

Energy Statement

2C Landrock Road

London

N8 9HP



Amendments

Date	Change	Document Version
14/12/2021	Initial Report for Review	V1
17/12/2021	Floor plan details and drawing updated	V2
19/06/2023	Dwelling built to 2021 Building Regulations and new building layout	V3

Report Sign off

Date	Name



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Executive Summary

Ashby Energy Assessors LTD were appointed to undertake an energy assessment of the proposed development. The works include the erection of one new residential dwelling with associated amenity space. Details of the floor layout plans can be found in Appendix A.

The aim of this report is to offer a preliminary estimation of the reduction in carbon emissions of the development, by using a range of appropriate measures to improve the energy efficiency of the building. It also demonstrates how the scheme delivers on the requirements of the Building Regulations and the local planning requirements of Haringey Council.

To further reduce carbon emissions and help in achieving the national net-zero target by 2050, an assessment of possible renewable technologies that could be incorporated have also been included.

The analysis of CO₂ and energy usage is based on the government approved national calculation method:

- SAP (Standard Assessment Procedure) for domestic dwellings.

This report demonstrates that the building achieves the Building Regulations Part L requirements. A carbon emissions reduction over the requirements by 59% was achieved by:

- focusing on low U and Ψ (psi) values for the new building to reduce carbon emissions by using efficient building fabric – these values have been independently assessed and calculated using specific materials and procedures.
- installation of energy efficient lighting and designing the building in a specific way to maximise natural light benefits where appropriate, allowing for solar gains to reduce energy usage.
- Using an air source heat pump to provide clean domestic hot water and space heating.



The summary of the carbon emission of the development

	Total Regulated CO ₂ Emissions (Tonnes CO ₂ /yr)	CO ₂ Savings (Tonnes CO ₂ /yr)	Cumulative CO ₂ Emissions Saving (%)
Part L 2021 baseline (TER)	1.2	-	-
Be Lean - Proposed scheme after reducing energy use (DER)	1.0	0.2	12%
Be Clean - Proposed scheme after CHP (DER)	1.0	0.0	12%
Be Green - Proposed scheme after renewables (DER)	0.5	0.5	59%

1.0 Introduction

This energy statement summarises the sustainable design stage considerations for the proposed erection of one new residential dwelling, with associated amenity space. The statement also conducts a renewable energy and low carbon technologies review.

The analysis of CO₂ and energy usage is based on the government approved national calculation method SAP.

The aim of this report is to offer a preliminary estimation of the reduction in carbon emissions of the development through a range of appropriate measures to improve the energy efficiency of the building. It also demonstrates how the scheme delivers on the requirements of Building Regulations Part L and the local planning requirements.

The development is designed in accordance with the Energy Hierarchy to minimise CO₂ emissions, as follows:

1. Be Lean – use less energy by reducing the energy demand of the development and improving the building fabric to be more thermally efficient.
2. Be Clean – supply energy efficiently by connecting into an existing district heating network where possible.
3. Be Green – use renewable energy sources to further offset the carbon emissions.

1.1 Site Location and Proposed Development

The site is located at 2C Landrock Road, London (see Figure 1). Details of the plans can be found in Appendix A – Building Plans. The floor plans show a two-storey building consisting of a ground floor and a basement floor.



Figure 1: Site location (in red)

2.0 Planning Policy Context

2.1 National Planning Policy

The National Planning Policy Framework (2021) promotes the objective of sustainable development. New developments are encouraged to reduce greenhouse gas emissions and identify suitable areas for renewable and low carbon energy sources.

The National Planning Policy Framework does not include a methodology on sustainable standards to adopt. These are addressed at regional and local level.

The development and its carbon emissions have been compared with, and must meet, current Part L1 Building Requirements 2021 Edition.

2.2 Local Planning Policy

The site is located within the London Borough of Haringey. The local planning authority is the Haringey Council. The development must achieve the targets set within the Haringey Local Plan and the overarching requirements of the London Plan 2021, these are as follows:

Haringey Local Plan

1. In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation, by incorporating the following measures:

a. From 2011 onwards, all new residential development will achieve a minimum 25% reduction in total (regulated) CO₂ emissions in line with Code for Sustainable Homes Level 4 energy standards, and should aim to achieve Level 6. All new residential development shall be zero carbon from 2016 onwards.

2. The Council will promote low- and zero-carbon energy generation through the following measures:

a. Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network;

b. Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible;

c. Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area; and

d. All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from on-site renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.

3.0 Be Lean – Use Less Energy

This energy statement uses the Energy Hierarchy approach to assess and achieve reduced carbon emissions, as promoted by the London Plan. This approach requires the development to be designed in a way that reduces energy consumption and carbon emissions before considering any centralised heat or renewable energy sources.

3.1 Baseline Emission Rates

The notional building represents a development that meets the minimum requirements for CO₂ emissions, as defined in Building Regulations Part L 2021 with amendments. The Dwelling Emission Rates (DER) are compared to the Target Emission Rates (TER) so that the reduction in CO₂ emissions can be calculated.

3.2 Design Specification

The design of this building has been optimized to maximise natural light where possible, allowing for solar gains to reduce energy usage. The basement floor has access to natural light through a light well. To further reduce energy usage, very efficient low energy lighting will be used throughout the building.

With regards to improving the insulation of the building through a 'fabric first' approach, the achieved U-values are below the minimum current U-value requirement of the proposed Building Regulations Part L 2021 (see Table 1). The building specification can be seen in more detail within the build standards in Appendix B. The average U-value of the building is a 35.52% improvement on the limiting Building Regulations Part L requirements.

Table 1: U-values for new dwelling

	Limiting Building Regulations L1A Part L Requirements 2013	Proposed Building
Walls	0.26 W/m ² K	0.13/0.18 W/m ² K
Floors	0.18 W/m ² K	0.11 W/m ² K
Roof	0.16 W/m ² K	0.13 W/m ² K
Windows	1.60 W/m ² K	1.30 W/m ² K
Rooflights	2.20 W/m ² K	1.30 W/m ² K
Doors	1.60 W/m ² K	1.30 W/m ² K

The building specification shows a reduction in the CO₂ building emissions by 12% against the baseline. Calculations of DERs and TERs were determined using the national approved method SAP (see table 2 below).

Table 2: Emission rates following 'Be Lean' measures

Dwelling Emission Rates (kg CO ₂ /m ² /yr)	Target Emission Rates (kg CO ₂ /m ² /yr)	Improvement (%)
15.64	13.64*	12

* An adjustment is made to the target emissions rates to remove the impact of solar PV in the notional dwelling

Further details of the specification can be found in Appendix B – Build Standards.

3.3 Be Lean Conclusion

By focusing on the building's fabric with good thermal properties, energy efficient lighting and efficient heating, the development improves on Part L Building Regulations requirements by 12%. The average U-value of the building is a 35.52% improvement from the limiting Building Regulations Part L1A requirements.

4.0 Be Clean – Supply Energy Efficiently

Subsequent to the 'Be Lean' measures reducing the energy load of the development, the 'Be Clean' measures aim to provide the required energy load in an efficient and clean approach. Connection to community heating systems and use of combined heat and power plants are considered below.

4.1 Community Heating

Connection to an existing heating or cooling network are not considered appropriate. The energy distribution losses as well as high investment cost of the connection to a network is not viable. There are no appropriate community heating networks for this development.

4.2 Combined Heat and Power (CHP)

Combined Heat and Power is not considered suitable for the following reasons:

- There is no appropriate space around the development for a large-scale combined heat and power plant, which would not disrupt the landscape of the development.

- Small scale/individual CHP would be appropriate but is significantly less efficient and provides less benefit than the other renewable options considered below.

4.3 Be Clean Conclusion

The use of community heating and combined heat and power are not appropriate for this development. There is no CHP network close enough to the development for connection to be currently viable both logistically and financially.

5.0 Be Green – Use Renewable Energy

The initial results from the SAP calculations without using renewable energy were used to generate the annual energy consumption figures. These figures were then used to determine the suitability of various renewable technologies to further improve the reduction in energy and carbon emissions within the building by using renewable energy sources. A selection of potential renewable and low carbon energy sources has been considered. These are:

- Photovoltaic cells (PV)
- solar water heating
- wind turbines
- ground source heat pump (GSHP) technologies
- air source heat pump (ASHP) technologies
- biomass
- hydropower

5.1 Photovoltaics (PV) – Not Suitable

Photovoltaic cells are panels which can be attached to the roof or walls of a building. Each cell is made of P-type and N-type semiconductor. P-N junction operates as a battery and creates an electric field which causes electrons to move towards the surface, where they are available for the electrodes. When photons of solar irradiance are absorbed by the PV plate, they create more holes and electrons, which are becoming available for direct current in an external load. The stronger the solar irradiance, the more electricity is produced. The greatest benefit from photovoltaics is seen when they are south facing at an angle of 45 degrees with no shading.

The overshadowing from neighbouring properties means that any solar PV placed on the roof of the property would not be operating efficiently, therefore it is not considered appropriate to install PV for this property.

5.2 Solar Hot Water – Not Suitable

Solar water heating systems use solar radiation to heat water directly, usually for domestic hot water purposes. The unit would be installed in the roof and the installation of solar hot water would require a suitable hot water cylinder so it can pre heat the water.

The solar hot water panels would sit on the roof space. To maintain the solar hot water, access would need to be available to the roof and safety rails installed around the solar hot water for health and safety reasons. These rails would be at least 1.0 m high.

The system will produce relatively small CO₂ savings and will have a significant negative impact of the cost of the heating system as it requires great modification. The heat losses associated with transportation would cause the investment to not be viable. Therefore, solar thermal systems are not appropriate for this development.

5.3 Wind Turbines – Not Suitable

Wind turbines can range from small domestic turbines (1kW) to large commercial turbines (140m tall, 2MW). There are also different designs and styles (horizontal or vertical axis; 1 blade to multiple blades) that can be implemented in various locations depending on wind speed and direction. They generate renewable electricity that can be provided for use on-site or sold directly to the local electricity network. Vertical axis turbines have a lower performance than horizontal axis turbines but work better in urban environments.

There is no appropriate space for the installation of large/medium scale wind turbines within the site because of the proximity of the dwellings. This would create noise that may potentially be disruptive and have a visual impact on the area, a common complaint associated with wind turbines. Therefore, wind turbines are not appropriate for this development.



5.4 Biomass – Not Suitable

Use of biomass fuels to run biomass boilers. The use of a large-scale biomass boiler has been considered for heating and hot water.

The potential reduction in carbon emissions by installing biomass boilers can be considerable. However, although biomass systems have several advantages, in the context of this development, the following issues prevent the installation of biomass boilers:

- Likely significant negative impact on local air quality and odour
- Significantly higher capital costs in comparison with other heating systems
- Requirements of additional resources for management of the operation
- The location of the development may not be suitable for large-scale fuel delivery
- Security of biomass supply, which must be sustainably grown to be considered renewable energy

5.5 Hydropower – Not Suitable

Hydropower is renewable energy produced by water in rivers. Electricity generated using hydropower is known as hydroelectricity. There are no rivers of any significant size within a close proximity of the site, therefore, this option has been considered not suitable for this development.

5.6 Heat Pump Technology

5.6.1 Air Source Heat Pump (ASHP) – Suitable

ASHP make use of the energy contained in air to provide heating and domestic hot water to the building by using the vapour-compression refrigeration process. An 'air to water' ASHP can provide domestic hot water and space heating in a building on small to medium scale.

An ASHP would be prove the property with clean, low carbon energy. By installing an ASHP at the property the DER for the property would be reduced to 5.61 kg CO₂/m²/yr. This is an improvement over the TER of 13.6 by 58.75%. The continued decarbonisation



of the electricity grid means that the limited carbon emissions associated with ASHPs will decrease over time.

5.6.2 Ground Source Heat Pump (GSHP) – Not Suitable

GSHP technology makes use of the heat from the ground to provide heating and domestic hot water to the building. The heat is transferred from the ground by either extracting and discharging (re-charging) water from/to the ground directly (open loop) or circulating water (or refrigerant) through pipes buried within the ground (closed loop). The fluid passes through a heat pump, which uses electrical energy, to transfer the heat from ground into a higher temperature water circuit used for heating purposes.

