

Sustainability & Energy Statement

Land at Cedar Cottage, Sandygate Lane, Lower Beeding

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Appendix 1: TER and DER Worksheets for the Modelled Units

Executive Summary

This Sustainability and Energy Statement has been prepared in support of a detailed planning application for the erection of 24 dwellings with associated parking, landscaping and open space on land at Cedar Cottage, Sandygate Lane, Lower Beeding.

The Statement includes an energy demand assessment showing which selected energy efficiency, low-carbon and renewable energy measures have been considered and those, which will be incorporated into the development.

SAP calculations have been prepared for representative units, the results from which have been aggregated across similar unit types to provide an accurate assessment of the total emissions from the site.

The calculations have allowed the testing of different construction specifications and technologies and the Statement demonstrates how the houses will exceed the requirements of the Building Regulations Part L (2021) and the objectives of the planning policy.

It is proposed to install air source heat pumps into the houses.

All space heating and hot water will therefore be provided to the houses from renewable technologies.

All systems are fuelled by mains electricity and therefore as the National Grid decarbonises so the homes will become zero carbon. The homes are zero carbon ready.

The TER and DER Worksheets for the modelled houses are attached as Appendix 1.

The total reduction in site carbon dioxide emissions from energy efficiency measures and low-carbon and renewable technologies can be summarised as follows;

	Total Emissions	% Reduction
	kg CO ₂ per year	
Baseline (Building Regulations TER)	27,123	
Be Green - after energy efficiency and Heat Pumps (DER)	11,016	59.39%

The water efficiency measures incorporated within the houses will ensure the water use is less than 110 litres per person per day and achieves the enhanced standard required by the Building Regulations (includes 5 l/p/d for external water use) and the planning policy.

The proposal meets the requirements of the adopted policy.

1.0 Introduction

This report has been commissioned by the BlackOnyx Becketts Ltd and provides a Sustainability and Energy Statement in support of a detailed planning application for the erection of 24 dwellings with associated parking, landscaping and open space on land at Cedar Cottage, Sandygate Lane, Lower Beeding.

The Statement describes the methodology used in assessing the dwellings and the initiatives proposed.

The homes have been designed and will be constructed to reduce energy demand and carbon dioxide emissions.

The objective has been to reduce the energy demand to an economic minimum by making investments in the parts of the buildings that have the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once cost-effective structures have been designed, low-carbon and renewable technologies have been considered to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled “A better quality of life: A strategy for sustainable development in the UK”. This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

- National Planning Policy Framework – December 2024 (updated in February 2025)

Paragraph 161 states;

‘The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.’

Local Policy

The local planning policy is provided by the **Horsham District Planning Framework**, which was adopted in November 2015.

The following policies are relevant to this Statement and may have been edited for clarity and specific relevance.

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*
- 5. Measures, which reduce the amount of biodegradable waste sent to landfill.*

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;*
- 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*

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.

Policy 37 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 adaptation, 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.

Note: The Deregulation Act of 2015 withdrew the Code for Sustainable Homes and compliance with the scheme is no longer applicable.

The Council are in the process of preparing their new Local Plan and have published the **Horsham District Local Plan 2023-2040 Regulation 19** (January 2024).

The emerging policies include:

Strategic Policy 6: Climate Change - Carbon Reduction

1. *Development proposals will only be supported where they include measures which contribute to achieving net zero carbon emissions across the District by 2050 at the latest. The Council will be supportive of a range of measures to achieve this target, including but not limited to:*

- a) *Design which incorporates high standards of energy efficiency including optimal levels of thermal insulation, ventilation and cooling and passive solar design;*
- b) *The use of renewable and low carbon energy supply systems and connection to renewable and low carbon heat networks;*
- c) *The efficient use of natural resources used in new buildings to reduce the environmental impacts of construction;*
- d) *Design that influences the behaviour of occupants to reduce energy use;*
- e) *Using patterns of development and providing sustainable transport infrastructure which reduce the need to travel, encourage walking and cycling and include good accessibility to public transport and other forms of sustainable transport and ensure residents have access to services and facilities that are within walking distance;*
- f) *Reduce whole life carbon emissions by retaining and reusing existing buildings, components or materials, including on-site where possible.*

Climate Change Adaptation

- 2. *Development will only be supported if it includes site and building level measures to adapt to the future impacts of climate change and reduce vulnerability, particularly in terms of the comfort, health and wellbeing of current and future occupiers. Flood risk, water supply, overheating and changes to the District's landscape should also be considered. Measures should include but are not limited to:*
 - a) *Use of site and interior building layout: new buildings should be orientated to maximise the opportunities for both natural heating and ventilation and to reduce the exposure to wind and other elements, and the potential for overheating;*
 - b) *The conservation of water supplies to minimise the risk and impact of drought and flooding;*
 - c) *The use of green/blue infrastructure and dual use Sustainable Drainage Systems (SuDS) to provide multifunctional benefits such as helping to absorb heat, reduce surface water runoff, provide flood storage capacity and assist habitat migration; and*
 - d) *Moderating external temperatures through the use of green walls and roofs, tree planting or other nature-based solutions and landscaping for shade and drainage design.*
- 3. *Development will be supported providing it avoids responses to climate impacts which lead to increases in energy use and carbon dioxide emissions. In considering the likely impact of climate change over the lifetime of the development reference should be made to the most recent climate change projections.*

Sustainability Statement

- 4. *Development will be supported provided a Sustainability Statement is submitted which demonstrates how the development has taken measures to mitigate and adapt to the effects of climate change.*

Strategic Policy 7: Appropriate Energy Use

Energy Hierarchy

1. *Development will be supported provided that it contributes to clean, efficient energy in Horsham based on the following cascade:*
 - a) **Be Lean** – use less energy – for example, by minimising energy demand through energy efficiency measures such as fabric performance and passive design;
 - b) **Be Clean** – supply energy efficiently and exploit local energy resources such as secondary heat and district energy networks where available. Preference must be given to technologies with greater efficiencies and fuels with lower carbon emissions to achieve the highest total lifecycle carbon emission savings, in accordance with Part 2 of this policy;
 - c) **Be Green** – maximise the use of renewable energy sources.
 - d) **Be Seen** – monitor, verify and report on energy performance.

Zero and Low Carbon Heating

2. *Development proposals must demonstrate how they will provide zero and low carbon heating in accordance with the following hierarchy. Evidence must be provided that opportunities to meet each level of the hierarchy have been exhausted before cascading to the next level:*
 - a) *Connect to local existing or planned heat networks*, in combination with on-site renewable energy generation;*
 - b) *Maximise use of on-site renewable energy generation;*
 - c) *Use of the optimum means of low or zero-carbon heat supply is demonstrated, based on the in order of preference below:*
 - i. *Use of waste heat sources;*
 - ii. *Electrically-driven ground, water or air source heat pumps;***
 - iii. *Direct Electric Heating. ***

Energy Statements

3. *Residential or commercial development will be supported provided that it includes an Energy Statement, (which may be incorporated into the Sustainability Statement), demonstrating how compliance with this policy has been achieved.*

Renewable Energy Schemes

4. *Stand-alone renewable energy schemes will be supported where they do not conflict with other policies in this Plan. Renewable and low carbon energy generation developments that are led by, or meet the needs of, local communities will carry significant weight.*

**Where a local heat network is planned but not yet in existence or connection is not currently viable, but may become viable in the future, the development should be designed to allow for the cost-effective connection and supply at a later date. In this case the heat should be supplied according to steps 2b and 2c of the above hierarchy.*

***Electric heat pumps and direct electric heating are assumed to become zero-carbon when the national grid decarbonises.*

Strategic Policy 8: Sustainable Design and Construction

1. *Development will be supported where it is demonstrated that sustainable design, including its construction and operation, is integrated into the development from the design stage onwards. To deliver sustainable design, development will only be supported where it meets all of the following requirements that are relevant:*
 - a) *New-build homes to deliver, as a minimum, carbon emissions reduction as set out in the 2021 Edition (or any future update) of the 2010 Building Regulations (Part L);*
 - b) *New non-domestic buildings to achieve a BREEAM rating of 'Excellent', unless it can be demonstrated that this would make the scheme unviable;*
 - c) *Incorporate a Fabric First Approach, maximising the performance of the components and materials that form the building fabric itself, before consideration of the use of mechanical or electrical building service systems;*
 - d) *Minimise construction and demolition waste, utilise recycled and low-impact materials and incorporate measures that reduce the amount of biodegradable waste sent to landfill;*
 - e) *Be designed flexibly to enable future modification of use or layout, facilitating future adaption, refurbishment and retrofitting;*
 - f) *Include the provision of gigabit capable broadband access and enable provision of future communication technologies.*
2. *Where permission is required to retrofit energy efficiency measures into existing development, schemes will be supported in principle.*
3. *Development that involves the retrofitting of an existing historic building (heritage asset) will be supported provided that the following criteria are met:*
 - a) *It does not result in detriment to the significance of the asset or damage to its fabric;*
 - b) *A whole building approach to improving energy efficiency is taken as advocated by Historic England;*
 - c) *Micro-renewable technologies do not result in harm to the heritage asset or their setting;*
 - d) *Where the proposal involves major development, it is demonstrated that opportunities for the retention and retrofitting of existing historic buildings within the site boundary have been included within the scheme.*
4. *In order to demonstrate compliance, proposals should be accompanied by a Sustainability Statement to demonstrate how these measures will be incorporated into development design.*

3.0 Assessment Methodology

The energy strategy uses SAP calculations, which have been prepared for representative units. The results have been aggregated across similar unit types to provide an accurate assessment of the total site emissions and allow different specification options, low-carbon and renewable technologies to be tested.

Emission Factors

The CO₂ emission factors, where applicable, used throughout this report have been taken from the Building Regulation Approved Document L - 2021.

	kg CO ₂ /kWh
Natural gas	0.210
Grid supplied and displaced electricity	0.136

4.0 Proposal

The proposal is for the construction of 24 dwellings.

The accommodation schedule can be expressed as follows:

Unit Type	Number	Area	Area
		m ²	m ²
2-Bedroom Mid-terrace house	1	79.6	79.6
2-Bedroom End-terrace/Semi-detached houses	2	79.6	159.2
2-Bedroom Semi-detached houses	4	79.8	319.2
3-Bedroom Semi-detached houses	4	97.8	391.2
3-Bedroom Detached house	1	97.8	97.8
3-Bedroom Detached house	1	116.6	116.6
3-Bedroom Detached house	1	125.6	125.6
3-Bedroom Semi-detached houses	2	125.8	251.6
3-Bedroom Detached houses	2	127.6	255.2
3-Bedroom Detached houses	2	140.7	281.4
3-Bedroom Semi-detached houses	2	142.3	284.6
4-Bedroom Detached houses	2	177.9	355.8
Total	24		2,717.8

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean and Be Clean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical.

Passive Design Measures

The passive design measures proposed include;

(i) Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The Site Layout sets out all homes in the context of the shape of the site and the surrounding development but generally locates all with either an orientation towards, (i) southeast-northwest, (ii) north-south, (iii) east-west or (vi) southwest-northeast. The design provides all homes with access to direct sunlight throughout the day.

(ii) Natural Daylighting

The design of the site seeks to maximise the standard of natural daylighting to all units. This will create a high-quality internal environment, which will reduce the need for artificial lighting.

(iii) Efficient Building Fabric

a. Building Envelope

U-values of the building envelope must meet Building Regulations Part L (2021) standards and further improvements to U-values will reduce the building's heating requirements.

It is assumed that the houses are built with traditional load bearing brick and block construction using 350mm thick cavity walls, with 102mm brickwork external skin, 150mm fully filled cavity and 100mm medium density blockwork internally.

The ground floors will be insulated with at least 175mm of PIR insulation.

The cold roofs will be insulated with 450mm of mineral wool insulation and flat roofs with 220mm PIR insulation arranged as a warm roof.

Windows are proposed as double glazed with Low 'e' soft coat and argon filled.

It is proposed to set maximum limits for the elemental U-values as follows:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m ² K	W/m ² K	
Ground Floors	0.18	0.11	39%
External Walls	0.26	0.18	31%
Roofs (cold)	0.16	0.10	38%
Flat Roof	0.16	0.11	31%
Windows and Glazed Doors	1.60	1.20	25%
Half Glazed External Doors	1.60	1.00	38%
'g' Value for Glazing			0.50

b. Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building.

The Building Regulations set a minimum standard for air permeability of 8 m³ of air per hour per m² of envelope area, at 50Pa. The SAP modelling has been based on achieving a 50% improvement over Building Regulations and will target a permeability of 4.0 m³/hr/m² for the homes.

c. Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO₂ reduction targets set out in this strategy.

The thermal details for the buildings will be modelled at the detailed working drawing stage but for the purposes of this assessment the thermal details formulated by the Recognised Construction Details have been used. Any details not available on the RCD website will be modelled.

