





ENERGY STATEMENT

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Document Version

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1	19/02/2025	First Draft V1	B.Whittingham	D.Barsted

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1. Executive Summary

1.1 Introduction

- 1.1.1 This energy strategy has been prepared on behalf of B2 Architecture, hereafter referred to as the Applicant, in support of a full planning application for the development known as 262 Ryebank Road, Manchester M21 9LJ, hereafter referred to as the Development.

1.2 Policies and Requirements

1.2.1 National Policies

- 1.2.1.1 Below outlines the national policies this energy statement has been developed in accordance with,

1.2.2 National Planning Policy Framework

- 1.2.2.1 The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied.

- 1.2.2.2 It provides a framework within which locally-prepared plans for housing and other development can be produced.

1.2.3 Building Regulations Approved Document Part L

- 1.2.3.1 Part L of Building Regulations covers the conservation of fuel and power, Notional specifications have been designed as a benchmarking tool to assess against.

- 1.2.3.2 The DER (Dwelling Emission Rate) can therefore be assessed against the notional specification TER (Target Emission Rate).

- 1.2.3.3 As the proposed development contains existing structures, a notional baseline calculation has been calculated in the place of the TER (Target Emission Rate) targets.

1.2.4 Local Policies

1.2.4.1 Below outlines the local policies this energy statement has been developed in accordance with,

1.2.5 Manchester Core Strategy 2012 to 2027

1.2.5.1 Policy EN4: Reducing CO2 emissions by enabling low and zero carbon development

1.2.6 The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO2 emissions, and rising fossil fuel prices, through the following actions: All development must follow the principle of the Energy Hierarchy, being designed:

1.2.7 to reduce the need for energy through design features that provide passive heating, natural lighting and cooling to reduce the need for energy through energy efficient features such as improved insulation and glazing to meet residual energy requirements through the use of low or zero carbon energy generating technologies. Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.

1.2.8 Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings. Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes. The use of building materials with low embodied carbon in new development and refurbishment schemes.

1.2.8.1 Policy EN6: Target framework for CO2 reductions from low or zero carbon energy supplies.

1.2.8.1.1 Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO2 emissions for all phases of the development.

1.2.8.1.2 Developments smaller than the above threshold but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement. The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows:

1.2.8.1.3 Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling). Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes. Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

1.2.8.1.4 Domestic CO2 emissions reduction targets.

Table 12.1:

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target 2: Electricity intense buildings	+15% increase on Part L 2010
Target 3: Micro generation area	+15%increase on Part L 2010

Non-domestic CO2 emissions reduction targets

Table 12.2:

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO2/m2))	+10%increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

- 1.2.9 Where the CO2 emissions reduction required under any future revision to Part L of the building regulations becomes greater than the '% Minimum requirement', the reduction required under building regulations would apply. Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the '% Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.
- 1.2.10 The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO2 mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance. Guidance on what the energy statement should contain and how to decide which target applies to a development proposal is given in Appendix A.

1.3 Assessment Methodology

- 1.3.1 As per the above national and local criteria, the below strategy has been adopted for the site,
 - 1.3.1.1 As part of the net-zero local carbon target, the development will have no connection to a main gas supply.
 - 1.3.1.2 To better reflect the emissions associated with the production of electricity, update fuel factors will be used as part of the assessment.
 - 1.3.1.3 The energy hierarchy and a fabric first approach will be utilised.

1.4 Energy Efficiency Measures

- 1.4.1 The proposed development incorporates several energy efficiency measure and designs to ensure compliance & CO₂ reduction including:
 - 1.4.2 Fabric Insulation improvements on Building Regulations Part L minimum standards,
 - 1.4.3 Air permeability targets implemented as part of the project to minimise heat loss,
 - 1.4.4 Improved glazing U & G Values for the development,
 - 1.4.5 Low Energy lighting scheme adopted on site.

1.5 Low Carbon Energy Supply

- 1.5.1 The proposed development is not within an area of which allows for a decentralised energy network to be utilised,
 - 1.5.2 Therefore, this option will not be explored further within this energy statement.
- 1.5.3 The proposed site sits within a Heat Network Priority Area; therefore, it is recommended that the site is development in a manner that will allow to connection to a district heating system in the future is one is to become feasible.

1.6 On-site renewable technologies

- 1.6.1 The proposed design of the development incorporates the use of **Air Source Heat Pump** and **Solar PV** to meet the requirements of the local authority.
- 1.6.2 Further options have been reviewed to provide further carbon reductions; the use of on-site renewable technologies has been reviewed in further details within this statement.

1.7 Site Description

- 1.7.1 The proposed development is set as 262 Ryebank Road, Manchester M21 9LJ.
- 1.7.2 The proposed works to the site is the construction of a 2 no. new build dwelling.
- 1.7.3 The proposed development is to incorporate a high level of thermal performance and incorporate low carbon heating to ensure the new development achieve the local policy requirements.

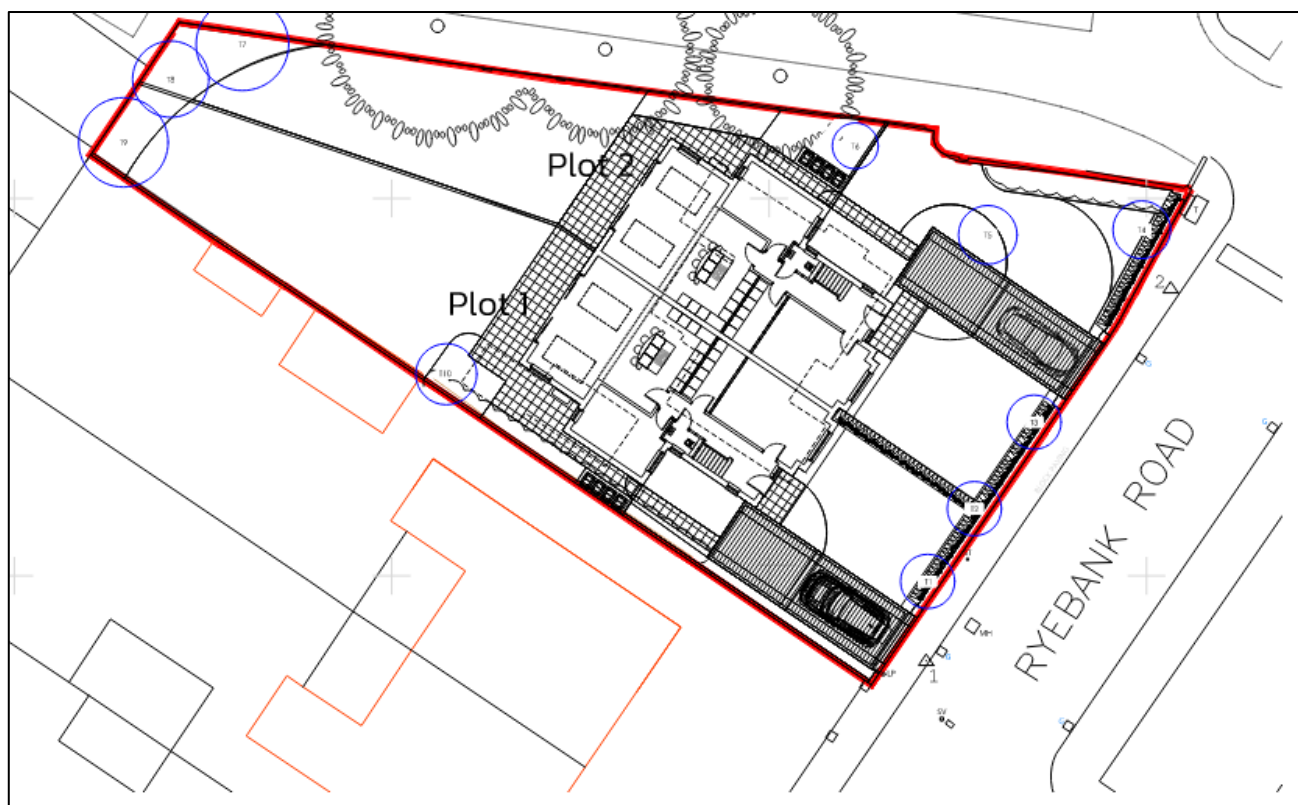


Fig.1 Proposed Site Plans

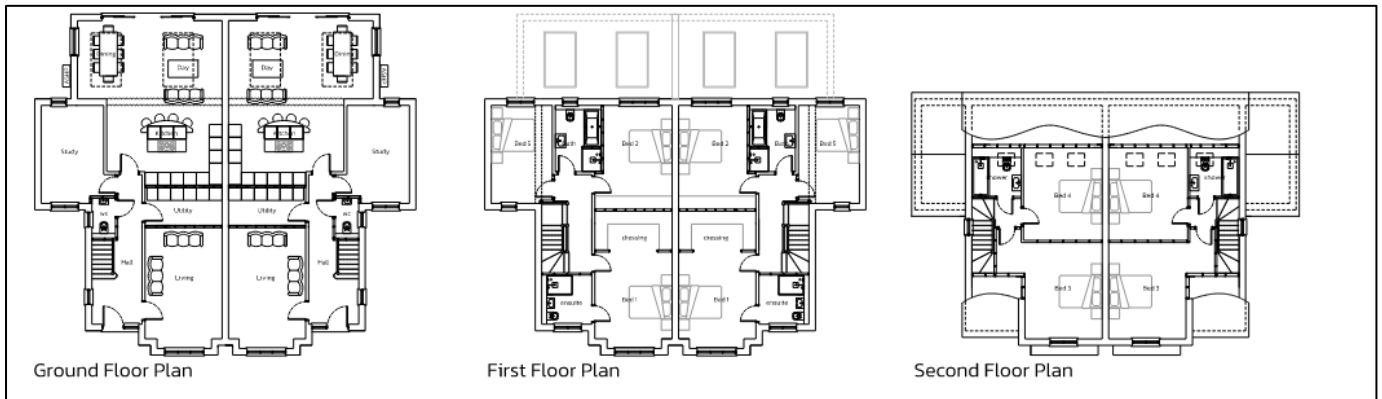


Fig.2 Proposed Floor Plans



Fig.3 Proposed Elevations

1.8 Renewable and Low Carbon Energy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	-0.2	-7%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	3.1	85%
Cumulative on site savings	2.8	78%

	Regulated domestic carbon dioxide	
	(Tonnes CO ₂ per annum)	
Baseline Carbon Emissions (Part L2021 standards)	3.6	
After Be Lean Measures	3.9	
After Be Green Measures	0.8	

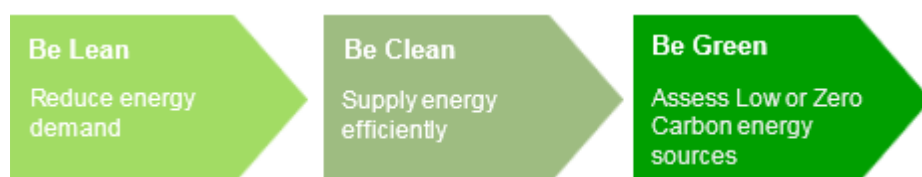
2. Methodology

2.1 Limitations

- 2.1.1 The calculations and figures utilised within this energy statement are based on Building regulations Part L methodology and should not be understood as a predictive assessment of likely future energy requirements.
- 2.1.2 Other external factors will be present such as occupant system operation patterns and weather patterns.