The development is within a heavily urban environment which would cause complications with the instillation of a GSHP. Therefore, GSHPs are not considered appropriate for this development.

5.7 Be Green Conclusion

Table 3 shows the cumulative reduction in carbon emissions considering all the Energy Hierarchy measures, including Be Lean, Be Clean and Be Green. The most appropriate renewable source of energy is an ASHP to supply the property with domestic hot water and space heating. An ASHP would supply the development a 59% improvement over the TER.

Table 3: Total emission rates of the development following 'Be Green' measures

Dwelling Emission Rate (kg CO ₂ /m ² /yr)	Target Emission Rate (kg CO ₂ /m ² /yr)	Improvement (%)
5.61	13.64	59%

6.0 Carbon Offsetting

For the new residential building to satisfy the requirements of Haringey Borough Council, the building must be zero carbon.

The remaining 5.61 kg CO₂/m²/yr must be financially offset. The cost for carbon offsetting is £45.06. This is based on the following calculation using the Haringey Borough Councils' pricing of £95 per tonne of CO₂ and a floor area of 84.55m².

$$\begin{aligned} 5.61 \text{ kg CO}_2/\text{m}^2/\text{yr} \times 84.55 &= 474.33 \text{ CO}_2/\text{yr} \\ 474.33 \text{ CO}_2/\text{yr} \div 1000 &= 0.47 \text{ CO}_2/\text{yr} \\ 0.47 \text{ CO}_2/\text{yr} \times 95 &= £45.06 \end{aligned}$$

7.0 Conclusion

The ambition of the development is to use a 'fabric first' approach before considering the use of renewable energy to offset carbon emissions. To help in achieving that goal, the Energy Hierarchy has been used as follows:

- Be lean – use less energy by reducing the energy demand of the development.
- Be clean – supply energy efficiently by connecting into an existing district heating network where possible.
- Be green – use renewable energy sources to further offset the carbon emissions.

Be Lean – By focusing on the building's fabric with good thermal properties, energy efficient lighting and efficient heating, the development improves on Part L Building Regulation requirements by 12%. The average U-value of the building is a 35.52% improvement from the minimum Building Regulations Part L1 requirements.

Be Clean - The use of community heating and combined heat and power are not appropriate for this development.

Be Green – The most appropriate renewable source of energy is an ASHP to supply the property with domestic hot water and space heating. An ASHP would supply the development a 59% improvement over the TER.



Glossary of Terms

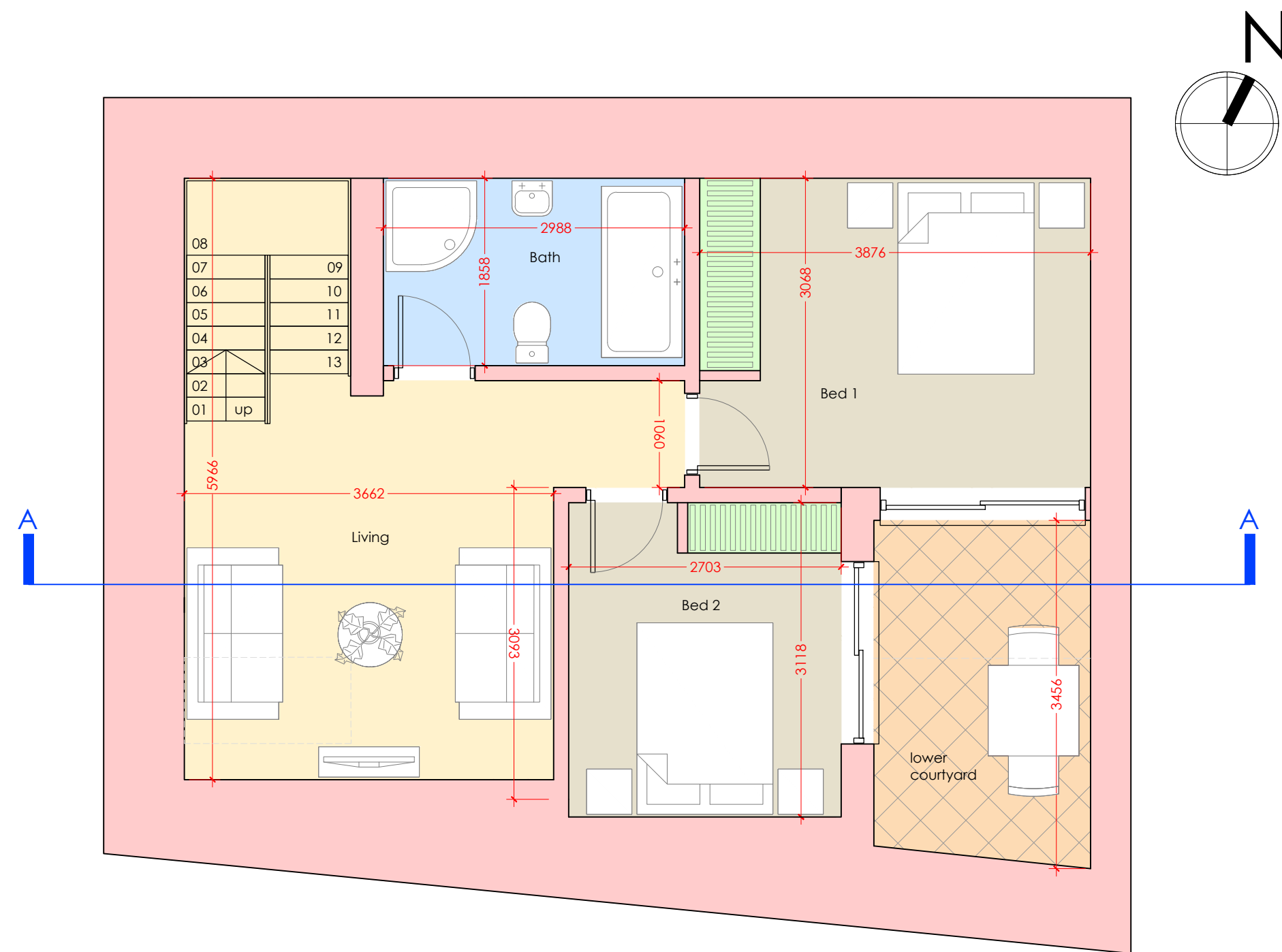
SAP – Standard Assessment Procedure

DER – Dwelling Emission Rate ($\text{kg CO}_2/\text{m}^2/\text{year}$)

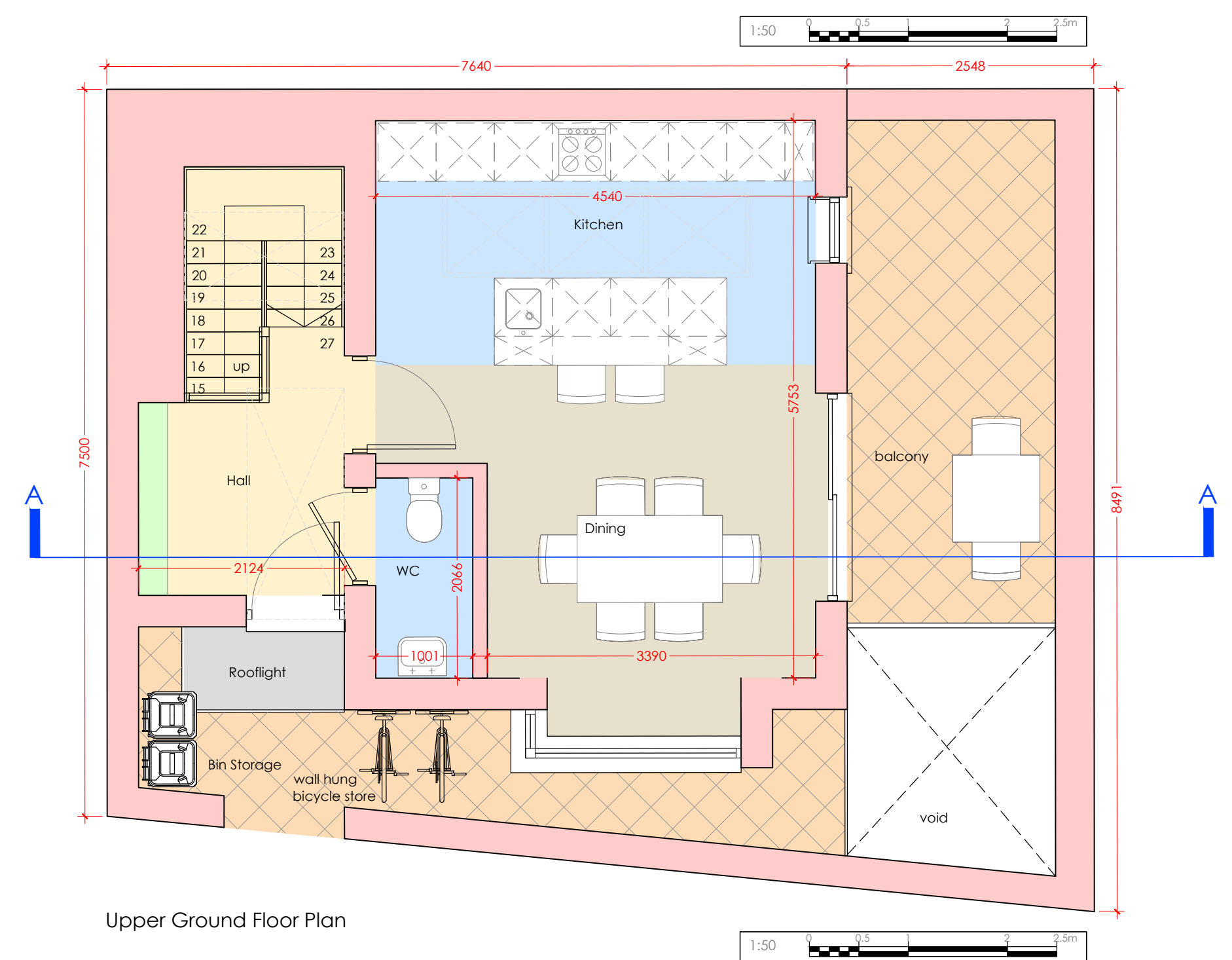
TER – Target Emission Rate ($\text{kg CO}_2/\text{m}^2/\text{year}$)

U-value - ($\text{W}/\text{m}^2\text{K}$)