These will enable the buildings to achieve the higher energy efficiency requirements of the Building Regulations.

The following table provides the values currently used within the modelled SAP calculations.

Reference	Location	PSI Value
		W/mK
E2	Other Lintels (including other steel lintels)	0.028
E3	Sill	0.024
E4	Jamb	0.019
E5	Ground Floor (Normal)	0.046
E6	Intermediate Floor	0.000
E10	Eaves (Ceiling)	0.051
E12	Gable (Ceiling)	0.029
E14	Flat Roof	0.041
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079
E18	Party Walls	0.041

d. Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. The ventilation to the En-Suites and Bathrooms will be comprised of continuous extract ventilation as per System 3 criteria. This will reduce the number of external penetrations required to the building envelope.

Active Design Measures will include;

(i) Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Part L of the Building Regulations requires all light fittings to have lamps with a minimum luminous efficacy of 80 light source lumens per circuit-watt. It is assumed all fittings will achieve this standard.

(ii) Space Heating and Hot Water

The SAP modelling has been based upon the installation of air source heat pumps to the houses.

5.2 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low-carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Sandygate Lane to be 4.7 m/s at 10m above ground level and 5.5 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. The use of wind turbines will also have a detrimental aesthetic impact on the appearance of the development.

The use of wind turbines is not proposed.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

CHP units are generally gas fuelled and generate electricity with heat being a by-product. The heat is usually used to meet the hot water load, which is fairly consistent throughout the year.

Historically CO₂ savings have been achieved because gas has been used to generate electricity and gas has had a lower emissions factor than electricity. However, with the de-carbonisation of the electricity grid the benefit of CHP is negated.

CHP is not proposed.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

The houses have insufficient ground area to sustain a horizontal collection system and the installations would require a bore hole to each, which would be cost prohibitive.

The use of ground source heat pumps is not proposed.

Solar

(i) Solar Water Heating

Solar hot water panels use the sun's energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees.

The installation of air source heat pumps reduces the emissions significantly and the installation of solar hot water heating panels would only increase the emissions reduction by a further 5-7%.

Solar hot water panels could be used to reduce emissions but the incremental increase in reductions does not represent good value when compared with other technologies.

Solar hot water heating panels are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels. The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The installation of air source heat pumps reduces the emissions significantly and whilst photovoltaic panels could be installed to some homes without detrimentally impacting the aesthetics of the development, they are not proposed at this stage.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The system works by transferring heat absorbed from the outside air to an indoor space using a wet central heating system to heat radiators or underfloor heating and provide domestic hot water. Heat pumps work similarly to a refrigerator in that they absorb heat and transfer it to another medium.

ASHPs use electricity and through a condenser/ evaporator system put out somewhere between 3.0 and 3.3 times as much energy as they require to run. ASHPs work well with low temperature systems.

The SAP modelling has been based on the installation of air source heat pumps to the houses.

5.3 Establishing Carbon Dioxide Emissions

There are 10 no. end-terrace and semi-detached houses with floor areas of 79.6 m² (4 no.), 79.8 m² (2 no.) and 97.8 m² (4 no.) and SAP calculations have therefore been prepared for a unit at 79.8 m², which are proposed as representative of these 10 units. There is a single mid-terrace house at 79.6 m² and for the purposes of this assessment the emissions are assumed to be similar to the end-terrace unit.

There are five no. detached houses with floor areas of 97.8 m² (1 no.), 116.6 m² (1 no.), 125.6 (1) m² and 127.6 m² and SAP calculations have been prepared for a unit at 116.6 m², which are proposed as representative of these five units.

There are four no. semi-detached houses with floor areas of 125.8 m² (2 no.) and 142.3 m² (2 no.) and SAP calculations have therefore been prepared for a unit at 125.8 m², which are proposed as representative of these four units.

There are four no. detached houses with floor areas of 140.7 m² and 177.9 m² and SAP calculations have been prepared for a unit at 140.7 m², which are proposed as representative of all four.

The TER & DER Worksheets for the modelled houses are attached as Appendix 1 but the emissions can be summarised as follows;

2-Bedroom Semi-detached house – 79.8 m ²	TER Emissions	DER Emissions
	kg CO ₂ /yr	kg CO ₂ /yr
Space heating	475.84	112.52
Water heating	599.11	195.52
Electricity for pumps, fans & keep-hot	11.93	0.00
Electricity for lighting	27.05	33.46
Energy saving/ generation technologies	-255.20	0.00
Total	858.74	341.49
Emissions CO₂/m²	10.76	4.28

3-Bedroom Detached house – 116.6 m ²	TER Emissions	DER Emissions
	kg CO ₂ /yr	kg CO ₂ /yr
Space heating	920.99	232.62
Water heating	637.06	214.76
Electricity for pumps, fans & keep-hot	11.93	0.00
Electricity for lighting	34.94	43.50
Energy saving/ generation technologies	-372.74	0.00
Total	1,232.18	490.87
Emissions CO₂/m²	10.57	4.21

3-Bedroom Semi-detached house – 125.8 m ²	TER Emissions	DER Emissions
	kg CO ₂ /yr	kg CO ₂ /yr
Space heating	793.21	199.57
Water heating	642.87	214.59
Electricity for pumps, fans & keep-hot	11.93	0.00
Electricity for lighting	37.76	47.54
Energy saving/ generation technologies	-402.11	0.00
Total	1,083.66	461.70
Emissions CO₂/m²	8.61	3.67

4-Bedroom Detached house – 140.7 m ²	TER Emissions	DER Emissions
	kg CO ₂ /yr	kg CO ₂ /yr
Space heating	1,117.52	271.97
Water heating	642.44	218.71
Electricity for pumps, fans & keep-hot	11.93	0.00
Electricity for lighting	44.13	56.39
Energy saving/ generation technologies	-490.82	0.00
Total	1,325.20	547.06
Emissions CO₂/m²	9.42	3.89

Summary

The emissions can be aggregated across the 24 units to provide an accurate assessment of the total site emissions as follows;

	Area	CO ₂ TER	CO ₂ DER
	m ²	kg/yr	kg/yr
2 & 3-Bed Terr/Semi-detached houses	949.2	10,213	4,063
3-Bedroom Detached houses	595.2	6,291	2,506
3-Bedroom Semi-detached houses	536.2	4,617	1,968
3 & 4-Bedroom Detached houses	637.2	6,002	2,479
Totals	2,717.8	27,123	11,016

The total emissions allowable through the Building Regulations (TER) are calculated as:

- **27,123 kg CO₂ per year**

With total actual site emissions (DER) assessed as:

- **11,016 kg CO₂ per year**

The site carbon dioxide emissions are reduced by 16,107 kg CO₂ per year as a result of the energy efficiency measures and renewable technologies, which equates to a reduction of 59.39% of the TER emissions.

5.4 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

The application seeks detailed consent for the construction of 24, 2, 3 and 4-bedroom terrace, semi-detached and detached houses.

SAP calculations have been prepared for representative units built to the specification set out above including the installation of air source heat pumps to all houses. The results from the calculations have been aggregated across similar unit types to provide an assessment of the total site emissions.

Various technologies have been considered and whilst wind turbines, combined heat and power, ground source heat pumps and solar hot water heating panels are not considered appropriate the use of photovoltaic panels and air source heat pumps are considered feasible, although the installation of photovoltaic panels are not considered at this stage.

Be Lean

The construction standards for the fabric of the buildings proposes U-values, which demonstrate good practice and improve upon those required by the Building Regulations. Air tightness standards are targeted at a 50% improvement upon the minimum required by the Building Regulations.

In addition, it is proposed to install energy efficiency mechanical and electrical services.

Be Clean and Be Green

As a result of the energy efficiency measures incorporated into the fabric specification of the homes and the installation of air source heat pumps to the houses the total emissions from the site based upon the maximum permissible by the Building Regulations (TER) are calculated as **27,123 kg CO₂ per year**, with actual (DER) emissions after energy efficiency measures and the installation of renewable technologies of **11,016 kg CO₂ per year**.

The emissions are reduced by a total of **16,107 kg CO₂ per year**, which equates to a reduction of **59.39%**.

All space heating and hot water will be provided to the homes from renewable technologies.

All systems to the homes are fuelled by mains electricity and therefore as the National Grid decarbonises so the homes will become zero carbon. The homes are zero carbon ready.

There will be no mains gas connection to the site and therefore there will be no on-site NO_x or CO₂ emissions.

The proposal meets the requirements of the adopted policy.

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and the risk of flooding is regarded as low.

Further details of the flood risk and the proposals for the disposal of surface water are set out within the Flood Risk Assessment and Drainage Strategy, which accompanies the application.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of less than 110 litres per person per day is achieved.

Water efficient devices have been evaluated and will be installed. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the houses:

- water efficient taps;
- water efficient toilets;
- low output showers;
- flow restrictors to manage water pressures to achieve optimum levels and
- water meters.

Below is a typical specification, which would achieve the 110 Litres per person per day target (including five litres per person per day allowance for external water use).

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	6/3 litres dual flush	17.64
Basin	2.0 litres/min.	4.74
Shower	9.0 litres/min	39.33
Bath	175 litres	19.25
Sink	5.0 litres/min	12.56
Washing Machine	6.75 litres/kg	14.18
Dishwasher	1.25 litres/places	4.50
		112.20
	Normalisation Factor	0.91
Total Internal Water Consumption		102.10
External Water Use		5.00
Total Water Consumption		107.10

7.0 Materials and Waste

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. A full evaluation of these suppliers will be undertaken at the next stage of design.

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

All insulation materials to will have a zero ozone depleting potential

Construction waste

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

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

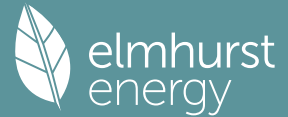
Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.

Appendix 1 – TER & DER Worksheets for the Modelled Units

Full SAP Calculation Printout



Plot Reference	Lower Beeding 2BH SEMI 80				Issued on Date	13/04/2026	
Assessment Reference	Lower Beeding 2BH SEMI 80			Plot Type Ref	Lower Beeding 2BH SEMI 80		
Plot Address	Land at Cedar Cottage, Sandygate Lane, Lower Beeding, West Sussex				SAP Version	10.2	
SAP Rating	83 B	DER	4.28	TER	10.76		
Environmental	96 A	% DER < TER				60.22	
CO ₂ Emissions (t/year)	0.31	DFEE	30.34	TFEE	33.12		
Compliance Check	See BREL	% DFEE < TFEE				8.40	
% DPER < TPER	19.43	DPER	45.14	TPER	56.03		
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001	
Client							

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	39.9000 (1b)	x 2.4000 (2b)	= 95.7600 (1b) - (3b)
First floor	39.9000 (1c)	x 2.4000 (2c)	= 95.7600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 191.5200 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.1044 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3044 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2588 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3299	0.3235	0.3170	0.2846	0.2782	0.2458	0.2458	0.2394	0.2588	0.2782	0.2911	0.3040 (22b)
Effective ac	0.5544	0.5523	0.5502	0.5405	0.5387	0.5302	0.5302	0.5286	0.5335	0.5387	0.5424	0.5462 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			15.3300	1.1450	17.5534		(27)
External Doors			2.1600	1.0000	2.1600		(26a)
Ground Floor			39.9000	0.1100	4.3890		(28a)
External Wall	86.8800	17.4900	69.3900	0.1800	12.4902		(29a)
Roof over FF	39.9000		39.9000	0.1000	3.9900		(30)
Total net area of external elements Aum(A, m ²)			166.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.5826		(33)
Main dwelling							
Party Wall			37.0100	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				11.1300	0.0280		0.3116
E3 Sill				7.1000	0.0240		0.1704
E4 Jamb				22.8000	0.0190		0.4332
E5 Ground floor (normal)				18.1000	0.0460		0.8326
E16 Corner (normal)				9.6000	0.0370		0.3552
E6 Intermediate floor within a dwelling				18.1000	0.0000		0.0000

