

Development Management
City Hall
Bristol City Council
PO Box 3399
Bristol
BS1 9NE



COTSWOLD VALE PLANNING

Bespoke Planning Services

09th April 2023

Dear Sir/Madam,

Re: Town and Country Planning Act 1990
Discharge of Conditions 2, 3 & 8 of application 23/04964/F - Erection of 1 residential unit, incorporating associated works on land at 4 Beaufort Close, Redfield, Bristol BS5 8DJ.

I am instructed by MMC Homebuilding Ltd (the applicant) to prepare and submit this discharge of condition application in relation to the above-mentioned works. Please find enclosed in support of the application;

- The completed application forms;
- A copy of the original decision notice;
- The necessary plans and elevations; and
- The required information to discharge the conditions (this letter);

The required application fee will be submitted via Planning Portal.

Introduction

Planning permission was granted for the above-mentioned works on 20th March 2024 and was subject to nine conditions, three of which required additional information to be supplied to the Council for consideration.

This application seeks to deal with these conditions by providing the following information in turn below.

Condition 2 - Renewable Energy

Condition 2 states:

Prior to the commencement of the relevant part of the works hereby approved details of the renewable energy technology (including the exact location, dimensions, design/appearance, noise levels and any noise mitigation measures and technical specification) together with calculation of energy generation and associated CO2 emissions to achieve the reduction on residual emissions from renewable energy in line with the approved Energy Statement V3 prepared by Green Build Consult dated May 2022 should be submitted to the Local Planning Authority and approved in writing. The renewable energy technology shall be installed prior to the occupation of the residential units and thereafter retained in perpetuity.

Reason: To ensure that the development contributes to mitigating and adapting to climate change and to meeting targets to reduce carbon dioxide emissions and to safeguard the amenity of nearby premises and the area generally.

Appendix A to this document includes the technical specification of the proposed air source heat pump (ASHP) that will be utilised within the proposed unit. This unit will be sited within the externally accessible store indicated on approved plan 23020-MOD-XX-XX-DR-A-10001-House Type A 1B1P that was submitted with the original application.

Appendix B includes details of the proposed solar panels that will be used, including their specification and location on the unit. It should be noted that the solar PV will produce 1.7kWh, exceeding the 1.4kWh that is required.

The Energy Statement submitted with the original application was based on these specifications and identifies the required reduction in CO2 levels. This document is again included in Appendix C for completeness.

Condition 3 - Details of Bin and waste storage cupboard

Condition 3 states:

Prior to the commencement of the relevant part of the works hereby approved details of the bin and recycling storage facility shall be submitted to and be approved in writing by the Local Planning Authority. The detail thereby approved shall be carried out in accordance with that approval.

Thereafter, all refuse and recyclable materials associated with the development shall either be stored within this dedicated store/area, or internally within the building(s) that form part of the application site. No refuse or recycling material shall be stored or placed for collection on the adopted highway (including the footway), except on the day of collection.

Reason: In the interests of visual amenity and the character of the area.

In compliance with condition 3, Appendix D contains a plan and elevation of the proposed bin/waste store that will be erected on site.

Condition 8 - Habitat Management and Monitoring Plan (HHMP)

Condition 8 states:

Prior to occupation of the development hereby approved, the applicant shall submit a 30-year Habitat Management and Monitoring Plan (HHMP). This should address retained features of ecological interest, together with mitigation and enhancements to be provided. The HHMP should set out management compartments, objectives, and prescriptions for all new proposed soft landscaping/planting to demonstrate how all habitats will be managed to their target condition (as specified in the BNGA). It should also show how management of the site will be resourced and monitored.

Reason: Ecological enhancement is needed to meet the requirements of the revised National Planning Policy Framework (NPPF, 2023). The NPPF states in paragraph 174 (d) on page 50 that "Planning policies and decisions should contribute to and enhance the

natural and local environment by... minimising impacts on and providing net gains for biodiversity..."

In compliance with condition 8, Appendix E contains the proposed HMMP for the site. As the Biodiversity Net Gain for this site is provided by additional landscaping, the plan concentrates on the long term management of the proposed landscaping.

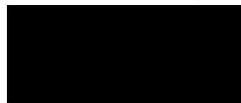
Summary and Conclusion

It is considered that the information provided is in compliance with the conditions outlined and will enable the proposed development to be completed in accordance with the approval.

I trust that you will have all that you require to register and validate this application and I look forward to receiving acknowledgement and the decision notice from you in due course.

However if I can be of any assistance in the meantime, please do not hesitate to contact me.