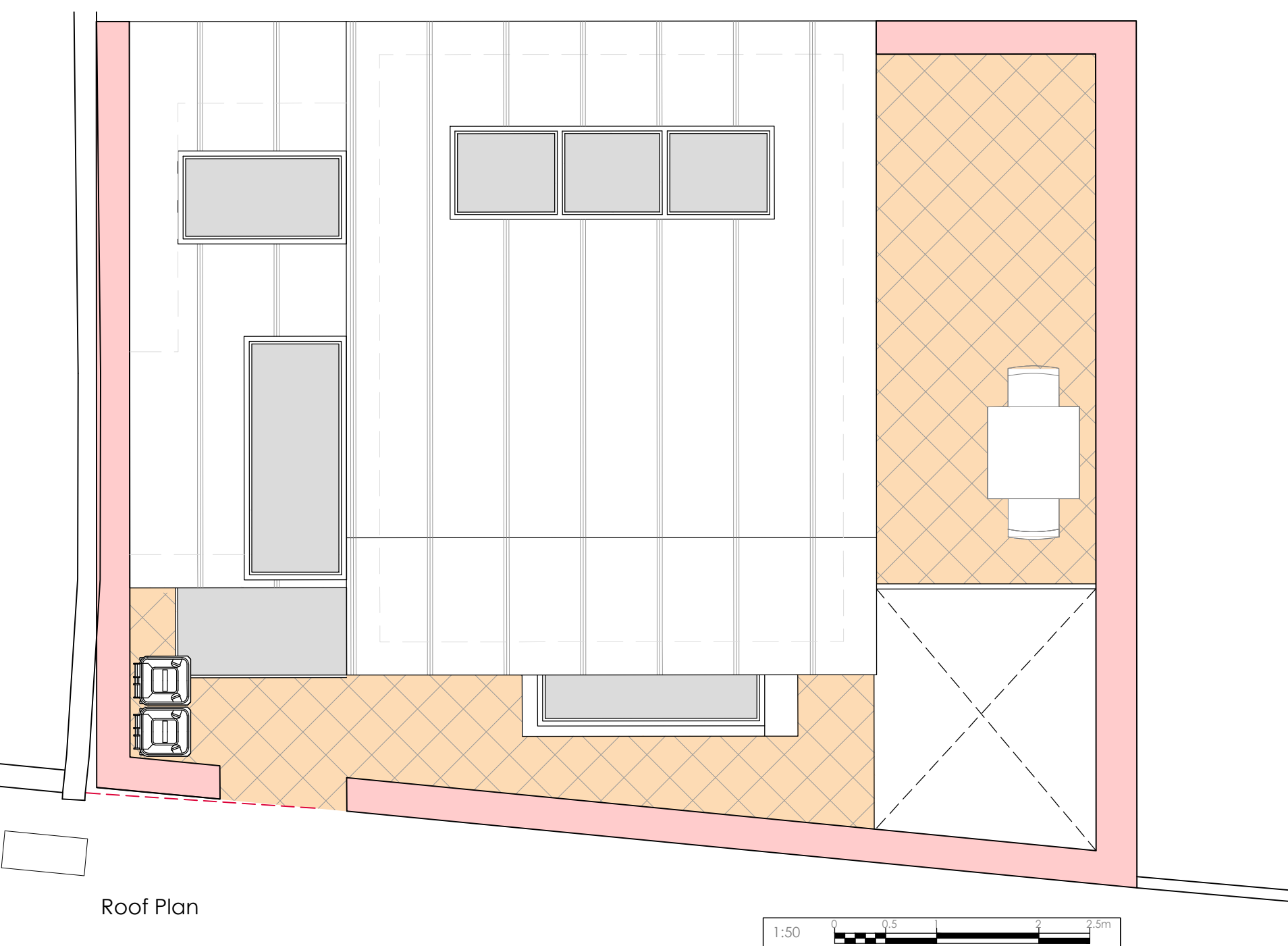




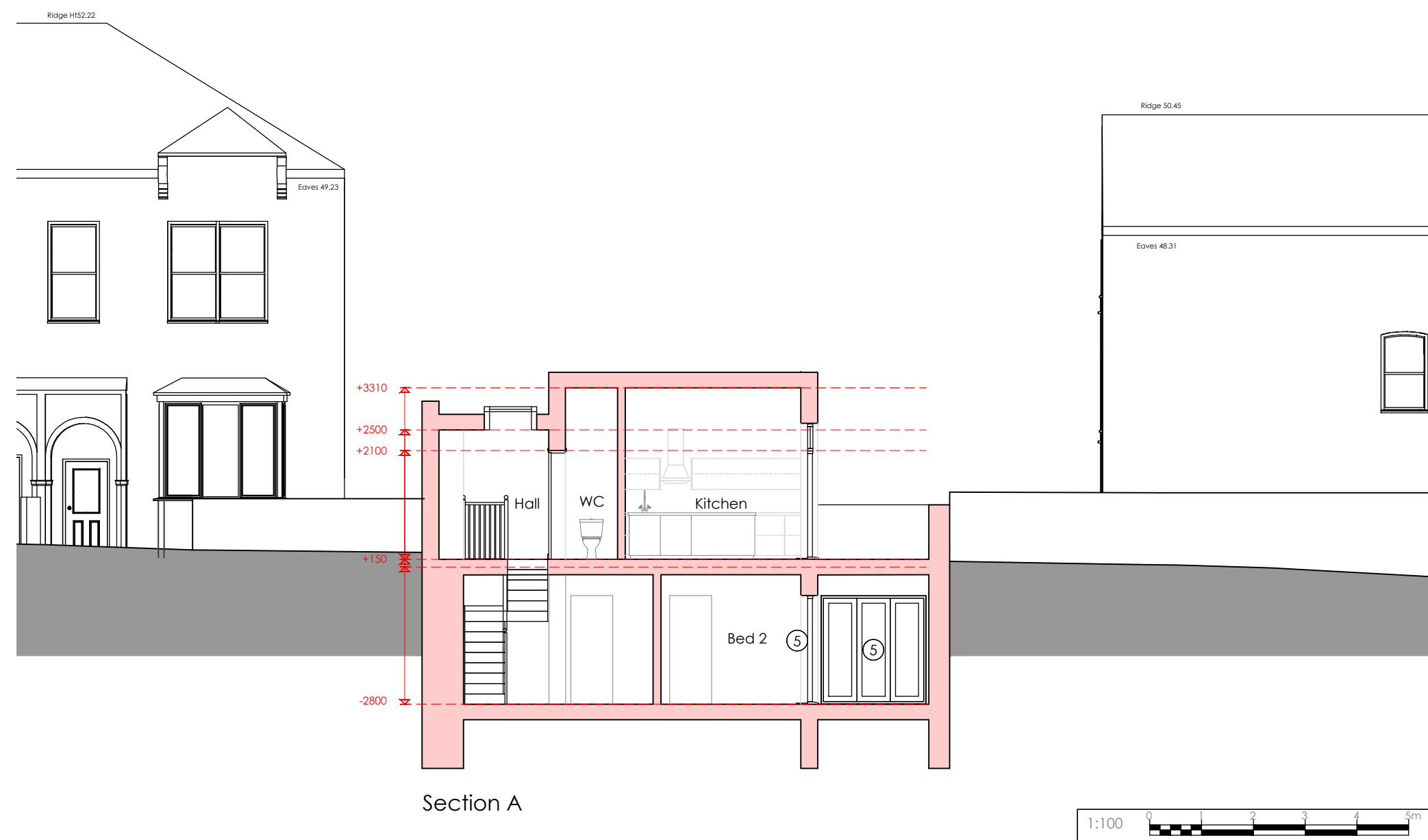
Basement Floor Plan



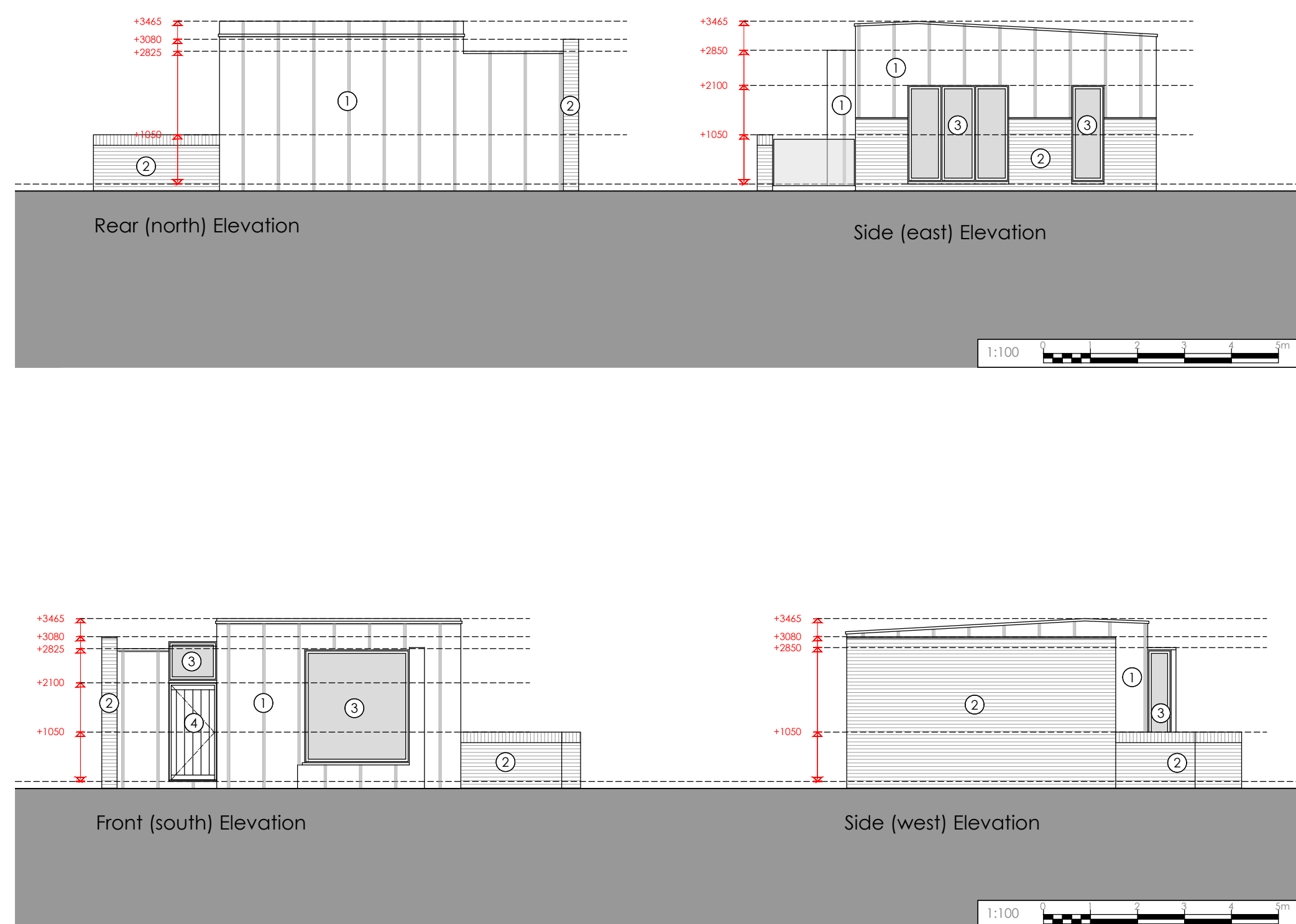
Upper Ground Floor Plan



Roof Plan

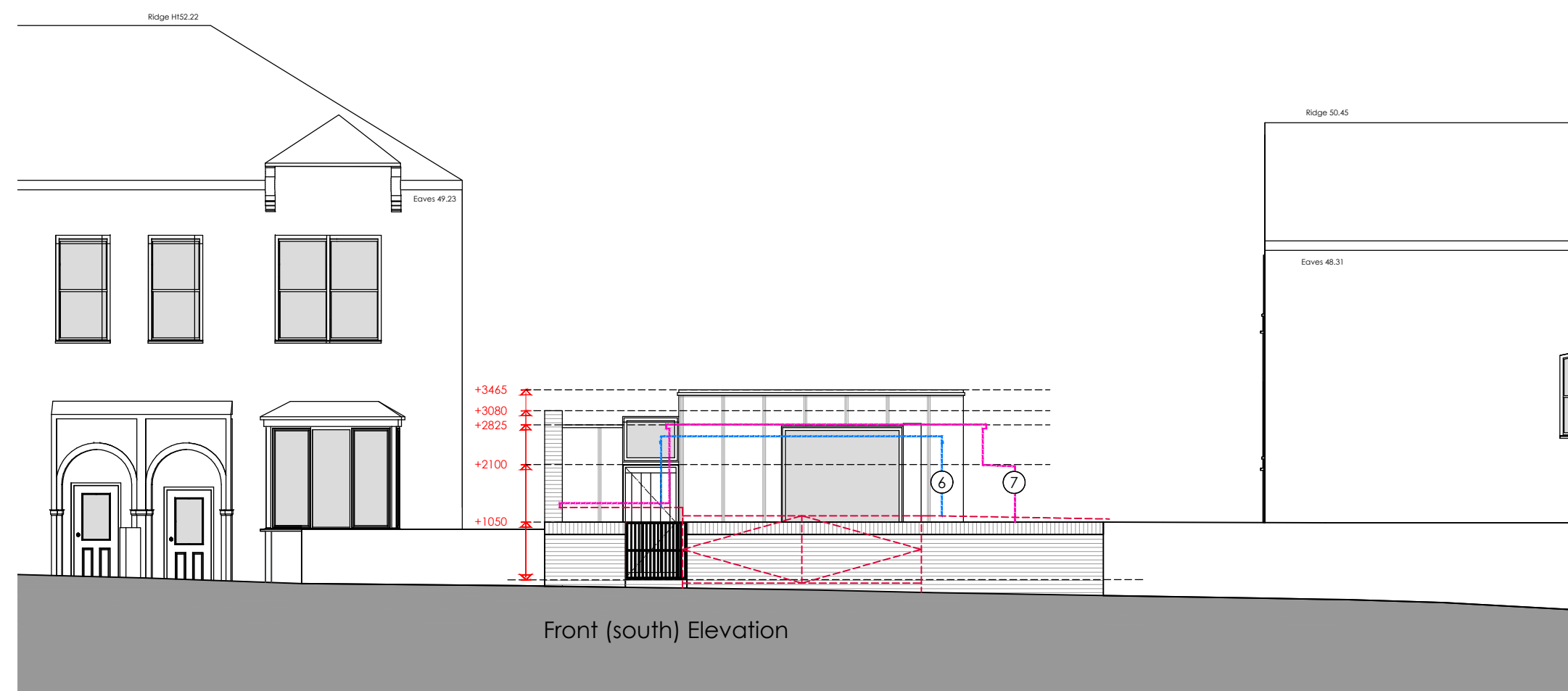


Section A



Front (south) Elevation

Side (west) Elevation



Front (south) Elevation

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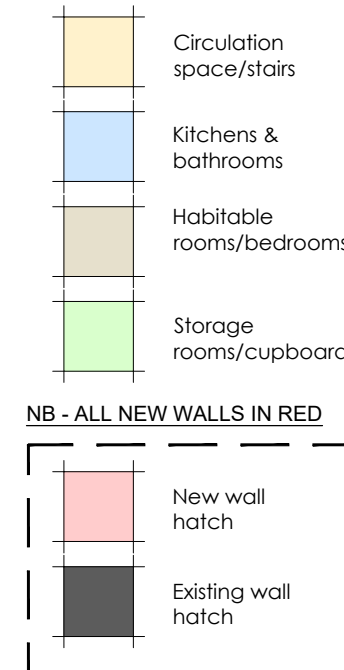
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Indicative 3D Visuals Not to Scale

Materials:

1. ZincCladding
2. Buff facing brickwork to match surrounding context - Ibstock Funtun Old Chelsea Yellow brick
3. Grey powder coated aluminium double glazed units (RAL 7015)
4. Timber front door
5. Grey powder coated aluminium double glazed patio doors to lower ground floors (RAL 7015)
6. Line of demolished garage
7. Line of approved dwelling ref: HGY/2016/2971



Revision Notes.
Drawing Status.

PLANNING

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Project:

Proposed New Dwelling
2C Landrock Road
Islington, London
For Mr Karimi

Title. Proposed Plans and Elevations

Scale, varies	Drawn, YT	Checked, JCB	Date, Jan '23
Drawing No. 8329-03-01			Revision.

HSSP A



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Revision Notes.

Drawing Status.

PLANNING

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Project.
Proposed New Dwelling
2C Landrock Road
Islington, London
For Mr Karimi

Title.
Proposed Site Plan

Scale. 1:200	Drawn. YT	Checked. JCB	Date. Jan '23
Drawing No. 8329-01-03	Revision.		

HSSP A3

Part L 2021 Performance

Residential

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

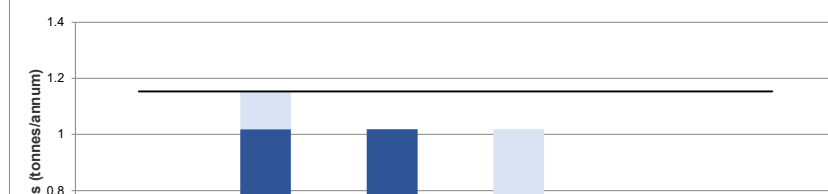
	Carbon Dioxide Emissions for residential buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	1.2	
After energy demand reduction (be lean)	1.0	
After heat network connection (be clean)	1.0	
After renewable energy (be green)	0.5	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.1	12%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.5	47%
Cumulative on site savings	0.7	59%
Annual savings from off-set payment	0.5	-
(Tonnes CO ₂)		
Cumulative savings for off-set payment	14	-
Cash in-lieu contribution (£)	1,352	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

Domestic Part L 2021 Carbon Emissions



Non-residential

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

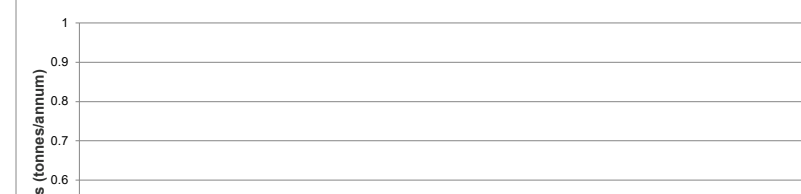
	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

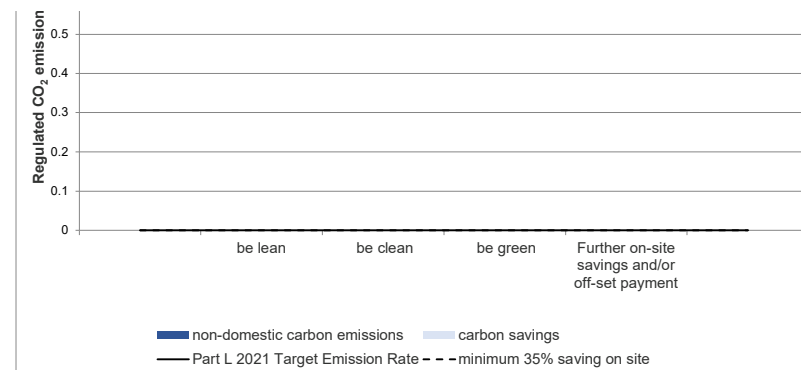
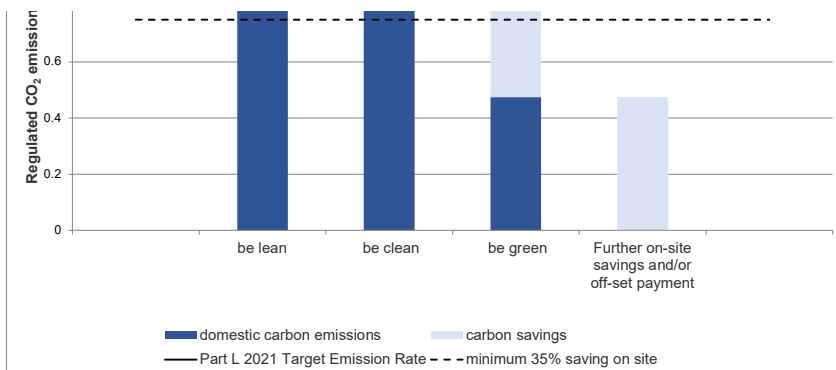
Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Total Cumulative Savings	0.0	0%
Annual savings from off-set payment	0.0	-
(Tonnes CO ₂)		
Cumulative savings for off-set payment	0	-
Cash in-lieu contribution (£)	0	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

Non-domestic Part L 2021 Carbon Emissions





SITE-WIDE

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	1.2		
Be lean	1.0	0.1	12%
Be clean	1.0	0.0	0%
Be green	0.5	0.5	47%
Total Savings	-	0.7	59%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	14.2	-

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total	50.94	48.99	4%

	Area weighted non-residential cooling demand (MJ/m ²)	Total non-residential cooling demand (MJ/year)
Actual		
Notional		