2.2 Energy Hierarchy

- 2.2.1 The assessment has been carried out in accordance to the energy hierarchy method in line with GLA policy/s.
- 2.2.2 The energy hierarchy method has been utilised to ensure the design of the development has reduced the demand for energy as far as reasonably practicable prior to the consideration of integrating Low or Zero Carbon technologies.



2.3 Carbon Factors

- 2.3.1 The below emissions factors have been used within the calculations based on SAP10 emission factors.

Fuel	Emission Factor (kgCO ₂ /KWh)
Gas	0.210
Electricity	0.213

3. Be Lean Measures

3.0.1 The following sections details the design measures that have been considered/to be implemented at the development.

3.1 Thermal insulation

- 3.1.1 In order to reduce the overall heating and cooling requirements for the development it is imperative that the development incorporates an efficient thermal envelope.
- 3.1.2 The below elements have been considered for the development.
- 3.1.3 Fabric Insulation improvements on Building Regulations Part L minimum standards,
- 3.1.4 Air permeability targets implemented as part of the project to minimise heat loss,
- 3.1.5 Improved glazing U & G Values for the development,
- 3.1.6 Low Energy lighting scheme adopted on site.
- 3.1.7 The table below outlines the u-value targets for the development in comparison to the limiting factor set out in Building regulations Part L.

Element	U-Value (W/m ² K)
	Development
External Façade (New Element Table 4.2)	0.18
Ashlar Wall (adjacent to loft space)	0.09
External Flat roof (New Element Table 4.2)	0.12
Plane ceiling loft space roof	0.11
Pitched roof	0.13
Ground Floor (New Element Table 4.2)	0.12
Glazing	1.2
Doors	1.2
Rooflight	1.2
Air Permeability New Build	4.5
Low Energy Lighting	120 lm/W
Thermal Bridging (Y-Value) New Build	Y=0.041 Target (Bespoke or Accredited Scheme)
MVHR	N/A
Waste Water Heat Recovery System	N/A

4. Be Clean Measures

4.1 Low Carbon Energy Supply

- 4.1.1 The proposed development does not have a significant thermal demand but however does fall within an area that has been prioritised for future
- 4.1.2 plans that could incorporate a decentralised energy network to be utilised.

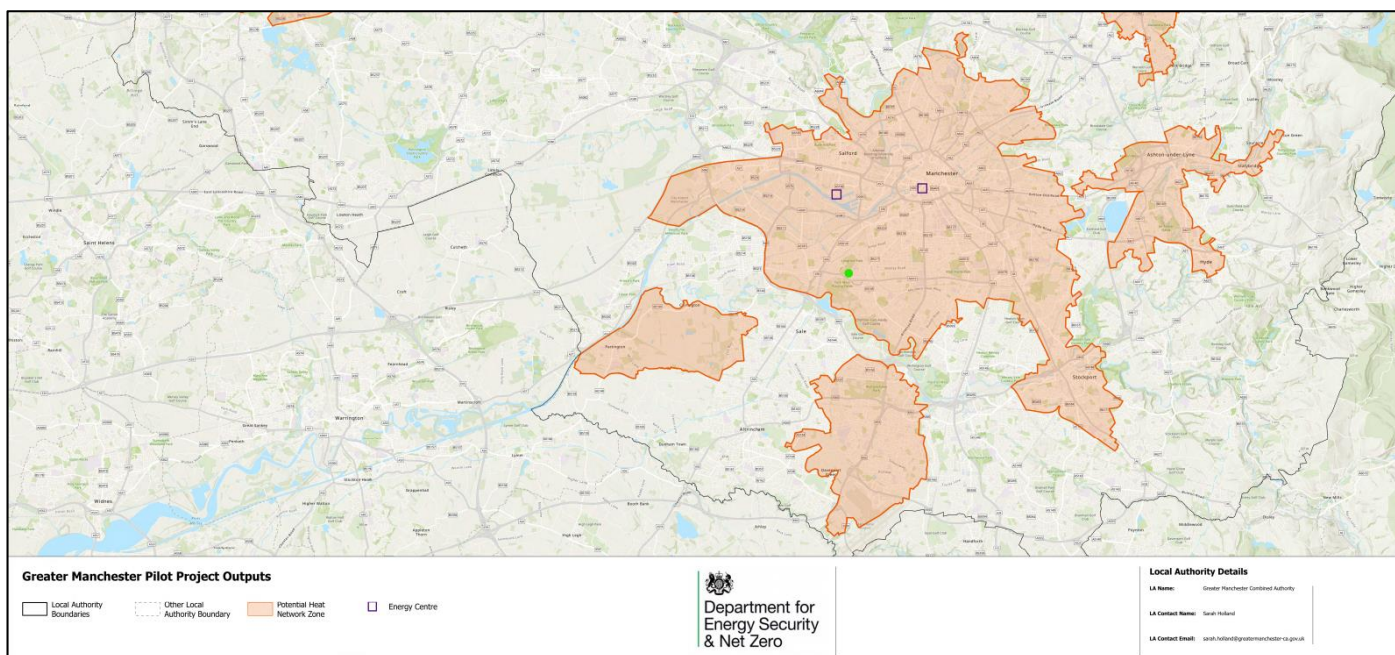


Fig 4. Heat network zoning map: Greater Manchester (green dot represents location of the development)

- 4.1.3 The development currently sits within a potential heat network area, if the development does become a part of a heat network area in the future, the proposed design already has capacity for connection as the heating system in place has a temperature flow suitably low enough with heat networks typically performing at temperatures of approximately 45 degrees or lower. This and the hot water storage system in place are both elements of the dwelling that are very suitable for heat network connection, so it is recommended that consideration is taken in the future for connection to a network if one is proposed in this area.

5. Be Green Measures

5.0.1 The following sections discuss the renewable energy generation measures that have been considered, and those which will be implemented at the Development.

5.0.2 Renewable technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available. However, not all these are commercially viable, suitable for city-centre locations or appropriate for the Development.

5.0.3 Technologies considered for the Development include:

- Solar Hot Water Panels (Solar Thermal)
- Photovoltaic (PV) Cells
- Combined Heat and Power (CHP) and Micro-CHP (mCHP)
- Ground Source Heat Pumps (GSHP)
- Air Source Heat Pumps (ASHP)
- Wind Turbines

5.1 Solar Hot Water Panels

- 5.1.1 Solar Hot Water Panels or, Solar Panels as they are commonly known, are used to supplement the energy required for the domestic hot water requirement. The system will collect and absorb solar radiation and transfer the heat directly to the storage tank.
- 5.1.2 The circulation may then be either 'passive' thus relying on the natural convection or 'active' using a pump which increases a system's efficiency but has additional costs for the controls and energy requirement.
- 5.1.3 There are two main types of solar panel collector available to the UK market. The first is Flat Plate Collectors which consist of a dark absorber sheet with pipes built into the sheet encased in a weatherproof box.
- 5.1.4 This will pump the collected solar radiation to the storage device to heat the water for use. The second main system is Evacuated Tube Collectors.
- 5.1.5 These devices are more efficient and are effective under a "...wider range of conditions..." (TM38:2006) due to the energy being drawn from "...light rather than outside temperature..." This therefore allows this type of system to adapt to cooler climates.
- 5.1.6 **Solar Hot Water Panels have been deemed possible for this development due to the available roof space and DHW demand, the available roof space would allow the design to fully support the DHW. However, an alternative technology has been selected to further reduce the carbon emissions on site and to meet the financial and on-site feasibility.**

5.2 Photovoltaic (PV) Cells

- 5.2.1 Solar panel electricity systems, also known as solar Photovoltaics' (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work - they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting.
- 5.2.2 PV cells are made from layers of semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers. The stronger the sunshine, the more electricity is produced. Groups of cells are mounted together in panels or modules that can be mounted on your roof.
- 5.2.3 The power of a PV cell is measured in kilowatts peak (kWp). That is the rate at which it generates energy at peak performance in full direct sunlight during the summer. PV cells come in a variety of shapes and sizes. Most PV systems are made up of panels that fit on top of an existing roof, but you can also fit solar tiles.
- 5.2.4 **Photovoltaic (PV) Cells have been considered and have been deemed viable for this site, the available roof space available would allow for a solar PV array as well as helping to exceed carbon reduction targets and therefore this technology has not been selected.**



Location	Roof Mounted
Acoustic considerations	No acoustic considerations
Groundworks	No groundwork considerations
Export possible	Yes export possible to grid