Full SAP Calculation Printout



E10 Eaves (insulation at ceiling level)	10.3900	0.0510	0.5299
E12 Gable (insulation at ceiling level)	7.7100	0.0290	0.2236
E18 Party wall between dwellings	9.6000	0.0410	0.3936
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			3.2501 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	43.8328 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.0405	34.9070	34.7760	34.1611	34.0460	33.5104	33.5104	33.4113	33.7167	34.0460	34.2788	34.5221 (38)
Heat transfer coeff	78.8733	78.7397	78.6088	77.9938	77.8788	77.3432	77.3432	77.2440	77.5495	77.8788	78.1115	78.3549 (39)
Average = Sum(39)m / 12 =												77.9933
HLP	0.9884	0.9867	0.9851	0.9774	0.9759	0.9692	0.9692	0.9680	0.9718	0.9759	0.9788	0.9819 (40)
HLP (average)												0.9774
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4591 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths												75.4685 (42b)
Hot water usage for other uses												39.8132 (42c)
Average daily hot water use (litres/day)												106.1650 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.2817	112.7131	109.6870	105.3291	101.7022	97.8382	96.5330	99.5481	102.7024	106.7356	111.1535	115.0265 (44)
Energy content (annual)	182.5780	160.5020	168.5849	144.1903	136.9108	120.3035	116.7484	123.2613	126.6423	144.8392	158.3585	180.1038 (45)
Distribution loss (46)m = 0.15 x (45)m												1763.0228
Water storage loss (or HIU loss):												200.0000 (47)
Store volume												1.6800 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.9072 (55)
Enter (49) or (54) in (55)												
Total storage loss												
If cylinder contains dedicated solar storage												
Primary loss												37.2980 (57)
Combi loss												0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS												0.0000 (62)
PV diverter												0.0000 (63a)
Solar input												0.0000 (63b)
FGHRS												0.0000 (63c)
Output from w/h												0.0000 (63d)
12Total per year (kWh/year)												2533.3042 (64)
Electric shower(s)												0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	113.0441	100.6390	108.3914	98.5919	97.8598	90.6495	91.1558	93.3213	92.7572	100.4960	103.3028	112.2214 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	111.7733	123.7490	111.7733	115.4991	111.7733	115.4991	111.7733	111.7733	115.4991	111.7733	115.4991	111.7733 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	219.0220	221.2948	215.5675	203.3748	187.9837	173.5182	163.8543	161.5816	167.3089	179.5016	194.8927	209.3582 (68)
Pumps, fans	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622 (71)
Total internal gains	151.9410	149.7604	145.6874	136.9332	131.5319	125.9022	122.5212	125.4319	128.8294	135.0752	143.4762	150.8353 (72)
	542.6222	554.6900	532.9140	515.6929	491.1747	474.8052	458.0346	458.6726	471.5232	486.2359	513.7538	531.8526 (73)

6. Solar gains

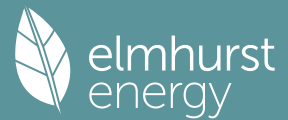
[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W

Southeast						8.7300	36.7938		0.5000	0.7000	0.7700		77.9095 (77)
Southwest						0.7400	36.7938		0.5000	0.7000	0.7700		6.6040 (79)
Northwest						5.8600	11.2829		0.5000	0.7000	0.7700		16.0369 (81)

Solar gains	100.5505	176.6015	255.7828	340.6432	403.1955	409.8015	391.1299	343.0073	284.9413	198.9972	121.4063	85.4225	(83)
Total gains	643.1726	731.2914	788.6968	856.3360	894.3702	884.6067	849.1645	801.6799	756.4645	685.2331	635.1601	617.2751	(84)

7. Mean internal temperature (heating season)

Full SAP Calculation Printout



Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	70.2604	70.3796	70.4968	71.0526	71.1576	71.6503	71.6503	71.7423	71.4597	71.1576	70.9455	70.7252
alpha	5.6840	5.6920	5.6998	5.7368	5.7438	5.7767	5.7767	5.7828	5.7640	5.7438	5.7297	5.7150
util living area	0.9912	0.9811	0.9587	0.8896	0.7494	0.5508	0.3995	0.4410	0.6762	0.9128	0.9802	0.9929 (86)
Living	20.0593	20.2381	20.4686	20.7477	20.9250	20.9892	20.9986	20.9975	20.9673	20.7441	20.3578	20.0252
Non living	19.0100	19.2363	19.5234	19.8579	20.0443	20.1032	20.1086	20.1093	20.0866	19.8623	19.3942	18.9709
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5188	20.2381	20.4686	20.7477	20.9250	20.9892	20.9986	20.9975	20.9673	20.7441	20.3578	20.1616 (87)
Th 2	20.0930	20.0944	20.0958	20.1022	20.1034	20.1091	20.1091	20.1101	20.1069	20.1034	20.1010	20.0985 (88)
util rest of house	0.9886	0.9755	0.9467	0.8600	0.6946	0.4780	0.3193	0.3569	0.6008	0.8824	0.9734	0.9908 (89)
MIT 2	19.6612	19.2363	19.5234	19.8579	20.0443	20.1032	20.1086	20.1093	20.0866	19.8623	19.3942	19.1741 (90)
Living area fraction									fLA = Living area / (4) =			0.1558 (91)
MIT	19.7948	19.3923	19.6706	19.9965	20.1815	20.2412	20.2472	20.2476	20.2238	19.9997	19.5443	19.3279 (92)
Temperature adjustment												0.0000
adjusted MIT	19.7948	19.3923	19.6706	19.9965	20.1815	20.2412	20.2472	20.2476	20.2238	19.9997	19.5443	19.3279 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9875	0.9699	0.9397	0.8560	0.6996	0.4890	0.3318	0.3700	0.6111	0.8783	0.9679	0.9883 (94)
Useful gains	635.1336	709.3062	741.1770	733.0554	625.7330	432.5527	281.7650	296.6019	462.2800	601.8623	614.7743	610.0795 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1222.1272	1141.1224	1035.3252	865.4602	660.5260	436.3117	282.0889	297.2049	474.8991	732.0374	972.0442	1185.3425 (97)
Space heating kWh	436.7232	290.1805	218.8463	95.3314	25.8860	0.0000	0.0000	0.0000	0.0000	96.8502	257.2344	427.9956 (98a)
Space heating requirement - total per year (kWh/year)												1849.0477
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	436.7232	290.1805	218.8463	95.3314	25.8860	0.0000	0.0000	0.0000	0.0000	96.8502	257.2344	427.9956 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1849.0477
Space heating per m2										(98c) / (4) =		23.1710 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													257.6763 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	436.7232	290.1805	218.8463	95.3314	25.8860	0.0000	0.0000	0.0000	0.0000	96.8502	257.2344	427.9956 (98)	
Space heating efficiency (main heating system 1)	257.6763	257.6763	257.6763	257.6763	257.6763	0.0000	0.0000	0.0000	0.0000	257.6763	257.6763	257.6763 (210)	
Space heating fuel (main heating system)	169.4852	112.6144	84.9307	36.9966	10.0459	0.0000	0.0000	0.0000	0.0000	37.5860	99.8285	166.0982 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	247.9992	219.5920	234.0060	207.5011	202.3319	183.6143	182.1695	188.6825	189.9531	210.2604	221.6693	245.5249 (64)	
Efficiency of water heater	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800	182.2800 (216)	
Fuel for water heating, kWh/month	136.0540	120.4696	128.3772	113.8364	111.0006	100.7320	99.9394	103.5125	104.2095	115.3502	121.6092	134.6966 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	28.7235	23.0431	20.7477	15.2007	11.7414	9.5929	10.7109	13.9225	18.0839	23.7271	26.7997	29.5218 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1													717.5856 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													182.2800
Water heating fuel used													1389.7872 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													231.8151 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

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PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2339.1879 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	717.5856	0.1568	112.5152 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1389.7872	0.1407	195.5186 (264)
Space and water heating			308.0338 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	231.8151	0.1443	33.4581 (268)
Total CO2, kg/year			341.4918 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.2800 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	717.5856	1.5805	1134.1082 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1389.7872	1.5202	2112.7290 (278)
Space and water heating			3246.8372 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	231.8151	1.5338	355.5657 (282)
Total Primary energy kWh/year			3602.4029 (286)
Dwelling Primary energy Rate (DPER)			45.1400 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	39.9000 (1b)	x 2.4000 (2b)	= 95.7600 (1b) - (3b)
First floor	39.9000 (1c)	x 2.4000 (2c)	= 95.7600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	191.5200 (5)

2. Ventilation rate

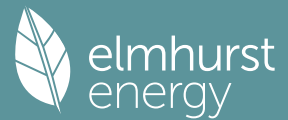
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1566 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4066 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3456 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4407	0.4321	0.4234	0.3802	0.3716	0.3284	0.3284	0.3197	0.3456	0.3716	0.3889	0.4061 (22b)
Effective ac	0.5971	0.5933	0.5896	0.5723	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5756	0.5825 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1600	1.0000	2.1600		(26a)
TER Opening Type			15.3300	1.1450	17.5534		(27)

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Ground Floor				39.9000	0.1300	5.1870	(28a)
External Wall	86.8800	17.4900		69.3900	0.1800	12.4902	(29a)
Roof over FF	39.9000			39.9000	0.1100	4.3890	(30)
Total net area of external elements Aum(A, m2)				166.6800			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =		41.7796	(33)
Main dwelling							
Party Wall				37.0100	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					11.1300	0.0500	0.5565
E3 Sill					7.1000	0.0500	0.3550
E4 Jamb					22.8000	0.0500	1.1400
E5 Ground floor (normal)					18.1000	0.1600	2.8960
E16 Corner (normal)					9.6000	0.0900	0.8640
E6 Intermediate floor within a dwelling					18.1000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)					10.3900	0.0600	0.6234
E12 Gable (insulation at ceiling level)					7.7100	0.0600	0.4626
E18 Party wall between dwellings					9.6000	0.0600	0.5760
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4735 (36)
Point Thermal bridges							(36a) = 0.0000
Total fabric heat loss							(33) + (36) + (36a) = 49.2531 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	37.7381	37.4998	37.2662	36.1690	35.9637	35.0081	35.0081	34.8311	35.3762	35.9637	36.3790	36.8132
	86.9913	86.7530	86.5194	85.4221	85.2168	84.2612	84.2612	84.0842	84.6293	85.2168	85.6321	86.0663
Average = Sum(39)m / 12 =												85.4211
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0901	1.0871	1.0842	1.0705	1.0679	1.0559	1.0559	1.0537	1.0605	1.0679	1.0731	1.0785
HLP (average)												1.0704
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

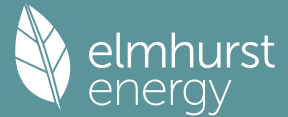
Assumed occupancy												2.4591 (42)
Hot water usage for mixer showers												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths												
	75.4685	74.3477	72.7693	69.8592	67.6801	65.2638	63.9586	65.5259	67.2324	69.8179	72.7880	75.2134 (42b)
Hot water usage for other uses												
	39.8132	38.3654	36.9177	35.4699	34.0222	32.5744	32.5744	34.0222	35.4699	36.9177	38.3654	39.8132 (42c)
Average daily hot water use (litres/day)												106.1650 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.2817	112.7131	109.6870	105.3291	101.7022	97.8382	96.5330	99.5481	102.7024	106.7356	111.1535	115.0265 (44)
Energy conte	182.5780	160.5020	168.5849	144.1903	136.9108	120.3035	116.7484	123.2613	126.6423	144.8392	158.3585	180.1038 (45)
Energy content (annual)												Total = Sum(45)m = 1763.0228
Distribution loss (46)m = 0.15 x (45)m												
	27.3867	24.0753	25.2877	21.6285	20.5366	18.0455	17.5123	18.4892	18.9963	21.7259	23.7538	27.0156 (46)
Water storage loss (or HIU loss):												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8924 (55)
Total storage loss												
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)
If cylinder contains dedicated solar storage												
	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	233.5041	206.4997	219.5109	193.4736	187.8368	169.5868	167.6744	174.1874	175.9256	195.7653	207.6418	231.0298 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	233.5041	206.4997	219.5109	193.4736	187.8368	169.5868	167.6744	174.1874	175.9256	195.7653	207.6418	231.0298 (64)
12Total per year (kWh/year)												2362.6362 (64)
Electric shower(s)												2363 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	101.4480	90.1651	96.7953	87.3699	86.2637	79.4275	79.5597	81.7253	81.5352	88.8999	92.0808	100.6254 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528	122.9528 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	111.7733	123.7490	111.7733	115.4991	111.7733	115.4991	111.7733	111.7733	115.4991	111.7733	115.4991	111.7733 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	219.0220	221.2948	215.5675	203.3748	187.9837	173.5182	163.8543	161.5816	167.3089	179.5016	194.8927	209.3582 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953	35.2953 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622	-98.3622 (71)
Water heating gains (Table 5)												
	136.3549	134.1743	130.1012	121.3471	115.9458	110.3160	106.9351	109.8458	113.2433	119.4891	127.8901	135.2491 (72)
Total internal gains												
	530.0360	542.1039	520.3279	503.1068	478.5886	459.2191	442.4485	443.0865	455.9371	473.6498	501.1677	519.2665 (73)

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W		
Southeast	8.7300				36.7938	0.6300	0.7000	0.7700	0.7700		98.1660 (77)		
Southwest	0.7400				36.7938	0.6300	0.7000	0.7700	0.7700		8.3211 (79)		
Northwest	5.8600				11.2829	0.6300	0.7000	0.7700	0.7700		20.2065 (81)		

Solar gains	126.6936	222.5178	322.2863	429.2104	508.0263	516.3498	492.8236	432.1892	359.0260	250.7364	152.9720	107.6324 (83)	
Total gains	656.7296	764.6217	842.6142	932.3172	986.6149	975.5689	935.2721	875.2757	814.9631	724.3863	654.1397	626.8989 (84)	