EUI & space heating demand (predicted energy use)

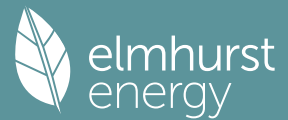
Residential

Building type	EUI (kWh/m ² /year) (excluding renewable energy)	Space heating demand (kWh/m ² /year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m ² /year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m ² /year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)
Residential	5.972087522	39.56179775	35	15	Part L1 - SAP 10.2 & none dwellings / & Landlord Circulation	

Non-residential

[illegible]

Full SAP Calculation Printout



Property Reference	2C Landrock Road			Issued on Date	19/06/2023
Assessment Reference	be lean	Prop Type Ref			
Property					
SAP Rating	83 B	DER	15.64	TER	13.96
Environmental	87 B	% DER < TER			-12.03
CO ₂ Emissions (t/year)	1.15	DFEE	48.99	TFEE	50.94
Compliance Check	See BREL	% DFEE < TFEE			3.84
% DPER < TPER	-21.04	DPER	88.71	TPER	73.29
Assessor Details	Mr. Dale Homewood			Assessor ID	AW52-0001
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)
Basement floor	47.5300 (1a)	x 2.5100 (2a)	= 119.3003 (1a) -
Ground floor	37.0200 (1b)	x 2.3800 (2b)	= 88.1076 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4079 (5)

2. Ventilation rate

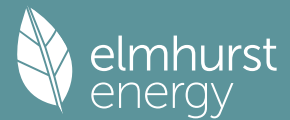
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (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) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2500 (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) = 0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.3659	0.3606	0.3553	0.3287	0.3234	0.2969	0.2969	0.2916	0.3075	0.3234	0.3341	0.3447 (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
Window (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
Door			2.0900	1.3000	2.7170		(26)

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Rooflight	8.2000	0.9615	7.8846			(27a)
Basement Floor	47.5300	0.1100	5.2283	110.0000	5228.3000	(28)
Ground Floor	3.1700	0.1100	0.3487	110.0000	348.7000	(28a)
Basement Wall	77.0100	0.1300	10.0113	110.0000	8471.1000	(29a)
Cavity Wall	91.7300	0.1800	13.8222	110.0000	8446.9000	(29a)
External Roof 1	50.7000	0.1300	5.5250	9.0000	382.5000	(30)
Total net area of external elements Aum(A, m2)	270.1400					(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	61.4164				(33)
Solid	35.0800			75.0000	2631.0000	(32c)
Timber	83.1000			9.0000	747.9000	(32c)
Internal Floor 1	33.8500			18.0000	609.3000	(32d)
Internal Ceiling 1	33.8500			9.0000	304.6500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27170.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 321.3525 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.4200	0.0210	0.1348
E3 Sill	2.7100	0.0210	0.0569
E4 Jamb	23.5400	0.0170	0.4002
E5 Ground floor (normal)	8.4400	0.0830	0.7005
E6 Intermediate floor within a dwelling	6.6200	0.0000	0.0000
E19 Ground floor (inverted)	6.5100	0.1000	0.6510
E22 Basement floor	30.6800	0.2200	6.7496
E24 Eaves (insulation at ceiling level - inverted)	16.0500	0.1500	2.4075
E14 Flat roof	48.6600	0.1600	7.7856
E16 Corner (normal)	44.9400	0.0460	2.0672
E17 Corner (inverted - internal area greater than external area)	20.5800	-0.0670	-1.3789
R3 Jamb of roof window	25.3800	0.2400	6.0912

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.6657 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 87.0821 (37)