5.3 Combined Heat and Power (CHP) and Micro-CHP (mCHP)

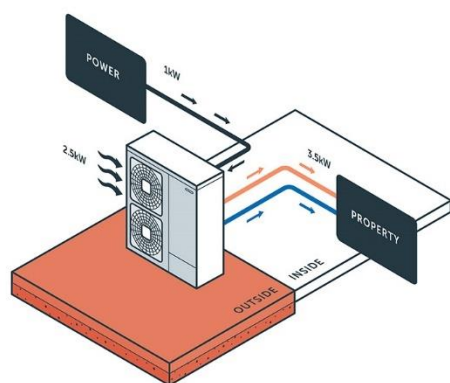
- 5.3.1 Micro-CHP' stands for micro combined heat and power. This technology generates heat and electricity simultaneously, from the same energy source, in individual homes or buildings. The main output of a micro-CHP system is heat, with some electricity generation, at a typical ratio of about 6:1 for domestic appliances.
- 5.3.2 A typical domestic system will generate up to 1kW of electricity once warmed up: the amount of electricity generated over a year depends on how long the system is able to run. Any electricity you generate and don't use can be sold back to the grid.
- 5.3.3 Domestic micro-CHP systems are currently powered by mains gas or LPG; in the future there may be models powered by oil or bio-liquids. Although gas and LPG are fossil fuels rather than renewable energy sources, the technology is still considered to be a 'low carbon technology' because it can be more efficient than just burning a fossil fuel for heat and getting electricity from the national grid. Micro-CHP systems are similar in size and shape to ordinary, domestic boilers and like them can be wall hung or floor standing. The only difference to a standard boiler is that they are able to generate electricity while they are heating water.
- 5.3.4 For the householder, there is little difference between a micro-CHP installation and a standard boiler. If the dwelling already has a conventional boiler then a micro-CHP unit should be able to replace it as it's roughly the same size. However, the installer must be approved under the Micro generation Certification Scheme. Servicing costs and maintenance are estimated to be similar to a standard boiler – although a specialist will be required.
- 5.3.5 **CHP and mCHP have been considered for the project, in order to house the system, an external additional plant area would be required and therefore the feasibility of the CHP has not been deemed acceptable or viable due to planning restrictions.**

5.4 Ground Source Heat Pumps (GSHP)

- 5.4.1 Ground source heat pumps use pipes which are buried in the garden to extract heat from the ground. This heat can then be used to heat radiators, underfloor or warm air heating systems and hot water in the home.
- 5.4.2 A ground source heat pump circulates a mixture of water and antifreeze around a loop of pipe - called a ground loop - which is buried in the garden. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump. The ground stays at a constant temperature under the surface, so the heat pump can be used throughout the year - even in the middle of winter.
- 5.4.3 The length of the ground loop depends on the size of the home and the amount of heat needed. Longer loops can draw more heat from the ground, but need more space to be buried in. If space is limited, a vertical borehole can be drilled instead. Running costs will depend on several factors - including the size of the dwelling and how well insulated it is.
- 5.4.4 **Ground Source Heat Pump has been considered for this project and has not been deemed viable due to the available external space. A more suitable technology has been selected to reduce the carbon emissions as well as financial and on-site feasibility.**

5.5 Air Source Heat Pumps (ASHP)

- 5.5.1 Air source heat pumps absorb heat from the outside air. This heat can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water in dwellings.
- 5.5.2 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 get heat from the air even when the temperature is as low as -15°C . Heat pumps have some impact on the environment as they need electricity to run, but the heat they extract from the ground, air, or water is constantly being renewed naturally.
- 5.5.3 Running costs will vary depending on several factors - including the size of the home, and how well insulated it is, and what room temperatures are achieved.
- 5.5.4 **Air Source Heat Pump has been considered for the project and has not been deemed a viable option for the residential element of the project, the carbon reductions of the installation of a ASHP exceed the council requirements for the commercial areas. Therefore, this technology has been adopted for the main heating and DHW for the commercial elements.**



Location	Ground/External Façade/internally Mounted
Acoustic considerations	Noise impacts of Air source heat pumps should be considered due to pumps and plant located Externally.
Groundworks	No groundwork requirements
Export possible	Export of electricity to the grid is not possible for this technology
Maintenance	heat pumps are a low-maintenance heating option, it is still important to have them serviced regularly to make sure they are performing safely and efficiently
Service Life	20-25 years

*Proposed location of ASHP only, to be confirmed for feasibility and suitability.

5.6 Wind Turbines

- 5.6.1 Wind turbines harness the power of the wind and use it to generate electricity. Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines (known as 'microwind' or 'small-wind' turbines). A typical system in an exposed site could easily generate more power than a dwelling's lights and electrical appliances use.
- 5.6.2 Wind turbines use large blades to catch the wind. When the wind blows, the blades are forced round, driving a turbine which generates electricity. The stronger the wind, the more electricity produced. There are two types of domestic-sized wind turbine:
- 5.6.3 **Pole mounted:** these are free standing and are erected in a suitably exposed position, often around 5kW to 6Kw
- 5.6.4 **Building mounted:** these are smaller than mast mounted systems and can be installed on the roof of a home where there is a suitable wind resource. Often these are around 1kW to 2kW in size. Wind turbines are eligible for the UK government's Feed-in-Tariffs which means money can be earned from the electricity generated by the turbine. Payments for the electricity not use and export to the local grid are available as well. To be eligible, the installer and wind turbine product must be certified under the Microgeneration Certification Scheme (MCS). If the turbine is not connected to the local electricity grid (known as off grid), unused electricity can be stored in a battery for use when there is no wind. Please note that the Feed-in Tariffs scheme is not available in Northern Ireland.
- 5.6.5 **Wind Turbines have been considered for this project, Pole mounted wind turbine has been excluded due to nature of the development and building mounted would not achieve the required reductions on site to meet the local requirements, therefore this has not been explored further.**

5.7 Biomass

- 5.7.1 Energy from Biomass is produced by burning organic matter. Biomass fuel sources include trees, crops or animal dung are "...harvested and processed to create energy in the form of Electricity, Heat and Steam." (TM38:2006) Biomass is carbon based and when used as a fuel, produces carbon emissions. However, the carbon emitted during the combustion process is "...equivalent to the amount absorbed during growth..." (TM38:2006) The only carbon emissions associated with this energy source is treatment and transportation costs of the fuel to the end user.
- 5.7.2 Carbon savings that can be attributed to this technology type are significant. Biomass boiler installation can "...deliver all of the heating requirements for a building...using an almost carbon neutral fuel source." (TM38:2005) Biomass can be cost effective when directly compared to convention as oil and electricity heating sources. The benefit can be increased when the biomass source, for example wood chips, is diverted from the waste stream. However, maintenance requirements of a biomass system are higher and should be taken into account when installing one. Additionally, the UK introduced the Clean Air Act (1993) (www.uksmokecontrolareas.co.uk) to control the smoke pollution in areas caused by burning of smoky fuels.
- 5.7.3 **Biomass been considered for the project, in order to house the system, an external additional plant area would be required and therefore the feasibility of the CHP has not been deemed acceptable or viable due to planning restrictions. If planning restrictions are limited on Biomass it is recommended to review the financial feasibility as the Biomass option exceeds the planning requirements.**

5.8 Summary of Be Green Measures

Technology	Deemed Viable	Adopted on site
Solar Hot Water Panels (Solar Thermal)	✓	✗
Photovoltaic (PV) Cells	✓	✓
Combined Heat and Power (CHP) and Micro-CHP (mCHP)	✗	✗
Ground Source Heat Pumps (GSHP)	✗	✗
Air Source Heat Pumps (ASHP)	✓	✓
Wind Turbines	✗	✗
Biomass	✗	✗

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	-0.2	-7%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	3.1	85%
Cumulative on site savings	2.8	78%

	Regulated domestic carbon dioxide	
	(Tonnes CO ₂ per annum)	
Baseline Carbon Emissions (Part L2021 standards)	3.6	
After Be Lean Measures	3.9	
After Be Green Measures	0.8	

6. Conclusion

- 6.1.1 After reviewing the above renewable technologies, Air source Heat Pump and Photovoltaic cells have been identified as the most viable options to achieve the criteria set out by the local authority.
- 6.1.2 The development has been deemed viable for additional measures and therefore it is recommended to explore the financial feasibility of these options to maximise the reduction in carbon emissions on site.
- 6.1.3 The key focus on site was to minimise heat loss and reduce the regulated energy consumption on-site through utilisation of the energy hierarchy.

7. Summary of energy efficient measures

Element	U-Value (W/m ² K)
	Development
External Façade (New Element Table 4.2)	0.18
Ashlar wall (adjacent to loft space)	0.09
External flat roof (New Element Table 4.2)	0.12
Plane ceiling loft space roof	0.11
Pitched roof	0.13
Ground Floor (New Element Table 4.2)	0.12
Glazing	1.2
Doors	1.2
Rooflight	1.2
Air Permeability New Build	4.5
Low Energy Lighting	120 lm/W
Thermal Bridging (Y-Value) New Build	Y=0.041 Target (Bespoke or Accredited Scheme)
MVHR	N/A
Waste Water Heat Recovery System	N/A

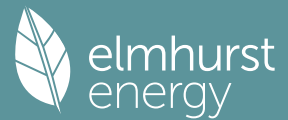
7.1 Summary of renewable or Low Carbon measures

Element	
Main Heating System (Residential)	Mitsubishi Ecodan 11.2 kW ASHP (TBC)
Hot Water System (Residential)	Provided via Main Heating System with 150L cylinder 2.09 kWh/day heat loss
Renewable Technologies	Solar PV: 1 kWp facing Southeast, 1kWp Facing Northwest
Mechanical Ventilation Heat Recovery System	N/A
Waste Water Heat Recovery	N/A

7.2 Appendix 1 – SAP Documents

- 7.2.1 SAP documentation has been included in a separate folder and is to be used in conjunction with this document to validate figures and reductions.

