Waterstone Design
Building Service & Environmental Consultants

Former Novartis Site, Parsonage Road, Horsham Lovells Site (Phase 1&2)

SUSTAINABILITY & ENERGY STATEMENT

Muse Developments Ltd
/Lovell Partnerships Ltd

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Issue and Revision Record

Rev	Date	Revision	Reason for Update
P01	12/03/2025	Energy Statement for Planning	First issue

Contents

1.0 Introduction

This report has been produced on behalf of Waterstone Design to demonstrate how the application for the development of the Former Novartis Site, Horsham can achieve a reduction in CO2 emissions over Building Regulations through the provision of renewable and low carbon technology in line with the Horsham District Council.

The following report demonstrates how we can feasibly achieve B EPC ratings on all house types & apartments and demonstrate a 68.41% reduction in CO2 emissions over Building Regulations Part L 2021 (based on the sample set of units assessed) through the provision of Heat Pump technology, Mechanical Ventilation & a low U-value fabric specification as is outlined further below in this report. Please note, as the development is still at the design stage and the drawings have only been issued for planning, results may vary at the Building Regulations stage.

About the development

Figure 1 - Proposed Site Plan

Development proposals are for the construction of 209 dwellings consisting of x7 apartment blocks as x8 House Types. For the purpose of the assessment, a sample set of SAP calculations from Apartment Block C11 & each house type have all been individually assessed and this report accompanies the energy modelling undertaken to address the requirements of the Building Regulations.

2.0 Summary of Targets

The following targets are applicable to the proposed development at Former Novartis Site, Horsham.

Targets set Nationally

Part L of the Building Regulations sets requirements for the conservation of fuel and power in buildings within England and Wales. Among other requirements, new buildings are expected to meet or exceed a TER (Target Emission Rate), a maximum level of regulated emissions expressed in kg of CO2 per m2 per year.

Targets set by Horsham District Council

In accordance with the Horsham District Local Plan (December 2023)

Strategic Policy 6: Climate Change

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.*

Strategic Policy 7: Appropriate Energy Use

The development of renewable and low carbon energy is a key means of reducing the District's contribution to climate change. Renewable and low carbon energy can encompass a wide range of technologies.

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.

Based on the above, there are no specific CO2/Energy reduction targets, however, the council are aiming to achieve a reduction in carbon emissions through the inclusion of renewable and low-carbon sources of energy.

Given the above and after discussion with the client, we have agreed and deemed it appropriate to include both heat pump technology to satisfy the councils policies and the client's preferences for a B rating for all dwellings.

This report outlines the strategy employed in achieving a significant reduction in CO2 emissions and how the development can achieve the targets set by the Horsham District Council. All results and strategies are directly affected by the inputs listed in this and accompanying documents; any deviation from these is certain to output different results. Enforcement bodies must ensure that they are satisfied that the below inputs are an accurate reflection of the final building before using this reporting to demonstrate compliance.

3.0 Proposed Specification (Be Lean)

The following section of the report outlines measures which have been taken to reduce the energy demand of the proposal. This includes both architectural and building fabric measures (passive design) and energy efficient services (active design), considered at the earliest design stage.

The energy systems for use at the development have been considered and selected in response to the local authority's policies with consideration to reducing energy consumption. Electricity has been chosen as the most sustainable fuel and will future proof the development. A combination of Air to Water Air Source Heat pumps (for the houses) and Exhaust Air Heat Pumps (for the apartments) have been selected to reduce carbon emissions. To further enhance the development's energy systems, advanced heating controls have also been recommended.

As well as this, active design measures to reduce energy can include high efficiency lighting and ventilation. Other possible measures include enhanced U-values, air tightness improvement and the development's approach to limiting thermal bridges. The specification for these items for both the apartment blocks and the house types are outlined below.

Specification at 'Be Lean' Stage for the Apartment Block C11

Demand Reduction Measures	**Specification**
Building Fabric - U-Values (W/m²K)	
External Walls	0.14
Corridor Wall	0.18
Plant Room/Bin Store Wall	0.18
Ground Floor	0.12
Exposed Floor/Corridor Below	0.15
Roof Insulation	0.10
Windows & Glazed Doors (whole frame)	0.8 (G-value of 0.40)
Corridor Doors	0.53/0.63 (shelter factor applied)
Party Walls	Single plasterboard on dabs both sides, dense blocks, cavity or cavity fill. Kappa value – 70.00

Internal Walls	Dense Block, plasterboard on dabs. Kappa value – 75.00
Building Fabric - Other	
Air Permeability (m^3/hm^2)	3.0
Thermal Bridging	For the purpose of the energy statement, SAP Appendix R Psi values have been used Please note, bespoke Psi value calculations may need to be carried out at the design stage
Building Services & HVAC	
Ventilation	Nilan Compact P Mechanical Ventilation (86%)
Low Energy Lighting	100% of fittings, minimum efficacy of 85 lumens/circuit watt
Main Heating System	Nilan Compact P Exhaust Air Heat Pump (EAHP) – (302.87% in winter & 194.18% in summer)
Heating Controls	Time and temperature zone controls
Water Heating	180 litre hot water cylinder with from main heating with 0.84kwh/day loss

Specification at 'Be Lean' Stage, Houses

Demand Reduction Measures	**Specification**
Building Fabric - U-Values (W/m^2K)	
External Walls	0.14
Ground Floor	0.12
Exposed Floor	0.15
Insulation at Ceiling Level	0.10
Windows & Glazed Doors (whole frame)	1.2 (G-value of 0.50)
Solid Entrance Doors	1.00
Party Walls	Single plasterboard on dabs both sides, dense blocks, cavity or cavity fill. Kappa value – 70.00
Internal Walls	Dense Block, plasterboard on dabs. Kappa value – 75.00
Building Fabric - Other	
Air Permeability (m^3/hm^2)	4.0
Thermal Bridging	For the purpose of the energy statement, SAP Appendix R Psi values have been used Please note, bespoke Psi value calculations may need to be carried out at the design stage
Building Services & HVAC	
Ventilation	Nuaire ISense-Plus DMEV system (SFP = 0.23)
Low Energy Lighting	100% of fittings, minimum efficacy of 85 lumens/circuit watt
Main Heating System	SAP Default Air to Water Air Source Heat Pump (ASHP) – (170%)
Heating Controls	Time and temperature zone controls
Water Heating	210 litre hot water cylinder with from main heating with 2.1kwh/day loss

Please note, for the purpose of the Be Lean assessment, SAP Default ASHP's have been assumed as the main heating source, so the Be Green assessment can demonstrate a further reduction in CO2 emissions after an ASHP model is specified.

4.0 Be Lean – Predicted Carbon Emissions & Results

For the purpose of the report and in line with Horsham District Council's requirement for the energy hierarchy to be followed, the Be Lean results are summarised below and are based on the above listed specification.

The below figures are based on the sample set of units assessed which include x10 apartments from Block C11 & x8 house types.

As can be seen from the table below, at the Be Lean stage of the assessment and after improving the building fabric, services & HVAC, the energy statement will result in a saving of **12,755.57kg CO2/year** which equates to a **62.48%** reduction in CO2 emissions over Building Regulations Part L.

SAP 10	Area Weighted DER (kgCO2/yr/m2)	Total CO2 Emissions (kgCO2/yr)	Total Floor Area (m2)	Reduction in CO2
Baseline	11.54	20,414.73	1,769.12	N/A
Be Lean	4.33	7,659.16	1,769.12	-62.48%

5.0 Heating Infrastructure (Be Clean)

5.1 The Future Homes Standard

Under the government's current plans, gas and oil boilers will be banned in newbuild homes from 2025. The government has stated that "… a low carbon heating system will be integral to the specification of the Future Homes Standard and we anticipate that heat pumps will become the primary heating technology for new homes"

5.2 The Heating Hierarchy

The energy systems for use at the development have been considered and selected in accordance with the order of preference within 'Energy Assessment Guidance' on preparing energy assessments as part of planning applications. The hierarchy is as follows:

- **Connection to an area wide heat network**. Where proposed developments are located near to existing or planned networks, connection must be prioritised.
- **Communal heating system**
    - **Site-wide heat network**. Where proposed developments are located in areas of decentralised energy potential, but no heat networks currently exist or are planned, developers should provide a site-wide heat network served by a single energy centre to future proof the development for easy connection to a wider heat network in the future.
    - **Building-level heating system**. Appropriate for single building applications or low density developments with domestic blocks, where no district heating networks are planned or feasible.
- **Individual heating system**. Appropriate for low density individual housing, where no district heating networks are planned or feasible, and where evidence is provided that a site-wide heat network is uneconomic.