Yours faithfully

A solid black rectangular box used to redact the signature of Ian C Pople.

Ian C Pople BA(Hons) MTP MRTPI
Director

CE-ES200

Features:

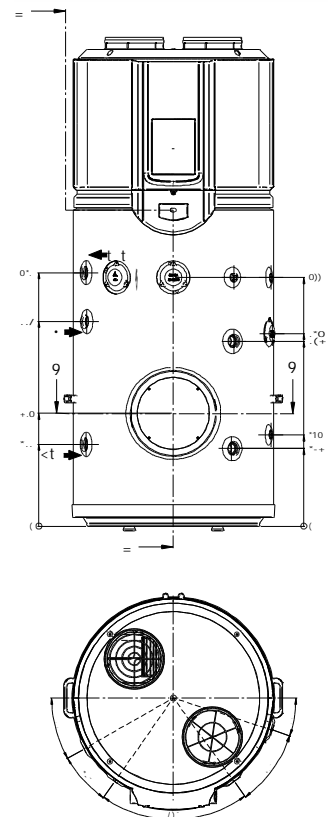
Water heating system with Integral air-source heat pump. The system utilizes the use of renewable energy and/or recovered waste heat energy.

- AISI 316L stainless steel tank pickled and passivated, welded with TIG and Plasma technology
- Front inspection hatch (100x150mm)
- Anti corrosion titanium electronic anode
- Thick polyurethane foam insulation (PU)
- Soft external PVC grey coating.
- Heat pump condenser coil wrapped outside the tank
- Environmentally-friendly refrigerant r134a
- Quiet Toshiba Rotary compressor
- 0.9 kW 230V-electric heating element (INOX Incoloy 800)
- Refrigerant pressure safety switches
- Air Supply and exhaust can be ducted from sources of heat
- Operating range with air temperature from -20 +43°C
- Automatic anti-legionella cycle and flexible programming
- Full range of ducting & accessories available
- Modbus Connectivity
- WiFi App
- Smart Grid Ready
- Large 1" Solar coil fitted as standard for secondary heat source
- Option to add a further 3kW independent element for Solar PV diverter or Backup



Specifications:

TECHNICAL DATA		CE-ES200
Capacity	Litres	204
Power Supply	V~/Hz/A	230/50/16
Refrigerant / Charge	Gas/Kg	R134a/1,02
Average Power Input (Heat pump only)	kW	0,627
Electric heating element	kW	0,9
Max Power Input	kW	1,527
Heating time (Heat pump only) ³	Min	200
ErP 2017 Energy Class / Test Profile		A+/L
Coefficient of performance EN 16147 (15°C) **	COP **	2,66/3,76
Coefficient of performance (26/43°C) ***	COP ***	4,13
Range of hot water	°C	38÷65
Range of use	°C	-20÷43
Range of use (Heat pump only)	°C	-7÷43
Max. noise level	Db (A)	53
Anti-legionella cycle temperature	°C	65
Max. operating pressure ^{1/2}	Mpa	0,6/1,2
Net weight	Kg	101
Heat Exchange surface	m ²	0,80
Primary coil power****	kW	29,0
Hydraulic connection (KW-WW-Z-PV-PR)	Rp	1"
Number of sensors	Tr	2
Overall Dimensions	mm	650/1594



*Ambient air 15°C, humidity 71%, inlet water temp. 15°C, Outlet water temperature 55°C. **Outlet water temperature 45°C

*** Ambient air 26/43°C, humidity 71%, inlet water temp 15°C, Outlet water temperature 65°C. **** Primary Temperature 80°C / Secondary temp. 10÷45°C

¹Max. operating pressure, ²Max. pressure test according to EN 12897 P.4.4. ³ Heating time (water temperature 45°C), Ambient temp. 20°C, inlet water temp 15°C

Vertex S

BACKSHEET MONOCRYSTALLINE MODULE

PRODUCT: TSM-DE09R.05

PRODUCT RANGE: 405-425W

425W

MAXIMUM POWER OUTPUT

0~+5W

POSITIVE POWER TOLERANCE

21.3%

MAXIMUM EFFICIENCY



reddot winner 2022



Outstanding Visual Appearance

- Designed with aesthetics in mind
- Excellent cell color control by dedicated cell blackening treatment and machine selection.
- Thinner wires that appear all black at a distance



Small in size, big on power

- Small form factor. Generate a huge amount of energy even in limited space.
- Up to 425W, 21.3% module efficiency with high density interconnect technology
- Multi-busbar technology for better light trapping effect, lower series resistance and improved current collection
- Reduce installation cost with higher power bin and efficiency
- Boost performance in warm weather lower temperature coefficient (-0.34%) and operating temperature