Full SAP Calculation Printout



Property Reference	plot 1	Issued on Date	19/02/2025
Assessment Reference	00001	Prop Type Ref	
Property	262, Ryebank Road, Chorlton, Manchester, M21 9LJ		
SAP Rating	90 B	DER	1.76
Environmental	98 A	% DER < TER	77.97
CO ₂ Emissions (t/year)	0.36	DFEE	36.56
Compliance Check	See BREL	% DFEE < TFEE	8.34
% DPER < TPER	52.70	DPER	19.85
Assessor Details	Mr. David Barsted	Assessor ID	AV66-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	102.7100 (1b)	x 2.5600 (2b)	= 262.9376 (1b) - (3b)
First floor	76.1800 (1c)	x 2.7700 (2c)	= 211.0186 (1c) - (3c)
Second floor	46.4800 (1d)	x 2.5500 (2d)	= 118.5240 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	225.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 592.4802 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1013 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.5000	(17)
Infiltration rate	0.3263	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2773 (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	0.3536	0.3467	0.3397	0.3051	0.2981	0.2635	0.2635	0.2565	0.2773	0.2981	0.3120	0.3259 (22b)
Effective ac	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5385	0.5444	0.5487	0.5531 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
windows			40.3100	1.1450	46.1565		(27)
door			2.3800	1.2000	2.8560		(26)
roof windows			9.5300	1.1450	10.9122		(27a)
Heatloss Floor 1			102.7100	0.1200	12.3252	75.0000	7703.2500 (28a)
cavity wall	187.4400	42.6900	144.7500	0.1800	26.0550	70.0000	10132.5000 (29a)
ashlar wall	15.7900		15.7900	0.0900	1.4211	9.0000	142.1100 (29a)
flat roof	26.5300	7.7600	18.7700	0.1200	2.2524	9.0000	168.9300 (30)
first floor plane roof	29.7000		29.7000	0.1100	3.2670	9.0000	267.3000 (30)
sloped roof	31.1900	1.7700	29.4200	0.1300	3.8246	9.0000	264.7800 (30)
second floor plane roof	21.1100		21.1100	0.1100	2.3221	9.0000	189.9900 (30)
Total net area of external elements A _{um} (A, m ²)			414.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	111.3921		(33)
Main dwelling							
Party Wall 1			90.6400	0.0000	0.0000	140.0000	12689.6000 (32)
Internal Wall 1			332.9600			9.0000	2996.6400 (32c)
Internal Floor 1			76.1800			18.0000	1371.2400 (32d)
Internal Floor 2			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			9.0000	418.3200 (32e)

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Internal Ceiling 2 76.1800 9.0000 685.6200 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 37866.9200 (34)
 List of Thermal Bridges 168.0211 (35)

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	32.5700	0.1000	3.2570
P1 Party wall - Ground floor	14.8000	0.0930	1.3764
E2 Other lintels (including other steel lintels)	22.8000	0.0200	0.4560
E3 Sill	22.8000	0.0180	0.4104
E4 Jamb	53.6600	0.0140	0.7512
E6 Intermediate floor within a dwelling	38.0400	0.0010	0.0380
P2 Party wall - Intermediate floor within a dwelling	19.7500	0.0000	0.0000
E14 Flat roof	10.5200	0.0430	0.4524
P4 Party wall - Roof (insulation at ceiling level)	11.1200	0.1010	1.1231
E10 Eaves (insulation at ceiling level)	12.5900	0.0680	0.8561
E12 Gable (insulation at ceiling level)	12.0400	0.0970	1.1679
E13 Gable (insulation at rafter level)	7.7600	0.0600	0.4656
E11 Eaves (insulation at rafter level)	9.6900	0.0180	0.1744
R8 Roof to wall (rafter)	9.6900	0.1200	1.1628
R9 Roof to wall (flat ceiling)	9.6900	0.3200	3.1008
P5 Party wall - Roof (insulation at rafter level)	2.7400	0.0460	0.1260
E18 Party wall between dwellings	14.4900	0.0510	0.7390
E16 Corner (normal)	42.1900	0.0490	2.0673
E17 Corner (inverted - internal area greater than external area)	26.4300	-0.0830	-2.1937
R1 Head of roof window	5.3400	0.0610	0.3257
R2 Sill of roof window	5.3400	0.0600	0.3204
R3 Jamb of roof window	14.8600	0.0560	0.8322
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.0091 (36)
Point Thermal Bridges			0.0000 (36a) =
Total fabric heat loss			128.4012 (37) (33) + (36) + (36a) =

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	109.9820	109.5073	109.0421	106.8570	106.4481	104.5449	104.5449	104.1925	105.2780	106.4481	107.2752	108.1399	(38)
Heat transfer coeff	238.3832	237.9086	237.4433	235.2582	234.8494	232.9462	232.9462	232.5937	233.6793	234.8494	235.6764	236.5411	(39)
Average = Sum(39)m / 12 =												235.2562	
HLP	1.0577	1.0556	1.0536	1.0439	1.0421	1.0336	1.0336	1.0321	1.0369	1.0421	1.0457	1.0496	(40)
HLP (average)												1.0439	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

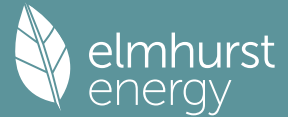
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0349 (42)
Hot water usage for mixer showers	103.2699	101.7179	99.4564	95.1295	91.9363	88.3753	86.3512	88.5956	91.0558	94.8793	99.2992	102.8742	(42a)
Hot water usage for baths	32.4210	31.9395	31.2614	30.0112	29.0751	28.0371	27.4764	28.1497	28.8828	29.9935	31.2695	32.3114	(42b)
Hot water usage for other uses	45.7105	44.0483	42.3861	40.7239	39.0617	37.3995	37.3995	39.0617	40.7239	42.3861	44.0483	45.7105	(42c)
Average daily hot water use (litres/day)												166.8257	(43)
Daily hot water use	181.4014	177.7057	173.1040	165.8646	160.0731	153.8119	151.2271	155.8070	160.6625	167.2589	174.6169	180.8961	(44)
Energy conte	287.2954	253.0506	266.0544	227.0604	215.4892	189.1296	182.8961	192.9216	198.1130	226.9688	248.7738	283.2395	(45)
Energy content (annual)												2770.9923	
Distribution loss (46)m = 0.15 x (45)m	43.0943	37.9576	39.9082	34.0591	32.3234	28.3694	27.4344	28.9382	29.7169	34.0453	37.3161	42.4859	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(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	345.5444	305.6626	324.3034	283.4304	273.7382	245.4996	241.1451	251.1706	254.4830	285.2178	305.1438	341.4885	(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	345.5444	305.6626	324.3034	283.4304	273.7382	245.4996	241.1451	251.1706	254.4830	285.2178	305.1438	341.4885	(64)
Total per year (kWh/year)												3456.8273	(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	142.1249	126.2289	135.0623	120.5936	118.2493	107.9816	107.4121	110.7456	110.9686	122.0663	127.8133	140.7763	(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	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	199.0108	220.3334	199.0108	205.6445	199.0108	205.6445	199.0108	199.0108	205.6445	199.0108	205.6445	199.0108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.5611	398.6554	388.3379	366.3731	338.6465	312.5874	295.1783	291.0840	301.4015	323.3663	351.0929	377.1520	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	(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)	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	(71)
Water heating gains (Table 5)	191.0281	187.8406	181.5353	167.4911	158.9373	149.9745	144.3712	148.8517	154.1230	164.0676	177.5185	189.2155	(72)

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Total internal gains
853.1237 875.3531 837.4076 808.0323 765.1182 736.7300 707.0839 707.4701 729.6927 754.9684 802.7795 833.9020 (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						18.0400	36.7938	0.6300	0.7000	0.7700	202.8539 (77)		
Southwest						5.3800	36.7938	0.6300	0.7000	0.7700	60.4963 (79)		
Northwest						16.8900	11.2829	0.6300	0.7000	0.7700	58.2403 (81)		
South						7.7600	26.0000	0.6300	0.7000	1.0000	80.0785 (82)		
Northwest						1.7700	26.0000	0.6300	0.7000	1.0000	18.2653 (82)		
Solar gains		419.9345	771.3855	1190.4757	1678.6350	2049.5559	2104.8252	2000.4318	1715.9020	1359.8282	890.2992	513.5354	352.3665 (83)
Total gains		1273.0581	1646.7385	2027.8834	2486.6673	2814.6741	2841.5552	2707.5157	2423.3721	2089.5208	1645.2676	1316.3149	1186.2685 (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	44.1247	44.2127	44.2994	44.7108	44.7887	45.1546	45.1546	45.2230	45.0129	44.7887	44.6315	44.4683
alpha	3.9416	3.9475	3.9533	3.9807	3.9859	4.0103	4.0103	4.0149	4.0009	3.9859	3.9754	3.9646
util living area	0.9924	0.9793	0.9453	0.8493	0.6878	0.5051	0.3737	0.4321	0.6857	0.9215	0.9839	0.9942 (86)
Living	19.5826	19.8285	20.1692	20.5592	20.7998	20.8955	20.9165	20.9118	20.8338	20.4643	19.9433	19.5423
Non living	18.3606	18.6741	19.1021	19.5771	19.8420	19.9386	19.9538	19.9527	19.8869	19.4791	18.8286	18.3142
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	20.2749	19.8285	20.1692	20.5592	20.7998	20.8955	20.9165	20.9118	20.8338	20.4643	19.9433	19.7462 (87)
Th 2	20.0355	20.0372	20.0389	20.0469	20.0484	20.0554	20.0554	20.0567	20.0527	20.0484	20.0454	20.0422 (88)
util rest of house	0.9906	0.9748	0.9335	0.8199	0.6367	0.4372	0.2957	0.3475	0.6155	0.8987	0.9796	0.9928 (89)
MIT 2	19.3678	18.6741	19.1021	19.5771	19.8420	19.9386	19.9538	19.9527	19.8869	19.4791	18.8286	18.6256 (90)
Living area fraction	19.4473	18.7753	19.1956	19.6632	19.9260	20.0224	20.0382	20.0368	19.9699	19.5654	18.9263	18.7238 (92)
MIT	19.4473	18.7753	19.1956	19.6632	19.9260	20.0224	20.0382	20.0368	19.9699	19.5654	18.9263	18.7238 (92)
Temperature adjustment	19.4473	18.7753	19.1956	19.6632	19.9260	20.0224	20.0382	20.0368	19.9699	19.5654	18.9263	18.7238 (93)
adjusted MIT	19.4473	18.7753	19.1956	19.6632	19.9260	20.0224	20.0382	20.0368	19.9699	19.5654	18.9263	18.7238 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9893	0.9667	0.9206	0.8064	0.6296	0.4348	0.2942	0.3457	0.6088	0.8844	0.9726	0.9903 (94)
Useful gains	1259.4456	1591.9766	1866.8175	2005.2456	1772.2425	1235.4898	796.6420	837.8068	1272.0611	1455.1312	1280.2510	1174.7447 (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	3610.8553	3301.0411	3014.4961	2532.1230	1931.8648	1263.1338	800.9162	845.8953	1371.6791	2105.5281	2787.1762	3435.4808 (97)
Space heating kWh	1749.4488	1148.4914	853.8729	379.3517	118.7590	0.0000	0.0000	0.0000	0.0000	483.8953	1084.9861	1681.9876 (98a)
Space heating requirement - total per year (kWh/year)												7500.7928
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	1749.4488	1148.4914	853.8729	379.3517	118.7590	0.0000	0.0000	0.0000	0.0000	483.8953	1084.9861	1681.9876 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7500.7928
Space heating per m2										(98c) / (4) =		33.2821 (99)