6.0 Consideration of Renewable/Low Carbon Technology

6.1 Photovoltaic Solar Panels

Photovoltaic panel systems convert energy from the sun into electricity through semi-conductor cells mounted in collector panels. The panels are connected to an inverter to turn the DC output into AC for use in the building to which they are attached and to be fed back into the grid when not required. Photovoltaic arrays provide a quiet and effective renewable energy source with a relatively low aesthetic impact. The major benefit of PV systems is the significant reductions they can achieve in comparison to other technologies, in terms of CO2 and energy use.

The PV panels should ideally be orientated between southeast and southwest (optimally south). The optimal tilt angle (inclination of panel from horizontal) should be calculated to ensure the best possible output of the system during the year. In the UK, the angles of most pitched roofs are suitable for mounting PV panels. Panels can also be mounted on A-frames on flat roofed buildings. PV technology comes in a range of forms: PV panels that can be retrofitted to the roof of an existing building or equally, sunk to fit flush with the roof line; PV cells that are 'laminated' between sheets of glass to provide shading in a glazed area, and PV cladding.

PV systems are low maintenance as they have no moving parts and panels generally have 25 year warranties, although the lifetime of the panel can be expected to be beyond this time. PV systems should not be shaded. Shading caused by other buildings, greenery and roof 'furniture' such as chimneys or satellite dishes, even over a small area of the panel, can significantly reduce performance. Excess energy can be exported to the grid. Although the Feed-in Tariffs are generally not high, exporters can negotiate with their utility company. Future consideration may be given to the benefits of battery storage.

Payback times for this technology are usually approximately twenty years; but this is reducing year on year as the technology matures and are set to reduce further as fuel prices increase. Integrating PV into a building and replacing other building materials can further offset the cost.

6.2 Solar Hot Water Systems

Solar water heating systems use the energy from the sun to heat water stored in a hot water cylinder inside the building. A solar collector comprises a housing that contains piping, through which the carrier fluid circulates, and a glass panel to retain the radiation from the sun. The temperature inside the collector increases and this heat is then transferred to a carrier fluid. In an open loop system, the hot water is heated directly.

Solar thermal panels are generally black in appearance for maximising energy absorption and the glass panels have a special coating in order to retain as much heat as possible. Two types of collector exist: flat plate and evacuated tube. Flat plate collectors can be mounted on or flush with the roof. The air in the collection tubes can be evacuated to reduce heat losses within the frame by convection. Evacuated tube collectors need to be re-evacuated every few years. They are more difficult to install but are more efficient and allow higher temperature heating.

Solar thermal collectors offer a good price-performance ratio. Solar hot water systems are best suited to developments with high hot water requirements, such as hotels, care homes and leisure centres. Many systems have been installed in the UK and they work well, even without direct sunlight. Solar thermal systems should be sized to the hot water requirements of the user since any excess heat that is generated cannot be exported elsewhere. The optimal angle for mounting depends on when the water demand is greatest. Ideally, the collectors should be mounted onto a non-shaded, south-facing roof.

Solar thermal technology is a cost effective way to reduce carbon emissions, especially if it is replacing electric water heating. Due to limited roof space, solar hot water cannot be used effectively alongside photovoltaic arrays. Accordingly, it is considered preferable to install photovoltaic panels as these represent a greater carbon saving.

6.3 Biomass Heating

With the long term availability of fossil fuels such as oil and gas, and the persistent number of price rises of oil and natural gas a growing concern in the UK, alternative heating methods such as wood burning boilers are becoming more popular.

Due to technical advances in wood burning technology, and improvements in the preparation of wood fuels, efficiencies of new wood pellet burning boilers have increased to around 90%, with carbon monoxide emissions dropping dramatically. There are three types of wood burning boiler - logs, woodchips and wood pellets. Wood logs are the most readily available, generally produced as a by-product from forestry and woodland from sawmills, tree surgery and wind damage.

Wood chips have a high moisture content which tends to restrict their efficiency to only 50% and they tend to suffer from blockages hence we would be cautious about their use on this site. Storage space requirements are also high due to the irregularity of the chips. Wood pellets are made from dry waste wood, such as used pallets and off-cuts/sawdust from furniture manufacturers. The waste wood is compressed into uniform, high density pellets that are easier to transport, handle and store than other forms of wood fuel.

Biomass combustion systems (BCS) are generally more mechanically complex than conventional boiler heating systems, especially when it comes to fuel delivery, storage, handling and combustion. The complexity is necessary because of the different combustion characteristics of biomass as compared to conventional fossil fuels. The increased complexity means higher capital costs than for conventional systems. BCSs typically require more frequent maintenance and greater operator attention than conventional systems. As a result, the degree of operator dedication to the system is critical to its success. They often require special attention to fire insurance premiums, air quality standards, ash disposal options and general safety issues.

Domestic scale boilers such as Woodchip-fed systems remain very costly and the requirements for siting both the boiler and the fuel source were considered impractical for this development.

There are also some concerns on current availability of suitable fuel within a reasonable distance of the development as well as the additional traffic that would be associated with it. The use of efficient heat pumps is considered more suitable.

Biomass can be burnt directly to provide heat in buildings using wood from forests, urban tree pruning, and farmed coppices or as liquid biofuel, such as bio diesel. In non-domestic applications, biomass boilers replace conventional fossil fuel boilers and come with automated features to enable reduced user intervention. Due to the size of the proposed project, biomass energy has not been considered as an economically suitable technology for this development.

6.4 Heat Pumps

Heat pumps transfer heat from a lower temperature source to one of a higher temperature. These are split into three main categories:

- Air source heat pumps operate by converting the energy of the outside air into heat, creating a comfortable temperature inside the building as well as supplying energy for the hot water system. Air-to-water systems provide hot water for direct use or to supply ‘wet’ heating through underfloor heating or radiators. Air-to-air systems provide hot air, either directly into an internal space, or to be distributed by fans.

- Ground source heat pumps apply the same principle to heat energy stored underground. In this case a circuit of piping is buried horizontally or via a bore hole.

- Water source heat pumps absorb heat from a local water source, such as a lake, river, well, or borehole.

The most prevalent system is an air source heat pump. As with all heat pumps, air source models are most efficient when supplying low temperature systems such as underfloor heating. An air source heat pump

extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can extract heat from the air even when the outside temperature is as low as minus 15°C. Cold water or another fluid is circulated through pipes, picking up the ambient temperature and then passing through the heat exchanger (the evaporator) in the heat pump unit. The heat exchanger extracts heat from the fluid, using a refrigerant compression cycle to upgrade the heat to a usable temperature (+55°C). This heat is then transferred to the heating system via another heat exchanger, the condenser of the heat pump.

Accordingly, ASHP heating systems generally run at a lower temperature than conventional heating systems. There are two main types of air source heat pumps. An air-to-water system uses the heat to warm water. Heat pumps heat water to a lower temperature than a standard boiler system would, so they are better suited to underfloor heating systems than radiator systems. An air-to-air system produces warm air, which is circulated by fans to heat the building. Whilst heat pumps are not a wholly renewable energy source due to use of electricity, the renewable component is considered as the heat is extracted from the air. It is measured as the difference between heat outputs, less the primary electrical energy input. Using this heat, for every Watt of electrical energy supplied to the system, 4 Watts or more of heating energy can be supplied to a heating system. This 'Coefficient of Performance' (CoP) of 4 is effectively an 'efficiency' of 400% for the system and compares very favourably with even the best gas condensing boiler's efficiency of around 85%. The smaller the temperature difference between the source and the output temperature of the heat pump (i.e. the temperature of the distribution system) the higher the heat pump's CoP.

Unlike boilers, there is no pollution on-site and as the mix of power stations used to supply the electricity grid gets 'cleaner', with more renewable electricity generation being brought on line, so the carbon emissions from the heat pumps system will decrease even further. The key operational benefit of air source heat pumps for the user is the reduction in fuel bills. In addition, space savings can be made over other plant types as an air source heat pump unit is compact and requires no storage space for fuel.

Since air source heat pumps produce less heat than traditional boilers, it is essential that the building where the air source heat pump is proposed is well insulated and draught proofed for the heating system to be effective. Fans and compressors integral to the air source heat pump unit generate some noise, but this is generally acceptable especially where outdoor units can be located away from windows and adjacent buildings. By selecting a heat pump with an outdoor sound rating of 7.6 dB or lower and mounting the unit on a noise-absorbing base these issues can be resolved for the site. Costs for installing a typical system vary but they are considerably more economical to install than an equivalent capacity ground source heat system and can produce similar levels of energy and carbon savings. Actual running costs and savings for space heating will vary depending on several factors - including the size and use pattern of the building and how well insulated it is.

6.5 Wind Turbines

Wind turbines are used to generate electricity. The wind force drives a turbine to produce electricity which means the effectiveness of the turbine is completely dependent on the wind speed. There are two types of domestic wind turbines;

- Pole mounted – Pole mounted turbines are free standing and have to be situated in a suitably exposed position. The typical generation capacity is around 6Kw.
- Building mounted – Building mounted turbines are a lot smaller than mast mounted systems and are most commonly installed on the roof of a home where there is again suitable exposure to a wind resource. The typical capacity for these is around 2Kw.