7. Mean internal temperature (heating season)													

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.7037	63.8787	64.0512	64.8739	65.0302	65.7677	65.7677	65.9061	65.4817	65.0302	64.7148	64.3883	
alpha	5.2469	5.2586	5.2701	5.3249	5.3353	5.3845	5.3845	5.3937	5.3654	5.3353	5.3143	5.2926	
util living area	0.9914	0.9805	0.9561	0.8819	0.7378	0.5424	0.3948	0.4389	0.6779	0.9137	0.9809	0.9932 (86)	
MIT	19.9113	20.1208	20.3896	20.7119	20.9120	20.9861	20.9979	20.9964	20.9571	20.6940	20.2525	19.8795 (87)	
Th 2	20.0089	20.0114	20.0138	20.0250	20.0272	20.0370	20.0370	20.0388	20.0332	20.0272	20.0229	20.0184 (88)	
util rest of house	0.9888	0.9747	0.9430	0.8498	0.6795	0.4653	0.3093	0.3488	0.5977	0.8823	0.9740	0.9910 (89)	
MIT 2	18.7591	19.0249	19.3602	19.7487	19.9586	20.0297	20.0364	20.0376	20.0069	19.7398	19.2022	18.7258 (90)	
Living area fraction	fLA = Living area / (4) =												
MIT	18.9385	19.1956	19.5205	19.8987	20.1071	20.1787	20.1861	20.1870	20.1549	19.8884	19.3658	18.9055 (92)	
Temperature adjustment	0.0000												
adjusted MIT	18.9385	19.1956	19.5205	19.8987	20.1071	20.1787	20.1861	20.1870	20.1549	19.8884	19.3658	18.9055 (93)	

8. Space heating requirement													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9848	0.9683	0.9349	0.8451	0.6846	0.4769	0.3226	0.3628	0.6083	0.8770	0.9679	0.9876 (94)	
Useful gains	646.7173	740.3987	787.7669	787.9222	675.4488	465.2412	301.7059	317.5559	495.7732	635.2702	633.1641	619.1251 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	1273.4238	1240.1883	1126.5267	939.5325	716.4241	470.0641	302.1726	318.4242	512.4203	791.5277	1050.3443	1265.6443 (97)	
Space heating kWh	466.2697	335.8586	252.0373	109.1594	30.4856	0.0000	0.0000	0.0000	0.0000	116.2556	300.3697	481.0103 (98a)	
Space heating requirement - total per year (kWh/year)	2091.4462												
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)	
Solar heating contribution - total per year (kWh/year)	0.0000												
Space heating kWh	466.2697	335.8586	252.0373	109.1594	30.4856	0.0000	0.0000	0.0000	0.0000	116.2556	300.3697	481.0103 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)	2091.4462												
Space heating per m2	(98c) / (4) = 26.2086 (99)												

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)	
Fraction of space heat from main system(s)												1.0000 (202)	
Efficiency of main space heating system 1 (in %)												92.3000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.2697	335.8586	252.0373	109.1594	30.4856	0.0000	0.0000	0.0000	0.0000	116.2556	300.3697	481.0103 (98)	
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)	
Space heating fuel (main heating system)	505.1676	363.8772	273.0631	118.2659	33.0288	0.0000	0.0000	0.0000	0.0000	125.9540	325.4276	521.1380 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	233.5041	206.4997	219.5109	193.4736	187.8368	169.5868	167.6744	174.1874	175.9256	195.7653	207.6418	231.0298 (64)	
Efficiency of water heater (217)m	85.5793	85.1438	84.3704	82.8280	80.9456	79.8000	79.8000	79.8000	79.8000	82.9317	84.8869	79.8000 (216)	
Fuel for water heating, kWh/month	272.8510	242.5304	260.1752	233.5848	232.0533	212.5148	210.1183	218.2800	220.4581	236.0560	244.6099	269.6892 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)	
Lighting	23.2243	18.6314	16.7755	12.2904	9.4935	7.7563	8.6603	11.2570	14.6217	19.1844	21.6688	23.8698 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.1789	-52.3397	-75.1317	-84.3625	-90.8773	-84.7893	-83.7308	-79.0801	-70.8733	-59.7802	-40.8424	-32.1514 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.2425	-44.6590	-88.7133	-133.1735	-176.0275	-176.8482	-174.7769	-148.0219	-108.5405	-63.8570	-28.3584	-16.8011 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													

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Space heating fuel - main system 1	2265.9222	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2852.9211	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	187.4332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1972.1575	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3420.1191	(238)

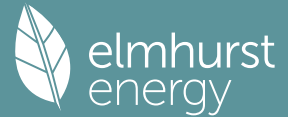
----- 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2265.9222	0.2100	475.8437 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2852.9211	0.2100	599.1134 (264)
Space and water heating			1074.9571 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	187.4332	0.1443	27.0524 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-791.1376	0.1346	-106.4996
PV Unit electricity exported	-1181.0198	0.1259	-148.7022
Total			-255.2018 (269)
Total CO2, kg/year			858.7369 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7600 (273)

----- 13a. Primary energy - Individual heating systems including micro-CHP -----

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2265.9222	1.1300	2560.4921 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2852.9211	1.1300	3223.8008 (278)
Space and water heating			5784.2929 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	187.4332	1.5338	287.4914 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-791.1376	1.4975	-1184.7436
PV Unit electricity exported	-1181.0198	0.4622	-545.8400
Total			-1730.5836 (283)
Total Primary energy kWh/year			4471.3014 (286)
Target Primary Energy Rate (TPER)			56.0300 (287)

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Plot Reference	Lower Beeding 3BH DET 117				Issued on Date	13/04/2026	
Assessment Reference	Lower Beeding 3BH DET 117			Plot Type Ref	Lower Beeding 3BH DET 117		
Plot Address	Land at Cedar Cottage, Sandygate Lane, Lower Beeding, West Sussex				SAP Version	10.2	
SAP Rating	81 B	DER	4.21	TER	10.57		
Environmental	96 A	% DER < TER				60.17	
CO ₂ Emissions (t/year)	0.44	DFEE	37.03	TFEE	40.33		
Compliance Check	See BREL	% DFEE < TFEE				8.19	
% DPER < TPER	20.21	DPER	44.05	TPER	55.20		
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001	
Client							

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	58.3000 (1b)	x 2.4000 (2b)	= 139.9200 (1b) - (3b)
First floor	58.3000 (1c)	x 2.4000 (2c)	= 139.9200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.8400 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.1072 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3072 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2611 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3329	0.3264	0.3199	0.2872	0.2807	0.2481	0.2481	0.2415	0.2611	0.2807	0.2938	0.3068 (22b)
Effective ac	0.5554	0.5533	0.5512	0.5413	0.5394	0.5308	0.5308	0.5292	0.5341	0.5394	0.5431	0.5471 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			21.2200	1.1450	24.2977		(27)
External Doors			2.1600	1.0000	2.1600		(26a)
Ground Floor			58.3000	0.1100	6.4130		(28a)
External Wall	157.1500	23.3800	133.7700	0.1800	24.0786		(29a)
Roof over FF	58.3000		58.3000	0.1000	5.8300		(30)
Total net area of external elements Aum(A, m ²)			273.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.7793		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

List of Thermal Bridges	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	17.0100	0.0280	0.4763
E3 Sill	13.8800	0.0240	0.3331
E4 Jamb	38.7000	0.0190	0.7353
E5 Ground floor (normal)	32.7400	0.0460	1.5060
E16 Corner (normal)	19.2000	0.0370	0.7104
E6 Intermediate floor within a dwelling	32.7400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	32.7400	0.0510	1.6697
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.4309 (36)

$$\begin{aligned} & (36a) = 0.0000 \\ (33) + (36) + (36a) &= 68.2102 \quad (37) \end{aligned}$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.2917	51.0929	50.8981	49.9831	49.8119	49.0150	49.0150	48.8674	49.3220	49.8119	50.1583	50.5203 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	119.5019	119.3031	119.1083	118.1933	118.0221	117.2252	117.2252	117.0776	117.5322	118.0221	118.3684	118.7305 (39) 118.1925

4. Water heating energy requirements (kWh/year)

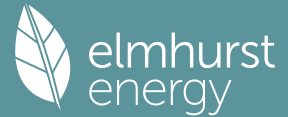
5. Internal gains (see Table 5 and 5a)

6. Solar gains

Solar gains	106.8311	194.0991	297.7844	422.9573	523.0251	540.9185	512.4828	434.5138	340.6095	223.2054	130.1673	89.9962 (83)
Total gains	757.7798	861.0289	937.4243	1042.1494	1111.7352	1109.7058	1060.3516	982.6725	904.6593	804.9429	745.6876	727.3422 (84)

Temperature during heating periods in the living area from Table 9, T_{h1} (C)	21.0000 (85)
Utilisation factor for gains for living area, $u_{l,m}$ (see Table 9a)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	67.7581	67.8710	67.9820	68.5083	68.6077	69.0741	69.0741	69.1611	68.8937	68.6077	68.4069	68.1983
alpha	5.5172	5.5247	5.5321	5.5672	5.5738	5.6049	5.6049	5.6107	5.5929	5.5738	5.5605	5.5466
util living area	0.9970	0.9934	0.9841	0.9468	0.8424	0.6497	0.4820	0.5394	0.7984	0.9650	0.9933	0.9976 (86)
Living	19.8333	19.9973	20.2426	20.5819	20.8481	20.9723	20.9956	20.9920	20.9163	20.5750	20.1473	19.8046
Non living	18.6999	18.9101	19.2220	19.6451	19.9453	20.0632	20.0774	20.0770	20.0197	19.6449	19.1073	18.6673
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.4031	19.9973	20.2426	20.5819	20.8481	20.9723	20.9956	20.9920	20.9163	20.5750	20.1473	19.9718 (87)
Th 2	20.0626	20.0641	20.0654	20.0720	20.0732	20.0789	20.0789	20.0799	20.0767	20.0732	20.0707	20.0681 (88)
util rest of house	0.9961	0.9913	0.9787	0.9284	0.7939	0.5671	0.3835	0.4360	0.7245	0.9493	0.9906	0.9969 (89)
MIT 2	19.5193	18.9101	19.2220	19.6451	19.9453	20.0632	20.0774	20.0770	20.0197	19.6449	19.1073	18.9197 (90)
Living area fraction									fLA = Living area /		(4) =	0.1827 (91)
MIT	19.6808	19.1087	19.4084	19.8162	20.1102	20.2292	20.2451	20.2442	20.1835	19.8148	19.2973	19.1119 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6808	19.1087	19.4084	19.8162	20.1102	20.2292	20.2451	20.2442	20.1835	19.8148	19.2973	19.1119 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9956	0.9882	0.9737	0.9223	0.7960	0.5811	0.4015	0.4549	0.7340	0.9436	0.9876	0.9957 (94)
Useful gains	754.4148	850.8667	912.7592	961.1994	884.9514	644.8810	425.7349	446.9979	663.9797	759.5761	736.4157	724.2495 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1838.0336	1695.1396	1537.4991	1290.2234	992.5934	659.8885	427.3033	450.0669	715.0086	1087.5531	1443.7731	1770.4984 (97)
Space heating kWh	806.2124	567.3514	464.8066	236.8973	80.0857	0.0000	0.0000	0.0000	0.0000	244.0149	509.2973	778.4092 (98a)
Space heating requirement - total per year (kWh/year)												3687.0746
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	806.2124	567.3514	464.8066	236.8973	80.0857	0.0000	0.0000	0.0000	0.0000	244.0149	509.2973	778.4092 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3687.0746
Space heating per m2										(98c) / (4) =		31.6216 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												247.0698 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	806.2124	567.3514	464.8066	236.8973	80.0857	0.0000	0.0000	0.0000	0.0000	244.0149	509.2973	778.4092 (98)
Space heating efficiency (main heating system 1)	247.0698	247.0698	247.0698	247.0698	247.0698	0.0000	0.0000	0.0000	0.0000	247.0698	247.0698	247.0698 (210)
Space heating fuel (main heating system)	326.3096	229.6320	188.1276	95.8827	32.4142	0.0000	0.0000	0.0000	0.0000	98.7635	206.1350	315.0564 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	266.3201	235.6977	250.9228	221.9699	216.0703	195.6862	193.8847	201.0513	202.6611	224.7944	237.5599	263.5976 (64)
Efficiency of water heater (217)m	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122	177.6122 (216)
Fuel for water heating, kWh/month	149.9447	132.7036	141.2757	124.9745	121.6529	110.1761	109.1618	113.1968	114.1031	126.5647	133.7520	148.4119 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	37.3475	29.9616	26.9771	19.7646	15.2667	12.4730	13.9268	18.1026	23.5135	30.8510	34.8461	38.3856 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1492.3210 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												177.6122
Water heating fuel used												1525.9178 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												301.4161 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)

