal wall **			110.85					75	8313.75	(32c)
Internal wall **			215.37					9	1938.33	(32c)
Internal floor			88.33					18	1589.94	(32d)
Internal ceiling			88.33					9	794.97	(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 95.62 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 29336.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 167.9 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.91 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 106.53 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	72.32	72.04	72.04	72.04	72.04	72.04	72.04	72.04	72.04	72.04	72.04	72.04	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	178.85	178.57	178.57	178.57	178.57	178.57	178.57	178.57	178.57	178.57	178.57	178.57	

Average = Sum(39)$_{1...12}$ /12= 178.59 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	1.02	

Average = Sum(40)$_{1...12}$ /12= 1.02 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.97 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 104.71 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	115.18	110.99	106.8	102.62	98.43	94.24	94.24	98.43	102.62	106.8	110.99	115.18	

Total = Sum(44)$_{1...12}$ = 1256.53 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	170.81	149.39	154.16	134.4	128.96	111.28	103.12	118.33	119.74	139.55	152.33	165.42	

Total = Sum(45)$_{1...12}$ = 1647.51 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.62	22.41	23.12	20.16	19.34	16.69	15.47	17.75	17.96	20.93	22.85	24.81	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.89 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 1.02 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		1.02	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	31.64	28.58	31.64	30.62	31.64	30.62	31.64	31.64	30.62	31.64	30.62	31.64	(57)

Primary circuit loss (annual) from Table 3: 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	0	0	0	0	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	225.71	198.98	209.06	187.53	183.86	141.9	134.76	149.97	150.36	194.45	205.46	220.32	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	225.71	198.98	209.06	187.53	183.86	0	0	0	0	194.45	205.46	220.32	

Output from water heater (annual)$_{1...12}$ 1625.38 (64)

Output immersion

(64)m=	0	0	0	0	0	141.9	134.76	149.97	150.36	0	0	0	

Output from immersion (annual)$_{1...12}$ 576.992119837714 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	100.72	89.34	95.18	87.19	86.8	61.5	59.6	64.66	64.31	90.32	93.15	98.92	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	31.2	27.71	22.54	17.06	12.75	10.77	11.64	15.12	20.3	25.78	30.08	32.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.34	349.94	340.88	321.6	297.26	274.39	259.11	255.51	264.57	283.85	308.19	331.06	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	(71)

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Water heating gains (Table 5)

(72)m=	135.37	132.95	127.93	121.1	116.67	85.41	80.11	86.9	89.32	121.4	129.38	132.96	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	580.45	578.14	558.88	527.3	494.22	438.1	418.38	425.07	441.72	498.56	535.18	563.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	12.58	x	10.63	x	0.47	x	1.11	=	48.41	(74)
North	0.9x 0.77	x	12.58	x	20.32	x	0.47	x	1.11	=	92.52	(74)
North	0.9x 0.77	x	12.58	x	34.53	x	0.47	x	1.11	=	157.21	(74)
North	0.9x 0.77	x	12.58	x	55.46	x	0.47	x	1.11	=	252.51	(74)
North	0.9x 0.77	x	12.58	x	74.72	x	0.47	x	1.11	=	340.16	(74)
North	0.9x 0.77	x	12.58	x	79.99	x	0.47	x	1.11	=	364.15	(74)
North	0.9x 0.77	x	12.58	x	74.68	x	0.47	x	1.11	=	339.98	(74)
North	0.9x 0.77	x	12.58	x	59.25	x	0.47	x	1.11	=	269.73	(74)
North	0.9x 0.77	x	12.58	x	41.52	x	0.47	x	1.11	=	189.01	(74)
North	0.9x 0.77	x	12.58	x	24.19	x	0.47	x	1.11	=	110.13	(74)
North	0.9x 0.77	x	12.58	x	13.12	x	0.47	x	1.11	=	59.72	(74)
North	0.9x 0.77	x	12.58	x	8.86	x	0.47	x	1.11	=	40.36	(74)
East	0.9x 0.77	x	0.67	x	19.64	x	0.47	x	1.11	=	4.76	(76)
East	0.9x 0.77	x	0.67	x	38.42	x	0.47	x	1.11	=	9.32	(76)
East	0.9x 0.77	x	0.67	x	63.27	x	0.47	x	1.11	=	15.34	(76)
East	0.9x 0.77	x	0.67	x	92.28	x	0.47	x	1.11	=	22.38	(76)
East	0.9x 0.77	x	0.67	x	113.09	x	0.47	x	1.11	=	27.42	(76)
East	0.9x 0.77	x	0.67	x	115.77	x	0.47	x	1.11	=	28.07	(76)
East	0.9x 0.77	x	0.67	x	110.22	x	0.47	x	1.11	=	26.72	(76)
East	0.9x 0.77	x	0.67	x	94.68	x	0.47	x	1.11	=	22.96	(76)
East	0.9x 0.77	x	0.67	x	73.59	x	0.47	x	1.11	=	17.84	(76)
East	0.9x 0.77	x	0.67	x	45.59	x	0.47	x	1.11	=	11.05	(76)
East	0.9x 0.77	x	0.67	x	24.49	x	0.47	x	1.11	=	5.94	(76)
East	0.9x 0.77	x	0.67	x	16.15	x	0.47	x	1.11	=	3.92	(76)
South	0.9x 0.77	x	15.98	x	46.75	x	0.47	x	1.11	=	270.37	(78)
South	0.9x 0.77	x	15.98	x	76.57	x	0.47	x	1.11	=	442.8	(78)
South	0.9x 0.77	x	15.98	x	97.53	x	0.47	x	1.11	=	564.05	(78)
South	0.9x 0.77	x	15.98	x	110.23	x	0.47	x	1.11	=	637.5	(78)
South	0.9x 0.77	x	15.98	x	114.87	x	0.47	x	1.11	=	664.32	(78)
South	0.9x 0.77	x	15.98	x	110.55	x	0.47	x	1.11	=	639.32	(78)
South	0.9x 0.77	x	15.98	x	108.01	x	0.47	x	1.11	=	624.65	(78)
South	0.9x 0.77	x	15.98	x	104.89	x	0.47	x	1.11	=	606.62	(78)