As mentioned above, the efficiency of a wind turbine is dependent on wind speed, meaning that the placing is crucial. Taller systems require sufficient space, so domestic wind turbines are typically found in fields or rural areas. It is important to note that wind turbines require planning permission and for off grid systems, batteries will need replacing around every 6 – 10 years.

Although the equipment and installation for wind turbines is expensive, the technology is designed to cut electricity bills as there are no operating costs other than maintenance checks that are required every few years. If a dwelling isn't connected to the electricity grid and the occupier has battery storage, excess electricity can be stored and used on a day where there are lighter or lower speed winds. As wind generated

electricity is a renewable energy source, wind turbines also cut the carbon footprint of a development as no carbon emissions or toxins are released into the atmosphere.

7.0 Be Green – Proposed Renewable/Low Carbon Technology

Low Carbon Heat Pumps

Taking various factors into account such as location, ease of installation and the client's preferred solution, individual heat pumps have been selected as the most desirable choice of renewable and low carbon technology for the development.

As such, the houses will have their own individual ASHP unit to supply electricity to from a renewable source, as the apartments will have their own individual EAHP units. After a review of the architect's drawings, it has been suggested that the ASHP for the houses will be situated to the side (where feasible) or at the rear within the garden amenity.

The development specification at the Be Green stage of the assessment will remain the same as per the Be Lean stage, bar the inclusion of an ASHP model the client has decided upon, that is listed within the SAP 10 product database.

Specification at "Be Green Stage, Houses	
Main Heating System	Samsung Electronics Monobloc 8Kw ASHP – (#278.75% in winter & 179.58% in summer). SAP Database Reference: 108781
Heating Controls	Time and temperature zone controls
Heat Emitters	Radiators & Underfloor heating with pipes in screed
Water Heating	Assumed 210 cylinders for three-storey dwellings with a measured heat loss of 2.1kWh/day

8.0 Be Green – Predicted Carbon Emissions

As can be seen from the table below, the specification outlined throughout the energy statement for the proposed development at the Former Novartis Site will result in a saving of 13,966.22kg CO2/year which equates to a **68.41%** reduction in CO2 emissions. The carbon figures can be found within the associated SAP documents.

SAP 10	Area Weighted DER (kgCO2/yr/m2)	Total CO2 Emissions (kgCO2/yr)	Total Floor Area (m2)	Reduction in CO2
Baseline	11.54	20,414.73	1,769.12	N/A
Be Green	3.65	6,448.51	1,769.12	-68.41%

9.0 Conclusion

This report outlines how a variety of sustainability criteria have been considered alongside the proposed design. Based on the modelling undertaken, the following measures will be incorporated into the design and the development build, to meet the requirements set by Horsham District Council.

- Nilan Compact P Exhaust Air Heat Pump for the Apartment units (heating & ventilation)
- DAP of 3.00 for the Apartment Units
- Samsung Electronics Monobloc 8Kw ASHP for the Houses
- Nuaire ISense-Plus DMEV system (SFP = 0.23) for the Houses
- DAP of 4.00 for the Houses
- Very low fabric u-values exceeding Part L minimum requirements
- High efficiency lighting with a minimum efficacy of 85 lumens/circuit watt
- Limiting thermal bridging with SAP 10.2 Appendix R psi values

Based on the above, the development at the Former Novartis will reduce CO2 emissions by approximately 68.41% beyond the requirements of Part L of the Building Regulations. This also ensure that all plots (houses and apartments) achieve a minimum B EPC rating with results ranging from 81-83 B for houses & 86-88 B for apartments.

As such, through Air Source Heat Pump technology & Mechanical Ventilation combined with the above energy efficient measurers, the development is compliant with both the policies of Horsham District Council and Building Regulations Part L.

10.0 Appendix - Water Calculations

10.1 Summary of Requirements

This appendix addresses water consumption for the proposed development. The approved document Part G gives two options to demonstrate compliance. These are as follows:

- **Fittings Approach.** Within the approved document, tables 2.1 and 2.2 describe the maximum rates for fittings to achieve 125/p/d or the 'optional' 110 l/p/d. The specifier may choose fittings which do not exceed these limits in order to attain compliance.

- **The Water Efficiency Calculator.** If any fittings exceed the amounts described within tables 2.1 or 2.2, then the water efficiency calculator must be completed to demonstrate compliance. Similarly, where a shower is not to be provided or where a waste disposal unit, a water softener or water re-use is to be provided the water efficiency calculator must be completed.

The standard required by default is **125 litres/person/day.** The 2015 edition of Approved Document G includes an 'optional' standard of **110 litres/person/day** which may be required by planning permission. This is intended to supersede the ability of planning authorities to require the Code for Sustainable Homes. The optional standard is equivalent to the minimum water use permitted under CSH Level 4.

By following the Government's national calculation methodology for assessing water efficiency in new dwellings for the project as designed, it is possible to achieve a water consumption of less than 110 litres per person per day using the fittings approach. Compliance with Building Regulation 36(1) can therefore be demonstrated.
This is compliant with Policy 5.15 B (Water Use and Supplies) of the London Plan, which states that developers should minimise the use of mains water by:

A. Incorporating water saving measures and equipment.
B. Designing domestic development so that mains water consumption would meet a target of 105 litres or less per head per day (excluding an allowance of 5 litres or less per head per day for external water consumption).

10.2 Compliant Design Specification

The fittings approach can be adopted to demonstrate compliance as follows. Fittings must not exceed the given the rates during design and construction:

Fitting	Maximum Consumption
WC flush	4/2.6 litres dual flush
Basin taps (in WCs and bathrooms)	5 l/min
Sink taps (kitchen and utility)	6 l/min
Showers	8 l/min
Baths	170 litres to overflow
Dishwasher	1.25 l/place setting
Washing machine	8.17 l/kilogram
Waste disposal unit	None fitted
Water softener	None fitted
Total consumption:	**110 litres/person/day (105 internal)**

10.3 Further Guidance for Specifiers on Achieving the Required Flowrates

Taps and showers will require flow limiters to meet these values. Please ensure these are installed along with the tap and shower fittings as these must be checked by Building Control prior to sign off.

Some taps and showers may already have built in limiters. Flow limiters are almost needed to meet the shower and tap values. You could alternatively check the flow rate with the manufacturer. For high pressure water systems (above 1 bar) it's the flow rates measured at 3 bar that is required. If it's a low-pressure water system (less than 0.3 bar), the flow rate at 0.1 bar is required. Tap values should be the maximum flow rate and showers should be the cold flow rate.

What if a waste disposal unit or water softener system is being used? These use additional water so may need to be compensated with lower values elsewhere. Please provide details of the waste disposal and softener systems being used. This report assumes that no such system is present.

What if any values are exceeded? It may be possible to compensate for them by further reducing values elsewhere. If you'd like us to look at this, please let us know. Grey water recycling or rainwater harvesting for internal use can also compensate for exceeding values.

WC Flush and Baths. The flush volume and capacity to overflow is often displayed on the manufacturer website or can be requested from them.

Dishwashers must achieve a water use of 1.25 l/place setting. This can be found by dividing the water consumption of a standard cycle by the number of place settings. If only the annual water consumption is given, divide this by 280 to get the water consumption of a single cycle. Where a dishwasher is not being fitted, 1.25 l/place setting is used as a default.

Washing machines need to achieve a water use of 8.17 l/kg dry load. This can be found by dividing the water consumption of a standard cycle by the dry load capacity in kg. If only the annual water consumption is given, divide this by 220 to get the water consumption of a single cycle. Where a washing machine is not being fitted, 8.17 l/place setting is used as a default.

External Water Use. Both the 125l and 110l target include a 5l allowance for external water use, e.g. to water a garden. This is not influenced by the building specification or fittings. It is common to see these targets described as 120l or 105 targets for internal water use. For example, the Greater London Authority require "mains water consumption would meet a target of 105 litres or less per head per day (excluding an allowance of 5 litres or less per head per day for external water consumption)".