Full SAP Calculation Printout



Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3319.6549 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1492.3210	0.1559	232.6154 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1525.9178	0.1407	214.7555 (264)
Space and water heating			447.3709 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	301.4161	0.1443	43.5037 (268)
Total CO2, kg/year			490.8746 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.2100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1492.3210	1.5771	2353.4854 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1525.9178	1.5204	2319.9933 (278)
Space and water heating			4673.4788 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	301.4161	1.5338	462.3221 (282)
Total Primary energy kWh/year			5135.8009 (286)
Dwelling Primary energy Rate (DPER)			44.0500 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.3000 (1b)	x 2.4000 (2b)	= 139.9200 (1b) - (3b)
First floor	58.3000 (1c)	x 2.4000 (2c)	= 139.9200 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	116.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 279.8400 (5)

2. Ventilation rate

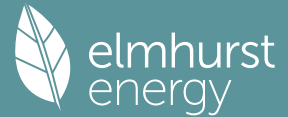
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1429 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3929 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3340 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4258	0.4175	0.4091	0.3674	0.3590	0.3173	0.3173	0.3089	0.3340	0.3590	0.3757	0.3924 (22b)
Effective ac	0.5907	0.5872	0.5837	0.5675	0.5645	0.5503	0.5503	0.5477	0.5558	0.5645	0.5706	0.5770 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1600	1.0000	2.1600		(26a)
TER Opening Type			21.2200	1.1450	24.2977		(27)
Ground Floor			58.3000	0.1300	7.5790		(28a)
External Wall	157.1500	23.3800	133.7700	0.1800	24.0786		(29a)
Roof over FF	58.3000		58.3000	0.1100	6.4130		(30)

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Total net area of external elements Aum(A, m2) 273.7500 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 64.5283 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	17.0100	0.0500	0.8505
E3 Sill	13.8800	0.0500	0.6940
E4 Jamb	38.7000	0.0500	1.9350
E5 Ground floor (normal)	32.7400	0.1600	5.2384
E16 Corner (normal)	19.2000	0.0900	1.7280
E6 Intermediate floor within a dwelling	32.7400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	32.7400	0.0600	1.9644

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4103 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 76.9386 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	54.5470	54.2219	53.9031	52.4062	52.1261	50.8223	50.8223	50.5808	51.3245	52.1261	52.6927	53.2850	(38)
Heat transfer coeff	131.4856	131.1605	130.8417	129.3448	129.0647	127.7609	127.7609	127.5194	128.2631	129.0647	129.6313	130.2236	(39)
Average = Sum(39)m / 12 =												129.3434	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1277	1.1249	1.1221	1.1093	1.1069	1.0957	1.0957	1.0936	1.1000	1.1069	1.1118	1.1168	(40)
HLP (average)												1.1093	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8492 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

Hot water usage for baths 83.0414 81.8081 80.0714 76.8692 74.4715 71.8127 70.3766 72.1012 73.9789 76.8239 80.0920 82.7607 (42b)

Hot water usage for other uses 43.8083 42.2152 40.6222 39.0292 37.4362 35.8431 35.8431 37.4362 39.0292 40.6222 42.2152 43.8083 (42c)

Average daily hot water use (litres/day) 116.8182 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	126.8497	124.0234	120.6936	115.8984	111.9076	107.6558	106.2197	109.5373	113.0081	117.4461	122.3072	126.5690	(44)
Energy conte	200.8989	176.6077	185.5016	158.6591	150.6492	132.3754	128.4636	135.6301	139.3503	159.3732	174.2491	198.1764	(45)
Energy content (annual)										Total = Sum(45)m =		1939.9346	
Distribution loss (46)m = 0.15 x (45)m	30.1348	26.4911	27.8252	23.7989	22.5974	19.8563	19.2695	20.3445	20.9025	23.9060	26.1374	29.7265	(46)
Water storage loss (or HIU loss):													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	251.8250	222.6054	236.4277	207.9424	201.5752	181.6587	179.3896	186.5562	188.6336	210.2993	223.5324	249.1025	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	251.8250	222.6054	236.4277	207.9424	201.5752	181.6587	179.3896	186.5562	188.6336	210.2993	223.5324	249.1025	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2539.5480	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	107.5397	95.5202	102.4202	92.1808	90.8317	83.4415	83.4550	85.8379	85.7606	93.7325	97.3645	106.6345	(65)

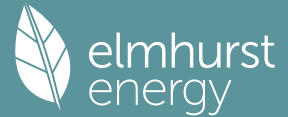
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	142.4581	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	144.3641	159.8317	144.3641	149.1762	144.3641	149.1762	144.3641	144.3641	149.1762	144.3641	149.1762	144.3641	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	280.7184	283.6314	276.2907	260.6634	240.9368	222.3965	210.0105	207.0975	214.4381	230.0654	249.7921	268.3323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	37.2458	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	-113.9665	(71)
Water heating gains (Table 5)	144.5427	142.1432	137.6615	128.0289	122.0856	115.8909	112.1707	115.3735	119.1120	125.9845	135.2284	143.3260	(72)
Total internal gains	638.3626	654.3437	627.0538	606.6060	576.1240	553.2011	532.2827	532.5725	548.4637	569.1514	602.9341	624.7598	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	4.4100	11.2829	0.6300	0.7000	0.7700	15.2066	(75)
Southeast	6.5400	36.7938	0.6300	0.7000	0.7700	73.5402	(77)

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Southwest	1.3400	36.7938	0.6300	0.7000	0.7700	15.0679 (79)
Northwest	8.9300	11.2829	0.6300	0.7000	0.7700	30.7925 (81)

Solar gains	134.6072	244.5649	375.2083	532.9262	659.0117	681.5573	645.7283	547.4874	429.1679	281.2388	164.0109	113.3952 (83)
Total gains	772.9698	898.9086	1002.2621	1139.5322	1235.1356	1234.7585	1178.0110	1080.0599	977.6317	850.3902	766.9450	738.1551 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.5826	61.7352	61.8856	62.6019	62.7377	63.3779	63.3779	63.4979	63.1298	62.7377	62.4635	62.1794
alpha	5.1055	5.1157	5.1257	5.1735	5.1825	5.2252	5.2252	5.2332	5.2087	5.1825	5.1642	5.1453
util living area	0.9969	0.9927	0.9817	0.9387	0.8260	0.6341	0.4719	0.5327	0.7945	0.9634	0.9930	0.9975 (86)
MIT	19.6843	19.8738	20.1561	20.5412	20.8332	20.9678	20.9942	20.9896	20.8995	20.5154	20.0369	19.6575 (87)
Th 2	19.9783	19.9806	19.9828	19.9932	19.9952	20.0043	20.0043	20.0060	20.0008	19.9952	19.9912	19.9871 (88)
util rest of house	0.9958	0.9903	0.9754	0.9177	0.7730	0.5470	0.3679	0.4229	0.7163	0.9465	0.9902	0.9967 (89)
MIT 2	18.4482	18.6914	19.0502	19.5308	19.8574	19.9865	20.0025	20.0024	19.9334	19.5105	18.9082	18.4203 (90)
Living area fraction									fLA = Living area / (4) =			0.1827 (91)
MIT	18.6740	18.9074	19.2523	19.7153	20.0357	20.1657	20.1837	20.1827	20.1099	19.6941	19.1144	18.6463 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6740	18.9074	19.2523	19.7153	20.0357	20.1657	20.1837	20.1827	20.1099	19.6941	19.1144	18.6463 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9938	0.9866	0.9694	0.9106	0.7754	0.5618	0.3870	0.4430	0.7258	0.9400	0.9867	0.9951 (94)
Useful gains	768.1925	886.9057	971.5521	1037.6838	957.6923	693.6493	455.8435	478.4150	709.5410	799.3272	756.7816	734.5021 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1889.9761	1837.2140	1668.5271	1398.9064	1075.8422	711.0808	457.8558	482.3715	770.8474	1173.7210	1557.4406	1881.2474 (97)
Space heating kWh	834.6070	638.6072	518.5494	260.0803	87.9035	0.0000	0.0000	0.0000	0.0000	278.5491	576.4745	853.1785 (98a)
Space heating requirement - total per year (kWh/year)												4047.9493
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	834.6070	638.6072	518.5494	260.0803	87.9035	0.0000	0.0000	0.0000	0.0000	278.5491	576.4745	853.1785 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4047.9493
Space heating per m2										(98c) / (4) =		34.7165 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	834.6070	638.6072	518.5494	260.0803	87.9035	0.0000	0.0000	0.0000	0.0000	278.5491	576.4745	853.1785 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	904.2329	691.8821	561.8087	281.7771	95.2367	0.0000	0.0000	0.0000	0.0000	301.7866	624.5661	924.3537 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating	
Water heating requirement	251.8250
Efficiency of water heater (217)m	86.5377
Fuel for water heating, kWh/month	291.0002
Space cooling fuel requirement	
(221)m	0.0000
Pumps and Fa	7.3041
Lighting	29.9960
Electricity generated by PVs (Appendix M) (negative quantity)	
(233a)m	-52.4444
Electricity generated by wind turbines (Appendix M) (negative quantity)	
(234a)m	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	
(235a)m	0.0000
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	
(235c)m	0.0000
Electricity generated by PVs (Appendix M) (negative quantity)	
(233b)m	-32.9183
Electricity generated by wind turbines (Appendix M) (negative quantity)	
(234b)m	0.0000
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	
(235b)m	0.0000
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	
(235d)m	0.0000
Annual totals kWh/year	
Space heating fuel - main system 1	4385.6439 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3033.6171 (219)
Space cooling fuel	0.0000 (221)

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Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	242.0850 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2881.6236 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4865.7224 (238)

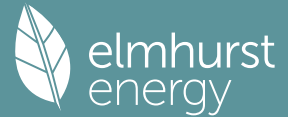
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4385.6439	0.2100	920.9852 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3033.6171	0.2100	637.0596 (264)
Space and water heating			1558.0448 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	242.0850	0.1443	34.9403 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1076.8292	0.1349	-145.2780
PV Unit electricity exported	-1804.7943	0.1260	-227.4605
Total			-372.7386 (269)
Total CO2, kg/year			1232.1759 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.5700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4385.6439	1.1300	4955.7776 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3033.6171	1.1300	3427.9874 (278)
Space and water heating			8383.7650 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	242.0850	1.5338	371.3180 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1076.8292	1.4986	-1613.7721
PV Unit electricity exported	-1804.7943	0.4626	-834.9466
Total			-2448.7187 (283)
Total Primary energy kWh/year			6436.4651 (286)
Target Primary Energy Rate (TPER)			55.2000 (287)

Full SAP Calculation Printout



Plot Reference	Lower Beeding 3BH SEMI 126				Issued on Date	13/04/2026	
Assessment Reference	Lower Beeding 3BH SEMI 126			Plot Type Ref	Lower Beeding 3BH SEMI 126		
Plot Address	Land at Cedar Cottage, Sandygate Lane, Lower Beeding, West Sussex				SAP Version	10.2	
SAP Rating	83 B	DER	3.67	TER	8.61		
Environmental	97 A	% DER < TER				57.38	
CO ₂ Emissions (t/year)	0.42	DFEE	30.23	TFEE	32.72		
Compliance Check	See BREL	% DFEE < TFEE				7.61	
% DPER < TPER	14.15	DPER	38.47	TPER	44.81		
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001	
Client							

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	62.9000 (1b)	x 2.4000 (2b)	= 150.9600 (1b) - (3b)
First floor	62.9000 (1c)	x 2.4000 (2c)	= 150.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 301.9200 (5)

2. Ventilation rate

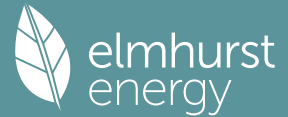
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.0994 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2994 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2545 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3244	0.3181	0.3117	0.2799	0.2735	0.2417	0.2417	0.2354	0.2545	0.2735	0.2863	0.2990 (22b)
Effective ac	0.5526	0.5506	0.5486	0.5392	0.5374	0.5292	0.5292	0.5277	0.5324	0.5374	0.5410	0.5447 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			18.8600	1.1450	21.5954		(27)
External Doors			2.1600	1.0000	2.1600		(26a)
Ground Floor			62.9000	0.1100	6.9190		(28a)
External Wall	110.8300	21.0200	89.8100	0.1800	16.1658		(29a)
Roof over FF	62.9000		62.9000	0.1000	6.2900		(30)
Total net area of external elements Aum(A, m ²)			236.6300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30)		= 53.1302		(33)
Main dwelling							
Party Wall			49.4900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				13.3600	0.0280		0.3741
E3 Sill				10.2300	0.0240		0.2455
E4 Jamb				27.6000	0.0190		0.5244
E5 Ground floor (normal)				23.0900	0.0460		1.0621
E16 Corner (normal)				14.4000	0.0370		0.5328
E6 Intermediate floor within a dwelling				23.0900	0.0000		0.0000