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South	0.9x	0.77	x	15.98	x	101.89	x	0.47	x	1.11	=	589.22	(78)
South	0.9x	0.77	x	15.98	x	82.59	x	0.47	x	1.11	=	477.61	(78)
South	0.9x	0.77	x	15.98	x	55.42	x	0.47	x	1.11	=	320.49	(78)
South	0.9x	0.77	x	15.98	x	40.4	x	0.47	x	1.11	=	233.63	(78)
West	0.9x	0.77	x	0.67	x	19.64	x	0.47	x	1.11	=	4.76	(80)
West	0.9x	0.77	x	0.67	x	38.42	x	0.47	x	1.11	=	9.32	(80)
West	0.9x	0.77	x	0.67	x	63.27	x	0.47	x	1.11	=	15.34	(80)
West	0.9x	0.77	x	0.67	x	92.28	x	0.47	x	1.11	=	22.38	(80)
West	0.9x	0.77	x	0.67	x	113.09	x	0.47	x	1.11	=	27.42	(80)
West	0.9x	0.77	x	0.67	x	115.77	x	0.47	x	1.11	=	28.07	(80)
West	0.9x	0.77	x	0.67	x	110.22	x	0.47	x	1.11	=	26.72	(80)
West	0.9x	0.77	x	0.67	x	94.68	x	0.47	x	1.11	=	22.96	(80)
West	0.9x	0.77	x	0.67	x	73.59	x	0.47	x	1.11	=	17.84	(80)
West	0.9x	0.77	x	0.67	x	45.59	x	0.47	x	1.11	=	11.05	(80)
West	0.9x	0.77	x	0.67	x	24.49	x	0.47	x	1.11	=	5.94	(80)
West	0.9x	0.77	x	0.67	x	16.15	x	0.47	x	1.11	=	3.92	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	328.31	553.95	751.94	934.77	1059.32	1059.61	1018.08	922.27	813.92	609.84	392.08	281.82	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	908.76	1132.09	1310.83	1462.06	1553.54	1497.71	1436.46	1347.34	1255.64	1108.4	927.27	845.45	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.97	0.92	0.83	0.68	0.52	0.57	0.79	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.77	19.94	20.19	20.47	20.72	20.87	20.91	20.91	20.8	20.48	20.04	19.72	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.96	0.9	0.79	0.61	0.42	0.47	0.73	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.39	18.65	19.01	19.41	19.74	19.91	19.96	19.95	19.85	19.42	18.81	18.33	(90)

fLA = Living area ÷ (4) = 0.1 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.53	18.78	19.13	19.52	19.84	20.01	20.05	20.05	19.94	19.53	18.94	18.47	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.53	18.78	19.13	19.52	19.84	20.01	20.05	20.05	19.94	19.53	18.94	18.47	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.98	0.95	0.89	0.77	0.6	0.42	0.47	0.72	0.92	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	899.57	1105.71	1245.34	1301.94	1202.82	900.36	605.17	633.24	905.86	1015.96	908.36	838.88	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2544.65	2479.31	2255.1	1896.56	1453.85	965.7	616.89	651.55	1043.3	1594.72	2113.87	2547.92	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1223.95	923.06	751.26	428.12	186.77	0	0	0	0	430.6	867.97	1271.52	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 6083.24 (98)

Space heating requirement in kWh/m²/year 34.82 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 445.58 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1223.95	923.06	751.26	428.12	186.77	0	0	0	0	430.6	867.97	1271.52	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	274.69	207.16	168.6	96.08	41.92	0	0	0	0	96.64	194.8	285.36	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 1365.24 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	225.71	198.98	209.06	187.53	183.86	0	0	0	0	194.45	205.46	220.32	

Efficiency of water heater 282.62 (216)

(217)m=	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	282.62	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	79.86	70.4	73.97	66.35	65.05	0	0	0	0	68.8	72.7	77.96	

Total = Sum(219a)$_{1...12}$ = 575.1 (219)

Water heating requirement (immersion)

	0	0	0	0	0	141.9	134.76	149.97	150.36	0	0	0	

Efficiency of water heater (Immersion) 100 (216)

(217)m=	0	0	0	0	0	100	100	100	100	0	0	0	(217)

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Fuel for water heating (Immersion), kWh/month
(219)m = [(64)m + (218) m] x 100 ÷ (217)m

(219)m=	0	0	0	0	0	141.9	134.76	149.97	150.36	0	0	0

Total = Sum(219a)$_{1...12}$ = 576.99 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1365.24	
Water heating fuel used		575.1	
Water heating fuel used (Immersion)		576.99	
Electricity for pumps, fans and electric keep-hot			
mechanical ventilation - balanced, extract or positive input from outside	79.57		(230a)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		79.57	(231)
Electricity for lighting		551.05	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		2570.97	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.519	=	708.56	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.519	=	298.48	(264)
Water heating (Immersion)	(219)	x	0.519	=	299.46	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1306.5	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	41.3	(267)
Electricity for lighting	(232)	x	0.519	=	286	(268)
Total CO2, kg/year	sum of (265)…(271) =				1633.79	(272)
Dwelling CO2 Emission Rate	(272) ÷ (4) =				9.35	(273)
EI rating (section 14)					90	(274)

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User Details:

Assessor Name:	Matt Fitzpatrick	**Stroma Number:**	STRO003572
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.59

Property Address: The Watchmaker Det (ASHP)

Address : The Watchmaker Det (ASHP)

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	86.4 (1a)	x	2.38 (2a)	=	206.06	(3a)
First floor	88.33 (1b)	x	2.61 (2b)	=	230.54	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	174.73 (4)					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		436.61	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.09	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration		0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate		(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.34	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor		(21) = (18) x (20) =	0.29	(21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.37	0.36	0.36	0.32	0.31	0.28	0.28	0.27	0.29	0.31	0.33	0.34

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.54	0.54	0.55	0.55	0.56	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.02	x	1.2	=	2.424			(26)
Doors Type 2			1.97	x	1.2	=	2.364			(26)
Windows Type 1			12.58	x1/[1/(1.4)+ 0.04]		=	16.68			(27)
Windows Type 2			0.67	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 3			0.67	x1/[1/(1.4)+ 0.04]		=	0.89			(27)
Windows Type 4			15.98	x1/[1/(1.4)+ 0.04]		=	21.19			(27)
Floor Type 1			86.4	x	0.13	=	11.232			(28)
Floor Type 2			1.97	x	0.13	=	0.2561			(28)
Walls	190.31	33.89	156.42	x	0.18	=	28.16			(29)
Roof	88.33	0	88.33	x	0.13	=	11.48			(30)
Total area of elements, m²			367.01							(31)
Internal wall **			110.85							(32c)
Internal wall **			215.37							(32c)
Internal floor			88.33							(32d)
Internal ceiling			88.33							(32e)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 95.55 (33)

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Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 29336.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 16.72 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 112.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	81.91	81.53	81.15	79.39	79.06	77.52	77.52	77.24	78.11	79.06	79.73	80.43	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	194.19	193.8	193.43	191.66	191.33	189.79	189.79	189.51	190.39	191.33	192	192.7	

Average = Sum(39)$_{1...12}$ /12= 191.66 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.11	1.11	1.11	1.1	1.1	1.09	1.09	1.08	1.09	1.1	1.1	1.1	

Average = Sum(40)$_{1...12}$ /12= 1.1 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.97 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 104.71 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	115.18	110.99	106.8	102.62	98.43	94.24	94.24	98.43	102.62	106.8	110.99	115.18	

Total = Sum(44)$_{1...12}$ = 1256.53 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	170.81	149.39	154.16	134.4	128.96	111.28	103.12	118.33	119.74	139.55	152.33	165.42	

Total = Sum(45)$_{1...12}$ = 1647.51 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.62	22.41	23.12	20.16	19.34	16.69	15.47	17.75	17.96	20.93	22.85	24.81	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

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Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)
Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0.75	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