11.0 Appendix – SAP Worksheets

Full SAP Calculation Printout

Property Reference	HT4 Semis NW Front Face	**Issued on Date**	11/03/2025
Assessment Reference	Be Lean	**Prop Type Ref**	
Property			

SAP Rating	78 C	**DER**	4.83	**TER**	10.59
Environmental	96 A	**% DER < TER**			54.39
CO_2 Emissions (t/year)	0.49	**DFEE**	32.77	**TFEE**	35.85
Compliance Check	See BREL	**% DFEE < TFEE**			8.57
% DPER < TPER	8.76	**DPER**	50.51	**TPER**	55.36

Assessor Details	Mr. Liam Rushton	**Assessor ID**	AK74-0001
Client	Waterstone Design, Waterstone Design		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	41.0800 (1b)	x	2.4000 (2b)	=	98.5920	(1b) - (3b)
First floor	40.0000 (1c)	x	2.7000 (2c)	=	108.0000	(1c) - (3c)
Second floor	32.9700 (1d)	x	2.2500 (2d)	=	74.1825	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.7745	(5)

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2. Ventilation rate

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		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	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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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								
D			2.1600	1.0000	2.1600			(26)
W			12.9000	1.1450	14.7710			(27)
GD			3.3000	1.1450	3.7786			(27)
Ground Floor			41.0800	0.1200	4.9296	110.0000	4518.8000	(28a)
External Wall	115.2500	18.3600	96.8900	0.1400	13.5646	110.0000	10657.9000	(29a)
NHER Stud Wall	15.9600		15.9600	0.0700	1.1172	9.0000	143.6400	(29a)
NHER Ins at Ceiling Level	26.7400		26.7400	0.0700	1.8718	9.0000	240.6600	(30)
Flat Roof over GF	1.0800		1.0800	0.1000	0.1080	9.0000	9.7200	(30)
Pitched Roof	19.6300		19.6300	0.1000	1.9630	9.0000	176.6700	(30)
Total net area of external elements Aum(A, m2)			219.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2638			(33)
Main dwelling								
Party Wall			52.0800	0.0000	0.0000	70.0000	3645.6001	(32)
Internal Wall Block			204.6800			75.0000	15350.9995	(32c)

Internal Floor 1	40.0000		18.0000	720.0000 (32d)
Internal Floor 2	32.9700		18.0000	593.4600 (32d)
Internal Ceiling 1	40.0000		9.0000	360.0000 (32e)
Internal Ceiling 2	32.9700		9.0000	296.7300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36714.1796 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 321.9130 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.8400	0.0500	0.4920
E3 Sill	8.8300	0.0500	0.4415
E4 Jamb	34.0000	0.0500	1.7000
E5 Ground floor (normal)	19.2100	0.1600	3.0736
E6 Intermediate floor within a dwelling	34.6900	0.0000	0.0000
E16 Corner (normal)	17.1000	0.0900	1.5390
E18 Party wall between dwellings	14.7000	0.0600	0.8820
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E14 Flat roof	3.0300	0.0800	0.2424
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	16.0000	0.0000	0.0000
E13 Gable (insulation at rafter level)	14.2000	0.0800	1.1360
E11 Eaves (insulation at rafter level)	8.0200	0.0400	0.3208
R4 Ridge (vaulted ceiling)	8.0200	0.0800	0.6416
R5 Ridge (inverted)	7.2000	0.0400	0.2880

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1809 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.4447 (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	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	(38)
Heat transfer coeff	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	(39)
Average = Sum(39)m / 12 =												101.7725	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	(40)
HLP (average)												0.8923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8371 (42)
Hot water usage for mixer showers

76.2750	75.1287	73.4584	70.2625	67.9040	65.2739	63.7789	65.4366	67.2537	70.0777	73.3422	75.9827	(42a)

Hot water usage for baths

30.9945	30.5342	29.8860	28.6908	27.7958	26.8035	26.2675	26.9111	27.6120	28.6738	29.8936	30.8897	(42b)

Hot water usage for other uses

43.6845	42.0959	40.5074	38.9189	37.3304	35.7418	35.7418	37.3304	38.9189	40.5074	42.0959	43.6845	(42c)

Average daily hot water use (litres/day) 138.7729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.9539	147.7588	143.8517	137.8722	133.0302	127.8192	125.7882	129.6781	133.7846	139.2589	145.3318	150.5569	(44)
Energy conte	239.0741	210.4066	221.0948	188.7401	179.0842	157.1686	152.1299	160.5685	164.9698	188.9731	207.0518	235.7357	(45)
Energy content (annual)										Total = Sum(45)m =		2304.9972	
Distribution loss (46)m = 0.15 x (45)m	35.8611	31.5610	33.1642	28.3110	26.8626	23.5753	22.8195	24.0853	24.7455	28.3460	31.0578	35.3604	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(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	297.4905	263.1698	279.5112	245.2721	237.5006	213.7006	210.5463	218.9849	221.5018	247.3895	263.5838	294.1521	(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	297.4905	263.1698	279.5112	245.2721	237.5006	213.7006	210.5463	218.9849	221.5018	247.3895	263.5838	294.1521	(64)
										Total per year (kWh/year) = Sum(64)m =		2992.8032	(64)
12Total per year (kWh/year)												2993	(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	126.2253	112.1708	120.2471	107.9817	106.2786	97.4842	97.3163	100.1222	100.0780	109.5667	114.0703	125.1152	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.5533	165.5769	149.5533	154.5384	149.5533	154.5384	149.5533	149.5533	154.5384	149.5533	154.5384	149.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.2511	280.1281	272.8782	257.4439	237.9609	219.6497	207.4166	204.5396	211.7895	227.2238	246.7068	265.0181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	(69)
Pumps, fans	7.0000	7.0000	7.0000	7.0000	7.0000	0.0000	0.0000	0.0000	0.0000	7.0000	7.0000	7.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	(71)
Water heating gains (Table 5)	169.6576	166.9208	161.6225	149.9746	142.8476	135.3947	130.8015	134.5728	138.9973	147.2670	158.4310	168.1657	(72)
Total internal gains	669.0182	685.1819	656.6101	634.5130	602.9180	575.1388	553.3275	554.2218	570.8814	596.6003	632.2324	655.2932	(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	6.8100	36.7938	0.5000	0.7000	0.7700	60.7748	(77)
Northwest	6.0900	11.2829	0.5000	0.7000	0.7700	16.6664	(81)
Southeast	3.3000	36.7938	0.5000	0.7000	0.7700	29.4503	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	106.8915	187.6116	271.4027	360.9279	426.7656	433.5749	413.8944	363.2637	302.1677	211.3155	129.0395	90.8245	(83)
Total gains	775.9097	872.7935	928.0129	995.4409	1029.6836	1008.7137	967.2220	917.4855	873.0490	807.9158	761.2719	746.1177	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	
alpha	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	
util living area	0.9987	0.9963	0.9893	0.9556	0.8442	0.6376	0.4623	0.5088	0.7695	0.9671	0.9960	0.9990	(86)
MIT	20.4073	20.5003	20.6265	20.7922	20.9134	20.9546	20.9591	20.9587	20.9413	20.7940	20.5675	20.3836	(87)
Th 2	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	(88)
util rest of house	0.9981	0.9948	0.9847	0.9372	0.7932	0.5594	0.3759	0.4183	0.6927	0.9496	0.9941	0.9986	(89)
MIT 2	19.4775	19.5962	19.7559	19.9577	20.0870	20.1197	20.1219	20.1218	20.1117	19.9632	19.6823	19.4472	(90)
Living area fraction										fLA = Living area / (4) =		0.2416	(91)
MIT	19.7021	19.8146	19.9662	20.1593	20.2866	20.3214	20.3242	20.3240	20.3121	20.1639	19.8961	19.6734	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7021	19.8146	19.9662	20.1593	20.2866	20.3214	20.3242	20.3240	20.3121	20.1639	19.8961	19.6734	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9977	0.9939	0.9833	0.9368	0.8007	0.5736	0.3917	0.4349	0.7063	0.9493	0.9932	0.9983	(94)
Useful gains	774.1377	867.4599	912.4864	932.5760	824.4876	578.6317	378.8432	398.9725	616.6593	766.9476	756.1040	744.8500	(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	1567.5122	1517.8918	1370.4879	1145.8852	873.8812	582.2798	379.0161	399.3518	632.2255	973.3443	1302.2963	1574.7682	(97)
Space heating kWh	590.2706	437.0902	340.7531	153.5826	36.7488	0.0000	0.0000	0.0000	0.0000	153.5591	393.2585	617.4591	(98a)
Space heating requirement - total per year (kWh/year)												2722.7221	
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	590.2706	437.0902	340.7531	153.5826	36.7488	0.0000	0.0000	0.0000	0.0000	153.5591	393.2585	617.4591	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2722.7221	
Space heating per m2											(98c) / (4) =	23.8731	(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 %)	170.0000	(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	590.2706	437.0902	340.7531	153.5826	36.7488	0.0000	0.0000	0.0000	0.0000	153.5591	393.2585	617.4591	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	347.2180	257.1119	200.4430	90.3427	21.6169	0.0000	0.0000	0.0000	0.0000	90.3289	231.3285	363.2113	(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	297.4905	263.1698	279.5112	245.2721	237.5006	213.7006	210.5463	218.9849	221.5018	247.3895	263.5838	294.1521	(64)
Efficiency of water heater												170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month	174.9944	154.8058	164.4183	144.2777	139.7062	125.7062	123.8508	128.8147	130.2952	145.5232	155.0493	173.0307	(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	9.9254	8.9649	9.9254	9.6052	9.9254	9.6052	9.9254	9.9254	9.6052	9.9254	9.6052	9.9254	(231)
Lighting	30.4391	24.4194	21.9869	16.1086	12.4427	10.1658	11.3507	14.7540	19.1640	25.1442	28.4004	31.2851	(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	1601.6012	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	170.0000	
Water heating fuel used	1760.4725	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 12.6230, total flow = 37.0000, SFP = 0.3412)		
mechanical ventilation fans (SFP = 0.3412)	116.8634	(230a)
Total electricity for the above, kWh/year	116.8634	(231)
Electricity for lighting (calculated in Appendix L)	245.6609	(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)
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	3724.5979	(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	1601.6012	0.1565	250.5934	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1760.4725	0.1409	248.0850	(264)
Space and water heating			498.6784	(265)
Pumps, fans and electric keep-hot	116.8634	0.1387	16.2104	(267)
Energy for lighting	245.6609	0.1443	35.4565	(268)
Total CO2, kg/year			550.3453	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8300	(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	1601.6012	1.5793	2529.3412	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1760.4725	1.5211	2677.8026	(278)
Space and water heating			5207.1439	(279)
Pumps, fans and electric keep-hot	116.8634	1.5128	176.7909	(281)
Energy for lighting	245.6609	1.5338	376.8028	(282)
Total Primary energy kWh/year			5760.7376	(286)
Dwelling Primary energy Rate (DPER)			50.5100	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	41.0800	(1b) x	2.4000	(2b) =	98.5920	(1b) - (3b)
First floor	40.0000	(1c) x	2.7000	(2c) =	108.0000	(1c) - (3c)
Second floor	32.9700	(1d) x	2.2500	(2d) =	74.1825	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		280.7745	(5)