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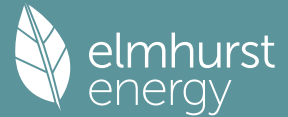
E10 Eaves (insulation at ceiling level)	19.4100	0.0510	0.9899										
E12 Gable (insulation at ceiling level)	3.6800	0.0290	0.1067										
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0790	-0.3792										
E18 Party wall between dwellings	9.6000	0.0410	0.3936										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				3.8500 (36)									
Point Thermal bridges				0.0000									
Total fabric heat loss		(33) + (36) + (36a) =		56.9802 (37)									
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	55.0604	54.8568	54.6572	53.7198	53.5444	52.7279	52.7279	52.5767	53.0424	53.5444	53.8992	54.2702	(38)
Average = Sum(39)m / 12 =	112.0406	111.8370	111.6374	110.7000	110.5246	109.7081	109.7081	109.5569	110.0226	110.5246	110.8794	111.2504	(39)
												110.6991	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8906	0.8890	0.8874	0.8800	0.8786	0.8721	0.8721	0.8709	0.8746	0.8786	0.8814	0.8843	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.8832 (42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	83.7023	82.4592	80.7086	77.4810	75.0641	72.3842	70.9367	72.6750	74.5676	77.4352	80.7294	83.4193	(42b)
Hot water usage for other uses	44.1569	42.5512	40.9455	39.3398	37.7341	36.1284	36.1284	37.7341	39.3398	40.9455	42.5512	44.1569	(42c)
Average daily hot water use (litres/day)												117.7478	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	127.8592	125.0104	121.6541	116.8208	112.7982	108.5126	107.0650	110.4090	113.9074	118.3807	123.2806	127.5762	(44)
Energy content (annual)	202.4977	178.0131	186.9779	159.9218	151.8481	133.4289	129.4859	136.7095	140.4592	160.6415	175.6358	199.7535	(45)
Distribution loss (46)m = 0.15 x (45)m	30.3747	26.7020	28.0467	23.9883	22.7772	20.0143	19.4229	20.5064	21.0689	24.0962	26.3454	29.9630	(46)
Water storage loss (or HIU loss):													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6800	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9072	(55)
Total storage loss	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	(56)
If cylinder contains dedicated solar storage	28.1232	25.4016	28.1232	27.2160	28.1232	27.2160	28.1232	28.1232	27.2160	28.1232	27.2160	28.1232	(57)
Primary loss	37.2980	33.6885	37.2980	36.0948	37.2980	36.0948	37.2980	37.2980	36.0948	37.2980	36.0948	37.2980	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	267.9189	237.1032	252.3990	223.2326	217.2692	196.7397	194.9070	202.1306	203.7700	226.0627	238.9466	265.1747	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	267.9189	237.1032	252.3990	223.2326	217.2692	196.7397	194.9070	202.1306	203.7700	226.0627	238.9466	265.1747	(64)
12Total per year (kWh/year)												2725.6542	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	119.6674	106.4614	114.5071	103.8226	102.8264	95.0137	95.3910	97.7928	97.3513	105.7502	109.0475	118.7550	(65)

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	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.0182	172.7345	156.0182	161.2188	156.0182	161.2188	156.0182	156.0182	161.2188	156.0182	161.2188	156.0182	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.5838	295.6199	287.9690	271.6812	251.1207	231.7968	218.8872	215.8511	223.5020	239.7898	260.3503	279.6742	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	(71)
Water heating gains (Table 5)	160.8433	158.4247	153.9074	144.1981	138.2075	131.9635	128.2137	131.4420	135.2102	142.1374	151.4549	159.6169	(72)
Total internal gains	675.6934	693.0272	664.1427	643.3462	611.5946	591.2272	569.3672	569.5594	586.1791	604.1935	639.2721	661.5574	(73)

6. Solar gains													
[Jan]													
	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	9.0700	11.2829	0.5000	0.7000	0.7700	24.8217	(75)						
Southeast	0.8400	36.7938	0.5000	0.7000	0.7700	7.4964	(77)						
Southwest	8.9500	36.7938	0.5000	0.7000	0.7700	79.8729	(79)						
Solar gains	112.1910	199.3475	294.6555	401.7994	483.5533	494.7940	470.9011	407.6560	331.4049	226.2262	135.8804	95.0406	(83)
Total gains	787.8844	892.3747	958.7982	1045.1456	1095.1478	1086.0212	1040.2683	977.2154	917.5840	830.4197	775.1525	756.5980	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	77.9727	78.1147	78.2543	78.9170	79.0422	79.6305	79.6305	79.7404	79.4029	79.0422	78.7893	78.5266
alpha	6.1982	6.2076	6.2170	6.2611	6.2695	6.3087	6.3087	6.3160	6.2935	6.2695	6.2526	6.2351
util living area												
	0.9973	0.9935	0.9839	0.9443	0.8336	0.6313	0.4621	0.5119	0.7695	0.9601	0.9932	0.9979 (86)
Living	20.0293	20.1823	20.3956	20.6841	20.8970	20.9852	20.9982	20.9966	20.9524	20.6843	20.3089	20.0025
Non living	19.0351	19.2312	19.5022	19.8614	20.0990	20.1828	20.1907	20.1911	20.1572	19.8682	19.3984	19.0049
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.5034	20.1823	20.3956	20.6841	20.8970	20.9852	20.9982	20.9966	20.9524	20.6843	20.3089	20.1420 (87)
Th 2	20.1755	20.1769	20.1782	20.1846	20.1858	20.1913	20.1913	20.1923	20.1892	20.1858	20.1833	20.1808 (88)
util rest of house												
	0.9964	0.9914	0.9786	0.9264	0.7876	0.5580	0.3782	0.4241	0.6998	0.9434	0.9906	0.9972 (89)
MIT 2	19.7209	19.2312	19.5022	19.8614	20.0990	20.1828	20.1907	20.1911	20.1572	19.8682	19.3984	19.2168 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.8334	19.3679	19.6307	19.9797	20.2138	20.2982	20.3068	20.3069	20.2715	19.9856	19.5293	19.3498 (91)
Temperature adjustment												0.0000
adjusted MIT	19.8334	19.3679	19.6307	19.9797	20.2138	20.2982	20.3068	20.3069	20.2715	19.9856	19.5293	19.3499 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9960	0.9887	0.9741	0.9210	0.7893	0.5680	0.3903	0.4367	0.7075	0.9383	0.9878	0.9963 (94)
Useful gains	784.7013	882.2830	933.9518	962.5601	864.3961	616.8521	406.0031	426.7180	649.1505	779.1974	765.7217	753.7629 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	1740.3708	1618.0498	1465.8740	1226.5212	940.9819	625.1361	406.6653	428.0297	679.0082	1037.3385	1378.1548	1685.4274 (97)
Space heating kWh												
	711.0181	494.4353	395.7501	190.0520	56.9798	0.0000	0.0000	0.0000	0.0000	192.0570	440.9518	693.1584 (98a)
Space heating requirement - total per year (kWh/year)												3174.4024
Solar heating kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
	711.0181	494.4353	395.7501	190.0520	56.9798	0.0000	0.0000	0.0000	0.0000	192.0570	440.9518	693.1584 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3174.4024
Space heating per m2										(98c) / (4) =		25.2337 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												248.5042 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement												
	711.0181	494.4353	395.7501	190.0520	56.9798	0.0000	0.0000	0.0000	0.0000	192.0570	440.9518	693.1584 (98)
Space heating efficiency (main heating system 1)												
	248.5042	248.5042	248.5042	248.5042	248.5042	0.0000	0.0000	0.0000	0.0000	248.5042	248.5042	248.5042 (210)
Space heating fuel (main heating system)												
	286.1192	198.9646	159.2529	76.4784	22.9291	0.0000	0.0000	0.0000	0.0000	77.2852	177.4424	278.9323 (211)
Space heating efficiency (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	267.9189	237.1032	252.3990	223.2326	217.2692	196.7397	194.9070	202.1306	203.7700	226.0627	238.9466	265.1747 (64)
Efficiency of water heater												178.7677 (216)
(217)m	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677	178.7677 (217)
Fuel for water heating, kWh/month												
	149.8698	132.6320	141.1883	124.8730	121.5372	110.0532	109.0281	113.0689	113.9859	126.4561	133.6632	148.3348 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	40.8128	32.7416	29.4801	21.5984	16.6832	13.6303	15.2190	19.7822	25.6952	33.7135	38.0793	41.9471 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1277.4040 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.7677
Water heating fuel used												1524.6904 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												329.3828 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3131.4771 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1277.4040	0.1562	199.5711 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1524.6904	0.1407	214.5897 (264)
Space and water heating			414.1607 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	329.3828	0.1443	47.5401 (268)
Total CO2, kg/year			461.7008 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6700 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1277.4040	1.5784	2016.2291 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1524.6904	1.5204	2318.1532 (278)
Space and water heating			4334.3823 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	329.3828	1.5338	505.2183 (282)
Total Primary energy kWh/year			4839.6006 (286)
Dwelling Primary energy Rate (DPER)			38.4700 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	62.9000 (1b)	x 2.4000 (2b)	= 150.9600 (1b) - (3b)
First floor	62.9000 (1c)	x 2.4000 (2c)	= 150.9600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8000		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 301.9200 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

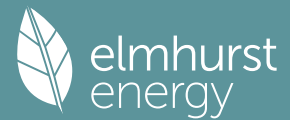
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1325 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3825	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3251 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4145	0.4064	0.3983	0.3576	0.3495	0.3089	0.3089	0.3007	0.3251	0.3495	0.3658	0.3820 (22b)
Effective ac	0.5859	0.5826	0.5793	0.5639	0.5611	0.5477	0.5477	0.5452	0.5528	0.5611	0.5669	0.5730 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1600	1.0000	2.1600		(26a)

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TER Opening Type			18.8600	1.1450	21.5954	(27)
Ground Floor			62.9000	0.1300	8.1770	(28a)
External Wall	110.8300	21.0200	89.8100	0.1800	16.1658	(29a)
Roof over FF	62.9000		62.9000	0.1100	6.9190	(30)
Total net area of external elements Aum(A, m2)			236.6300			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.0172		(33)
Main dwelling						
Party Wall			49.4900	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges						
K1 Element			Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)			13.3600	0.0500	0.6680	
E3 Sill			10.2300	0.0500	0.5115	
E4 Jamb			27.6000	0.0500	1.3800	
E5 Ground floor (normal)			23.0900	0.1600	3.6944	
E16 Corner (normal)			14.4000	0.0900	1.2960	
E6 Intermediate floor within a dwelling			23.0900	0.0000	0.0000	
E10 Eaves (insulation at ceiling level)			19.4100	0.0600	1.1646	
E12 Gable (insulation at ceiling level)			3.6800	0.0600	0.2208	
E17 Corner (inverted - internal area greater than external area)			4.8000	-0.0900	-0.4320	
E18 Party wall between dwellings			9.6000	0.0600	0.5760	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.0793 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.0965 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m	58.3766	58.0442	57.7184	56.1881	55.9018	54.5690	54.5690	54.3221	55.0823	55.9018	56.4810	57.0865	(38)
Heat transfer coeff													
122.4731	122.1407	121.8149	120.2846	119.9983	118.6655	118.6655	118.4187	119.1789	119.9983	120.5775	121.1831	121.1831	(39)
Average = Sum(39)m / 12 =												120.2833	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9736	0.9709	0.9683	0.9562	0.9539	0.9433	0.9433	0.9413	0.9474	0.9539	0.9585	0.9633	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