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

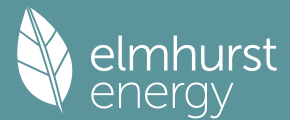
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.0464	24.6828	24.3192	22.5012	22.1376	20.3195	20.3195	19.9559	21.0467	22.1376	22.8648	23.5920	(38)
Heat transfer coeff	112.1286	111.7649	111.4013	109.5833	109.2197	107.4016	107.4016	107.0380	108.1288	109.2197	109.9469	110.6741	(39)
Average = Sum(39)m / 12 =												109.4924	(39)
HLP	1.3262	1.3219	1.3176	1.2961	1.2918	1.2703	1.2703	1.2660	1.2789	1.2918	1.3004	1.3090	(40)
HLP (average)												1.2950	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5435 (42)
Hot water usage for mixer showers	91.9417	90.5600	88.5466	84.6943	81.8513	78.6810	76.8789	78.8771	81.0675	84.4715	88.4065	91.5894	(42a)
Hot water usage for baths	28.8781	28.4492	27.8452	26.7317	25.8978	24.9732	24.4738	25.0735	25.7265	26.7159	27.8524	28.7805	(42b)
Hot water usage for other uses	40.6785	39.1993	37.7200	36.2408	34.7616	33.2824	33.2824	34.7616	36.2408	37.7200	39.1993	40.6785	(42c)
Average daily hot water use (litres/day)												148.5221	(43)
Daily hot water use	161.4982	158.2084	154.1118	147.6667	142.5108	136.9366	134.6351	138.7123	143.0348	148.9074	155.4582	161.0483	(44)
Energy conte	255.7737	225.2867	236.8642	202.1484	191.8469	168.3795	162.8295	171.7547	176.3763	202.0660	221.4787	252.1628	(45)
Energy content (annual)										Total = Sum(45)m =		2466.9674	
Distribution loss (46)m = 0.15 x (45)m	38.3661	33.7930	35.5296	30.3223	28.7770	25.2569	24.4244	25.7632	26.4564	30.3099	33.2218	37.8244	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary 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	(59)
Combi loss	14.3704	12.9660	14.3250	13.7980	14.2170	13.7169	14.1474	14.1688	13.7361	14.2415	13.8443	14.3618	(61)
Total heat required for water heating calculated for each month	270.1441	238.2527	251.1892	215.9464	206.0639	182.0964	176.9769	185.9235	190.1124	216.3075	235.3231	266.5245	(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	270.1441	238.2527	251.1892	215.9464	206.0639	182.0964	176.9769	185.9235	190.1124	216.3075	235.3231	266.5245	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2634.8606	(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)
Heat gains from water heating, kWh/month	88.6374	78.1493	82.3386	70.6638	67.3433	59.4154	57.6777	60.6506	62.0791	70.7473	77.1028	87.4346	(65)

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

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Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.3463	127.7048	115.3463	119.1911	115.3463	119.1911	115.3463	115.3463	119.1911	115.3463	119.1911	115.3463	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6869	231.0599	225.0799	212.3492	196.2789	181.1751	171.0848	168.7117	174.6918	187.4225	203.4928	218.5966	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	(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)	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	(71)
Water heating gains (Table 5)	119.1362	116.2936	110.6702	98.1442	90.5153	82.5214	77.5237	81.5197	86.2210	95.0905	107.0872	117.5196	(72)
Total internal gains	527.3226	539.2116	515.2496	493.8377	466.2936	444.0408	425.1080	426.7309	441.2571	462.0125	493.9243	515.6157	(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
East				1.2200	19.6403		0.4400		0.0000		0.7700		8.1180 (76)
South				6.0700	46.7521		0.4400		0.0000		0.7700		96.1464 (78)
West				5.5600	19.6403		0.4400		0.0000		0.7700		36.9969 (80)
North				8.2000	26.0000		0.6300		0.7000		1.0000		84.6191 (82)
Solar gains	225.8804	421.4647	658.3620	926.8591	1120.8948	1144.1916	1090.4222	944.1628	752.8453	489.3622	277.6204	188.5258	(83)
Total gains	753.2030	960.6763	1173.6116	1420.6968	1587.1884	1588.2324	1515.5302	1370.8937	1194.1025	951.3746	771.5447	704.1415	(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)													
tau	67.3095	67.5285	67.7489	68.8729	69.1022	70.2719	70.2719	70.5107	69.7993	69.1022	68.6451	68.1941	
alpha	5.4873	5.5019	5.5166	5.5915	5.6068	5.6848	5.6848	5.7007	5.6533	5.6068	5.5763	5.5463	
util living area	0.9960	0.9850	0.9464	0.8175	0.6201	0.4307	0.3115	0.3585	0.6076	0.9129	0.9889	0.9971	(86)
MIT	19.8686	20.1394	20.4907	20.8335	20.9680	20.9966	20.9996	20.9991	20.9792	20.7291	20.2257	19.8306	(87)
Th 2	19.8204	19.8237	19.8271	19.8439	19.8473	19.8642	19.8642	19.8676	19.8574	19.8473	19.8405	19.8338	(88)
util rest of house	0.9942	0.9790	0.9269	0.7683	0.5508	0.3553	0.2313	0.2706	0.5150	0.8728	0.9835	0.9959	(89)
MIT 2	18.5380	18.8822	19.3132	19.7039	19.8270	19.8629	19.8641	19.8674	19.8475	19.6138	19.0070	18.4995	(90)
Living area fraction									fLA = Living area / (4) =			0.2176	(91)
MIT	18.8275	19.1558	19.5694	19.9497	20.0753	20.1096	20.1112	20.1137	20.0938	19.8565	19.2722	18.7891	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6775	19.0058	19.4194	19.7997	19.9253	19.9596	19.9612	19.9637	19.9438	19.7065	19.1222	18.6391	(93)

8. Space heating requirement

Utilisation	0.9918	0.9733	0.9186	0.7662	0.5557	0.3617	0.2381	0.2781	0.5222	0.8668	0.9787	0.9940	(94)
Useful gains	746.9928	935.0643	1078.0431	1088.5835	881.9498	574.4809	360.9201	381.2595	623.6180	824.6883	755.1103	699.9408	(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	1612.1322	1576.5365	1439.2421	1194.4297	898.3669	575.6276	360.9991	381.4469	631.8830	994.6078	1321.8086	1598.0399	(97)
Space heating kWh	643.6637	431.0694	268.7320	76.2093	12.2144	0.0000	0.0000	0.0000	0.0000	126.4201	408.0227	668.1858	(98a)
Space heating requirement - total per year (kWh/year)												2634.5174	
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	643.6637	431.0694	268.7320	76.2093	12.2144	0.0000	0.0000	0.0000	0.0000	126.4201	408.0227	668.1858	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2634.5174	
Space heating per m2										(98c) / (4) =		31.1593	(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 %)													89.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement													

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643.6637	431.0694	268.7320	76.2093	12.2144	0.0000	0.0000	0.0000	0.0000	126.4201	408.0227	668.1858	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	723.2177	484.3476	301.9461	85.6284	13.7240	0.0000	0.0000	0.0000	142.0451	458.4525	750.7705	(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	(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	(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	(215)
Water heating												
Water heating requirement	270.1441	238.2527	251.1892	215.9464	206.0639	182.0964	176.9769	185.9235	190.1124	216.3075	235.3231	266.5245 (64)
Efficiency of water heater	88.4906	88.3873	88.1705	87.7372	87.3934	87.3000	87.3000	87.3000	87.3000	87.9195	88.3705	87.3000 (216)
Fuel for water heating, kWh/month	305.2801	269.5552	284.8903	246.1287	235.7888	208.5870	202.7227	212.9708	217.7690	246.0292	266.2913	301.1286 (217)
Space cooling fuel requirement	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	24.2282	21.8835	24.2282	23.4466	24.2282	23.4466	24.2282	24.2282	23.4466	24.2282	23.4466	24.2282 (231)
Lighting	27.2182	21.8354	19.6604	14.4040	11.1261	9.0901	10.1496	13.1928	17.1362	22.4836	25.3952	27.9746 (232)
Electricity generated by PVs (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 (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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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												2960.1319 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												87.3000
Water heating fuel used												2997.1417 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)												
mechanical ventilation fans (SFP = 0.7875)												199.2671 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												285.2671 (231)
Electricity for lighting (calculated in Appendix L)												219.6662 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												6462.2070 (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	2960.1319	0.2100	621.6277 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2997.1417	0.2100	629.3998 (264)
Space and water heating			1251.0275 (265)
Pumps, fans and electric keep-hot	285.2671	0.1387	39.5701 (267)
Energy for lighting	219.6662	0.1443	31.7046 (268)
Total CO2, kg/year			1322.3021 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			15.6400 (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	2960.1319	1.1300	3344.9490 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2997.1417	1.1300	3386.7702 (278)
Space and water heating			6731.7192 (279)
Pumps, fans and electric keep-hot	285.2671	1.5128	431.5521 (281)
Energy for lighting	219.6662	1.5338	336.9314 (282)
Total Primary energy kWh/year			7500.2027 (286)

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Dwelling Primary energy Rate (DPER)

88.7100 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	47.5300 (1a)	x 2.5100 (2a)	= 119.3003 (1a) -
Ground floor	37.0200 (1b)	x 2.3800 (2b)	= 88.1076 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4079 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (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) = 0.3354 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (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
TER Opaque door			2.0900	1.0000	2.0900		(26)
TER Opening Type (Uw = 1.20)			11.6200	1.1450	13.3053		(27)
Rooflight			7.4200	2.0221	15.0037		(27a)
Basement Floor			47.5300	0.1300	6.1789		(28)
Ground Floor			3.1700	0.1300	0.4121		(28a)
Basement Wall	77.0100		77.0100	0.1800	13.8618		(29a)
Cavity Wall	91.7300	13.7100	78.0200	0.1800	14.0436		(29a)
External Roof 1	50.7000	7.4200	43.2800	0.1100	4.7608		(30)
Total net area of external elements Aum(A, m ²)			270.1400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 69.6562		(33)

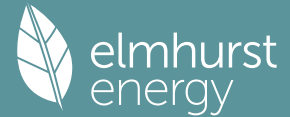
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K

321.3525 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.4200	0.0500	0.3210
E3 Sill	2.7100	0.0500	0.1355
E4 Jamb	23.5400	0.0500	1.1770
E5 Ground floor (normal)	8.4400	0.1600	1.3504
E6 Intermediate floor within a dwelling	6.6200	0.0000	0.0000
E19 Ground floor (inverted)	6.5100	0.0700	0.4557
E22 Basement floor	30.6800	0.0700	2.1476
E24 Eaves (insulation at ceiling level - inverted)	16.0500	0.2400	3.8520
E14 Flat roof	48.6600	0.0800	3.8928
E16 Corner (normal)	44.9400	0.0900	4.0446

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E17 Corner (inverted - internal area greater than external area) 20.5800 -0.0900 -1.8522
 R3 Jamb of roof window 25.3800 0.0800 2.0304
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.5548 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 87.2110 (37)

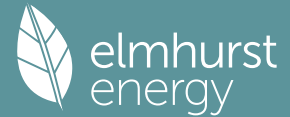
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.4823	Feb 40.2392	Mar 40.0010	Apr 38.8818	May 38.6724	Jun 37.6977	Jul 37.6977	Aug 37.5172	Sep 38.0731	Oct 38.6724	Nov 39.0960	Dec 39.5389 (38)
Heat transfer coeff	127.6933	127.4503	127.2120	126.0928	125.8834	124.9087	124.9087	124.7282	125.2842	125.8834	126.3070	126.7499 (39)
Average = Sum(39)m / 12 =												126.0918
HLP	Jan 1.5103	Feb 1.5074	Mar 1.5046	Apr 1.4913	May 1.4889	Jun 1.4773	Jul 1.4773	Aug 1.4752	Sep 1.4818	Oct 1.4889	Nov 1.4939	Dec 1.4991 (40)
HLP (average)												1.4913
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.5435 (42)
Hot water usage for mixer showers												66.6105 (42a)
Hot water usage for baths												28.7805 (42b)
Hot water usage for other uses												40.6785 (42c)
Average daily hot water use (litres/day)												125.4038 (43)
Daily hot water use	Jan 136.4232	Feb 133.5103	Mar 129.9628	Apr 124.5683	May 120.1877	Jun 115.4782	Jul 113.6682	Aug 117.2003	Sep 120.9255	Oct 125.8697	Nov 131.3473	Dec 136.0694 (44)
Energy content (annual)	216.0611	190.1168	199.7480	170.5278	161.7957	141.9939	137.4718	145.1185	149.1133	170.8041	187.1284	213.0518 (45)
Distribution loss (46)m = 0.15 x (45)m												2082.9310
Water storage loss:												
Total storage 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 (56)
If cylinder contains dedicated solar storage												0.0000 (57)
Primary 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 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	267.0200	236.1442	250.7069	219.8429	212.7546	191.3089	188.4307	196.0774	198.4283	221.7630	236.4434	264.0107 (62)
WWHRS	-30.5687	-27.0352	-28.3097	-23.4415	-21.8467	-18.6943	-17.5230	-18.6339	-19.3419	-22.8019	-25.8318	-30.0026 (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	236.4513	209.1091	222.3972	196.4013	190.9080	172.6146	170.9077	177.4435	179.0865	198.9610	210.6116	234.0082 (64)
12Total per year (kWh/year)												2398.8999 (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)
Heat gains from water heating, kWh/month	84.5800	74.7207	79.1559	69.0293	66.5368	59.5417	58.4491	60.9916	61.9089	69.5321	74.5489	83.5795 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts	Jan 127.1774	Feb 127.1774	Mar 127.1774	Apr 127.1774	May 127.1774	Jun 127.1774	Jul 127.1774	Aug 127.1774	Sep 127.1774	Oct 127.1774	Nov 127.1774	Dec 127.1774 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.3463	127.7048	115.3463	119.1911	115.3463	119.1911	115.3463	115.3463	119.1911	115.3463	119.1911	115.3463 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6869	231.0599	225.0799	212.3492	196.2789	181.1751	171.0848	168.7117	174.6918	187.4225	203.4928	218.5966 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177 (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)	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419 (71)
Water heating gains (Table 5)	113.6828	111.1915	106.3924	95.8740	89.4312	82.6968	78.5606	81.9780	85.9846	93.4571	103.5402	112.3380 (72)
Total internal gains	521.8692	534.1095	510.9718	491.5675	465.2095	444.2163	426.1449	427.1892	441.0207	460.3791	490.3774	510.4341 (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						