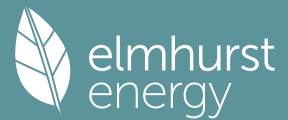
9a. Energy requirements - Individual heating systems, including micro-CHP

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 %)												324.6638 (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	1749.4488	1148.4914	853.8729	379.3517	118.7590	0.0000	0.0000	0.0000	0.0000	483.8953	1084.9861	1681.9876 (98)
Space heating efficiency (main heating system 1)	324.6638	324.6638	324.6638	324.6638	324.6638	0.0000	0.0000	0.0000	0.0000	324.6638	324.6638	324.6638 (210)
Space heating fuel (main heating system)	538.8493	353.7479	263.0022	116.8445	36.5791	0.0000	0.0000	0.0000	0.0000	149.0450	334.1876	518.0705 (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	345.5444	305.6626	324.3034	283.4304	273.7382	245.4996	241.1451	251.1706	254.4830	285.2178	305.1438	341.4885 (64)
Efficiency of water heater (217)m	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700 (216)
Fuel for water heating, kWh/month	124.3100	109.9624	116.6685	101.9644	98.4776	88.3188	86.7522	90.3589	91.5505	102.6074	109.7758	122.8509 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	36.5611	29.3307	26.4090	19.3484	14.9453	12.2104	13.6336	17.7214	23.0184	30.2014	34.1124	37.5773 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.7716	-45.2297	-76.0964	-97.2709	-112.6042	-106.5910	-104.2598	-92.3639	-73.4260	-54.6512	-32.0356	-23.1607 (233a)

13a. Primary energy - Individual heating systems including micro-CHP			
	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	2310.3260	1.5791	3648.1226 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1243.5973	1.5214	1892.0193 (278)
Space and water heating			5540.1418 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	295.0693	1.5338	452.5871 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-845.4610	1.4890	-1258.8921
PV Unit electricity exported	-593.4165	0.4401	-261.1710
Total			-1520.0631 (283)
Total Primary energy kWh/year			4472.6659 (286)
Dwelling Primary energy Rate (DPER)			19.8500 (287)

$$0 \star 80 = 0.0000 \quad (6a)$$

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000	Air changes per hour	0.0675 (8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				5.0000	(17)
Infiltration rate				0.3175	(18)
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =			0.2699	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.3441	0.3374	0.3306	0.2969	0.2901	0.2564	0.2564	0.2496	0.2699	0.2901	0.3036	0.3171
	0.5592	0.5569	0.5547	0.5441	0.5421	0.5329	0.5329	0.5312	0.5364	0.5421	0.5461	0.5503

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type			40.3100	1.1450	46.1565		(27)
TER Roof Light			9.5300	1.5918	19.2702		(27a)
Heatloss Floor 1			102.7100	0.1300	13.3523		(28a)
cavity wall	187.4400	42.6900	144.7500	0.1800	26.0550		(29a)
ashlar wall	15.7900		15.7900	0.1800	2.8422		(29a)
flat roof	26.5300	7.7600	18.7700	0.1100	2.0647		(30)
first floor plane roof	29.7000		29.7000	0.1100	3.2670		(30)
sloped roof	31.1900	1.7700	29.4200	0.1100	3.2362		(30)
second floor plane roof	21.1100		21.1100	0.1100	2.3221		(30)
Total net area of external elements Aum(A, m2)			414.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	120.9462		(33)
Main dwelling							
Party Wall 1			90.6400	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 168.0211 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	32.5700	0.1600	5.2112
P1 Party wall - Ground floor	14.8000	0.0800	1.1840
E2 Other lintels (including other steel lintels)	22.8000	0.0500	1.1400
E3 Sill	22.8000	0.0500	1.1400
E4 Jamb	53.6600	0.0500	2.6830
E6 Intermediate floor within a dwelling	38.0400	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	19.7500	0.0000	0.0000
E14 Flat roof	10.5200	0.0800	0.8416
P4 Party wall - Roof (insulation at ceiling level)	11.1200	0.1200	1.3344
E10 Eaves (insulation at ceiling level)	12.5900	0.0600	0.7554
E12 Gable (insulation at ceiling level)	12.0400	0.0600	0.7224
E13 Gable (insulation at rafter level)	7.7600	0.0800	0.6208
E11 Eaves (insulation at rafter level)	9.6900	0.0400	0.3876
R8 Roof to wall (rafter)	9.6900	0.0600	0.5814
R9 Roof to wall (flat ceiling)	9.6900	0.0400	0.3876
P5 Party wall - Roof (insulation at rafter level)	2.7400	0.0800	0.2192
E18 Party wall between dwellings	14.4900	0.0600	0.8694
E16 Corner (normal)	42.1900	0.0900	3.7971
E17 Corner (inverted - internal area greater than external area)	26.4300	-0.0900	-2.3787
R1 Head of roof window	5.3400	0.0800	0.4272
R2 Sill of roof window	5.3400	0.0600	0.3204
R3 Jamb of roof window	14.8600	0.0800	1.1888

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.4328 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	142.3790 (37)

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

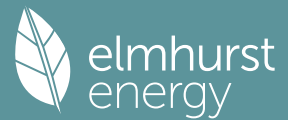
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	109.3347	108.8852	108.4446	106.3752	105.9880	104.1856	104.1856	103.8518	104.8799	105.9880	106.7713	107.5901
Average = Sum(39)m / 12 =	251.7137	251.2642	250.8236	248.7542	248.3670	246.5646	246.5646	246.2308	247.2589	248.3670	249.1503	249.9692

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1169	1.1149	1.1129	1.1038	1.1020	1.0940	1.0940	1.0926	1.0971	1.1020	1.1055	1.1092
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

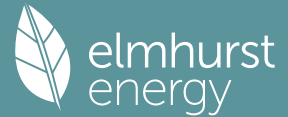
Assumed occupancy												3.0349 (42)
Hot water usage for mixer showers												
Hot water usage for baths	75.1053	73.9767	72.3319	69.1851	66.8628	64.2729	62.8009	64.4331	66.2224	69.0031	72.2176	74.8176 (42a)
Hot water usage for other uses	32.4210	31.9395	31.2614	30.0112	29.0751	28.0371	27.4764	28.1497	28.8828	29.9935	31.2695	32.3114 (42b)
Average daily hot water use (litres/day)	45.7105	44.0483	42.3861	40.7239	39.0617	37.3995	37.3995	39.0617	40.7239	42.3861	44.0483	45.7105 (42c)
Daily hot water use	153.2368	149.9645	145.9795	139.9202	134.9996	129.7095	127.6768	131.6446	135.8291	141.3827	147.5354	152.8395 (44)
Energy conte	242.6897	213.5474	224.3650	191.5438	181.7354	159.4930	154.4140	163.0035	167.4909	191.8550	210.1912	239.3097 (45)
Energy content (annual)										Total = Sum(45)m =		2339.6385

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Distribution loss (46)m = 0.15 x (45)m												
	36.4035	32.0321	33.6548	28.7316	27.2603	23.9239	23.1621	24.4505	25.1236	28.7783	31.5287	35.8965 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b												1.3938 (48)
Enter (49) or (54) in (55)												0.5400 (49)
Total storage loss												0.7527 (55)
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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												
WWHRS	289.2846	255.6331	270.9599	236.6356	228.3303	204.5848	201.0089	209.5984	212.5827	238.4499	255.2830	285.9046 (62)
PV diverter	-34.3350	-30.3662	-31.7977	-26.3298	-24.5384	-20.9977	-19.6820	-20.9298	-21.7250	-25.6114	-29.0146	-33.6992 (63a)
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 (63b)
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 (63c)
Output from w/h	254.9496	225.2669	239.1622	210.3059	203.7919	183.5872	181.3269	188.6686	190.8577	212.8386	226.2684	252.2054 (64)
												Total per year (kWh/year) = Sum(64)m = 2569.2292 (64)
12Total per year (kWh/year)												2569 (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												
	117.9702	104.6731	111.8773	99.7618	97.7029	89.1049	88.6186	91.4746	91.7642	101.0677	105.9620	116.8464 (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	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	199.0108	220.3334	199.0108	205.6445	199.0108	205.6445	199.0108	199.0108	205.6445	199.0108	205.6445	199.0108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	394.5611	398.6554	388.3379	366.3731	338.6465	312.5874	295.1783	291.0840	301.4015	323.3663	351.0929	377.1520 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746 (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)												
	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964 (71)
Water heating gains (Table 5)												
	158.5622	155.7635	150.3727	138.5580	131.3211	123.7568	119.1110	122.9497	127.4503	135.8437	147.1695	157.0516 (72)
Total internal gains	823.6577	846.2760	809.2450	782.0993	740.5021	710.5123	681.8237	681.5681	703.0199	729.7445	775.4305	804.7381 (73)
6. Solar gains												
[Jan]												
			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
Southeast			18.0400		36.7938		0.6300		0.7000		0.7700	202.8539 (77)
Southwest			5.3800		36.7938		0.6300		0.7000		0.7700	60.4963 (79)
Northwest			16.8900		11.2829		0.6300		0.7000		0.7700	58.2403 (81)
South			7.7600		26.0000		0.6300		0.7000		1.0000	80.0785 (82)
Northwest			1.7700		26.0000		0.6300		0.7000		1.0000	18.2653 (82)
Solar gains	419.9345	771.3855	1190.4757	1678.6350	2049.5559	2104.8252	2000.4318	1715.9020	1359.8282	890.2992	513.5354	352.3665 (83)
Total gains	1243.5922	1617.6614	1999.7208	2460.7342	2790.0579	2815.3375	2682.2555	2397.4701	2062.8481	1620.0436	1288.9659	1157.1046 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.7879	41.8627	41.9362	42.2851	42.3510	42.6606	42.6606	42.7184	42.5408	42.3510	42.2178	42.0795
alpha	3.7859	3.7908	3.7957	3.8190	3.8234	3.8440	3.8440	3.8479	3.8361	3.8234	3.8145	3.8053
util living area	0.9930	0.9812	0.9507	0.8639	0.7121	0.5322	0.3969	0.4581	0.7121	0.9300	0.9854	0.9946 (86)
MIT	19.0781	19.4079	19.8752	20.4258	20.7902	20.9481	20.9869	20.9777	20.8458	20.3006	19.5763	19.0226 (87)
Th 2	19.9871	19.9887	19.9903	19.9978	19.9992	20.0057	20.0057	20.0069	20.0032	19.9992	19.9963	19.9934 (88)
util rest of house	0.9913	0.9769	0.9396	0.8354	0.6598	0.4590	0.3106	0.3653	0.6400	0.9086	0.9814	0.9934 (89)
MIT 2	17.7310	18.1511	18.7391	19.4103	19.8154	19.9717	20.0001	19.9966	19.8868	19.2801	18.3734	17.6642 (90)
Living area fraction												0.0876 (91)
MIT	17.8491	18.2613	18.8386	19.4993	19.9009	20.0573	20.0866	20.0826	19.9709	19.3695	18.4789	17.7833 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8491	18.2613	18.8386	19.4993	19.9009	20.0573	20.0866	20.0826	19.9709	19.3695	18.4789	17.7833 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9859	0.9664	0.9231	0.8189	0.6542	0.4629	0.3177	0.3726	0.6374	0.8913	0.9724	0.9890 (94)
Useful gains	1226.1156	1563.3804	1845.9284	2015.1405	1825.3639	1303.2555	852.2825	893.2652	1314.9047	1443.9473	1253.4021	1144.3456 (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	3410.4883	3357.2113	3094.8195	2636.6235	2036.8209	1345.5666	859.6731	906.7622	1451.6204	2178.0536	2835.0445	3395.4020 (97)
Space heating kWh	1625.1733	1205.4543	929.1749	447.4677	157.3240	0.0000	0.0000	0.0000	0.0000	546.1751	1138.7825	1674.7860 (98a)
Space heating requirement - total per year (kWh/year)												7724.3379
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