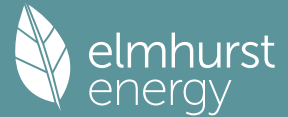
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8832 (42)
Hot water usage for mixer showers													(42a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for baths													(42b)
83.7023	82.4592	80.7086	77.4810	75.0641	72.3842	70.9367	72.6750	74.5676	77.4352	80.7294	83.4193	83.4193	
Hot water usage for other uses													(42c)
44.1569	42.5512	40.9455	39.3398	37.7341	36.1284	36.1284	37.7341	39.3398	40.9455	42.5512	44.1569	44.1569	(42c)
Average daily hot water use (litres/day)												117.7478	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	127.8592	125.0104	121.6541	116.8208	112.7982	108.5126	107.0650	110.4090	113.9074	118.3807	123.2806	127.5762	(44)
Energy conte	202.4977	178.0131	186.9779	159.9218	151.8481	133.4289	129.4859	136.7095	140.4592	160.6415	175.6358	199.7535	(45)
Energy content (annual)										Total = Sum(45)m =	1955.3728		
Distribution loss (46)m = 0.15 x (45)m													
30.3747	26.7020	28.0467	23.9883	22.7772	20.0143	19.4229	20.5064	21.0689	24.0962	26.3454	29.9630	29.9630	(46)
Water storage loss (or HIU loss):													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss													
27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	(56)
If cylinder contains dedicated solar storage													
27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
253.4238	224.0109	237.9040	209.2051	202.7741	182.7122	180.4120	187.6355	189.7425	211.5676	224.9191	250.6796	250.6796	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
253.4238	224.0109	237.9040	209.2051	202.7741	182.7122	180.4120	187.6355	189.7425	211.5676	224.9191	250.6796	250.6796	(64)
12Total per year (kWh/year)												2554.9862	(64)
Electric shower(s)												2555	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
108.0713	95.9876	102.9110	92.6006	91.2303	83.7917	83.7949	86.1968	86.1293	94.1542	97.8255	107.1589	107.1589	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	144.1602	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
156.0182	172.7345	156.0182	161.2188	156.0182	161.2188	156.0182	156.0182	161.2188	156.0182	161.2188	156.0182	156.0182	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
292.5838	295.6199	287.9690	271.6812	251.1207	231.7968	218.8872	215.8511	223.5020	239.7898	260.3503	279.6742	279.6742	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	37.4160	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	-115.3282	(71)
Water heating gains (Table 5)													
145.2572	142.8386	138.3212	128.6120	122.6214	116.3774	112.6276	115.8558	119.6241	126.5513	135.8688	144.0308	144.0308	(72)
Total internal gains													
663.1073	680.4410	651.5565	630.7601	599.0084	575.6411	553.7811	553.9733	570.5930	591.6074	626.6860	648.9713	648.9713	(73)

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6. Solar gains

[Jan]	Area				Solar flux	g	Specific data	FF	Access	Gains		
	m2				Table 6a	W/m2	or Table 6b	Specific data	Table 6c	factor	W	
										Table 6d		
Northeast	9.0700				11.2829	0.6300		0.7000		0.7700	31.2753	(75)
Southeast	0.8400				36.7938	0.6300		0.7000		0.7700	9.4455	(77)
Southwest	8.9500				36.7938	0.6300		0.7000		0.7700	100.6398	(79)
Solar gains	141.3607	251.1779	371.2659	506.2673	609.2771	623.4404	593.3354	513.6465	417.5702	285.0450	171.2093	119.7511 (83)
Total gains	804.4679	931.6189	1022.8225	1137.0274	1208.2856	1199.0815	1147.1165	1067.6198	988.1632	876.6524	797.8953	768.7224 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	71.3308	71.5250	71.7163	72.6287	72.8019	73.6197	73.6197	73.7731	73.3025	72.8019	72.4522	72.0902
alpha	5.7554	5.7683	5.7811	5.8419	5.8535	5.9080	5.9080	5.9182	5.8868	5.8535	5.8301	5.8060
util living area	0.9972	0.9929	0.9817	0.9366	0.8181	0.6170	0.4528	0.5055	0.7662	0.9587	0.9930	0.9978 (86)
MIT	19.9055	20.0826	20.3282	20.6550	20.8873	20.9827	20.9976	20.9956	20.9423	20.6398	20.2198	19.8807 (87)
Th 2	20.1054	20.1076	20.1098	20.1200	20.1219	20.1309	20.1309	20.1325	20.1274	20.1219	20.1181	20.1140 (88)
util rest of house	0.9963	0.9906	0.9756	0.9162	0.7683	0.5402	0.3647	0.4127	0.6928	0.9411	0.9904	0.9971 (89)
MIT 2	18.8240	19.0513	19.3634	19.7711	20.0286	20.1211	20.1301	20.1309	20.0891	19.7618	19.2350	18.7987 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.9795	19.1996	19.5022	19.8982	20.1521	20.2450	20.2548	20.2553	20.2118	19.8880	19.3766	18.9543 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.9795	19.1996	19.5022	19.8982	20.1521	20.2450	20.2548	20.2553	20.2118	19.8880	19.3766	18.9543 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9946	0.9874	0.9702	0.9101	0.7702	0.5506	0.3773	0.4260	0.7005	0.9351	0.9873	0.9957 (94)
Useful gains	800.1054	919.8710	992.3341	1034.7747	930.5772	660.2128	432.8385	454.8164	692.1673	819.7866	787.7269	765.4517 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1797.8459	1746.5590	1583.8590	1322.9126	1014.2380	669.8673	433.7011	456.5339	728.3954	1114.5477	1480.2815	1787.9733 (97)
Space heating kWh	742.3190	555.5343	440.0946	207.4593	62.2437	0.0000	0.0000	0.0000	0.0000	219.3022	498.6393	760.7561 (98a)
Space heating requirement - total per year (kWh/year)	3486.3485											
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000											
Space heating kWh	742.3190	555.5343	440.0946	207.4593	62.2437	0.0000	0.0000	0.0000	0.0000	219.3022	498.6393	760.7561 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	3486.3485											
Space heating per m2	(98c) / (4) = 27.7134 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	92.3000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	742.3190	555.5343	440.0946	207.4593	62.2437	0.0000	0.0000	0.0000	0.0000	219.3022	498.6393	760.7561 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	804.2459	601.8790	476.8089	224.7663	67.4363	0.0000	0.0000	0.0000	0.0000	237.5972	540.2376	824.2212 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	253.4238	224.0109	237.9040	209.2051	202.7741	182.7122	180.4120	187.6355	189.7425	211.5676	224.9191	250.6796 (64)
Efficiency of water heater (217)m	86.3222	86.0124	85.4196	84.0410	81.7459	79.8000	79.8000	79.8000	79.8000	84.1404	85.7923	79.8000 (216)
Fuel for water heating, kWh/month	293.5788	260.4402	278.5122	248.9322	248.0542	228.9626	226.0801	235.1322	237.7726	251.4459	262.1671	290.1877 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	32.4175	26.0065	23.4160	17.1556	13.2514	10.8265	12.0884	15.7130	20.4096	26.7785	30.2463	33.3185 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-56.0989	-77.7111	-109.7440	-121.1045	-128.6180	-119.2615	-117.6950	-112.0168	-101.7828	-87.6951	-61.1463	-48.6562 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-35.9991	-75.2016	-148.5480	-221.8282	-292.1418	-293.1947	-289.8271	-245.9962	-181.0524	-107.2116	-47.9447	-28.5145 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3777.1924	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												3061.2659	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												261.6279	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3108.9901	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4077.0960	(238)

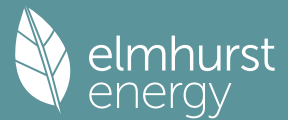
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3777.1924	0.2100	793.2104 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3061.2659	0.2100	642.8658 (264)
Space and water heating			1436.0762 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	261.6279	0.1443	37.7610 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1141.5301	0.1350	-154.0937
PV Unit electricity exported	-1967.4600	0.1261	-248.0174
Total			-402.1111 (269)
Total CO2, kg/year			1083.6554 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.6100 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3777.1924	1.1300	4268.2274 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3061.2659	1.1300	3459.2305 (278)
Space and water heating			7727.4578 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	261.6279	1.5338	401.2936 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1141.5301	1.4989	-1711.0603
PV Unit electricity exported	-1967.4600	0.4627	-910.4079
Total			-2621.4681 (283)
Total Primary energy kWh/year			5637.3841 (286)
Target Primary Energy Rate (TPER)			44.8100 (287)

Full SAP Calculation Printout



Plot Reference	Lower Beeding 3BH DET 141				Issued on Date	13/04/2026	
Assessment Reference	Lower Beeding 3BH DET 141			Plot Type Ref	Lower Beeding 3BH DET 141		
Plot Address	Land at Cedar Cottage, Sandygate Lane, Lower Beeding, West Sussex				SAP Version	10.2	
SAP Rating	81 B	DER	3.89	TER	9.42		
Environmental	96 A	% DER < TER				58.70	
CO ₂ Emissions (t/year)	0.5	DFEE	34.88	TFEE	39.28		
Compliance Check	See BREL	% DFEE < TFEE				11.19	
% DPER < TPER	17.88	DPER	40.66	TPER	49.51		
Assessor Details	Mr. Ivan Ball				Assessor ID	DE88-0001	
Client							

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	76.8000 (1b)	x 2.4000 (2b)	= 184.3200 (1b) - (3b)
First floor	63.9000 (1c)	x 2.4000 (2c)	= 153.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 337.6800 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.0888 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2888 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2455 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3130	0.3069	0.3008	0.2701	0.2639	0.2332	0.2332	0.2271	0.2455	0.2639	0.2762	0.2885 (22b)
Effective ac	0.5490	0.5471	0.5452	0.5365	0.5348	0.5272	0.5272	0.5258	0.5301	0.5348	0.5381	0.5416 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows & Glazed Doors			11.2900	1.1450	12.9275		(27)
External Doors			2.1600	1.0000	2.1600		(26a)
Skylight			1.8000	1.1450	2.0611		(27a)
Ground Floor			76.8000	0.1100	8.4480		(28a)
External Wall	174.3100	13.4500	160.8600	0.1800	28.9548		(29a)
Roof over FF	63.9000		63.9000	0.1000	6.3900		(30)
Flat Roof over GF	5.9500	1.8000	4.1500	0.1100	0.4565		(30)
Total net area of external elements Aum(A, m ²)			320.9600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.3978		(33)

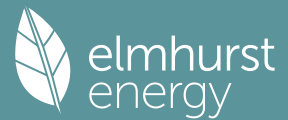
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.6300	0.0280	0.3536
E3 Sill	9.5000	0.0240	0.2280
E4 Jamb	30.4000	0.0190	0.5776
E5 Ground floor (normal)	39.2900	0.0460	1.8073
E16 Corner (normal)	21.6000	0.0370	0.7992
E6 Intermediate floor within a dwelling	33.3400	0.0000	0.0000

7. Mean internal temperature (heating season)

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Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	76.0570	76.1827	76.3064	76.8925	77.0032	77.5225	77.5225	77.6195	77.3216	77.0032	76.7796	76.5473	
alpha	6.0705	6.0788	6.0871	6.1262	6.1335	6.1682	6.1682	6.1746	6.1548	6.1335	6.1186	6.1032	
util living area	0.9985	0.9970	0.9934	0.9772	0.9194	0.7573	0.5740	0.6279	0.8685	0.9818	0.9965	0.9988 (86)	
Living	19.9213	20.0464	20.2390	20.5297	20.7940	20.9568	20.9932	20.9887	20.8967	20.5695	20.2010	19.9002	
Non living	18.8825	19.0436	19.2904	19.6611	19.9773	20.1440	20.1687	20.1675	20.0924	19.7148	19.2463	18.8593	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4482	20.0464	20.2390	20.5297	20.7940	20.9568	20.9932	20.9887	20.8967	20.5695	20.2010	20.0540 (87)	
Th 2	20.1564	20.1577	20.1589	20.1648	20.1659	20.1711	20.1711	20.1720	20.1691	20.1659	20.1637	20.1614 (88)	
util rest of house	0.9980	0.9960	0.9910	0.9683	0.8876	0.6800	0.4706	0.5229	0.8094	0.9730	0.9951	0.9984 (89)	
MIT 2	19.6486	19.0436	19.2904	19.6611	19.9773	20.1440	20.1687	20.1675	20.0924	19.7148	19.2463	19.0940 (90)	
Living area fraction									fLA = Living area / (4) =				0.1565 (91)
MIT	19.7737	19.2005	19.4388	19.7970	20.1052	20.2712	20.2977	20.2960	20.2183	19.8486	19.3957	19.2442 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.7737	19.2005	19.4388	19.7970	20.1052	20.2712	20.2977	20.2960	20.2183	19.8486	19.3957	19.2442 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9977	0.9943	0.9882	0.9632	0.8849	0.6901	0.4868	0.5392	0.8135	0.9685	0.9933	0.9978 (94)
Useful gains	790.0128	865.3635	896.8276	934.4534	887.3047	685.7735	463.1223	485.1036	695.5252	769.6318	764.6513	763.9775 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1987.8634	1834.1193	1656.7841	1384.7007	1066.5203	714.7958	466.0541	490.4388	773.1438	1173.5379	1564.7314	1920.3096 (97)
Space heating kWh	891.2008	651.0039	565.4076	324.1781	133.3364	0.0000	0.0000	0.0000	0.0000	300.5062	576.0576	860.3111 (98a)
Space heating requirement - total per year (kWh/year)												4302.0017
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	891.2008	651.0039	565.4076	324.1781	133.3364	0.0000	0.0000	0.0000	0.0000	300.5062	576.0576	860.3111 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4302.0017
Space heating per m2									(98c) / (4) =			30.5757 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													245.6066 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	891.2008	651.0039	565.4076	324.1781	133.3364	0.0000	0.0000	0.0000	0.0000	300.5062	576.0576	860.3111 (98)	
Space heating efficiency (main heating system 1)	245.6066	245.6066	245.6066	245.6066	245.6066	0.0000	0.0000	0.0000	0.0000	245.6066	245.6066	245.6066 (210)	
Space heating fuel (main heating system)	362.8571	265.0596	230.2087	131.9908	54.2886	0.0000	0.0000	0.0000	0.0000	122.3526	234.5449	350.2802 (211)	
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)	
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)	
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	269.5720	238.5564	253.9255	224.5381	218.5089	197.8290	195.9641	203.2467	204.9167	227.3741	240.3804	266.8054 (64)	
Efficiency of water heater	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351	176.4351 (216)	
Fuel for water heating, kWh/month	152.7882	135.2092	143.9201	127.2639	123.8466	112.1256	111.0687	115.1963	116.1428	128.8713	136.2430	151.2202 (219)	
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)	
Lighting	48.4076	38.8344	34.9661	25.6176	19.7878	16.1668	18.0511	23.4635	30.4768	39.9872	45.1654	49.7530 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1													1751.5824 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													176.4351
Water heating fuel used													1553.8957 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													390.6772 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													