Primary circuit loss (annual) from Table 3	0	(58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	217.41	191.48	200.75	179.49	175.56	156.37	149.71	164.93	164.84	186.15	197.42	212.02	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	217.41	191.48	200.75	179.49	175.56	156.37	149.71	164.93	164.84	186.15	197.42	212.02	

Output from water heater (annual)$_{1...12}$ 2196.12 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	94.07	83.34	88.53	80.76	80.16	73.07	71.56	76.62	75.89	83.68	86.72	92.28	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	148.44	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	31.2	27.71	22.54	17.06	12.75	10.77	11.64	15.12	20.3	25.78	30.08	32.07	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	346.34	349.94	340.88	321.6	297.26	274.39	259.11	255.51	264.57	283.85	308.19	331.06	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	37.84	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	-118.75	(71)

Water heating gains (Table 5)

(72)m=	126.44	124.02	119	112.17	107.74	101.49	96.19	102.99	105.4	112.47	120.45	124.03	(72)

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Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	574.52	572.2	552.95	521.37	488.29	457.18	437.46	444.15	460.8	492.63	529.25	557.7	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x 0.77	x	12.58	x	10.63	x	0.63	x	0.7	=	40.88	(74)
North	0.9x 0.77	x	12.58	x	20.32	x	0.63	x	0.7	=	78.13	(74)
North	0.9x 0.77	x	12.58	x	34.53	x	0.63	x	0.7	=	132.76	(74)
North	0.9x 0.77	x	12.58	x	55.46	x	0.63	x	0.7	=	213.24	(74)
North	0.9x 0.77	x	12.58	x	74.72	x	0.63	x	0.7	=	287.25	(74)
North	0.9x 0.77	x	12.58	x	79.99	x	0.63	x	0.7	=	307.51	(74)
North	0.9x 0.77	x	12.58	x	74.68	x	0.63	x	0.7	=	287.1	(74)
North	0.9x 0.77	x	12.58	x	59.25	x	0.63	x	0.7	=	227.78	(74)
North	0.9x 0.77	x	12.58	x	41.52	x	0.63	x	0.7	=	159.62	(74)
North	0.9x 0.77	x	12.58	x	24.19	x	0.63	x	0.7	=	93	(74)
North	0.9x 0.77	x	12.58	x	13.12	x	0.63	x	0.7	=	50.43	(74)
North	0.9x 0.77	x	12.58	x	8.86	x	0.63	x	0.7	=	34.08	(74)
East	0.9x 0.77	x	0.67	x	19.64	x	0.63	x	0.7	=	4.02	(76)
East	0.9x 0.77	x	0.67	x	38.42	x	0.63	x	0.7	=	7.87	(76)
East	0.9x 0.77	x	0.67	x	63.27	x	0.63	x	0.7	=	12.96	(76)
East	0.9x 0.77	x	0.67	x	92.28	x	0.63	x	0.7	=	18.9	(76)
East	0.9x 0.77	x	0.67	x	113.09	x	0.63	x	0.7	=	23.16	(76)
East	0.9x 0.77	x	0.67	x	115.77	x	0.63	x	0.7	=	23.71	(76)
East	0.9x 0.77	x	0.67	x	110.22	x	0.63	x	0.7	=	22.57	(76)
East	0.9x 0.77	x	0.67	x	94.68	x	0.63	x	0.7	=	19.39	(76)
East	0.9x 0.77	x	0.67	x	73.59	x	0.63	x	0.7	=	15.07	(76)
East	0.9x 0.77	x	0.67	x	45.59	x	0.63	x	0.7	=	9.33	(76)
East	0.9x 0.77	x	0.67	x	24.49	x	0.63	x	0.7	=	5.01	(76)
East	0.9x 0.77	x	0.67	x	16.15	x	0.63	x	0.7	=	3.31	(76)
South	0.9x 0.77	x	15.98	x	46.75	x	0.63	x	0.7	=	228.32	(78)
South	0.9x 0.77	x	15.98	x	76.57	x	0.63	x	0.7	=	373.93	(78)
South	0.9x 0.77	x	15.98	x	97.53	x	0.63	x	0.7	=	476.33	(78)
South	0.9x 0.77	x	15.98	x	110.23	x	0.63	x	0.7	=	538.35	(78)
South	0.9x 0.77	x	15.98	x	114.87	x	0.63	x	0.7	=	561	(78)
South	0.9x 0.77	x	15.98	x	110.55	x	0.63	x	0.7	=	539.88	(78)
South	0.9x 0.77	x	15.98	x	108.01	x	0.63	x	0.7	=	527.5	(78)
South	0.9x 0.77	x	15.98	x	104.89	x	0.63	x	0.7	=	512.27	(78)
South	0.9x 0.77	x	15.98	x	101.89	x	0.63	x	0.7	=	497.58	(78)
South	0.9x 0.77	x	15.98	x	82.59	x	0.63	x	0.7	=	403.32	(78)

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South	0.9x	0.77	x	15.98	x	55.42	x	0.63	x	0.7	=	270.64	(78)
South	0.9x	0.77	x	15.98	x	40.4	x	0.63	x	0.7	=	197.29	(78)
West	0.9x	0.77	x	0.67	x	19.64	x	0.63	x	0.7	=	4.02	(80)
West	0.9x	0.77	x	0.67	x	38.42	x	0.63	x	0.7	=	7.87	(80)
West	0.9x	0.77	x	0.67	x	63.27	x	0.63	x	0.7	=	12.96	(80)
West	0.9x	0.77	x	0.67	x	92.28	x	0.63	x	0.7	=	18.9	(80)
West	0.9x	0.77	x	0.67	x	113.09	x	0.63	x	0.7	=	23.16	(80)
West	0.9x	0.77	x	0.67	x	115.77	x	0.63	x	0.7	=	23.71	(80)
West	0.9x	0.77	x	0.67	x	110.22	x	0.63	x	0.7	=	22.57	(80)
West	0.9x	0.77	x	0.67	x	94.68	x	0.63	x	0.7	=	19.39	(80)
West	0.9x	0.77	x	0.67	x	73.59	x	0.63	x	0.7	=	15.07	(80)
West	0.9x	0.77	x	0.67	x	45.59	x	0.63	x	0.7	=	9.33	(80)
West	0.9x	0.77	x	0.67	x	24.49	x	0.63	x	0.7	=	5.01	(80)
West	0.9x	0.77	x	0.67	x	16.15	x	0.63	x	0.7	=	3.31	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	277.25	467.79	634.99	789.38	894.56	894.8	859.74	778.82	687.33	514.99	331.1	237.99	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	851.77	1040	1187.94	1310.75	1382.85	1351.99	1297.2	1222.98	1148.13	1007.62	860.35	795.68	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.98	0.92	0.79	0.62	0.67	0.89	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.87	20.12	20.44	20.73	20.92	20.98	20.97	20.84	20.46	20.02	19.68	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.99	19.99	20	20	20	20.01	20.01	20.01	20.01	20	20	20	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	0.99	0.97	0.89	0.71	0.49	0.55	0.83	0.98	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.25	18.5	18.86	19.32	19.72	19.96	20.01	20	19.87	19.36	18.72	18.21	(90)

fLA = Living area ÷ (4) = 0.1 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.4	18.64	18.99	19.43	19.82	20.05	20.1	20.1	19.97	19.47	18.85	18.36	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.4	18.64	18.99	19.43	19.82	20.05	20.1	20.1	19.97	19.47	18.85	18.36	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Utilisation factor for gains, hm:

(94)m=	1	1	0.99	0.96	0.88	0.71	0.51	0.56	0.83	0.97	1	1	(94)

TER WorkSheet: New dwelling design stage

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	850.36	1035.09	1172.48	1259.01	1222.76	961.86	655.39	684.83	951.32	979.71	856.85	794.75	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	2737.71	2662.01	2415.15	2018.89	1554.41	1035.13	665.18	701.32	1117.95	1697.06	2255.55	2728.86	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	1404.19	1093.29	924.55	547.12	246.75	0	0	0	0	533.71	1007.07	1438.98	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 7195.64 (98)

Space heating requirement in kWh/m²/year 41.18 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	1404.19	1093.29	924.55	547.12	246.75	0	0	0	0	533.71	1007.07	1438.98	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1501.81	1169.29	988.82	585.15	263.9	0	0	0	0	570.81	1077.08	1539.01	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 7695.87 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	217.41	191.48	200.75	179.49	175.56	156.37	149.71	164.93	164.84	186.15	197.42	212.02	

Efficiency of water heater 79.8 (216)

(217)m=	88.9	88.73	88.39	87.6	85.72	79.8	79.8	79.8	79.8	87.47	88.55	88.97	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	244.55	215.81	227.13	204.9	204.8	195.96	187.61	206.67	206.56	212.82	222.94	238.31	

Total = Sum(219a)$_{1...12}$ = 2568.06 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		7695.87
Water heating fuel used		2568.06
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)

TER WorkSheet: New dwelling design stage

boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		551.05	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		10889.99	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

		Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	1662.31	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	554.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =				2217.01	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	286	(268)
Total CO2, kg/year	sum of (265)…(271) =				2541.93	(272)

TER = 21.53 (273)

15.6 Appendix F: BREL Reports (SAP 10 Initial Assessment)

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:18

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	1 Bed EF	Plot Reference	1 Bed EF
Address	1 Bed EF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*16.7 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	8.27 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*88.63 kWh_{PE}/m^2*	
Dwelling primary energy	85.74 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*44.8 kWh/m^2*	
Dwelling fabric energy efficiency	42.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.15	Exposed Floor (0.15)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.16	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	25.64	0.23
Exposed wall: Communal Wall	16.89	0.227
Party wall: Party Wall	15.28	0 **(!)**
Ground floor: Exposed Floor	50.41	0.15
Exposed roof: Exposed Roof	0	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	6.54	North	1.0	1.2
3, Windows (1)	2.1	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.2	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.19500000000000003 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:15

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	1 Bed GF	Plot Reference	1 Bed GF
Address	1 Bed Corner GF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*15.59 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	7.25 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*82.64 kWh_{PE}/m^2*	
Dwelling primary energy	75.23 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*39.7 kWh/m^2*	
Dwelling fabric energy efficiency	35.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.16	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	25.64	0.23
Exposed wall: Communal Wall	16.89	0.226
Party wall: Party Wall	15.28	0 **(!)**
Ground floor: Ground Floor	50.41	0.1 **(!)**
Exposed roof: Exposed Roof	0	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	6.54	North	1.0	1.2
3, Windows (1)	2.1	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.19500000000000003 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:16

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	1 Bed MF	Plot Reference	1 Bed MF
Address	1 Bed MF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.47 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.14 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*71.23 kWh_{PE}/m^2*	
Dwelling primary energy	63.97 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*29.6 kWh/m^2*	
Dwelling fabric energy efficiency	28.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.16	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	25.64	0.23
Exposed wall: Communal Wall	16.89	0.227
Party wall: Party Wall	15.28	0 **(!)**
Exposed roof: Exposed Roof	0	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	6.54	North	1.0	1.2
3, Windows (1)	2.1	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.19500000000000003 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:19

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	50 m^2
Site Reference	1 Bed TF	Plot Reference	1 Bed TF
Address	1 Bed TF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*14.92 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.99 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*79.04 kWh_{PE}/m^2*	
Dwelling primary energy	72.68 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*36.3 kWh/m^2*	
Dwelling fabric energy efficiency	34.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.16	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	25.64	0.23
Exposed wall: Communal Wall	16.89	0.226
Party wall: Party Wall	15.28	0 **(!)**
Exposed roof: Cold Roof	50.41	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	6.54	North	1.0	1.2
3, Windows (1)	2.1	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Government-approved scheme	0.06	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.19500000000000003 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations

a. Assessor Declaration

This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration

N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:12

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	72 m^2
Site Reference	2 Bed EF	Plot Reference	2 Bed EF
Address	2 Bed Mid EF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*12.09 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.1 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*63.69 kWh_{PE}/m^2*	
Dwelling primary energy	63.33 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*31.3 kWh/m^2*	
Dwelling fabric energy efficiency	30.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.15	Exposed Floor (0.15)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.16	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	16.69	0.23
Exposed wall: Communal Wall	27.23	0.227
Party wall: Party Wall	29.87	0 **(!)**
Upper floor: Exposed Floor	71.95	0.15
Exposed roof: Exposed Roof	0	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	7.98	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.2	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:09

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	2 Bed GF	Plot Reference	2 Bed GF
Address	2 Bed GF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.2 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.42 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*69.58 kWh_{PE}/m^2*	
Dwelling primary energy	66.56 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*36.8 kWh/m^2*	
Dwelling fabric energy efficiency	32.9 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.17	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	31.93	0.23
Exposed wall: Communal Wall	16.89	0.226
Party wall: Party Wall	20.93	0 **(!)**
Ground floor: Ground Floor	70.71	0.1 **(!)**
Exposed roof: Exposed Roof	0	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	7.95	North	1.0	1.2
3, Windows (1)	2.76	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:10

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	2 Bed MF	Plot Reference	2 Bed MF
Address	2 Bed Corner MF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*11.06 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	5.44 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*58.06 kWh_{PE}/m^2*	
Dwelling primary energy	56.58 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*26.8 kWh/m^2*	
Dwelling fabric energy efficiency	26.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	N/A	N/A	**N/A**
Windows, doors, and roof windows	*1.6*	1.17	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	31.93	0.23
Exposed wall: Communal Wall	16.89	0.227
Party wall: Party Wall	20.93	0 **(!)**
Exposed roof: Exposed Roof	0	0 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	7.95	North	1.0	1.2
3, Windows (1)	2.76	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration
N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Thu 26 Jan 2023 15:58:13