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Space heating kWh	1625.1733	1205.4543	929.1749	447.4677	157.3240	0.0000	0.0000	0.0000	0.0000	546.1751	1138.7825	1674.7860 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7724.3379
Space heating per m2												(98c) / (4) = 34.2740 (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	1625.1733	1205.4543	929.1749	447.4677	157.3240	0.0000	0.0000	0.0000	0.0000	546.1751	1138.7825	1674.7860 (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)	1760.7511	1306.0177	1006.6901	484.7971	170.4485	0.0000	0.0000	0.0000	0.0000	591.7390	1233.7839	1814.5027 (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 requirement	254.9496	225.2669	239.1622	210.3059	203.7919	183.5872	181.3269	188.6686	190.8577	212.8386	226.2684	252.2054 (64)
Efficiency of water heater (217)m	87.4624	87.2506	86.7962	85.7094	83.4863	79.8000	79.8000	79.8000	79.8000	86.0777	87.1704	79.8000 (216)
Fuel for water heating, kWh/month	291.4962	258.1837	275.5447	245.3708	244.1021	230.0591	227.2267	236.4268	239.1701	247.2632	259.5703	288.2074 (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	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	41.3505	33.1729	29.8685	21.8830	16.9030	13.8099	15.4195	20.0429	26.0337	34.1576	38.5810	42.4998 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-86.5310	-117.4206	-162.4527	-175.4510	-183.1341	-168.5513	-166.1556	-159.5570	-147.4043	-130.4355	-93.3531	-75.3306 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-63.8567	-132.2721	-259.3147	-384.5270	-503.9285	-504.9523	-499.2910	-425.0458	-314.4399	-187.8296	-84.7827	-50.6822 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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												8368.7301 (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												3042.6211 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												86.0000 (231)
Total electricity for the above, kWh/year												333.7223 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-5076.6991 (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												6754.3744 (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	8368.7301	0.2100	1757.4333 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3042.6211	0.2100	638.9504 (264)
Space and water heating			2396.3838 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	333.7223	0.1443	48.1664 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1665.7768	0.1355	-225.6479
PV Unit electricity exported	-3410.9223	0.1263	-430.6776
Total			-656.3255 (269)
Total CO2, kg/year			1800.1540 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.9900 (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	8368.7301	1.1300	9456.6650 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3042.6211	1.1300	3438.1619 (278)
Space and water heating			12894.8269 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)

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Energy for lighting	333.7223	1.5338	511.8744 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1665.7768	1.5007	-2499.8140
PV Unit electricity exported	-3410.9223	0.4635	-1580.9358
Total			-4080.7498 (283)
Total Primary energy kWh/year			9456.0523 (286)
Target Primary Energy Rate (TPER)			41.9600 (287)

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Property Reference	plot 2	Issued on Date	19/02/2025
Assessment Reference	00001	Prop Type Ref	
Property	262, Ryebank Road, Chorlton, Manchester, M21 9LJ		
SAP Rating	90 B	DER	1.80
Environmental	98 A	% DER < TER	77.97
CO ₂ Emissions (t/year)	0.37	DFEE	37.33
Compliance Check	See BREL	% DFEE < TFEE	8.21
% DPER < TPER	52.82	DPER	20.26
Assessor Details	Mr. David Barsted	Assessor ID	AV66-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	102.7100 (1b)	x 2.5600 (2b)	= 262.9376 (1b) - (3b)
First floor	76.1800 (1c)	x 2.7700 (2c)	= 211.0186 (1c) - (3c)
Second floor	46.4800 (1d)	x 2.5500 (2d)	= 118.5240 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	225.3700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 592.4802 (5)

2. Ventilation rate

		m ³ per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	6 * 10 =	60.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	60.0000 / (5) =	0.1013 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.5000	(17)
Infiltration rate	0.3263	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2773 (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	0.3536	0.3467	0.3397	0.3051	0.2981	0.2635	0.2635	0.2565	0.2773	0.2981	0.3120	0.3259 (22b)
Effective ac	0.5625	0.5601	0.5577	0.5465	0.5444	0.5347	0.5347	0.5329	0.5385	0.5444	0.5487	0.5531 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
windows			40.3100	1.1450	46.1565		(27)
door			2.3800	1.2000	2.8560		(26)
roof windows			9.5300	1.1450	10.9122		(27a)
Heatloss Floor 1			102.7100	0.1200	12.3252	75.0000	7703.2500 (28a)
cavity wall	187.4400	42.6900	144.7500	0.1800	26.0550	70.0000	10132.5000 (29a)
ashlar wall	15.7900		15.7900	0.0900	1.4211	9.0000	142.1100 (29a)
flat roof	26.5300	7.7600	18.7700	0.1200	2.2524	9.0000	168.9300 (30)
first floor plane roof	29.7000		29.7000	0.1100	3.2670	9.0000	267.3000 (30)
sloped roof	31.1900	1.7700	29.4200	0.1300	3.8246	9.0000	264.7800 (30)
second floor plane roof	21.1100		21.1100	0.1100	2.3221	9.0000	189.9900 (30)
Total net area of external elements A _{um} (A, m ²)			414.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	111.3921		(33)
Main dwelling							
Party Wall 1			90.6400	0.0000	0.0000	140.0000	12689.6000 (32)
Internal Wall 1			332.9600			9.0000	2996.6400 (32c)
Internal Floor 1			76.1800			18.0000	1371.2400 (32d)
Internal Floor 2			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			9.0000	418.3200 (32e)

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Internal Ceiling 2 76.1800 9.0000 685.6200 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 37866.9200 (34)
 List of Thermal Bridges 168.0211 (35)

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	32.5700	0.1000	3.2570
P1 Party wall - Ground floor	14.8000	0.0930	1.3764
E2 Other lintels (including other steel lintels)	22.8000	0.0200	0.4560
E3 Sill	22.8000	0.0180	0.4104
E4 Jamb	53.6600	0.0140	0.7512
E6 Intermediate floor within a dwelling	38.0400	0.0010	0.0380
P2 Party wall - Intermediate floor within a dwelling	19.7500	0.0000	0.0000
E14 Flat roof	10.5200	0.0430	0.4524
P4 Party wall - Roof (insulation at ceiling level)	11.1200	0.1010	1.1231
E10 Eaves (insulation at ceiling level)	12.5900	0.0680	0.8561
E12 Gable (insulation at ceiling level)	12.0400	0.0970	1.1679
E13 Gable (insulation at rafter level)	7.7600	0.0600	0.4656
E11 Eaves (insulation at rafter level)	9.6900	0.0180	0.1744
R8 Roof to wall (rafter)	9.6900	0.1200	1.1628
R9 Roof to wall (flat ceiling)	9.6900	0.3200	3.1008
P5 Party wall - Roof (insulation at rafter level)	2.7400	0.0460	0.1260
E18 Party wall between dwellings	14.4900	0.0510	0.7390
E16 Corner (normal)	42.1900	0.0490	2.0673
E17 Corner (inverted - internal area greater than external area)	26.4300	-0.0830	-2.1937
R1 Head of roof window	5.3400	0.0610	0.3257
R2 Sill of roof window	5.3400	0.0600	0.3204
R3 Jamb of roof window	14.8600	0.0560	0.8322
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			17.0091 (36)
Point Thermal Bridges			0.0000 (36a) =
Total fabric heat loss			128.4012 (37) (33) + (36) + (36a) =

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	109.9820	109.5073	109.0421	106.8570	106.4481	104.5449	104.5449	104.1925	105.2780	106.4481	107.2752	108.1399	(38)
Heat transfer coeff	238.3832	237.9086	237.4433	235.2582	234.8494	232.9462	232.9462	232.5937	233.6793	234.8494	235.6764	236.5411	(39)
Average = Sum(39)m / 12 =												235.2562	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0577	1.0556	1.0536	1.0439	1.0421	1.0336	1.0336	1.0321	1.0369	1.0421	1.0457	1.0496	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