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East	1.1000	19.6403	0.6300	0.7000	0.7700	6.6026 (76)
South	5.4900	46.7521	0.6300	0.7000	0.7700	78.4413 (78)
West	5.0300	19.6403	0.6300	0.7000	0.7700	30.1917 (80)
North	7.4200	26.0000	0.6300	0.7000	1.0000	76.5699 (82)

Solar gains	191.8055	359.4739	564.8999	799.5809	970.0408	991.3637	944.3124	815.7248	647.4827	418.3404	236.0427	159.8833 (83)
Total gains	713.6747	893.5833	1075.8717	1291.1484	1435.2504	1435.5800	1370.4573	1242.9140	1088.5035	878.7195	726.4201	670.3173 (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	59.1050	59.2178	59.3287	59.8553	59.9548	60.4227	60.4227	60.5101	60.2416	59.9548	59.7538	59.5450
alpha	4.9403	4.9479	4.9552	4.9904	4.9970	5.0282	5.0282	5.0340	5.0161	4.9970	4.9836	4.9697
util living area	0.9970	0.9907	0.9700	0.8943	0.7387	0.5435	0.3986	0.4565	0.7256	0.9506	0.9928	0.9978 (86)
MIT	19.6048	19.8540	20.2129	20.6347	20.8911	20.9810	20.9967	20.9937	20.9264	20.5333	19.9819	19.5636 (87)
Th 2	19.6798	19.6820	19.6841	19.6940	19.6959	19.7045	19.7045	19.7062	19.7012	19.6959	19.6921	19.6882 (88)
util rest of house	0.9957	0.9867	0.9572	0.8542	0.6609	0.4399	0.2826	0.3309	0.6174	0.9221	0.9890	0.9968 (89)
MIT 2	18.1007	18.4187	18.8678	19.3679	19.6226	19.6969	19.7039	19.7048	19.6636	19.2728	18.5908	18.0541 (90)
Living area fraction	18.4281	18.7310	19.1606	19.6436	19.8987	19.9764	19.9853	19.9853	fLa = Living area / (4) =	19.5472	18.8935	0.2176 (91)
MIT	18.4281	18.7310	19.1606	19.6436	19.8987	19.9764	19.9853	19.9853	19.9384	19.5472	18.8935	18.3826 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4281	18.7310	19.1606	19.6436	19.8987	19.9764	19.9853	19.9853	19.9384	19.5472	18.8935	18.3826 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9938	0.9826	0.9506	0.8524	0.6740	0.4623	0.3080	0.3584	0.6390	0.9179	0.9855	0.9953 (94)
Useful gains	709.2399	878.0294	1022.6833	1100.5986	967.3145	663.6365	422.0572	445.5170	695.5070	806.5585	715.8908	667.1861 (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	1804.0588	1762.7690	1610.5740	1354.6910	1032.0772	671.5544	422.8488	447.1875	731.4644	1126.2985	1489.6054	1797.6410 (97)
Space heating kWh	814.5452	594.5450	437.3907	182.9465	48.1834	0.0000	0.0000	0.0000	0.0000	237.8865	557.0745	841.0585 (98a)
Space heating requirement - total per year (kWh/year)												3713.6303
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	814.5452	594.5450	437.3907	182.9465	48.1834	0.0000	0.0000	0.0000	0.0000	237.8865	557.0745	841.0585 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3713.6303
Space heating per m2										(98c) / (4) =		43.9223 (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 %)												92.4000 (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	814.5452	594.5450	437.3907	182.9465	48.1834	0.0000	0.0000	0.0000	0.0000	237.8865	557.0745	841.0585 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	881.5424	643.4470	473.3666	197.9941	52.1466	0.0000	0.0000	0.0000	0.0000	257.4529	602.8945	910.2364 (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	236.4513	209.1091	222.3972	196.4013	190.9080	172.6146	170.9077	177.4435	179.0865	198.9610	210.6116	234.0082 (64)
Efficiency of water heater (217)m	86.8084	86.4898	85.8025	84.2296	81.8966	80.3000	80.3000	80.3000	80.3000	84.7653	86.3625	80.3000 (216)
Fuel for water heating, kWh/month	272.3831	241.7731	259.1966	233.1738	233.1086	214.9621	212.8365	220.9757	223.0217	234.7198	243.8693	269.3626 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	23.9667	19.2270	17.3117	12.6833	9.7970	8.0042	8.9371	11.6168	15.0891	19.7977	22.3614	24.6328 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-42.8746	-59.6492	-84.6312	-93.8903	-100.1909	-93.1342	-91.9547	-87.2948	-78.9514	-67.5764	-46.8402	-37.1595 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

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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	(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	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-26.7187	-55.8984	-110.5456	-165.2447	-217.7536	-218.5358	-215.9869	-183.2356	-134.7713	-79.7037	-35.5938	(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	(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	(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	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											4019.0804	(211)
Space heating fuel - main system 2											0.0000	(213)
Space heating fuel - secondary											0.0000	(215)
Efficiency of water heater											80.3000	
Water heating fuel used											2859.3827	(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)											193.4248	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-2349.2893	(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											4808.5986	(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	4019.0804	0.2100	844.0069 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2859.3827	0.2100	600.4704 (264)
Space and water heating			1444.4773 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	193.4248	0.1443	27.9172 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-884.1473	0.1349	-119.2449
PV Unit electricity exported	-1465.1421	0.1260	-184.6588
Total			-303.9038 (269)
Total CO2, kg/year			1180.4199 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.9600 (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	4019.0804	1.1300	4541.5609 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2859.3827	1.1300	3231.1025 (278)
Space and water heating			7772.6634 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	193.4248	1.5338	296.6814 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-884.1473	1.4985	-1324.8703
PV Unit electricity exported	-1465.1421	0.4626	-677.8341
Total			-2002.7043 (283)
Total Primary energy kWh/year			6196.7413 (286)
Target Primary Energy Rate (TPER)			73.2900 (287)

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Property Reference	2C Landrock Road				Issued on Date	19/06/2023
Assessment Reference	be green		Prop Type Ref			
Property						
SAP Rating	77 C	DER	5.61	TER	13.60	
Environmental	95 A	% DER < TER				58.75
CO ₂ Emissions (t/year)	0.43	DFEE	48.99	TFEE	50.94	
Compliance Check	See BREL	% DFEE < TFEE				3.84
% DPER < TPER	17.30	DPER	58.99	TPER	71.33	
Assessor Details	Mr. Dale Homewood				Assessor ID	AW52-0001
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)
Basement floor	47.5300 (1a)	x 2.5100 (2a)	= 119.3003 (1a) -
Ground floor	37.0200 (1b)	x 2.3800 (2b)	= 88.1076 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4079 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

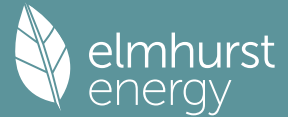
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.2500	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.3659	0.3606	0.3553	0.3287	0.3234	0.2969	0.2969	0.2916	0.3075	0.3234	0.3341	0.3447 (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
Window (Uw = 1.30)			12.8500	1.2357	15.8793		(27)
Door			2.0900	1.3000	2.7170		(26)

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Rooflight	8.2000	0.9615	7.8846			(27a)
Basement Floor	47.5300	0.1100	5.2283	110.0000	5228.3000	(28)
Ground Floor	3.1700	0.1100	0.3487	110.0000	348.7000	(28a)
Basement Wall	77.0100	0.1300	10.0113	110.0000	8471.1000	(29a)
Cavity Wall	91.7300	0.1800	13.8222	110.0000	8446.9000	(29a)
External Roof 1	50.7000	0.1300	5.5250	9.0000	382.5000	(30)
Total net area of external elements Aum(A, m2)	270.1400					(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	61.4164				(33)
Solid	35.0800			75.0000	2631.0000	(32c)
Timber	83.1000			9.0000	747.9000	(32c)
Internal Floor 1	33.8500			18.0000	609.3000	(32d)
Internal Ceiling 1	33.8500			9.0000	304.6500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27170.3500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 321.3525 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	6.4200	0.0210	0.1348
E3 Sill	2.7100	0.0210	0.0569
E4 Jamb	23.5400	0.0170	0.4002
E5 Ground floor (normal)	8.4400	0.0830	0.7005
E6 Intermediate floor within a dwelling	6.6200	0.0000	0.0000
E19 Ground floor (inverted)	6.5100	0.1000	0.6510
E22 Basement floor	30.6800	0.2200	6.7496
E24 Eaves (insulation at ceiling level - inverted)	16.0500	0.1500	2.4075
E14 Flat roof	48.6600	0.1600	7.7856
E16 Corner (normal)	44.9400	0.0460	2.0672
E17 Corner (inverted - internal area greater than external area)	20.5800	-0.0670	-1.3789
R3 Jamb of roof window	25.3800	0.2400	6.0912

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 25.6657 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 87.0821 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.0464	24.6828	24.3192	22.5012	22.1376	20.3195	20.3195	19.9559	21.0467	22.1376	22.8648	23.5920	(38)
Heat transfer coeff	112.1286	111.7649	111.4013	109.5833	109.2197	107.4016	107.4016	107.0380	108.1288	109.2197	109.9469	110.6741	(39)
Average = Sum(39)m / 12 =												109.4924	(39)
HLP	1.3262	1.3219	1.3176	1.2961	1.2918	1.2703	1.2703	1.2660	1.2789	1.2918	1.3004	1.3090	(40)
HLP (average)												1.2950	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5435 (42)
Hot water usage for mixer showers	91.9417	90.5600	88.5466	84.6943	81.8513	78.6810	76.8789	78.8771	81.0675	84.4715	88.4065	91.5894	(42a)
Hot water usage for baths	28.8781	28.4492	27.8452	26.7317	25.8978	24.9732	24.4738	25.0735	25.7265	26.7159	27.8524	28.7805	(42b)
Hot water usage for other uses	40.6785	39.1993	37.7200	36.2408	34.7616	33.2824	33.2824	34.7616	36.2408	37.7200	39.1993	40.6785	(42c)
Average daily hot water use (litres/day)												148.5221	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	161.4982	158.2084	154.1118	147.6667	142.5108	136.9366	134.6351	138.7123	143.0348	148.9074	155.4582	161.0483	(44)
Energy conte	255.7737	225.2867	236.8642	202.1484	191.8469	168.3795	162.8295	171.7547	176.3763	202.0660	221.4787	252.1628	(45)
Energy content (annual)										Total = Sum(45)m =		2466.9674	(45)

Distribution loss (46)m = 0.15 x (45)m
 38.3661 33.7930 35.5296 30.3223 28.7770 25.2569 24.4244 25.7632 26.4564 30.3099 33.2218 37.8244 (46)