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2. Ventilation rate

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		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)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3925	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3630	(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													
	0.4629	0.4538	0.4447	0.3993	0.3903	0.3449	0.3449	0.3358	0.3630	0.3903	0.4084	0.4266	(22b)
Effective ac	0.6071	0.6030	0.5989	0.5797	0.5761	0.5595	0.5595	0.5564	0.5659	0.5761	0.5834	0.5910	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1600	1.0000	2.1600			(26)
TER Opening Type			16.2000	1.1450	18.5496			(27)
Ground Floor			41.0800	0.1300	5.3404			(28a)
External Wall	115.2500	18.3600	96.8900	0.1800	17.4402			(29a)
NHER Stud Wall	15.9600		15.9600	0.1800	2.8728			(29a)
NHER Ins at Ceiling Level	26.7400		26.7400	0.1100	2.9414			(30)
Flat Roof over GF	1.0800		1.0800	0.1100	0.1188			(30)
Pitched Roof	19.6300		19.6300	0.1100	2.1593			(30)
Total net area of external elements Aum(A, m2)			219.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5825			(33)
Main dwelling								
Party Wall			52.0800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 321.9130 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	9.8400	0.0500	0.4920	
E3 Sill	8.8300	0.0500	0.4415	
E4 Jamb	34.0000	0.0500	1.7000	
E5 Ground floor (normal)	19.2100	0.1600	3.0736	
E6 Intermediate floor within a dwelling	34.6900	0.0000	0.0000	
E16 Corner (normal)	17.1000	0.0900	1.5390	
E18 Party wall between dwellings	14.7000	0.0600	0.8820	
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160	
E14 Flat roof	3.0300	0.0800	0.2424	
P1 Party wall - Ground floor	8.0000	0.0800	0.6400	
P2 Party wall - Intermediate floor within a dwelling	16.0000	0.0000	0.0000	
E13 Gable (insulation at rafter level)	14.2000	0.0800	1.1360	
E11 Eaves (insulation at rafter level)	8.0200	0.0400	0.3208	
R4 Ridge (vaulted ceiling)	8.0200	0.0800	0.6416	
R5 Ridge (inverted)	7.2000	0.0400	0.2880	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1809 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 62.7634 (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	56.2531	55.8677	55.4899	53.7155	53.3835	51.8380	51.8380	51.5518	52.4333	53.3835	54.0551	54.7572	(38)
Heat transfer coeff													
	119.0165	118.6311	118.2533	116.4789	116.1469	114.6014	114.6014	114.3152	115.1967	116.1469	116.8185	117.5206	(39)
Average = Sum(39)m / 12 =												116.4773	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0435	1.0402	1.0369	1.0213	1.0184	1.0048	1.0048	1.0023	1.0101	1.0184	1.0243	1.0304	(40)
HLP (average)												1.0213	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8371 (42)

Hot water usage for mixer showers

71.7882	70.7094	69.1373	66.1294	63.9097	61.4342	60.0272	61.5874	63.2976	65.9555	69.0280	71.5132	(42a)

Hot water usage for baths

30.9945	30.5342	29.8860	28.6908	27.7958	26.8035	26.2675	26.9111	27.6120	28.6738	29.8936	30.8897	(42b)

Hot water usage for other uses

43.6845	42.0959	40.5074	38.9189	37.3304	35.7418	35.7418	37.3304	38.9189	40.5074	42.0959	43.6845	(42c)

Average daily hot water use (litres/day) 134.6363 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.4672	143.3395	139.5307	133.7391	129.0358	123.9795	122.0365	125.8289	129.8285	135.1367	141.0176	146.0873	(44)
Energy conte	231.9682	204.1135	214.4534	183.0821	173.7071	152.4473	147.5925	155.8024	160.0915	183.3793	200.9054	228.7375	(45)
Energy content (annual)										Total = Sum(45)m =		2236.2801	
Distribution loss (46)m = 0.15 x (45)m													
	34.7952	30.6170	32.1680	27.4623	26.0561	22.8671	22.1389	23.3704	24.0137	27.5069	30.1358	34.3106	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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													
	283.7148	250.8524	266.2000	233.1594	225.4536	202.5246	199.3391	207.5490	210.1688	235.1259	250.9827	280.4840	(62)
WWHRS	-32.8186	-29.0250	-30.3933	-25.1669	-23.4546	-20.0703	-18.8127	-20.0054	-20.7655	-24.4802	-27.7331	-32.2108	(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													
	250.8962	221.8274	235.8067	207.9926	201.9990	182.4544	180.5264	187.5436	189.4034	210.6456	223.2496	248.2732	(64)
										Total per year (kWh/year) = Sum(64)m =		2540.6181	(64)
12Total per year (kWh/year)												2541	(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													
	118.5267	105.2588	112.7030	100.9367	99.1549	90.7506	90.4718	93.2016	93.2923	102.3709	106.8629	117.4525	(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	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	149.5533	165.5769	149.5533	154.5384	149.5533	154.5384	149.5533	149.5533	154.5384	149.5533	154.5384	149.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	277.2511	280.1281	272.8782	257.4439	237.9609	219.6497	207.4166	204.5396	211.7895	227.2238	246.7068	265.0181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	(71)
Water heating gains (Table 5)													
	159.3101	156.6352	151.4826	140.1898	133.2727	126.0425	121.6019	125.2709	129.5726	137.5953	148.4207	157.8662	(72)
Total internal gains													
	654.6706	670.8963	642.4702	620.7283	589.3430	565.7867	544.1279	544.9200	561.4567	582.9285	618.2221	640.9937	(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	10.1100	36.7938	0.6300	0.7000	0.7700	113.6836	(77)
Northwest	6.0900	11.2829	0.6300	0.7000	0.7700	20.9996	(81)