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	Flat, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	71 m^2
Site Reference	2 Bed TF	Plot Reference	2 Bed TF
Address	2 Bed Corner TF, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*13.6 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	6.63 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*71.68 kWh_{PE}/m^2*	
Dwelling primary energy	68.98 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38.6 kWh/m^2*	
Dwelling fabric energy efficiency	37.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.23	External Wall (0.23)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	N/A	N/A	**N/A**
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.17	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: External Wall	38.22	0.23
Exposed wall: Communal Wall	32.72	0.226
Party wall: Party Wall	15.43	0 **(!)**
Exposed roof: Cold Roof	70.81	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	8.41	North	1.0	1.2
3, Windows (1)	3.64	East	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.015 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.01 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.092	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided
External wall	E7: Party floor between dwellings (in blocks of flats)	Not government-approved scheme	0.047	Not Provided
External wall	E9: Balcony between dwellings - wall insulation continuous	Not government-approved scheme	0.35	Not Provided
External wall	E23: Balcony within or between dwellings - balcony support penetrates wall insulation	Not government-approved scheme	0.35	Not Provided
External wall	E15: Flat roof with parapet	Not government-approved scheme	0.28	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.062	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.106	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.04	Not Provided
External wall	E25: Staggered party wall between dwellings	Not government-approved scheme	0.12	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Government-approved scheme	0.06	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.08	Not Provided
Party wall	P3: Intermediate floor between dwellings (in blocks of flats)	Not government-approved scheme	0 **(!)**	Not Provided
Party wall	P7: Exposed floor (normal)	Not government-approved scheme	0.16	Not Provided
Party wall	P8: Exposed floor (inverted)	Not government-approved scheme	0.24	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Room heaters - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	Panel, convector or radiant heaters
Manufacturer	
Model	
Commissioning	
Main heating system 2: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	100.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: N/A		
Capacity	200 litres	
Declared heat loss	1.61 kWh/day	
Primary pipework insulated	No	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: N/A		
Efficiency		
Manufacturer		
Model		

6 Controls		
Main heating 1 - type: Programmer and room thermostats		
Function		
Ecodesign class		
Manufacturer		
Model		
Main heating 2 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: N/A		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.3 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations

a. Assessor Declaration

This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration

N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:40

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Semi-detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	100 m^2
Site Reference	HT Cartographer Semi	Plot Reference	HT Cartographer Semi
Address	HT Cartographer Semi, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.05 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	3.62 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*52.35 kWh$_{PE}$/m^2*	
Dwelling primary energy	39.2 kWh$_{PE}$/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*35.1 kWh/m^2*	
Dwelling fabric energy efficiency	34.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	83.65	0.25
Party wall: Party Wall	45.71	0 **(!)**
Ground floor: Ground Floor	50.18	0.1 **(!)**
Exposed roof: Cold Roof	50.18	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	6.08	North	1.0	1.2
3, Windows (1)	1.42	East	1.0	1.2
4, Windows (1)	7.52	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	372.4%
Emitter type	Underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:45

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	97 m^2
Site Reference	HT Hillard Det	Plot Reference	HT Hillard Det
Address	HT Hillard Det, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*11.31 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	10.98 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*59.17 kWh_{PE}/m^2*	
Dwelling primary energy	57.97 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38.4 kWh/m^2*	
Dwelling fabric energy efficiency	38.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.17	2 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	129.81	0.25
Ground floor: Ground Floor	48.28	0.1 **(!)**
Exposed roof: Cold Roof	48.28	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1 **(!)**
2, Windows (1)	4.2	North	1.0	1.2
3, Windows (1)	7.47	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.6 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	2.1 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:47

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Semi-detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	97 m^2
Site Reference	HT Hillard Semi	Plot Reference	HT Hillard Semi
Address	HT Hillard Semi, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*10.1 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	9.62 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*52.69 kWh_{PE}/m^2*	
Dwelling primary energy	50.64 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*32.7 kWh/m^2*	
Dwelling fabric energy efficiency	32.1 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.22	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	85.1	0.25
Party wall: Party Wall	44.71	0 **(!)**
Ground floor: Ground Floor	48.28	0.1 **(!)**
Exposed roof: Cold Roof	48.28	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	4.2	North	1.0	1.2
3, Windows (1)	7.47	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	2.1 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:43

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	69 m^2
Site Reference	HT Saddler	Plot Reference	HT Saddler
Address	HT Saddler, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*19.21 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	16.77 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*104.93 kWh_{PE}/m^2*	
Dwelling primary energy	93.68 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*53.3 kWh/m^2*	
Dwelling fabric energy efficiency	52.5 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.17	Exposed over unheated store/garage (0.17)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.2	1 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	71.79	0.25
Exposed wall: Wall to Garage	20.51	0.25
Ground floor: Ground Floor	3.63	0.1 **(!)**
Upper floor: Exposed over unheated store/garage	61.49	0.17
Exposed roof: Cold Roof	65.12	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.13	North	0.7	1.2
2, Windows (1)	5.25	North	1.0	1.2
3, Windows (1)	3.04	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.2	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.2	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.19500000000000003 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:51

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	154 m^2
Site Reference	HT Weaver Det	Plot Reference	HT Weaver Det
Address	HT Weaver Det, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*8.78 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	2.98 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*45.86 kWh_{PE}/m^2*	
Dwelling primary energy	31.91 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38.5 kWh/m^2*	
Dwelling fabric energy efficiency	37.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	156.12	0.25
Ground floor: Ground Floor	77.21	0.1 **(!)**
Exposed roof: Cold Roof	77.21	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.13	North	0.7	1.3
2, Windows (1)	11.49	North	1.0	1.2
3, Windows (1)	1.68	East	1.0	1.2
4, Windows (1)	2.87	West	1.0	1.2
5, Windows (1)	15.66	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.039 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.052	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.054	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.05	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.065	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	397.7%
Emitter type	Underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:48

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	138 m^2
Site Reference	The Arkwright DET	Plot Reference	Arkwright DET
Address	Arkwright DET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.31 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.22 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*48.62 kWh_{PE}/m^2*	
Dwelling primary energy	34.54 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38.8 kWh/m^2*	
Dwelling fabric energy efficiency	38.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Brick (2.9N Inner Block) (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Brick (2.9N Inner Block)	144.33	0.25
Ground floor: Suspended Floor	69.16	0.1 **(!)**
Exposed roof: Cold Roof	69.16	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.02	North	0.7	1.3
2, Doors	2.03	East	0.7	1.3
3, Windows (1)	10.65	North	1.0	1.2
4, Windows (1)	1.32	East	1.0	1.2
5, Windows (1)	1.32	West	1.0	1.2
6, Windows (1)	10.5	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.065	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	392.3%
Emitter type	Underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:37

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, End-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	80 m^2
Site Reference	The Baker R1 - ET	Plot Reference	The Baker R1 - ET
Address	The Baker R1 - ET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*11.71 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	11.14 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*61.4 kWh_{PE}/m^2*	
Dwelling primary energy	60.08 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*35.3 kWh/m^2*	
Dwelling fabric energy efficiency	35.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.2	1 (1.2)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	77.8	0.25
Party wall: Party Wall	48.89	0 **(!)**
Ground floor: Suspended Floor	39.97	0.1 **(!)**
Exposed roof: Cold Roof	39.97	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.2
2, Doors	2.15	South	0.7	1.2
3, Windows (1)	3.53	North	1.0	1.2
4, Windows (1)	3.95	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.9 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:38