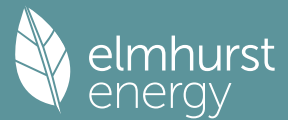
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0349 (42)
Hot water usage for mixer showers	103.2699	101.7179	99.4564	95.1295	91.9363	88.3753	86.3512	88.5956	91.0558	94.8793	99.2992	102.8742	(42a)
Hot water usage for baths	32.4210	31.9395	31.2614	30.0112	29.0751	28.0371	27.4764	28.1497	28.8828	29.9935	31.2695	32.3114	(42b)
Hot water usage for other uses	45.7105	44.0483	42.3861	40.7239	39.0617	37.3995	37.3995	39.0617	40.7239	42.3861	44.0483	45.7105	(42c)
Average daily hot water use (litres/day)												166.8257	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	181.4014	177.7057	173.1040	165.8646	160.0731	153.8119	151.2271	155.8070	160.6625	167.2589	174.6169	180.8961	(44)
Energy content (annual)	287.2954	253.0506	266.0544	227.0604	215.4892	189.1296	182.8961	192.9216	198.1130	226.9688	248.7738	283.2395	(45)
Distribution loss (46)m = 0.15 x (45)m	43.0943	37.9576	39.9082	34.0591	32.3234	28.3694	27.4344	28.9382	29.7169	34.0453	37.3161	42.4859	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1286	(55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(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	345.5444	305.6626	324.3034	283.4304	273.7382	245.4996	241.1451	251.1706	254.4830	285.2178	305.1438	341.4885	(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	345.5444	305.6626	324.3034	283.4304	273.7382	245.4996	241.1451	251.1706	254.4830	285.2178	305.1438	341.4885	(64)
Total per year (kWh/year)												3456.8273	(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	142.1249	126.2289	135.0623	120.5936	118.2493	107.9816	107.4121	110.7456	110.9686	122.0663	127.8133	140.7763	(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	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	199.0108	220.3334	199.0108	205.6445	199.0108	205.6445	199.0108	199.0108	205.6445	199.0108	205.6445	199.0108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.5611	398.6554	388.3379	366.3731	338.6465	312.5874	295.1783	291.0840	301.4015	323.3663	351.0929	377.1520	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	(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)	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	(71)
Water heating gains (Table 5)	191.0281	187.8406	181.5353	167.4911	158.9373	149.9745	144.3712	148.8517	154.1230	164.0676	177.5185	189.2155	(72)

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Total internal gains
853.1237 875.3531 837.4076 808.0323 765.1182 736.7300 707.0839 707.4701 729.6927 754.9684 802.7795 833.9020 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	5.3800	11.2829	0.6300	0.7000	0.7700	18.5514 (75)
Southeast	18.0400	36.7938	0.6300	0.7000	0.7700	202.8539 (77)
Northwest	16.8900	11.2829	0.6300	0.7000	0.7700	58.2403 (81)
South	7.7600	26.0000	0.6300	0.7000	1.0000	80.0785 (82)
Northwest	1.7700	26.0000	0.6300	0.7000	1.0000	18.2653 (82)
Solar gains	377.9895	706.0997	1117.5164	1615.6691	2004.0696	2070.6825
Total gains	1231.1132	1581.4528	1954.9240	2423.7014	2769.1878	2807.4125

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	44.1247	44.2127	44.2994	44.7108	44.7887	45.1546	45.1546	45.2230	45.0129	44.7887	44.6315	44.4683
alpha	3.9416	3.9475	3.9533	3.9807	3.9859	4.0103	4.0103	4.0149	4.0009	3.9859	3.9754	3.9646
util living area	0.9932	0.9819	0.9509	0.8579	0.6955	0.5105	0.3788	0.4409	0.7016	0.9301	0.9858	0.9948 (86)
Living	19.5626	19.7990	20.1406	20.5430	20.7948	20.8944	20.9162	20.9109	20.8260	20.4401	19.9207	19.5247
Non living	18.3351	18.6369	19.0671	19.5590	19.8373	19.9378	19.9537	19.9523	19.8804	19.4510	18.8000	18.2917
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	20.2647	19.7990	20.1406	20.5430	20.7948	20.8944	20.9162	20.9109	20.8260	20.4401	19.9207	19.7310 (87)
Th 2	20.0355	20.0372	20.0389	20.0469	20.0484	20.0554	20.0554	20.0567	20.0527	20.0484	20.0454	20.0422 (88)
util rest of house	0.9916	0.9778	0.9400	0.8294	0.6444	0.4421	0.2997	0.3549	0.6317	0.9092	0.9820	0.9936 (89)
MIT 2	19.3576	18.6369	19.0671	19.5590	19.8373	19.9378	19.9537	19.9523	19.8804	19.4510	18.8000	18.6072 (90)
Living area fraction	19.4371	18.7388	19.1612	19.6452	19.9212	20.0217	20.0380	20.0363	19.9633	19.5377	18.8982	18.7057 (92)
MIT	19.4371	18.7388	19.1612	19.6452	19.9212	20.0217	20.0380	20.0363	19.9633	19.5377	18.8982	18.7057 (92)
Temperature adjustment	19.4371	18.7388	19.1612	19.6452	19.9212	20.0217	20.0380	20.0363	19.9633	19.5377	18.8982	18.7057 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9904	0.9705	0.9276	0.8157	0.6371	0.4396	0.2983	0.3530	0.6244	0.8952	0.9756	0.9913 (94)
Useful gains	1219.3539	1534.7458	1813.4057	1976.9805	1764.3389	1234.2079	796.3861	837.0657	1261.2009	1412.1718	1236.2455	1139.5869 (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	3608.4329	3292.3589	3006.3206	2527.9062	1930.7455	1262.9568	800.8794	845.7896	1370.1352	2099.0023	2780.5641	3431.1874 (97)
Space heating kWh	1777.4748	1181.1161	887.5287	396.6665	123.8065	0.0000	0.0000	0.0000	0.0000	511.0019	1111.9094	1704.9508 (98a)
Space heating requirement - total per year (kWh/year)												7694.4546
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	1777.4748	1181.1161	887.5287	396.6665	123.8065	0.0000	0.0000	0.0000	0.0000	511.0019	1111.9094	1704.9508 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7694.4546
Space heating per m2										(98c) / (4) =		34.1414 (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 %)												324.6638 (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	1777.4748	1181.1161	887.5287	396.6665	123.8065	0.0000	0.0000	0.0000	0.0000	511.0019	1111.9094	1704.9508 (98)
Space heating efficiency (main heating system 1)	324.6638	324.6638	324.6638	324.6638	324.6638	0.0000	0.0000	0.0000	0.0000	324.6638	324.6638	324.6638 (210)
Space heating fuel (main heating system)	547.4816	363.7966	273.3685	122.1776	38.1338	0.0000	0.0000	0.0000	0.0000	157.3942	342.4802	525.1434 (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	345.5444	305.6626	324.3034	283.4304	273.7382	245.4996	241.1451	251.1706	254.4830	285.2178	305.1438	341.4885 (64)
Efficiency of water heater (217)m	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700	277.9700 (216)
Fuel for water heating, kWh/month	124.3100	109.9624	116.6685	101.9644	98.4776	88.3188	86.7522	90.3589	91.5505	102.6074	109.7758	122.8509 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	36.5611	29.3307	26.4090	19.3484	14.9453	12.2104	13.6336	17.7214	23.0184	30.2014	34.1124	37.5773 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.7891	-45.2935	-76.2636	-97.4750	-112.7082	-106.5910	-104.2598	-92.3639	-73.4260	-54.7713	-32.0682	-23.1721 (233a)

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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	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	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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-5.0074	-12.8998	-32.5933	-63.4049	-99.7081	-108.0196	-105.0627	-81.2738	-51.1795	-22.2153	-7.5045	-3.8268		(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	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	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	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													2369.9760	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													277.9700	
Water heating fuel used													1243.5973	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
Total electricity for the above, kWh/year													0.0000	(231)
Electricity for lighting (calculated in Appendix L)													295.0693	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1438.8775	(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													2469.7650	(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	2369.9760	0.1563	370.4959	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1243.5973	0.1410	175.3593	(264)
Space and water heating			545.8552	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	295.0693	0.1443	42.5876	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-846.1818	0.1324	-111.9961	
PV Unit electricity exported	-592.6957	0.1199	-71.0914	
Total			-183.0875	(269)
Total CO2, kg/year			405.3553	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.8000	(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	2369.9760	1.5787	3741.5071	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1243.5973	1.5214	1892.0193	(278)
Space and water heating			5633.5264	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	295.0693	1.5338	452.5871	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-846.1818	1.4890	-1260.0007	
PV Unit electricity exported	-592.6957	0.4399	-260.7506	
Total			-1520.7513	(283)
Total Primary energy kWh/year			4565.3623	(286)
Dwelling Primary energy Rate (DPER)			20.2600	(287)

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

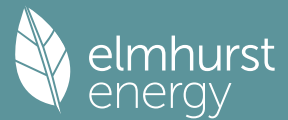
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	102.7100 (1b)	x 2.5600 (2b)	= 262.9376 (1b) - (3b)	
First floor	76.1800 (1c)	x 2.7700 (2c)	= 211.0186 (1c) - (3c)	
Second floor	46.4800 (1d)	x 2.5500 (2d)	= 118.5240 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	225.3700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 592.4802 (5)	

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000	Air changes per hour	0.0675 (8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				5.0000	(17)
Infiltration rate				0.3175	(18)
Number of sides sheltered				2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =			0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =			0.2699	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750
Effective ac	0.3441	0.3374	0.3306	0.2969	0.2901	0.2564	0.2564	0.2496	0.2699	0.2901	0.3036	0.3171
	0.5592	0.5569	0.5547	0.5441	0.5421	0.5329	0.5329	0.5312	0.5364	0.5421	0.5461	0.5503

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type			40.3100	1.1450	46.1565		(27)
TER Roof Light			9.5300	1.5918	19.2702		(27a)
Heatloss Floor 1			102.7100	0.1300	13.3523		(28a)
cavity wall	187.4400	42.6900	144.7500	0.1800	26.0550		(29a)
ashlar wall	15.7900		15.7900	0.1800	2.8422		(29a)
flat roof	26.5300	7.7600	18.7700	0.1100	2.0647		(30)
first floor plane roof	29.7000		29.7000	0.1100	3.2670		(30)
sloped roof	31.1900	1.7700	29.4200	0.1100	3.2362		(30)
second floor plane roof	21.1100		21.1100	0.1100	2.3221		(30)
Total net area of external elements Aum(A, m2)			414.4700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	120.9462		(33)
Main dwelling							
Party Wall 1			90.6400	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 168.0211 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	32.5700	0.1600	5.2112
P1 Party wall - Ground floor	14.8000	0.0800	1.1840
E2 Other lintels (including other steel lintels)	22.8000	0.0500	1.1400
E3 Sill	22.8000	0.0500	1.1400
E4 Jamb	53.6600	0.0500	2.6830
E6 Intermediate floor within a dwelling	38.0400	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	19.7500	0.0000	0.0000
E14 Flat roof	10.5200	0.0800	0.8416
P4 Party wall - Roof (insulation at ceiling level)	11.1200	0.1200	1.3344
E10 Eaves (insulation at ceiling level)	12.5900	0.0600	0.7554
E12 Gable (insulation at ceiling level)	12.0400	0.0600	0.7224
E13 Gable (insulation at rafter level)	7.7600	0.0800	0.6208
E11 Eaves (insulation at rafter level)	9.6900	0.0400	0.3876
R8 Roof to wall (rafter)	9.6900	0.0600	0.5814
R9 Roof to wall (flat ceiling)	9.6900	0.0400	0.3876
P5 Party wall - Roof (insulation at rafter level)	2.7400	0.0800	0.2192
E18 Party wall between dwellings	14.4900	0.0600	0.8694
E16 Corner (normal)	42.1900	0.0900	3.7971
E17 Corner (inverted - internal area greater than external area)	26.4300	-0.0900	-2.3787
R1 Head of roof window	5.3400	0.0800	0.4272
R2 Sill of roof window	5.3400	0.0600	0.3204
R3 Jamb of roof window	14.8600	0.0800	1.1888