Water storage loss:
 Store volume 180.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.4000 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7560 (55)

Total storage loss 23.4360 21.1680 23.4360 22.6800 23.4360 22.6800 23.4360 23.4360 22.6800 23.4360 22.6800 23.4360 (56)

If cylinder contains dedicated solar storage 23.4360 21.1680 23.4360 22.6800 23.4360 22.6800 23.4360 23.4360 22.6800 23.4360 22.6800 23.4360 (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 302.4721 267.4659 283.5626 247.3404 238.5453 213.5715 209.5279 218.4531 221.5683 248.7644 266.6707 298.8612 (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 302.4721 267.4659 283.5626 247.3404 238.5453 213.5715 209.5279 218.4531 221.5683 248.7644 266.6707 298.8612 (64)

Total per year (kWh/year) = Sum(64)m = 3016.8034 (64)

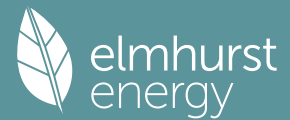
12Total per year (kWh/year) 3017 (64)

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 122.4035 108.6512 116.1161 103.3679 101.1478 92.1398 91.4995 94.4672 94.7987 104.5457 109.7953 121.2028 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	115.3463	127.7048	115.3463	119.1911	115.3463	119.1911	115.3463	115.3463	119.1911	115.3463	119.1911	115.3463	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6869	231.0599	225.0799	212.3492	196.2789	181.1751	171.0848	168.7117	174.6918	187.4225	203.4928	218.5966	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	(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)	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	(71)
Water heating gains (Table 5)	164.5208	161.6833	156.0700	143.5666	135.9514	127.9719	122.9832	126.9720	131.6649	140.5184	152.4934	162.9071	(72)
Total internal gains	569.7072	581.6013	557.6494	536.2601	508.7297	489.4914	470.5675	472.1832	486.7010	504.4404	536.3306	558.0031	(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				
East				1.2200	19.6403	0.4400	0.0000	0.7700	8.1180 (76)				
South				6.0700	46.7521	0.4400	0.0000	0.7700	96.1464 (78)				
West				5.5600	19.6403	0.4400	0.0000	0.7700	36.9969 (80)				
North				8.2000	26.0000	0.6300	0.7000	1.0000	84.6191 (82)				
Solar gains	225.8804	421.4647	658.3620	926.8591	1120.8948	1144.1916	1090.4222	944.1628	752.8453	489.3622	277.6204	188.5258	(83)
Total gains	795.5876	1003.0660	1216.0114	1463.1192	1629.6245	1633.6829	1560.9897	1416.3460	1239.5463	993.8025	813.9510	746.5290	(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)

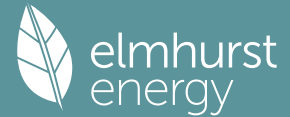
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.3095	67.5285	67.7489	68.8729	69.1022	70.2719	70.2719	70.5107	69.7993	69.1022	68.6451	68.1941	21.0000 (85)
alpha	5.4873	5.5019	5.5166	5.5915	5.6068	5.6848	5.6848	5.7007	5.6533	5.6068	5.5763	5.5463	
util living area	0.9947	0.9818	0.9388	0.8036	0.6060	0.4190	0.3025	0.3471	0.5878	0.8992	0.9858	0.9962	(86)
Living	19.9101	20.1783	20.5218	20.8479	20.9714	20.9970	20.9996	20.9992	20.9823	20.7545	20.2656	19.8726	
Non living	18.5907	18.9304	19.3489	19.7174	19.8293	19.8630	19.8641	19.8674	19.8491	19.6394	19.0565	18.5529	
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	20.4425	20.1783	20.5218	20.8479	20.9714	20.9970	20.9996	20.9992	20.9823	20.7545	20.2656	20.0303	(87)
Th 2	19.8204	19.8237	19.8271	19.8439	19.8473	19.8642	19.8642	19.8676	19.8574	19.8473	19.8405	19.8338	(88)
util rest of house	0.9926	0.9748	0.9173	0.7531	0.5376	0.3455	0.2246	0.2620	0.4971	0.8554	0.9791	0.9946	(89)
MIT 2	19.3302	18.9304	19.3489	19.7174	19.8293	19.8630	19.8641	19.8674	19.8491	19.6394	19.0565	18.7837	(90)
Living area fraction									fLA = Living area / (4) =			0.2176	(91)
MIT	19.5722	19.2020	19.6042	19.9634	20.0778	20.1098	20.1112	20.1137	20.0957	19.8821	19.3197	19.0550	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5722	19.2020	19.6042	19.9634	20.0778	20.1098	20.1112	20.1137	20.0957	19.8821	19.3197	19.0550	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9920	0.9699	0.9124	0.7587	0.5516	0.3615	0.2415	0.2805	0.5165	0.8570	0.9750	0.9931	(94)
Useful gains	789.1976	972.8309	1109.5358	1110.1339	898.8906	590.5881	377.0229	397.3043	640.2774	851.6482	793.5801	741.3886	(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	1712.4526	1598.4613	1459.8241	1212.3648	915.0241	591.7635	377.1119	397.5087	648.3099	1013.7887	1343.5125	1644.0655	(97)
Space heating kWh	686.9018	420.4237	260.6144	73.6062	12.0033	0.0000	0.0000	0.0000	0.0000	120.6325	395.9514	671.5916	(98a)
Space heating requirement - total per year (kWh/year)												2641.7250	
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	686.9018	420.4237	260.6144	73.6062	12.0033	0.0000	0.0000	0.0000	0.0000	120.6325	395.9514	671.5916	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2641.7250	
Space heating per m2										(98c) / (4) =		31.2445	(99)

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

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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 %)												241.3554 (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	686.9018	420.4237	260.6144	73.6062	12.0033	0.0000	0.0000	0.0000	0.0000	120.6325	395.9514	671.5916 (98)
Space heating efficiency (main heating system 1)	241.3554	241.3554	241.3554	241.3554	241.3554	0.0000	0.0000	0.0000	0.0000	241.3554	241.3554	241.3554 (210)
Space heating fuel (main heating system)	284.6018	174.1928	107.9795	30.4970	4.9733	0.0000	0.0000	0.0000	0.0000	49.9813	164.0533	278.2584 (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	302.4721	267.4659	283.5626	247.3404	238.5453	213.5715	209.5279	218.4531	221.5683	248.7644	266.6707	298.8612 (64)
Efficiency of water heater	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968	175.4968 (216)
Fuel for water heating, kWh/month	172.3519	152.4050	161.5770	140.9372	135.9257	121.6954	119.3913	124.4770	126.2520	141.7486	151.9519	170.2944 (219)
Space cooling fuel requirement	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	16.9241	15.2862	16.9241	16.3781	16.9241	16.3781	16.9241	16.9241	16.3781	16.9241	16.3781	16.9241 (231)
Lighting	27.2182	21.8354	19.6604	14.4040	11.1261	9.0901	10.1496	13.1928	17.1362	22.4836	25.3952	27.9746 (232)
Electricity generated by PVs (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 (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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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												1094.5374 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												175.4968
Water heating fuel used												1719.0074 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7875)												
mechanical ventilation fans (SFP = 0.7875)												199.2671 (230a)
Total electricity for the above, kWh/year												199.2671 (231)
Electricity for lighting (calculated in Appendix L)												219.6662 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												3232.4781 (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	1094.5374	0.1578	172.7250 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1719.0074	0.1411	242.4762 (264)
Space and water heating			415.2012 (265)
Pumps, fans and electric keep-hot	199.2671	0.1387	27.6408 (267)
Energy for lighting	219.6662	0.1443	31.7046 (268)
Total CO2, kg/year			474.5466 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.6100 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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Space heating - main system 1	1094.5374	1.5841	1733.8821 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1719.0074	1.5216	2615.6102 (278)
Space and water heating			4349.4923 (279)
Pumps, fans and electric keep-hot	199.2671	1.5128	301.4513 (281)
Energy for lighting	219.6662	1.5338	336.9314 (282)
Total Primary energy kWh/year			4987.8750 (286)
Dwelling Primary energy Rate (DPER)			58.9900 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	47.5300 (1a)	x 2.5100 (2a)	= 119.3003 (1a) -
Ground floor	37.0200 (1b)	x 2.3800 (2b)	= 88.1076 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	207.4079 (5)

2. Ventilation rate

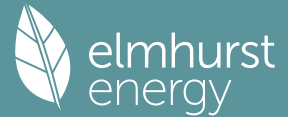
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1446 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3946 (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) = 0.3354 (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	0.4277	0.4193	0.4109	0.3690	0.3606	0.3187	0.3187	0.3103	0.3354	0.3606	0.3774	0.3941 (22b)
Effective ac	0.5915	0.5879	0.5844	0.5681	0.5650	0.5508	0.5508	0.5481	0.5563	0.5650	0.5712	0.5777 (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
TER Opaque door			2.0900	1.0000	2.0900		(26)
TER Opening Type (Uw = 1.20)			11.6200	1.1450	13.3053		(27)
Rooflight			7.4200	2.0221	15.0037		(27a)
Basement Floor			47.5300	0.1300	6.1789		(28)
Ground Floor			3.1700	0.1300	0.4121		(28a)
Basement Wall	77.0100		77.0100	0.1800	13.8618		(29a)
Cavity Wall	91.7300	13.7100	78.0200	0.1800	14.0436		(29a)
External Roof 1	50.7000	7.4200	43.2800	0.1100	4.7608		(30)
Total net area of external elements Aum(A, m ²)			270.1400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.6562		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							321.3525 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				6.4200	0.0500	0.3210	
E3 Sill				2.7100	0.0500	0.1355	
E4 Jamb				23.5400	0.0500	1.1770	

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E5 Ground floor (normal)						8.4400	0.1600	1.3504				
E6 Intermediate floor within a dwelling						6.6200	0.0000	0.0000				
E19 Ground floor (inverted)						6.5100	0.0700	0.4557				
E22 Basement floor						30.6800	0.0700	2.1476				
E24 Eaves (insulation at ceiling level - inverted)						16.0500	0.2400	3.8520				
E14 Flat roof						48.6600	0.0800	3.8928				
E16 Corner (normal)						44.9400	0.0900	4.0446				
E17 Corner (inverted - internal area greater than external area)						20.5800	-0.0900	-1.8522				
R3 Jamb of roof window						25.3800	0.0800	2.0304				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											17.5548	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	87.2110 (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	40.4823	40.2392	40.0010	38.8818	38.6724	37.6977	37.6977	37.5172	38.0731	38.6724	39.0960	39.5389 (38)
Average = Sum(39)m / 12 =	127.6933	127.4503	127.2120	126.0928	125.8834	124.9087	124.9087	124.7282	125.2842	125.8834	126.3070	126.7499 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5103	1.5074	1.5046	1.4913	1.4889	1.4773	1.4773	1.4752	1.4818	1.4889	1.4939	1.4991 (40)
HLP (average)												1.4913
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