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	80 m^2
Site Reference	The Baker R1 - MT	Plot Reference	The Baker R1 - MT
Address	The Baker R1 - MT, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*10.39 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	9.86 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*54.26 kWh_{PE}/m^2*	
Dwelling primary energy	53.92 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*29.1 kWh/m^2*	
Dwelling fabric energy efficiency	27.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.24	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	28.99	0.25
Party wall: Party Wall	97.81	0 **(!)**
Ground floor: Suspended Floor	39.97	0.1 **(!)**
Exposed roof: Cold Roof	39.97	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Doors	2.15	South	0.7	1.3
3, Windows (1)	3.53	North	1.0	1.2
4, Windows (1)	3.95	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.6 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:23

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, End-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	94 m^2
Site Reference	The Blenmere - ET	Plot Reference	The Blenmere - ET
Address	The Blenmere - ET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*10.84 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	10.46 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.52 kWh_{PE}/m^2*	
Dwelling primary energy	55.19 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*36.4 kWh/m^2*	
Dwelling fabric energy efficiency	35.4 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	**OK**
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	**OK**
Roofs	*0.16*	0.09	Cold Roof (0.09)	**OK**
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	75.82	0.25
Party wall: Party Wall	48.89	0 **(!)**
Ground floor: Suspended Floor	46.85	0.1 **(!)**
Exposed roof: Cold Roof	46.85	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	7.8	North	1.0	1.2
3, Windows (1)	4.75	East	1.0	1.2
4, Windows (1)	1.5	West	1.0	1.2
5, Windows (1)	4.64	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.8 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:31

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, End-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	80 m^2
Site Reference	The Coiner - ET	Plot Reference	The Coiner - ET
Address	The Coiner - ET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*11.29 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	10.81 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*59.02 kWh_{PE}/m^2*	
Dwelling primary energy	57.3 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*33.7 kWh/m^2*	
Dwelling fabric energy efficiency	33.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Brick (2.9N Inner Block) (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.22	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Brick (2.9N Inner Block)	77.23	0.25
Party wall: Party Wall	48.89	0 **(!)**
Ground floor: Suspended Floor	39.97	0.1 **(!)**
Exposed roof: Cold Roof	39.97	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	3.53	North	1.0	1.2
3, Windows (1)	2.17	South	1.0	1.2
4, Windows (1)	4.51	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.5 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations		
a. Assessor Declaration		
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.		
Signed: Name:	Assessor ID: Date:	
b. Client Declaration		
N/A		

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:54

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	96 m^2
Site Reference	The Framer Det	Plot Reference	The Framer Det
Address	The Framer Det, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*12.05 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	11.44 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*62.99 kWh_{PE}/m^2*	
Dwelling primary energy	60.3 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*42.7 kWh/m^2*	
Dwelling fabric energy efficiency	42.6 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	124.91	0.25
Ground floor: Ground Floor	48.19	0.1 **(!)**
Exposed roof: Cold Roof	48.19	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.14	North	0.7	1.3
2, Doors	2.14	South	0.7	1.3
3, Windows (1)	9.11	North	1.0	1.2
4, Windows (1)	5.33	East	1.0	1.2
5, Windows (1)	12.86	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E4: Jamb	Not government-approved scheme	0.039 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.052	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.054	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.05	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.065	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	2.1 kWp
Orientation	South East
Pitch	30°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:24

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, End-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	94 m^2
Site Reference	The Harper - ET	Plot Reference	The Harper - ET
Address	The Harper - ET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*10.31 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	9.65 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.74 kWh_{PE}/m^2*	
Dwelling primary energy	50.71 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*33.2 kWh/m^2*	
Dwelling fabric energy efficiency	32.3 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	**OK**
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	**OK**
Roofs	*0.16*	0.09	Cold Roof (0.09)	**OK**
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	81.13	0.25
Party wall: Party Wall	48.86	0 **(!)**
Ground floor: Suspended Floor	46.76	0.1 **(!)**
Exposed roof: Cold Roof	46.76	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	2.89	North	1.0	1.2
3, Windows (1)	2.58	North	1.0	1.2
4, Windows (1)	2.99	South	1.0	1.2
5, Windows (1)	4.83	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	2.1 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:26

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	94 m^2
Site Reference	The Harper - MT	Plot Reference	The Harper - MT
Address	The Harper - MT, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*9.23 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	8.25 $kgCO_2/m^2$	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*47.9 kWh_{PE}/m^2*	
Dwelling primary energy	43.2 kWh_{PE}/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*28.1 kWh/m^2*	
Dwelling fabric energy efficiency	26.1 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	**OK**
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	**OK**
Roofs	*0.16*	0.09	Cold Roof (0.09)	**OK**
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	32.27	0.25
Party wall: Party Wall	97.73	0 **(!)**
Ground floor: Suspended Floor	46.76	0.1 **(!)**
Exposed roof: Cold Roof	46.76	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	2.89	North	1.0	1.2
3, Windows (1)	2.58	North	1.0	1.2
4, Windows (1)	2.99	South	1.0	1.2
5, Windows (1)	4.83	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	2.1 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:58

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Semi-detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	112 m^2
Site Reference	The Lacemaker Semi	Plot Reference	The Lacemaker Semi
Address	The Lacemaker Det, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*10.69 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	9.95 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*55.84 kWh_{PE}/m^2*	
Dwelling primary energy	52.27 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*36.8 kWh/m^2*	
Dwelling fabric energy efficiency	36.7 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.24	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.1	Sloping Ceiling (0.13)	OK
Windows, doors, and roof windows	*1.6*	1.18	7 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	97.31	0.25
Exposed wall: Timber Stud Wall	22.1	0.222
Exposed wall: Dormer Cheek	2.88	0.25
Party wall: Party Wall	58.2	0 **(!)**
Ground floor: Ground Floor	43.01	0.1 **(!)**
Exposed roof: Cold Roof	18.77	0.09 **(!)**
Exposed roof: Bay Roof	2.09	0.09 **(!)**
Exposed roof: Exposed Roof	13.33	0.09 **(!)**
Exposed roof: Sloping Ceiling	9.72	0.13
Exposed roof: Dormer Roof	2.16	0.13

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.12	North	0.7	1 **(!)**
2, Windows (1)	3.37	North	1.0	1.2
3, Windows (1)	1.51	East	1.0	1.2
4, Windows (1)	0.84	West	1.0	1.2
5, Windows (1)	8.24	South	1.0	1.2
6, Windows (1)	1.44	North	1.0	1.2
7, Roof windows (1)	0	South	0.7	1.3

Name	Area [m^2]	Orientation	Frame factor	U-Value [W/m^2K]

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.065	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
External wall	E13: Gable (insulation at rafter level)	Not government-approved scheme	0.08	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided
Party wall	P5: Roof (insulation at rafter level)	Not government-approved scheme	0.069	Not Provided
Roof	R1: Head of roof window	Not government-approved scheme	0.08	Not Provided
Roof	R2: Sill of roof window	Not government-approved scheme	0.06	Not Provided
Roof	R3: Jamb of roof window	Not government-approved scheme	0.08	Not Provided
Roof	R7: Flat ceiling (inverted)	Not government-approved scheme	0.04	Not Provided
Roof	R8: Roof to wall (rafter)	Not government-approved scheme	0.06	Not Provided
Roof	R9: Roof to wall (flat ceiling)	Not government-approved scheme	0.04	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	88.9%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	

Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water		
Cylinder/store - type: Cylinder		
Capacity	210 litres	
Declared heat loss	1.48 kWh/day	
Primary pipework insulated	Yes	
Manufacturer		
Model		
Commissioning		
Waste water heat recovery system 1 - type: Instantaneous		
Efficiency	62.7%	
Manufacturer	Q-Blue B.V.	
Model	QB1-21	

6 Controls		
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services		
Function		
Ecodesign class		
Manufacturer		
Model		
Water heating - type: Cylinder thermostat and HW separately timed		
Manufacturer		
Model		

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	3 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations

a. Assessor Declaration

This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	

Signed:	Assessor ID:
Name:	Date:

b. Client Declaration

N/A

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:35

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	124 m^2
Site Reference	The Pargeter	Plot Reference	Pargeter
Address	Pargeter, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*10.26 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	3.47 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*53.58 kWh_{PE}/m^2*	
Dwelling primary energy	37.2 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*41.9 kWh/m^2*	
Dwelling fabric energy efficiency	41 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	59.32	0.25
Exposed wall: Tile Hanging Wall	72.4	0.25
Ground floor: Suspended Floor	63.01	0.1 **(!)**
Exposed roof: Cold Roof	60.97	0.09 **(!)**
Exposed roof: Bay Roof	2.09	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	1.78	North	0.7	1.3
2, Windows (1)	6.44	North	1.0	1.2
3, Windows (1)	3	East	1.0	1.2
4, Windows (1)	5.73	West	1.0	1.2
5, Windows (1)	3.09	South	1.0	1.2
6, Windows (1)	4.43	North	1.0	1.2
7, Windows (1)	3	East	1.0	1.2
8, Windows (1)	1.5	West	1.0	1.2
9, Windows (1)	1.5	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.065	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	389.0%
Emitter type	Underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:42

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, End-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	94 m^2
Site Reference	The Ploughwright - ET	Plot Reference	The Ploughwright - ET
Address	The Ploughwright - ET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*11.42 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	11 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*59.68 kWh_{PE}/m^2*	
Dwelling primary energy	58.72 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38.6 kWh/m^2*	
Dwelling fabric energy efficiency	38.3 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.22	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	76.77	0.25
Party wall: Party Wall	48.91	0 **(!)**
Ground floor: Suspended Floor	46.85	0.1 **(!)**
Exposed roof: Cold Roof	46.85	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Doors	2.15	West	0.7	1.3
3, Windows (1)	8.28	North	1.0	1.2
4, Windows (1)	4.07	East	1.0	1.2
5, Windows (1)	3.27	West	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.2 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:33

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	120 m^2
Site Reference	The Reedmaker - DET	Plot Reference	The Reedmaker - DET
Address	The Reedmaker - DET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*9.7 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	3.44 kgCO_2/m^2	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*50.61 kWh_{PE}/m^2*	
Dwelling primary energy	37 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*37.4 kWh/m^2*	
Dwelling fabric energy efficiency	37.2 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	137.86	0.25
Ground floor: Suspended Floor	59.86	0.1 **(!)**
Exposed roof: Cold Roof	59.86	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Windows (1)	3.67	North	1.0	1.2
3, Windows (1)	0.72	East	1.0	1.2
4, Windows (1)	0.72	West	1.0	1.2
5, Windows (1)	2.99	South	1.0	1.2
6, Windows (1)	3.3	North	1.0	1.2
7, Windows (1)	6.29	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	380.6%
Emitter type	Underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:53

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	92 m^2
Site Reference	The Tenterer Det	Plot Reference	The Tenterer Det
Address	The Tenterer Det, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*11.32 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	10.88 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*59.09 kWh_{PE}/m^2*	
Dwelling primary energy	57.42 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*37.8 kWh/m^2*	
Dwelling fabric energy efficiency	37 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.1	Ground Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	110.19	0.25
Ground floor: Ground Floor	45.18	0.1 **(!)**
Exposed roof: Cold Roof	45.18	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.14	North	0.7	1.3
2, Windows (1)	7.11	North	1.0	1.2
3, Windows (1)	10.78	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E1: Steel lintel with perforated steel base plate	Not government-approved scheme	0.05	Not Provided
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.039 **(!)**	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.052	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.054	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.05	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.8 kWp
Orientation	South East
Pitch	30°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:27

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, End-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m^2
Site Reference	The Tillman - ET	Plot Reference	The Tillman - ET
Address	The Tillman - ET, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*10.73 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	10.34 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*56.12 kWh_{PE}/m^2*	
Dwelling primary energy	55.39 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*34.5 kWh/m^2*	
Dwelling fabric energy efficiency	34.4 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.23	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	82.81	0.25
Party wall: Party Wall	48.9	0 **(!)**
Ground floor: Suspended Floor	46.73	0.1 **(!)**
Exposed roof: Cold Roof	46.73	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Doors	2.15	South	0.7	1.3
3, Windows (1)	2.89	North	1.0	1.2
4, Windows (1)	1.9	North	1.0	1.2
5, Windows (1)	2.99	South	1.0	1.2
6, Windows (1)	1.78	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))

Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.063	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.058	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	OK
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	OK
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	1.2 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:29

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Mid-terrace
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	93 m^2
Site Reference	The Tillman - MT	Plot Reference	The Tillman - MT
Address	The Tillman - MT, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Mains gas	
Target carbon dioxide emission rate	*9.59 $kgCO_2/m^2$*	
Dwelling carbon dioxide emission rate	9.19 $kgCO_2/m^2$	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*49.98 kWh_{PE}/m^2*	
Dwelling primary energy	49.7 kWh_{PE}/m^2	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*29.2 kWh/m^2*	
Dwelling fabric energy efficiency	27.8 kWh/m^2	OK

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.25	Masonary Wall (0.25)	OK
Party walls	*0.2*	0	Party Wall (0)	**N/A**
Curtain walls	*1.6*	0	N/A	**N/A**
Floors	*0.18*	0.1	Suspended Floor (0.1)	OK
Roofs	*0.16*	0.09	Cold Roof (0.09)	OK
Windows, doors, and roof windows	*1.6*	1.23	1 (1.3)	OK
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	33.91	0.25
Party wall: Party Wall	97.79	0 **(!)**
Ground floor: Suspended Floor	46.73	0.1 **(!)**
Exposed roof: Cold Roof	46.73	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.15	North	0.7	1.3
2, Doors	2.15	South	0.7	1.3
3, Windows (1)	2.89	North	1.0	1.2
4, Windows (1)	1.9	North	1.0	1.2
5, Windows (1)	2.99	South	1.0	1.2
6, Windows (1)	1.78	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.04	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.06	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E18: Party wall between dwellings	Not government-approved scheme	0.069	Not Provided
Party wall	P1: Ground floor	Not government-approved scheme	0.043	Not Provided
Party wall	P2: Intermediate floor within a dwelling	Not government-approved scheme	0.073	Not Provided
Party wall	P4: Roof (insulation at ceiling level)	Not government-approved scheme	0.041	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	**OK**
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Boiler with radiators or underfloor heating - Mains gas	
Efficiency	89.0%
Emitter type	Radiators
Flow temperature	
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: N/A	
Capacity	N/A
Declared heat loss	N/A
Primary pipework insulated	N/A
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: N/A	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation	
Technology type: **Photovoltaic system (1)**	
Peak power	0.9 kWp
Orientation	South East
Pitch	45°
Overshading	None or very little
Manufacturer	Not Provided
MCS certificate	