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PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	3696.1554 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1751.5824	0.1553	271.9699 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1553.8957	0.1407	218.7074 (264)
Space and water heating			490.6772 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	390.6772	0.1443	56.3868 (268)
Total CO2, kg/year			547.0640 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8900 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1751.5824	1.5748	2758.4660 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1553.8957	1.5204	2362.5844 (278)
Space and water heating			5121.0504 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	390.6772	1.5338	599.2338 (282)
Total Primary energy kWh/year			5720.2842 (286)
Dwelling Primary energy Rate (DPER)			40.6600 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	76.8000 (1b)	x 2.4000 (2b)	= 184.3200 (1b) - (3b)
First floor	63.9000 (1c)	x 2.4000 (2c)	= 153.3600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	337.6800 (5)

2. Ventilation rate

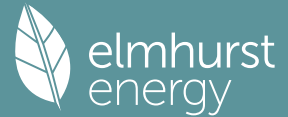
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1185 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3685 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3132 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3993	0.3915	0.3837	0.3445	0.3367	0.2975	0.2975	0.2897	0.3132	0.3367	0.3523	0.3680 (22b)
Effective ac	0.5797	0.5766	0.5736	0.5593	0.5567	0.5443	0.5443	0.5420	0.5490	0.5567	0.5621	0.5677 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Semi-glazed door			2.1600	1.0000	2.1600		(26a)
TER Opening Type			11.2900	1.1450	12.9275		(27)

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TER Roof Light			1.8000	1.5918	3.6397	(27a)
Ground Floor			76.8000	0.1300	9.9840	(28a)
External Wall	174.3100	13.4500	160.8600	0.1800	28.9548	(29a)
Roof over FF	63.9000		63.9000	0.1100	7.0290	(30)
Flat Roof over GF	5.9500	1.8000	4.1500	0.1100	0.4565	(30)
Total net area of external elements Aum(A, m2)			320.9600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	65.1515		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges						
K1 Element				Length	Psi-value	Total
E2 Other lintels (including other steel lintels)				12.6300	0.0500	0.6315
E3 Sill				9.5000	0.0500	0.4750
E4 Jamb				30.4000	0.0500	1.5200
E5 Ground floor (normal)				39.2900	0.1600	6.2864
E16 Corner (normal)				21.6000	0.0900	1.9440
E6 Intermediate floor within a dwelling				33.3400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)				33.3400	0.0600	2.0004
E14 Flat roof				10.4000	0.0800	0.8320

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.6893 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 78.8408 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	64.6014	64.2564	63.9182	62.3300	62.0328	60.6494	60.6494	60.3933	61.1823	62.0328	62.6339	63.2624
Average = Sum(39)m / 12 =	143.4422	143.0972	142.7590	141.1707	140.8736	139.4902	139.4902	139.2340	140.0231	140.8736	141.4747	142.1032
												141.1693

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0195	1.0170	1.0146	1.0033	1.0012	0.9914	0.9914	0.9896	0.9952	1.0012	1.0055	1.0100
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9184
Hot water usage for mixer showers												(42)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for other uses	84.3856	83.1324	81.3675	78.1135	75.6769	72.9751	71.5158	73.2683	75.1764	78.0674	81.3884	84.1003
Average daily hot water use (litres/day)	44.5174	42.8986	41.2798	39.6609	38.0421	36.4233	36.4233	38.0421	39.6609	41.2798	42.8986	44.5174
												118.7091

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	128.9030	126.0309	122.6473	117.7744	113.7190	109.3985	107.9391	111.3104	114.8373	119.3471	124.2870	128.6177
Energy content (annual)	204.1508	179.4664	188.5043	161.2273	153.0877	134.5182	130.5430	137.8255	141.6059	161.9530	177.0696	201.3843
Distribution loss (46)m = 0.15 x (45)m	30.6226	26.9200	28.2756	24.1841	22.9632	20.1777	19.5814	20.6738	21.2409	24.2929	26.5604	30.2076

Water storage loss (or HIU loss): 200.0000 (47)

Store volume 1.6525 (48)

a) If manufacturer declared loss factor is known (kWh/day): 0.5400 (49)

Temperature factor from Table 2b 0.8924 (55)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss 27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 26.7713 27.6637 26.7713 27.6637 (56)

If cylinder contains dedicated solar storage 27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 27.6637 26.7713 27.6637 26.7713 27.6637 (57)

Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)

Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)

Total heat required for water heating calculated for each month 255.0769 225.4641 239.4304 210.5106 204.0138 183.8015 181.4690 188.7516 190.8892 212.8790 226.3529 252.3103 (62)

WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)

PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)

Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63c)

FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)

Output from w/h 255.0769 225.4641 239.4304 210.5106 204.0138 183.8015 181.4690 188.7516 190.8892 212.8790 226.3529 252.3103 (64)

Total per year (kWh/year) = Sum(64)m = 2570.9494 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

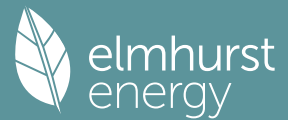
Heat gains from water heating, kWh/month 108.6210 96.4708 103.4185 93.0347 91.6425 84.1539 84.1464 86.5678 86.5106 94.5902 98.3023 107.7011 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	182.3512	201.8889	182.3512	188.4296	182.3512	188.4296	182.3512	182.3512	188.4296	182.3512	188.4296	182.3512
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	310.2065	313.4255	305.3138	288.0449	266.2461	245.7582	232.0711	228.8521	236.9638	254.2327	276.0315	296.5194
Pumps, fans	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000
Water heating gains (Table 5)	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362
Total internal gains	145.9960	143.5577	139.0034	129.2149	123.1754	116.8805	113.1000	116.3546	120.1536	127.1374	136.5310	144.7596
	708.3298	728.6481	696.4445	675.4655	641.5488	617.8444	594.2984	594.3341	612.3231	633.4974	670.7682	693.4063

6. Solar gains

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[Jan]	Area m2				Solar flux Table 6a W/m2	Specific data or Table 6b		g	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
North	7.6500				10.6334	0.6300			0.7000		0.7700		24.8602 (74)
East	0.7400				19.6403	0.6300			0.7000		0.7700		4.4417 (76)
South	2.9000				46.7521	0.6300			0.7000		0.7700		41.4353 (78)
North	1.8000				26.0000	0.6300			0.7000		1.0000		18.5749 (82)
Solar gains	89.3122	162.6372	250.0655	355.4034	439.2335	454.0430	430.2695	365.0553	286.1630	187.2091	108.8974	75.1841	(83)
Total gains	797.6420	891.2853	946.5100	1030.8688	1080.7823	1071.8873	1024.5679	959.3893	898.4861	820.7065	779.6656	768.5904	(84)
7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.1169	68.2811	68.4428	69.2129	69.3589	70.0467	70.0467	70.1756	69.7802	69.3589	69.0642	68.7587	
alpha	5.5411	5.5521	5.5629	5.6142	5.6239	5.6698	5.6698	5.6784	5.6520	5.6239	5.6043	5.5839	
util living area	0.9985	0.9968	0.9930	0.9759	0.9177	0.7628	0.5854	0.6436	0.8787	0.9827	0.9966	0.9988	(86)
MIT	19.7520	19.8949	20.1172	20.4503	20.7507	20.9411	20.9891	20.9819	20.8615	20.4843	20.0693	19.7337	(87)
Th 2	20.0671	20.0692	20.0712	20.0805	20.0823	20.0905	20.0905	20.0920	20.0873	20.0823	20.0787	20.0755	(88)
util rest of house	0.9980	0.9958	0.9904	0.9662	0.8839	0.6806	0.4715	0.5285	0.8187	0.9741	0.9953	0.9984	(89)
MIT 2	18.5994	18.7836	19.0688	19.4957	19.8557	20.0539	20.0867	20.0850	19.9840	19.5433	19.0142	18.5817	(90)
Living area fraction	fLA = Living area / (4) =												0.1565 (91)
MIT	18.7798	18.9575	19.2329	19.6451	19.9958	20.1927	20.2279	20.2253	20.1213	19.6906	19.1794	18.7620	(92)
Temperature adjustment													0.0000
adjusted MIT	18.7798	18.9575	19.2329	19.6451	19.9958	20.1927	20.2279	20.2253	20.1213	19.6906	19.1794	18.7620	(93)
8. Space heating requirement													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9939	0.9871	0.9603	0.8801	0.6906	0.4893	0.5463	0.8214	0.9690	0.9933	0.9975	(94)
Useful gains	795.1922	885.8511	934.3140	989.9190	951.2344	740.2939	501.3221	524.0684	737.9948	795.2305	774.4206	766.6722	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2077.0097	2011.5885	1817.7361	1516.8889	1168.6564	780.1325	506.0589	532.6182	843.1243	1280.6214	1708.9231	2069.3041	(97)
Space heating kWh	953.6723	756.4955	657.2660	379.4184	161.7620	0.0000	0.0000	0.0000	0.0000	361.1309	672.8418	969.1582	(98a)
Space heating requirement - total per year (kWh/year)													4911.7450
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	953.6723	756.4955	657.2660	379.4184	161.7620	0.0000	0.0000	0.0000	0.0000	361.1309	672.8418	969.1582	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													4911.7450
Space heating per m2	(98c) / (4) =												34.9093 (99)
9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	953.6723	756.4955	657.2660	379.4184	161.7620	0.0000	0.0000	0.0000	0.0000	361.1309	672.8418	969.1582	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	1033.2311	819.6051	712.0975	411.0708	175.2567	0.0000	0.0000	0.0000	0.0000	391.2577	728.9727	1050.0088	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.0769	225.4641	239.4304	210.5106	204.0138	183.8015	181.4690	188.7516	190.8892	212.8790	226.3529	252.3103	(64)
Efficiency of water heater	86.7357	86.5585	86.2040	85.3645	83.5446	79.8000	79.8000	79.8000	79.8000	85.2349	86.3485	79.8000	(216)
(217)m	86.7357	86.5585	86.2040	85.3645	83.5446	79.8000	79.8000	79.8000	79.8000	85.2349	86.3485	86.7784	(217)
Fuel for water heating, kWh/month	294.0852	260.4759	277.7485	246.6021	244.1973	230.3276	227.4048	236.5308	239.2095	249.7557	262.1387	290.7526	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	37.8890	30.3960	27.3682	20.0511	15.4880	12.6539	14.1287	18.3650	23.8544	31.2982	35.3513	38.9420	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-66.0925	-90.3355	-125.8461	-136.8863	-143.7068	-132.6335	-130.9054	-125.4470	-115.2963	-101.0518	-71.6131	-57.4729	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-46.3578	-96.3688	-189.5247	-281.8296	-370.0349	-370.9696	-366.6732	-311.6817	-230.0414	-136.9265	-61.5855	-36.7515	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													

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Space heating fuel - main system 1	5321.5005 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.8000
Water heating fuel used	3059.2289 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	305.7858 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3796.0324 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4976.4828 (238)

----- 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP -----

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5321.5005	0.2100	1117.5151 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3059.2289	0.2100	642.4381 (264)
Space and water heating			1759.9532 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	305.7858	0.1443	44.1343 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1297.2872	0.1353	-175.5127
PV Unit electricity exported	-2498.7452	0.1262	-315.3090
Total			-490.8217 (269)
Total CO2, kg/year			1325.1951 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.4200 (273)

----- 13a. Primary energy - Individual heating systems including micro-CHP -----

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5321.5005	1.1300	6013.2956 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3059.2289	1.1300	3456.9286 (278)
Space and water heating			9470.2242 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	305.7858	1.5338	469.0245 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1297.2872	1.5001	-1946.0034
PV Unit electricity exported	-2498.7452	0.4632	-1157.4322
Total			-3103.4356 (283)
Total Primary energy kWh/year			6965.9139 (286)
Target Primary Energy Rate (TPER)			49.5100 (287)