Universal solution for residential and C&I rooftops

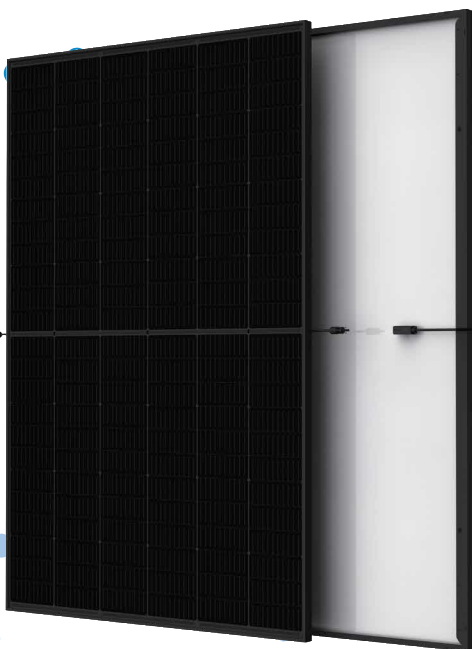
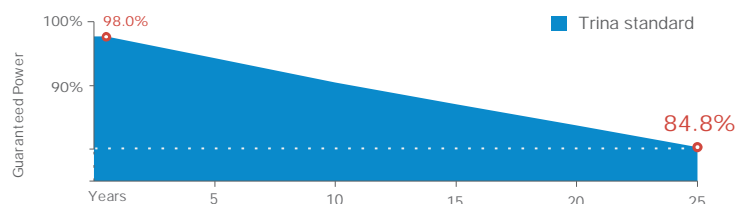
- Designed for compatibility with existing mainstream optimizers, inverters and mounting systems
- Perfect size and low weight. Easy for handling. Economy for transporting
- Diverse installation solutions. Flexible for system deployment



High Reliability

- 15 year product warranty
- 25 year performance warranty with lowest degradation;
- Minimized micro-cracks with innovative non-destructive cutting technology
- Ensured PID resistance through cell process and module material control
- Mechanical performance up to 6000 Pa positive load and 4000 Pa negative load

Trina Solar's Backsheet Performance Warranty



Comprehensive Products and System Certificates

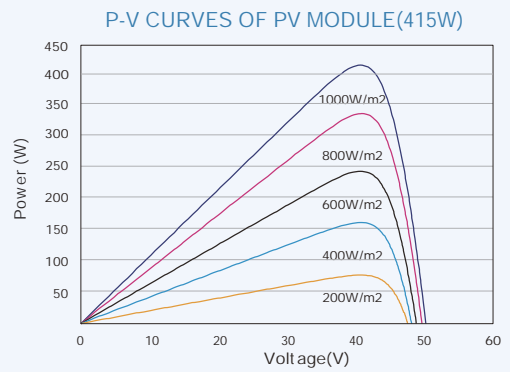
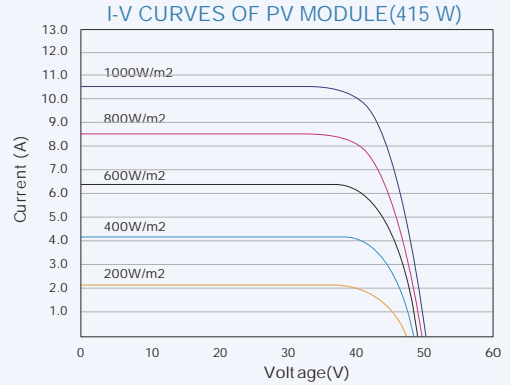
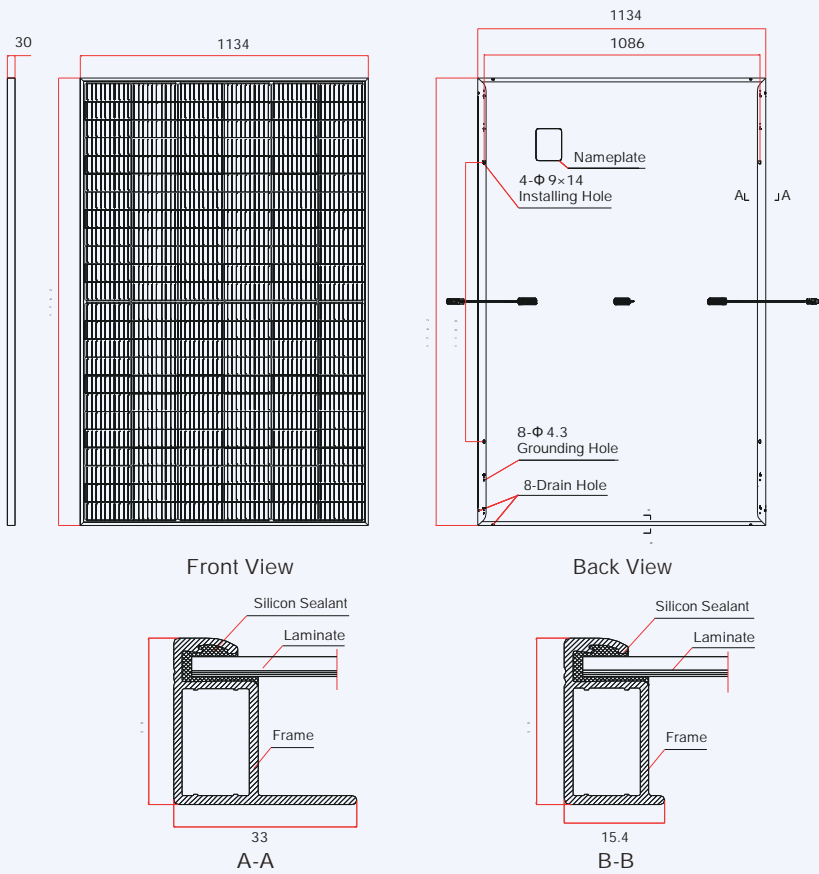