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Stroma SAP 10.2 SAP 10 program, 10.2

Date: Wed 25 Jan 2023 17:55:56

Project Information			
Assessed By	Matt Fitzpatrick	Building Type	House, Detached
OCDEA Registration	STRO003572	Assessment Date	2023-01-25

Dwelling Details			
Assessment Type	As designed	Total Floor Area	175 m^2
Site Reference	The Watchmaker Det	Plot Reference	The Watchmaker Det
Address	The Watchmaker Det, RH20 3JX		

Client Details	
Name	Bellway Homes South London
Company	Not Provided
Address	1st Floor, REDHILL, RH1 1QT

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	*8.35 kgCO_2/m^2*	
Dwelling carbon dioxide emission rate	2.83 kgCO_2/m^2	**OK**
1b Target primary energy rate and dwelling primary energy		
Target primary energy	*43.72 kWh$_{PE}$/m^2*	
Dwelling primary energy	30.2 kWh$_{PE}$/m^2	**OK**
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	*38 kWh/m^2*	
Dwelling fabric energy efficiency	36.9 kWh/m^2	**OK**

2a Fabric U-values				
Element	***Maximum permitted average U-Value [W/m^2K]***	**Dwelling average U-Value [W/m^2K]**	**Element with highest individual U-Value**	
External walls	*0.26*	0.24	Masonary Wall (0.24)	**OK**
Party walls	*0.2*	N/A	N/A	**N/A**
Curtain walls	*1.6*	N/A	N/A	**N/A**
Floors	*0.18*	0.12	Exposed Floor (0.19)	**OK**
Roofs	*0.16*	0.09	Cold Roof (0.09)	**OK**
Windows, doors, and roof windows	*1.6*	1.21	1 (1.3)	**OK**
Rooflights	*2.2*	N/A	N/A	**N/A**

2b Envelope elements (better than typically expected values are flagged with a subsequent (!))		
Name	**Net area [m^2]**	**U-Value [W/m^2K]**
Exposed wall: Masonary Wall	156.42	0.24
Ground floor: Ground Floor	86.4	0.12
Upper floor: Exposed Floor	1.97	0.19
Exposed roof: Cold Roof	88.33	0.09 **(!)**

2c Openings (better than typically expected values are flagged with a subsequent (!))				
Name	**Area [m^2]**	**Orientation**	**Frame factor**	**U-Value [W/m^2K]**
1, Doors	2.02	North	0.7	1.3
2, Doors	1.97	South	0.7	1.3
3, Windows (1)	12.58	North	1.0	1.2
4, Windows (1)	0.67	East	1.0	1.2
5, Windows (1)	0.67	West	1.0	1.2
6, Windows (1)	15.98	South	1.0	1.2

2d Thermal bridging (better than typically expected values are flagged with a subsequent (!))				
Building part **1 - Main Dwelling**: Thermal bridging calculated from linear thermal transmittances for each junction				
Main element	**Junction detail**	**Source**	**Psi value [W/mK]**	**Drawing / reference**
External wall	E2: Other lintels (including other steel lintels)	Not government-approved scheme	0.05	Not Provided

Main element	Junction detail	Source	Psi value [W/mK]	Drawing / reference
External wall	E3: Sill	Not government-approved scheme	0.034 **(!)**	Not Provided
External wall	E4: Jamb	Not government-approved scheme	0.039 **(!)**	Not Provided
External wall	E5: Ground floor (normal)	Not government-approved scheme	0.052	Not Provided
External wall	E6: Intermediate floor within a dwelling	Not government-approved scheme	0 **(!)**	Not Provided
External wall	E10: Eaves (insulation at ceiling level)	Not government-approved scheme	0.06	Not Provided
External wall	E12: Gable (insulation at ceiling level)	Not government-approved scheme	0.054	Not Provided
External wall	E16: Corner (normal)	Not government-approved scheme	0.05	Not Provided
External wall	E17: Corner (inverted - internal area greater than external area)	Not government-approved scheme	-0.065	Not Provided
External wall	E20: Exposed floor (normal)	Not government-approved scheme	0.32	Not Provided
External wall	E21: Exposed floor (inverted)	Not government-approved scheme	0.32	Not Provided

3 Air permeability (better than typically expected values are flagged with a subsequent (!))		
Maximum permitted air permeability at 50Pa	*8 m^3/hm^2*	
Dwelling air permeability at 50Pa	4.65 m^3/hm^2, Design value	OK
Air permeability test certificate reference	Not Provided	

4 Space heating	
Main heating system 1: Heat pump with radiators or underfloor heating - Electricity	
Efficiency	398.7%
Emitter type	Underfloor
Flow temperature	35°C
System type	
Manufacturer	
Model	
Commissioning	
Secondary heating system: N/A	
Fuel	N/A
Efficiency	N/A
Commissioning	

5 Hot water	
Cylinder/store - type: Cylinder	
Capacity	150 litres
Declared heat loss	1.89 kWh/day
Primary pipework insulated	Yes
Manufacturer	
Model	
Commissioning	
Waste water heat recovery system 1 - type: Instantaneous	
Efficiency	62.7%
Manufacturer	Q-Blue B.V.
Model	QB1-21

6 Controls	
Main heating 1 - type: Time and temperature zone control by arrangement of plumbing and electrical services	
Function	
Ecodesign class	
Manufacturer	
Model	
Water heating - type: Cylinder thermostat and HW separately timed	
Manufacturer	
Model	

7 Lighting		
Minimum permitted light source efficacy	*75 lm/W*	
Lowest light source efficacy	75 lm/W	**OK**
External lights control	N/A	

8 Mechanical ventilation		
System type: Decentralised mechanical extract		
Maximum permitted specific fan power	*0.7 W/(l/s)*	
Specific fan power	0.195 W/(l/s)	**OK**
Minimum permitted heat recovery efficiency	*N/A*	
Heat recovery efficiency	N/A	**N/A**
Manufacturer/Model		
Commissioning	Not Provided / Not Provided	

9 Local generation
N/A

10 Heat networks
N/A

11 Supporting documentary evidence
N/A

12 Declarations	
a. Assessor Declaration	
This declaration by the assessor is confirmation that the contents of this BREL Compliance Report are a true and accurate reflection based upon the design information submitted for this dwelling for the purpose of carrying out the "As designed" assessment, and that the supporting documentary evidence (SAP Conventions, Appendix 1 (documentary evidence) schedules the minimum documentary evidence required) has been reviewed in the course of preparing this BREL Compliance Report.	
Signed: Name:	Assessor ID: Date:
b. Client Declaration	
N/A	