Solar gains	134.6833	236.3907	341.9675	454.7691	537.7247	546.3044	521.5070	457.7122	380.7313	266.2575	162.5898	114.4389	(83)
Total gains	789.3539	907.2870	984.4377	1075.4974	1127.0677	1112.0910	1065.6349	1002.6322	942.1880	849.1860	780.8118	755.4326	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	85.6888	85.9672	86.2418	87.5556	87.8059	88.9900	88.9900	89.2128	88.5301	87.8059	87.3011	86.7795	
alpha	6.7126	6.7311	6.7495	6.8370	6.8537	6.9327	6.9327	6.9475	6.9020	6.8537	6.8201	6.7853	
util living area													
	0.9988	0.9965	0.9898	0.9576	0.8534	0.6465	0.4718	0.5216	0.7884	0.9717	0.9965	0.9991	(86)
MIT	20.0670	20.2170	20.4234	20.7037	20.9076	20.9887	20.9988	20.9978	20.9593	20.7010	20.3401	20.0492	(87)
Th 2	20.0472	20.0500	20.0527	20.0656	20.0680	20.0793	20.0793	20.0814	20.0750	20.0680	20.0632	20.0581	(88)
util rest of house													
	0.9983	0.9950	0.9853	0.9390	0.7998	0.5599	0.3739	0.4191	0.7059	0.9554	0.9947	0.9987	(89)
MIT 2	18.9627	19.1565	19.4204	19.7745	19.9974	20.0740	20.0790	20.0808	20.0517	19.7790	19.3245	18.9484	(90)
Living area fraction									fLA = Living area / (4) =			0.2416	(91)
MIT	19.2295	19.4126	19.6627	19.9990	20.2172	20.2950	20.3012	20.3023	20.2710	20.0018	19.5698	19.2143	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2295	19.4126	19.6627	19.9990	20.2172	20.2950	20.3012	20.3023	20.2710	20.0018	19.5698	19.2143	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9936	0.9828	0.9374	0.8092	0.5808	0.3976	0.4440	0.7248	0.9539	0.9934	0.9982	(94)
Useful gains	787.4589	901.4915	967.5250	1008.2222	912.0525	645.8517	423.7348	445.2004	682.8811	810.0671	775.6199	754.0642	(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													
	1776.8532	1721.6501	1556.5320	1292.7948	989.2500	652.6519	424.1651	446.0935	710.8736	1091.9851	1456.7063	1764.4937	(97)
Space heating kWh													
	736.1093	551.1466	438.2212	204.8923	57.4349	0.0000	0.0000	0.0000	0.0000	209.7470	490.3822	751.7596	(98a)
Space heating requirement - total per year (kWh/year)												3439.6931	
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													
	736.1093	551.1466	438.2212	204.8923	57.4349	0.0000	0.0000	0.0000	0.0000	209.7470	490.3822	751.7596	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3439.6931	
Space heating per m2											(98c) / (4) =	30.1595	(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													
	736.1093	551.1466	438.2212	204.8923	57.4349	0.0000	0.0000	0.0000	0.0000	209.7470	490.3822	751.7596	(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)													
	797.5182	597.1253	474.7792	221.9851	62.2263	0.0000	0.0000	0.0000	0.0000	227.2448	531.2916	814.4741	(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												
	250.8962	221.8274	235.8067	207.9926	201.9990	182.4544	180.5264	187.5436	189.4034	210.6456	223.2496	248.2732 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.3251	86.0160	85.4293	84.0261	81.6316	79.8000	79.8000	79.8000	79.8000	84.0502	85.7737	86.3813 (217)
Fuel for water heating, kWh/month												
	290.6410	257.8908	276.0257	247.5333	247.4519	228.6396	226.2236	235.0170	237.3476	250.6189	260.2774	287.4154 (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	31.0742	24.9289	22.4457	16.4447	12.7024	10.3779	11.5875	15.0619	19.5639	25.6689	28.9930	31.9379 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-39.9598	-57.1360	-83.2563	-94.9015	-103.3795	-96.8115	-95.5733	-89.7001	-79.5276	-65.8831	-44.1986	-34.4509 (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	-20.1894	-42.7313	-85.4342	-129.0679	-171.4188	-172.5637	-170.5795	-144.1183	-105.1921	-61.4105	-27.0487	-15.9493 (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	3726.6447 (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	3045.0820 (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)	250.7868 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2030.4820 (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	5078.0316 (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	3726.6447	0.2100	782.5954	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3045.0820	0.2100	639.4672	(264)
Space and water heating			1422.0626	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	250.7868	0.1443	36.1963	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-884.7783	0.1343	-118.8348	
PV Unit electricity exported	-1145.7037	0.1257	-144.0346	
Total			-262.8694	(269)
Total CO2, kg/year			1207.3188	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.5900	(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	3726.6447	1.1300	4211.1086	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3045.0820	1.1300	3440.9427	(278)
Space and water heating			7652.0513	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	250.7868	1.5338	384.6652	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-884.7783	1.4964	-1323.9582	
PV Unit electricity exported	-1145.7037	0.4615	-528.6955	
Total			-1852.6537	(283)
Total Primary energy kWh/year			6314.1636	(286)
Target Primary Energy Rate (TPER)			55.3600	(287)

Full SAP Calculation Printout

Property Reference	HT4 Semis NW Front Face	**Issued on Date**	11/03/2025
Assessment Reference	Be Green	**Prop Type Ref**	
Property			

SAP Rating	82 B	**DER**	3.89	**TER**	10.59
Environmental	96 A	**% DER < TER**			63.27
CO_2 Emissions (t/year)	0.41	**DFEE**	32.77	**TFEE**	35.85
Compliance Check	See BREL	**% DFEE < TFEE**			8.57
% DPER < TPER	25.94	**DPER**	41.00	**TPER**	55.36

Assessor Details	Mr. Liam Rushton	**Assessor ID**	AK74-0001
Client	Waterstone Design, Waterstone Design		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	41.0800 (1b)	x	2.4000 (2b)	=	98.5920	(1b) - (3b)
First floor	40.0000 (1c)	x	2.7000 (2c)	=	108.0000	(1c) - (3c)
Second floor	32.9700 (1d)	x	2.2500 (2d)	=	74.1825	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.7745	(5)

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2. Ventilation rate

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		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	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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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								
D			2.1600	1.0000	2.1600			(26)
W			12.9000	1.1450	14.7710			(27)
GD			3.3000	1.1450	3.7786			(27)
Ground Floor			41.0800	0.1200	4.9296	110.0000	4518.8000	(28a)
External Wall	115.2500	18.3600	96.8900	0.1400	13.5646	110.0000	10657.9000	(29a)
NHER Stud Wall	15.9600		15.9600	0.0700	1.1172	9.0000	143.6400	(29a)
NHER Ins at Ceiling Level	26.7400		26.7400	0.0700	1.8718	9.0000	240.6600	(30)
Flat Roof over GF	1.0800		1.0800	0.1000	0.1080	9.0000	9.7200	(30)
Pitched Roof	19.6300		19.6300	0.1000	1.9630	9.0000	176.6700	(30)
Total net area of external elements Aum(A, m2)			219.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2638			(33)
Main dwelling								
Party Wall			52.0800	0.0000	0.0000	70.0000	3645.6001	(32)
Internal Wall Block			204.6800			75.0000	15350.9995	(32c)

Internal Floor 1	40.0000		18.0000	720.0000 (32d)
Internal Floor 2	32.9700		18.0000	593.4600 (32d)
Internal Ceiling 1	40.0000		9.0000	360.0000 (32e)
Internal Ceiling 2	32.9700		9.0000	296.7300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 36714.1796 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 321.9130 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.8400	0.0500	0.4920
E3 Sill	8.8300	0.0500	0.4415
E4 Jamb	34.0000	0.0500	1.7000
E5 Ground floor (normal)	19.2100	0.1600	3.0736
E6 Intermediate floor within a dwelling	34.6900	0.0000	0.0000
E16 Corner (normal)	17.1000	0.0900	1.5390
E18 Party wall between dwellings	14.7000	0.0600	0.8820
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E14 Flat roof	3.0300	0.0800	0.2424
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	16.0000	0.0000	0.0000
E13 Gable (insulation at rafter level)	14.2000	0.0800	1.1360
E11 Eaves (insulation at rafter level)	8.0200	0.0400	0.3208
R4 Ridge (vaulted ceiling)	8.0200	0.0800	0.6416
R5 Ridge (inverted)	7.2000	0.0400	0.2880

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1809 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.4447 (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	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	46.3278	(38)
Heat transfer coeff	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	101.7725	(39)
Average = Sum(39)m / 12 =												101.7725	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	0.8923	(40)
HLP (average)												0.8923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8371 (42)
Hot water usage for mixer showers

76.2750	75.1287	73.4584	70.2625	67.9040	65.2739	63.7789	65.4366	67.2537	70.0777	73.3422	75.9827	(42a)

Hot water usage for baths

30.9945	30.5342	29.8860	28.6908	27.7958	26.8035	26.2675	26.9111	27.6120	28.6738	29.8936	30.8897	(42b)

Hot water usage for other uses

43.6845	42.0959	40.5074	38.9189	37.3304	35.7418	35.7418	37.3304	38.9189	40.5074	42.0959	43.6845	(42c)