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.4328 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	142.3790 (37)

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

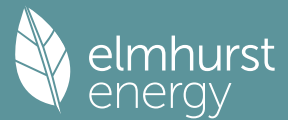
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	109.3347	108.8852	108.4446	106.3752	105.9880	104.1856	104.1856	103.8518	104.8799	105.9880	106.7713	107.5901
Average = Sum(39)m / 12 =	251.7137	251.2642	250.8236	248.7542	248.3670	246.5646	246.5646	246.2308	247.2589	248.3670	249.1503	249.9692

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1169	1.1149	1.1129	1.1038	1.1020	1.0940	1.0940	1.0926	1.0971	1.1020	1.1055	1.1092
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0349 (42)
Hot water usage for mixer showers												
Hot water usage for baths	75.1053	73.9767	72.3319	69.1851	66.8628	64.2729	62.8009	64.4331	66.2224	69.0031	72.2176	74.8176 (42a)
Hot water usage for other uses	32.4210	31.9395	31.2614	30.0112	29.0751	28.0371	27.4764	28.1497	28.8828	29.9935	31.2695	32.3114 (42b)
Average daily hot water use (litres/day)	45.7105	44.0483	42.3861	40.7239	39.0617	37.3995	37.3995	39.0617	40.7239	42.3861	44.0483	45.7105 (42c)
Daily hot water use	153.2368	149.9645	145.9795	139.9202	134.9996	129.7095	127.6768	131.6446	135.8291	141.3827	147.5354	152.8395 (44)
Energy conte	242.6897	213.5474	224.3650	191.5438	181.7354	159.4930	154.4140	163.0035	167.4909	191.8550	210.1912	239.3097 (45)
Energy content (annual)										Total = Sum(45)m =		2339.6385

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Distribution loss (46)m = 0.15 x (45)m												
	36.4035	32.0321	33.6548	28.7316	27.2603	23.9239	23.1621	24.4505	25.1236	28.7783	31.5287	35.8965 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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												
WWHRS	289.2846	255.6331	270.9599	236.6356	228.3303	204.5848	201.0089	209.5984	212.5827	238.4499	255.2830	285.9046 (62)
PV diverter	-34.3350	-30.3662	-31.7977	-26.3298	-24.5384	-20.9977	-19.6820	-20.9298	-21.7250	-25.6114	-29.0146	-33.6992 (63a)
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 (63b)
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 (63c)
Output from w/h	254.9496	225.2669	239.1622	210.3059	203.7919	183.5872	181.3269	188.6686	190.8577	212.8386	226.2684	252.2054 (64)
	Total per year (kWh/year) = Sum(64)m =											2569.2292 (64)
12Total per year (kWh/year)												2569 (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	117.9702	104.6731	111.8773	99.7618	97.7029	89.1049	88.6186	91.4746	91.7642	101.0677	105.9620	116.8464 (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	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455	151.7455 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	199.0108	220.3334	199.0108	205.6445	199.0108	205.6445	199.0108	199.0108	205.6445	199.0108	205.6445	199.0108 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	394.5611	398.6554	388.3379	366.3731	338.6465	312.5874	295.1783	291.0840	301.4015	323.3663	351.0929	377.1520 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746	38.1746 (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)	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964	-121.3964 (71)
Water heating gains (Table 5)	158.5622	155.7635	150.3727	138.5580	131.3211	123.7568	119.1110	122.9497	127.4503	135.8437	147.1695	157.0516 (72)
Total internal gains	823.6577	846.2760	809.2450	782.0993	740.5021	710.5123	681.8237	681.5681	703.0199	729.7445	775.4305	804.7381 (73)

6. Solar gains												

[Jan]												
			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
Northeast			5.3800		11.2829		0.6300		0.7000		0.7700	18.5514 (75)
Southeast			18.0400		36.7938		0.6300		0.7000		0.7700	202.8539 (77)
Northwest			16.8900		11.2829		0.6300		0.7000		0.7700	58.2403 (81)
South			7.7600		26.0000		0.6300		0.7000		1.0000	80.0785 (82)
Northwest			1.7700		26.0000		0.6300		0.7000		1.0000	18.2653 (82)

Solar gains	377.9895	706.0997	1117.5164	1615.6691	2004.0696	2070.6825	1962.9307	1663.6765	1290.0628	822.5576	464.4172	315.7443 (83)
Total gains	1201.6472	1552.3757	1926.7614	2397.7683	2744.5717	2781.1948	2644.7545	2345.2446	1993.0827	1552.3021	1239.8477	1120.4823 (84)

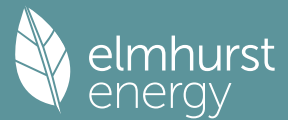
7. Mean internal temperature (heating season)												

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	41.7879	41.8627	41.9362	42.2851	42.3510	42.6606	42.6606	42.7184	42.5408	42.3510	42.2178	42.0795
alpha	3.7859	3.7908	3.7957	3.8190	3.8234	3.8440	3.8440	3.8479	3.8361	3.8234	3.8145	3.8053
util living area	0.9937	0.9835	0.9557	0.8718	0.7195	0.5377	0.4022	0.4673	0.7276	0.9377	0.9871	0.9952 (86)
MIT	19.0517	19.3687	19.8365	20.4028	20.7823	20.9462	20.9863	20.9761	20.8335	20.2675	19.5463	18.9994 (87)
Th 2	19.9871	19.9887	19.9903	19.9978	19.9992	20.0057	20.0057	20.0069	20.0032	19.9992	19.9963	19.9934 (88)
util rest of house	0.9923	0.9797	0.9456	0.8443	0.6674	0.4640	0.3149	0.3730	0.6561	0.9182	0.9836	0.9940 (89)
MIT 2	17.6974	18.1018	18.6916	19.3843	19.8079	19.9704	19.9999	19.9958	19.8763	19.2411	18.3355	17.6346 (90)
Living area fraction												0.0876 (91)
MIT	17.8161	18.2128	18.7919	19.4735	19.8933	20.0559	20.0863	20.0817	19.9602	19.3311	18.4416	17.7542 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8161	18.2128	18.7919	19.4735	19.8933	20.0559	20.0863	20.0817	19.9602	19.3311	18.4416	17.7542 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9873	0.9701	0.9296	0.8275	0.6615	0.4679	0.3221	0.3804	0.6527	0.9011	0.9753	0.9900 (94)
Useful gains	1186.4276	1505.8885	1791.2029	1984.0697	1815.4619	1301.3568	851.8497	892.0619	1300.8583	1398.8323	1209.2209	1109.3009 (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	3402.1901	3345.0285	3083.1089	2630.2076	2034.9457	1345.2344	859.5985	906.5542	1448.9895	2168.5100	2825.7744	3388.1350 (97)
Space heating kWh	1648.5273	1235.9021	961.1781	465.2193	163.2960	0.0000	0.0000	0.0000	0.0000	572.6402	1163.9186	1695.4526 (98a)
Space heating requirement - total per year (kWh/year)												7906.1340
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

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Space heating kWh	1648.5273	1235.9021	961.1781	465.2193	163.2960	0.0000	0.0000	0.0000	0.0000	572.6402	1163.9186	1695.4526 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7906.1340
Space heating per m2												(98c) / (4) = 35.0807 (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	1648.5273	1235.9021	961.1781	465.2193	163.2960	0.0000	0.0000	0.0000	0.0000	572.6402	1163.9186	1695.4526 (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)	1786.0534	1339.0055	1041.3631	504.0296	176.9187	0.0000	0.0000	0.0000	0.0000	620.4119	1261.0169	1836.8933 (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	254.9496	225.2669	239.1622	210.3059	203.7919	183.5872	181.3269	188.6686	190.8577	212.8386	226.2684	252.2054 (64)
Efficiency of water heater (217)m	87.4786	87.2824	86.8484	85.7879	83.5677	79.8000	79.8000	79.8000	79.8000	86.1667	87.1993	79.8000 (216)
Fuel for water heating, kWh/month	291.4424	258.0898	275.3790	245.1464	243.8645	230.0591	227.2267	236.4268	239.1701	247.0078	259.4841	87.5218 (217)
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	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Lighting	41.3505	33.1729	29.8685	21.8830	16.9030	13.8099	15.4195	20.0429	26.0337	34.1576	38.5810	42.4998 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-86.5310	-117.4206	-162.4527	-175.4510	-183.1341	-168.5513	-166.1556	-159.5570	-147.4043	-130.4355	-93.3531	-75.3306 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-63.8567	-132.2721	-259.3147	-384.5270	-503.9285	-504.9523	-499.2910	-425.0458	-314.4399	-187.8296	-84.7827	-50.6822 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	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												8565.6924 (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												3041.4596 (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)												333.7223 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-5076.6991 (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												6950.1751 (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	8565.6924	0.2100	1798.7954 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3041.4596	0.2100	638.7065 (264)
Space and water heating			2437.5019 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	333.7223	0.1443	48.1664 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1665.7768	0.1355	-225.6479
PV Unit electricity exported	-3410.9223	0.1263	-430.6776
Total			-656.3255 (269)
Total CO2, kg/year			1841.2721 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.1700 (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	8565.6924	1.1300	9679.2324 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3041.4596	1.1300	3436.8493 (278)
Space and water heating			13116.0817 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)

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Energy for lighting	333.7223	1.5338	511.8744 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1665.7768	1.5007	-2499.8140
PV Unit electricity exported	-3410.9223	0.4635	-1580.9358
Total			-4080.7498 (283)
Total Primary energy kWh/year			9677.3070 (286)
Target Primary Energy Rate (TPER)			42.9400 (287)