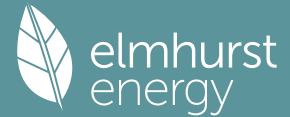
4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.5435 (42)
Hot water usage for mixer showers												
66.8667	65.8618	64.3975	61.5958	59.5283	57.2225	55.9119	57.3652	58.9582	61.4338	64.2957	66.6105	(42a)
Hot water usage for baths												
28.8781	28.4492	27.8452	26.7317	25.8978	24.9732	24.4738	25.0735	25.7265	26.7159	27.8524	28.7805	(42b)
Hot water usage for other uses												
40.6785	39.1993	37.7200	36.2408	34.7616	33.2824	33.2824	34.7616	36.2408	37.7200	39.1993	40.6785	(42c)
Average daily hot water use (litres/day)												125.4038 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	136.4232	133.5103	129.9628	124.5683	120.1877	115.4782	113.6682	117.2003	120.9255	125.8697	131.3473	136.0694 (44)
Energy conte	216.0611	190.1168	199.7480	170.5278	161.7957	141.9939	137.4718	145.1185	149.1133	170.8041	187.1284	213.0518 (45)
Energy content (annual)												Total = Sum(45)m = 2082.9310
Distribution loss (46)m = 0.15 x (45)m												
32.4092	28.5175	29.9622	25.5792	24.2694	21.2991	20.6208	21.7678	22.3670	25.6206	28.0693	31.9578	(46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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	(61)
Total heat required for water heating calculated for each month												
265.3037	234.5941	248.9906	218.1820	211.0384	189.6481	186.7145	194.3611	196.7675	220.0467	234.7826	262.2945	(62)
WWHRS	-30.5687	-27.0352	-28.3097	-23.4415	-21.8467	-18.6943	-17.5230	-18.6339	-19.3419	-22.8019	-25.8318	-30.0026 (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												
234.7351	207.5589	220.6810	194.7405	189.1917	170.9537	169.1915	175.7272	177.4256	197.2448	208.9507	232.2919	(64)
Total per year (kWh/year) = Sum(64)m =												2378.6926 (64)
12Total per year (kWh/year)												2379 (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												
111.2344	98.7956	105.8103	94.8238	93.1912	85.3363	85.1035	87.6460	87.7035	96.1865	100.3435	110.2339	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	127.1774	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
115.3463	127.7048	115.3463	119.1911	115.3463	119.1911	115.3463	115.3463	119.1911	115.3463	119.1911	115.3463	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
228.6869	231.0599	225.0799	212.3492	196.2789	181.1751	171.0848	168.7117	174.6918	187.4225	203.4928	218.5966	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	35.7177	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	-101.7419	(71)
Water heating gains (Table 5)												
149.5087	147.0173	142.2182	131.6998	125.2570	118.5227	114.3864	117.8038	121.8104	129.2829	139.3660	148.1638	(72)
Total internal gains												
557.6950	569.9353	546.7976	527.3933	501.0354	480.0421	461.9707	463.0150	476.8466	496.2049	526.2032	546.2599	(73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6b	Specific data or Table 6c	FF		Access factor Table 6d		Gains W
East				1.1000	19.6403		0.6300		0.7000		0.7700		6.6026 (76)
South				5.4900	46.7521		0.6300		0.7000		0.7700		78.4413 (78)
West				5.0300	19.6403		0.6300		0.7000		0.7700		30.1917 (80)
North				7.4200	26.0000		0.6300		0.7000		1.0000		76.5699 (82)
Solar gains	191.8055	359.4739	564.8999	799.5809	970.0408	991.3637	944.3124	815.7248	647.4827	418.3404	236.0427	159.8833	(83)
Total gains	749.5005	929.4092	1111.6975	1326.9742	1471.0762	1471.4058	1406.2831	1278.7398	1124.3293	914.5453	762.2459	706.1432	(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	59.1050	59.2178	59.3287	59.8553	59.9548	60.4227	60.4227	60.5101	60.2416	59.9548	59.7538	59.5450
alpha	4.9403	4.9479	4.9552	4.9904	4.9970	5.0282	5.0282	5.0340	5.0161	4.9970	4.9836	4.9697
util living area	0.9963	0.9890	0.9660	0.8854	0.7262	0.5315	0.3887	0.4443	0.7090	0.9432	0.9911	0.9972 (86)
MIT	19.6393	19.8873	20.2427	20.6546	20.8992	20.9828	20.9971	20.9944	20.9336	20.5602	20.0156	19.5984 (87)
Th 2	19.6798	19.6820	19.6841	19.6940	19.6959	19.7045	19.7045	19.7062	19.7012	19.6959	19.6921	19.6882 (88)
util rest of house	0.9947	0.9844	0.9519	0.8434	0.6481	0.4296	0.2754	0.3217	0.6007	0.9115	0.9865	0.9960 (89)
MIT 2	18.1447	18.4605	18.9036	19.3885	19.6287	19.6977	19.7040	19.7050	19.6679	19.3024	18.6332	18.0984 (90)
Living area fraction	18.4700	18.7710	19.1950	19.6641	19.9051	19.9773	19.9854	19.9856	19.9433	19.5761	18.9340	18.4248 (92)
MIT	18.4700	18.7710	19.1950	19.6641	19.9051	19.9773	19.9854	19.9856	19.9433	19.5761	18.9340	18.4248 (93)
Temperature adjustment												0.0000
adjusted MIT	18.4700	18.7710	19.1950	19.6641	19.9051	19.9773	19.9854	19.9856	19.9433	19.5761	18.9340	18.4248 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9924	0.9799	0.9451	0.8423	0.6615	0.4516	0.3002	0.3486	0.6226	0.9078	0.9826	0.9942 (94)
Useful gains	743.8273	910.6948	1050.6410	1117.7428	973.1708	664.5361	422.1619	445.7521	699.9616	830.2383	748.9843	702.0553 (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	1809.4121	1767.8662	1614.9597	1357.2696	1032.8919	671.6774	422.8652	447.2230	732.0777	1129.9417	1494.7215	1802.9960 (97)
Space heating kWh	792.7951	576.0192	419.8531	172.4593	44.4325	0.0000	0.0000	0.0000	0.0000	222.9793	536.9308	819.0999 (98a)
Space heating requirement - total per year (kWh/year)												3584.5691
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	792.7951	576.0192	419.8531	172.4593	44.4325	0.0000	0.0000	0.0000	0.0000	222.9793	536.9308	819.0999 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3584.5691
Space heating per m2										(98c) / (4) =		42.3958 (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	792.7951	576.0192	419.8531	172.4593	44.4325	0.0000	0.0000	0.0000	0.0000	222.9793	536.9308	819.0999 (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)	858.9330	624.0728	454.8788	186.8464	48.1392	0.0000	0.0000	0.0000	0.0000	241.5810	581.7235	887.4322 (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	234.7351	207.5589	220.6810	194.7405	189.1917	170.9537	169.1915	175.7272	177.4256	197.2448	208.9507	232.2919 (64)
Efficiency of water heater												79.8000 (216)

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(217)m	86.5696	86.2241	85.4786	83.7884	81.3684	79.8000	79.8000	79.8000	79.8000	84.3355	86.0803	86.6411	(217)
Fuel for water heating, kWh/month	271.1519	240.7203	258.1710	232.4194	232.5124	214.2277	212.0194	220.2096	222.3378	233.8811	242.7392	268.1082	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.9667	19.2270	17.3117	12.6833	9.7970	8.0042	8.9371	11.6168	15.0891	19.7977	22.3614	24.6328	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.8746	-59.6492	-84.6312	-93.8903	-100.1909	-93.1342	-91.9547	-87.2948	-78.9514	-67.5764	-46.8402	-37.1595	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-26.7187	-55.8984	-110.5456	-165.2447	-217.7536	-218.5358	-215.9869	-183.2356	-134.7713	-79.7037	-35.5938	-21.1541	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3883.6068	(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												2848.4982	(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)												193.4248	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2349.2893	(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												4662.2404	(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	3883.6068	0.2100	815.5574 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2848.4982	0.2100	598.1846 (264)
Space and water heating			1413.7420 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	193.4248	0.1443	27.9172 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-884.1473	0.1349	-119.2449
PV Unit electricity exported	-1465.1421	0.1260	-184.6588
Total			-303.9038 (269)
Total CO2, kg/year			1149.6847 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.6000 (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	3883.6068	1.1300	4388.4757 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2848.4982	1.1300	3218.8029 (278)
Space and water heating			7607.2786 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	193.4248	1.5338	296.6814 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-884.1473	1.4985	-1324.8703
PV Unit electricity exported	-1465.1421	0.4626	-677.8341
Total			-2002.7043 (283)
Total Primary energy kWh/year			6031.3565 (286)
Target Primary Energy Rate (TPER)			71.3300 (287)

Standard Assessment Procedure
SAP Build Standards

Project: 2C Landrock Road, Hornsey, London, N8 9HP

Dear Sir / Madam

The SAP calculation for the above property is complete. The calculations were carried out on the 2021 Building Regulations.

The details used to produce the calculations are attached below. To achieve compliance some items have been either changed or been included, these items are marked in blue.

With the information detailed below, we have gained overall compliance. However, if details are amended during the build overall compliance could be lost. Therefore, it is advised that changes are agreed before they are implemented.

Once the project has been completed we require the sign off sheet to be completed along with relevant supporting documents. Once all items are received the final document will be released.

Amendments

Date	Change	Prepared By	Signed	Checked By	Signed
06/12/2021	Original Specification	Kamil Hamela		-	-
16/06/2023	Second basement floor removed, layout updated and converted to SAP 10.	Dale Homewood		-	-
20/06/2023	ASHP added	Dale Homewood		-	-

Technical Report – Design Stage Assessment

Floor		U-value W/m²K		Notes:				
Ground Floor		0.11		- 75 mm screed, - 150 mm rigid foam insulation (0.022 W/mK).				
Wall		U-value W/m²K		Notes:				
Cavity Wall		0.18		- Brick outer skin, - 150 mm DriTherm 32 insulation (0.032 W/mK), - inner blockwork (0.19 W/mK), - Dot/ dabs & plasterboard.				
Wall to ground		0.13		- reinforced concrete, - 150 mm DriTherm 32 insulation (0.032 W/mK), - inner blockwork (0.19 W/mK), - Dot/ dabs & plasterboard.				
Roof		U-value W/m²K		Notes:				
Flat Roof U-value		0.13		- 150 mm rigid foam insulation, - 150 mm unventilated timber joists & plasterboard.				
Openings - U-value W/m²K								
Windows	1.30 / G value = 0.44 Frame Type / Factor = U-PVC '0.7' From BFRC Certificate		Doors	1.30	Rooflights	1.00 / G value = 0.63 Frame Type / Factor = U-PVC '0.7'		
Heating System / Controls				Secondary Heating				
Electricity (Air Source Heat Pump - MCS Approved) SEDBUK 2009/12 Make: Vaillant Model: . aroTHERM – Efficiency:300% (Or Similar, check with assessor)				None				
Flue Gas Heat Recovery	No	Emitter	Radiators		Heat Distribution	>45	Interlock	Yes
Delayed Start Thermostat	Yes	Heating Controls	Time and temperature zone control		Compensator	No	Other	In heated space
Water Heating								
From heat pump : 180 litres, 1.4 kwh/day								
Cylinder in Heated Space	Yes	Insulated Hot Water Pipes	Fully Insulated	Cylinder Thermostat	Yes	Waste Water Heat Recovery	None	
Ventilation – Part F System 3								
Mechanical Ventilation with Heat Recovery (MVHR) – Sentinel Kinetic Plus B SFP = 0.74, Wet rooms - 4								
Air Test Score	5	Extracts	0		Open Flue	0	Passive Vent	0
Thermal Mass		Lighting		Renewables		Summer Overheating		
Calculated		80lm/w		None		Cross Ventilation Yes		
						Ventilation Fully open half the time		
						Blind / Curtain Type: None		

Thermal Bridging Details <i>(Please click on the details to download pack)</i>			
Calculated	Aircrete	Concrete	Default
		E2-CBA-313	E14
		E3-CBA-314	E19
		E4-CBA-315	E22
		E5-CBA-302	E24
		E6-CBA-303	R3
		E16-CBA-316	
		E17-CBA-317	

Photographs of details	
1a. Ground floor perimeter edge insulation	✓
1b. External door threshold	✓
1c. Below damp-proof course on external wall type 1	✓
1c. Below damp-proof course on external wall type 2	N/A
2a. Ground floor to wall junction	✓
2b. Structural penetrating elements	N/A
3a. Joist / Rafter level	✓
3b. Eaves and gable edges	✓
4a. Window positioning in relation to cavity closer or insulation line (WT1)	✓
4a. Window positioning in relation to cavity closer or insulation line (WT2)	N/A
4b. External door set positioning in relation to cavity closer or insulation line	✓
5. Airtightness details	N/A
6a. Boiler / heat pump identification label (with S/N)	✓
6b. Primary pipework continuity of insulation	✓
6c. Mechanical ventilation ductwork continuity of insulation (MVHR)	N/A

Design Stage Notes:

No specification provided

Photographs for all details must be provided