Average daily hot water use (litres/day) 138.7729 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	150.9539	147.7588	143.8517	137.8722	133.0302	127.8192	125.7882	129.6781	133.7846	139.2589	145.3318	150.5569	(44)
Energy conte	239.0741	210.4066	221.0948	188.7401	179.0842	157.1686	152.1299	160.5685	164.9698	188.9731	207.0518	235.7357	(45)
Energy content (annual)										Total = Sum(45)m =		2304.9972	
Distribution loss (46)m = 0.15 x (45)m	35.8611	31.5610	33.1642	28.3110	26.8626	23.5753	22.8195	24.0853	24.7455	28.3460	31.0578	35.3604	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1340	(55)
Total storage loss	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(56)
If cylinder contains dedicated solar storage	35.1540	31.7520	35.1540	34.0200	35.1540	34.0200	35.1540	35.1540	34.0200	35.1540	34.0200	35.1540	(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	297.4905	263.1698	279.5112	245.2721	237.5006	213.7006	210.5463	218.9849	221.5018	247.3895	263.5838	294.1521	(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	297.4905	263.1698	279.5112	245.2721	237.5006	213.7006	210.5463	218.9849	221.5018	247.3895	263.5838	294.1521	(64)
										Total per year (kWh/year) = Sum(64)m =		2992.8032	(64)
12Total per year (kWh/year)												2993	(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	126.2253	112.1708	120.2471	107.9817	106.2786	97.4842	97.3163	100.1222	100.0780	109.5667	114.0703	125.1152	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	149.5533	165.5769	149.5533	154.5384	149.5533	154.5384	149.5533	149.5533	154.5384	149.5533	154.5384	149.5533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	277.2511	280.1281	272.8782	257.4439	237.9609	219.6497	207.4166	204.5396	211.7895	227.2238	246.7068	265.0181	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	(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)	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	(71)
Water heating gains (Table 5)	169.6576	166.9208	161.6225	149.9746	142.8476	135.3947	130.8015	134.5728	138.9973	147.2670	158.4310	168.1657	(72)
Total internal gains	662.0182	678.1819	649.6101	627.5130	595.9180	575.1388	553.3275	554.2218	570.8814	589.6003	625.2324	648.2932	(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	6.8100	36.7938	0.5000	0.7000	0.7700	60.7748	(77)
Northwest	6.0900	11.2829	0.5000	0.7000	0.7700	16.6664	(81)
Southeast	3.3000	36.7938	0.5000	0.7000	0.7700	29.4503	(77)

Solar gains	106.8915	187.6116	271.4027	360.9279	426.7656	433.5749	413.8944	363.2637	302.1677	211.3155	129.0395	90.8245	(83)
Total gains	768.9097	865.7935	921.0129	988.4409	1022.6836	1008.7137	967.2220	917.4855	873.0490	800.9158	754.2719	739.1177	(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, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	100.2076	
alpha	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	7.6805	
util living area	0.9988	0.9965	0.9898	0.9572	0.8477	0.6376	0.4623	0.5088	0.7695	0.9686	0.9963	0.9991	(86)
Living	20.4031	20.4962	20.6226	20.7891	20.9120	20.9546	20.9591	20.9587	20.9413	20.7907	20.5635	20.3794	
Non living	19.4722	19.5910	19.7511	19.9542	20.0858	20.1197	20.1219	20.1218	20.1117	19.9595	19.6772	19.4419	
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	20.6947	20.4962	20.6226	20.7891	20.9120	20.9546	20.9591	20.9587	20.9413	20.7907	20.5635	20.4662	(87)
Th 2	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	20.1740	(88)
util rest of house	0.9982	0.9950	0.9854	0.9393	0.7971	0.5594	0.3759	0.4183	0.6927	0.9517	0.9944	0.9987	(89)
MIT 2	19.8942	19.5910	19.7511	19.9542	20.0858	20.1197	20.1219	20.1218	20.1117	19.9595	19.6772	19.5738	(90)
Living area fraction										fLA = Living area / (4) =		0.2416	(91)
MIT	20.0876	19.8097	19.9616	20.1559	20.2854	20.3214	20.3242	20.3240	20.3121	20.1603	19.8913	19.7894	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0876	19.8097	19.9616	20.1559	20.2854	20.3214	20.3242	20.3240	20.3121	20.1603	19.8913	19.7894	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9942	0.9840	0.9388	0.8045	0.5736	0.3917	0.4349	0.7063	0.9513	0.9936	0.9985	(94)
Useful gains	767.5117	860.7583	906.2473	927.9737	822.7589	578.6317	378.8432	398.9725	616.6593	761.9471	749.4323	737.9983	(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	1606.7426	1517.3937	1370.0219	1145.5419	873.7556	582.2798	379.0161	399.3518	632.2255	972.9708	1301.8002	1586.5734	(97)
Space heating kWh	624.3878	441.2590	345.0483	156.6491	37.9416	0.0000	0.0000	0.0000	0.0000	157.0016	397.7049	631.3398	(98a)
Space heating requirement - total per year (kWh/year)												2791.3322	
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	624.3878	441.2590	345.0483	156.6491	37.9416	0.0000	0.0000	0.0000	0.0000	157.0016	397.7049	631.3398	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2791.3322	
Space heating per m2											(98c) / (4) =	24.4746	(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 %)	277.7518	(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	624.3878	441.2590	345.0483	156.6491	37.9416	0.0000	0.0000	0.0000	0.0000	157.0016	397.7049	631.3398	(98)
Space heating efficiency (main heating system 1)	277.7518	277.7518	277.7518	277.7518	277.7518	0.0000	0.0000	0.0000	0.0000	277.7518	277.7518	277.7518	(210)
Space heating fuel (main heating system)	224.8006	158.8681	124.2290	56.3989	13.6602	0.0000	0.0000	0.0000	0.0000	56.5259	143.1871	227.3036	(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	297.4905	263.1698	279.5112	245.2721	237.5006	213.7006	210.5463	218.9849	221.5018	247.3895	263.5838	294.1521	(64)
Efficiency of water heater												179.5800	(216)
(217)m	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	179.5800	(217)
Fuel for water heating, kWh/month	165.6591	146.5474	155.6472	136.5810	132.2534	119.0002	117.2437	121.9428	123.3443	137.7600	146.7779	163.8000	(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	9.9254	8.9649	9.9254	9.6052	9.9254	9.6052	9.9254	9.9254	9.6052	9.9254	9.6052	9.9254	(231)
Lighting	30.4391	24.4194	21.9869	16.1086	12.4427	10.1658	11.3507	14.7540	19.1640	25.1442	28.4004	31.2851	(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	1004.9734	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	179.5800	
Water heating fuel used	1666.5571	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 12.6230, total flow = 37.0000, SFP = 0.3412)		
mechanical ventilation fans (SFP = 0.3412)	116.8634	(230a)
Total electricity for the above, kWh/year	116.8634	(231)
Electricity for lighting (calculated in Appendix L)	245.6609	(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)
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	3034.0547	(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	1004.9734	0.1565	157.2959	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1666.5571	0.1409	234.8505	(264)
Space and water heating			392.1464	(265)
Pumps, fans and electric keep-hot	116.8634	0.1387	16.2104	(267)
Energy for lighting	245.6609	0.1443	35.4565	(268)
Total CO2, kg/year			443.8132	(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	1004.9734	1.5794	1587.2970	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1666.5571	1.5211	2534.9507	(278)
Space and water heating			4122.2477	(279)
Pumps, fans and electric keep-hot	116.8634	1.5128	176.7909	(281)
Energy for lighting	245.6609	1.5338	376.8028	(282)
Total Primary energy kWh/year			4675.8414	(286)
Dwelling Primary energy Rate (DPER)			41.0000	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	41.0800 (1b)	x	2.4000 (2b)	=	98.5920	(1b) - (3b)
First floor	40.0000 (1c)	x	2.7000 (2c)	=	108.0000	(1c) - (3c)
Second floor	32.9700 (1d)	x	2.2500 (2d)	=	74.1825	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	114.0500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	280.7745	(5)

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2. Ventilation rate

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		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)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1425	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)

Infiltration rate												0.3925	(18)
Number of sides sheltered												1	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.9250	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.3630	(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													
	0.4629	0.4538	0.4447	0.3993	0.3903	0.3449	0.3449	0.3358	0.3630	0.3903	0.4084	0.4266	(22b)
Effective ac	0.6071	0.6030	0.5989	0.5797	0.5761	0.5595	0.5595	0.5564	0.5659	0.5761	0.5834	0.5910	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Opaque door			2.1600	1.0000	2.1600			(26)
TER Opening Type			16.2000	1.1450	18.5496			(27)
Ground Floor			41.0800	0.1300	5.3404			(28a)
External Wall	115.2500	18.3600	96.8900	0.1800	17.4402			(29a)
NHER Stud Wall	15.9600		15.9600	0.1800	2.8728			(29a)
NHER Ins at Ceiling Level	26.7400		26.7400	0.1100	2.9414			(30)
Flat Roof over GF	1.0800		1.0800	0.1100	0.1188			(30)
Pitched Roof	19.6300		19.6300	0.1100	2.1593			(30)
Total net area of external elements Aum(A, m2)			219.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5825			(33)
Main dwelling								
Party Wall			52.0800	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	321.9130	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.8400	0.0500	0.4920
E3 Sill	8.8300	0.0500	0.4415
E4 Jamb	34.0000	0.0500	1.7000
E5 Ground floor (normal)	19.2100	0.1600	3.0736
E6 Intermediate floor within a dwelling	34.6900	0.0000	0.0000
E16 Corner (normal)	17.1000	0.0900	1.5390
E18 Party wall between dwellings	14.7000	0.0600	0.8820
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160
E14 Flat roof	3.0300	0.0800	0.2424
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	16.0000	0.0000	0.0000
E13 Gable (insulation at rafter level)	14.2000	0.0800	1.1360
E11 Eaves (insulation at rafter level)	8.0200	0.0400	0.3208
R4 Ridge (vaulted ceiling)	8.0200	0.0800	0.6416
R5 Ridge (inverted)	7.2000	0.0400	0.2880

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1809	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	62.7634	(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	56.2531	55.8677	55.4899	53.7155	53.3835	51.8380	51.8380	51.5518	52.4333	53.3835	54.0551	54.7572	(38)
Heat transfer coeff													
	119.0165	118.6311	118.2533	116.4789	116.1469	114.6014	114.6014	114.3152	115.1967	116.1469	116.8185	117.5206	(39)
Average = Sum(39)m / 12 =												116.4773	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0435	1.0402	1.0369	1.0213	1.0184	1.0048	1.0048	1.0023	1.0101	1.0184	1.0243	1.0304	(40)
HLP (average)												1.0213	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8371	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	71.7882	70.7094	69.1373	66.1294	63.9097	61.4342	60.0272	61.5874	63.2976	65.9555	69.0280	71.5132	(42a)
Hot water usage for baths													
	30.9945	30.5342	29.8860	28.6908	27.7958	26.8035	26.2675	26.9111	27.6120	28.6738	29.8936	30.8897	(42b)
Hot water usage for other uses													
	43.6845	42.0959	40.5074	38.9189	37.3304	35.7418	35.7418	37.3304	38.9189	40.5074	42.0959	43.6845	(42c)
Average daily hot water use (litres/day)												134.6363	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.4672	143.3395	139.5307	133.7391	129.0358	123.9795	122.0365	125.8289	129.8285	135.1367	141.0176	146.0873	(44)
Energy conte	231.9682	204.1135	214.4534	183.0821	173.7071	152.4473	147.5925	155.8024	160.0915	183.3793	200.9054	228.7375	(45)
Energy content (annual)											Total = Sum(45)m =	2236.2801	
Distribution loss (46)m = 0.15 x (45)m													
	34.7952	30.6170	32.1680	27.4623	26.0561	22.8671	22.1389	23.3704	24.0137	27.5069	30.1358	34.3106	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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													
	283.7148	250.8524	266.2000	233.1594	225.4536	202.5246	199.3391	207.5490	210.1688	235.1259	250.9827	280.4840	(62)
WWHRS	-32.8186	-29.0250	-30.3933	-25.1669	-23.4546	-20.0703	-18.8127	-20.0054	-20.7655	-24.4802	-27.7331	-32.2108	(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													
	250.8962	221.8274	235.8067	207.9926	201.9990	182.4544	180.5264	187.5436	189.4034	210.6456	223.2496	248.2732	(64)
											Total per year (kWh/year) = Sum(64)m =	2540.6181	(64)
12Total per year (kWh/year)												2541	(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

	118.5267	105.2588	112.7030	100.9367	99.1549	90.7506	90.4718	93.2016	93.2923	102.3709	106.8629	117.4525 (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	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	141.8537	(66)

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

	149.5533	165.5769	149.5533	154.5384	149.5533	154.5384	149.5533	149.5533	154.5384	149.5533	154.5384	149.5533	(67)

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

	277.2511	280.1281	272.8782	257.4439	237.9609	219.6497	207.4166	204.5396	211.7895	227.2238	246.7068	265.0181	(68)

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

	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	37.1854	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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

	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	-113.4829	(71)

Water heating gains (Table 5)

	159.3101	156.6352	151.4826	140.1898	133.2727	126.0425	121.6019	125.2709	129.5726	137.5953	148.4207	157.8662	(72)

Total internal gains

	654.6706	670.8963	642.4702	620.7283	589.3430	565.7867	544.1279	544.9200	561.4567	582.9285	618.2221	640.9937	(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	10.1100	36.7938	0.6300	0.7000	0.7700	113.6836	(77)
Northwest	6.0900	11.2829	0.6300	0.7000	0.7700	20.9996	(81)

Solar gains	134.6833	236.3907	341.9675	454.7691	537.7247	546.3044	521.5070	457.7122	380.7313	266.2575	162.5898	114.4389	(83)
Total gains	789.3539	907.2870	984.4377	1075.4974	1127.0677	1112.0910	1065.6349	1002.6322	942.1880	849.1860	780.8118	755.4326	(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	85.6888	85.9672	86.2418	87.5556	87.8059	88.9900	88.9900	89.2128	88.5301	87.8059	87.3011	86.7795	
alpha	6.7126	6.7311	6.7495	6.8370	6.8537	6.9327	6.9327	6.9475	6.9020	6.8537	6.8201	6.7853	
util living area	0.9988	0.9965	0.9898	0.9576	0.8534	0.6465	0.4718	0.5216	0.7884	0.9717	0.9965	0.9991	(86)
MIT	20.0670	20.2170	20.4234	20.7037	20.9076	20.9887	20.9988	20.9978	20.9593	20.7010	20.3401	20.0492	(87)
Th 2	20.0472	20.0500	20.0527	20.0656	20.0680	20.0793	20.0793	20.0814	20.0750	20.0680	20.0632	20.0581	(88)
util rest of house	0.9983	0.9950	0.9853	0.9390	0.7998	0.5599	0.3739	0.4191	0.7059	0.9554	0.9947	0.9987	(89)
MIT 2	18.9627	19.1565	19.4204	19.7745	19.9974	20.0740	20.0790	20.0808	20.0517	19.7790	19.3245	18.9484	(90)
Living area fraction									fLA = Living area / (4) =			0.2416	(91)
MIT	19.2295	19.4126	19.6627	19.9990	20.2172	20.2950	20.3012	20.3023	20.2710	20.0018	19.5698	19.2143	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2295	19.4126	19.6627	19.9990	20.2172	20.2950	20.3012	20.3023	20.2710	20.0018	19.5698	19.2143	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9936	0.9828	0.9374	0.8092	0.5808	0.3976	0.4440	0.7248	0.9539	0.9934	0.9982	(94)
Useful gains	787.4589	901.4915	967.5250	1008.2222	912.0525	645.8517	423.7348	445.2004	682.8811	810.0671	775.6199	754.0642	(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	1776.8532	1721.6501	1556.5320	1292.7948	989.2500	652.6519	424.1651	446.0935	710.8736	1091.9851	1456.7063	1764.4937	(97)
Space heating kWh	736.1093	551.1466	438.2212	204.8923	57.4349	0.0000	0.0000	0.0000	0.0000	209.7470	490.3822	751.7596	(98a)

Space heating requirement - total per year (kWh/year) 3439.6931

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	736.1093	551.1466	438.2212	204.8923	57.4349	0.0000	0.0000	0.0000	0.0000	209.7470	490.3822	751.7596	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3439.6931

Space heating per m2 (98c) / (4) = 30.1595 (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	736.1093	551.1466	438.2212	204.8923	57.4349	0.0000	0.0000	0.0000	0.0000	209.7470	490.3822	751.7596	(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)	797.5182	597.1253	474.7792	221.9851	62.2263	0.0000	0.0000	0.0000	0.0000	227.2448	531.2916	814.4741	(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												
	250.8962	221.8274	235.8067	207.9926	201.9990	182.4544	180.5264	187.5436	189.4034	210.6456	223.2496	248.2732 (64)
Efficiency of water heater												79.8000 (216)
(217)m	86.3251	86.0160	85.4293	84.0261	81.6316	79.8000	79.8000	79.8000	79.8000	84.0502	85.7737	86.3813 (217)
Fuel for water heating, kWh/month												
	290.6410	257.8908	276.0257	247.5333	247.4519	228.6396	226.2236	235.0170	237.3476	250.6189	260.2774	287.4154 (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	31.0742	24.9289	22.4457	16.4447	12.7024	10.3779	11.5875	15.0619	19.5639	25.6689	28.9930	31.9379 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-39.9598	-57.1360	-83.2563	-94.9015	-103.3795	-96.8115	-95.5733	-89.7001	-79.5276	-65.8831	-44.1986	-34.4509 (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	-20.1894	-42.7313	-85.4342	-129.0679	-171.4188	-172.5637	-170.5795	-144.1183	-105.1921	-61.4105	-27.0487	-15.9493 (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	3726.6447 (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	3045.0820 (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)	250.7868 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2030.4820 (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	5078.0316 (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	3726.6447	0.2100	782.5954	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3045.0820	0.2100	639.4672	(264)
Space and water heating			1422.0626	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	250.7868	0.1443	36.1963	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-884.7783	0.1343	-118.8348	
PV Unit electricity exported	-1145.7037	0.1257	-144.0346	
Total			-262.8694	(269)
Total CO2, kg/year			1207.3188	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.5900	(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	3726.6447	1.1300	4211.1086	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3045.0820	1.1300	3440.9427	(278)
Space and water heating			7652.0513	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	250.7868	1.5338	384.6652	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-884.7783	1.4964	-1323.9582	
PV Unit electricity exported	-1145.7037	0.4615	-528.6955	
Total			-1852.6537	(283)
Total Primary energy kWh/year			6314.1636	(286)
Target Primary Energy Rate (TPER)			55.3600	(287)