IEC61215/IEC61730/IEC61701/IEC62716
ISO 9001: Quality Management System



ISO 14001: Environmental Management System
ISO14064: Greenhouse Gases Emissions Verification
ISO45001: Occupational Health and Safety Management System

DIMENSIONS OF PV MODULE(mm)



ELECTRICAL DATA (STC)

Parameter	405	410	415	420	425
Peak Power Watts- P_{MAX} (Wp)*	405	410	415	420	425
Power Tolerance- P_{MAX} (W)			0 ~ +5		
Maximum Power Voltage- V_{MPP} (V)	41.3	41.5	41.7	42.0	42.2
Maximum Power Current- I_{MPP} (A)	9.82	9.87	9.94	10.01	10.08
Open Circuit Voltage- V_{OC} (V)	49.7	49.8	50.0	50.1	50.2
Short Circuit Current- I_{SC} (A)	10.50	10.53	10.55	10.58	10.61
Module Efficiency η_m (%)	20.3	20.5	20.8	21.0	21.3

STC: Irradiance 1000W/m², Cell Temperature 25°C, Air Mass AM1.5. *Measuring tolerance: ±3%.

ELECTRICAL DATA (NOCT)

Parameter	306	309	312	317	321
Maximum Power- P_{MAX} (Wp)	306	309	312	317	321
Maximum Power Voltage- V_{MPP} (V)	38.3	38.5	38.7	39.2	39.5
Maximum Power Current- I_{MPP} (A)	7.99	8.03	8.07	8.10	8.13
Open Circuit Voltage- V_{OC} (V)	46.8	46.9	47.1	47.1	47.2
Short Circuit Current- I_{SC} (A)	8.46	8.49	8.50	8.53	8.55

NOCT: Irradiance at 800W/m², Ambient Temperature 20°C, Wind Speed 1m/s.

MECHANICAL DATA

Solar Cells	Monocrystalline
No. of cells	144 cells
Module Dimensions	1762×1134×30 mm (69.37×44.65×1.18 inches)
Weight	21.8 kg (48.1 lb)
Glass	3.2 mm (0.13 inches), High Transmission, AR Coated Heat Strengthened Glass
Encapsulant material	EVA/POE
Backsheet	Black-White
Frame	30mm(1.18 inches) Anodized Aluminium Alloy
J-Box	IP 68 rated
Cables	Photovoltaic Technology Cable 4.0mm ² (0.006 inches ²), Portrait: 350/280 mm(13.78/11.02 inches) Length can be customized
Connector	MC4 EVO2 / TS4*

*Please refer to regional datasheet for specified connector.

TEMPERATURE RATINGS

NOCT (Nominal Operating Cell Temperature)	43°C (±2°C)
Temperature Coefficient of P_{MAX}	-0.34%/°C
Temperature Coefficient of V_{OC}	-0.25%/°C
Temperature Coefficient of I_{SC}	0.04%/°C

MAXIMUM RATINGS

Operational Temperature	-40 ~ +85°C
Maximum System Voltage	1500V DC (IEC)
Max Series Fuse Rating	20A

WARRANTY

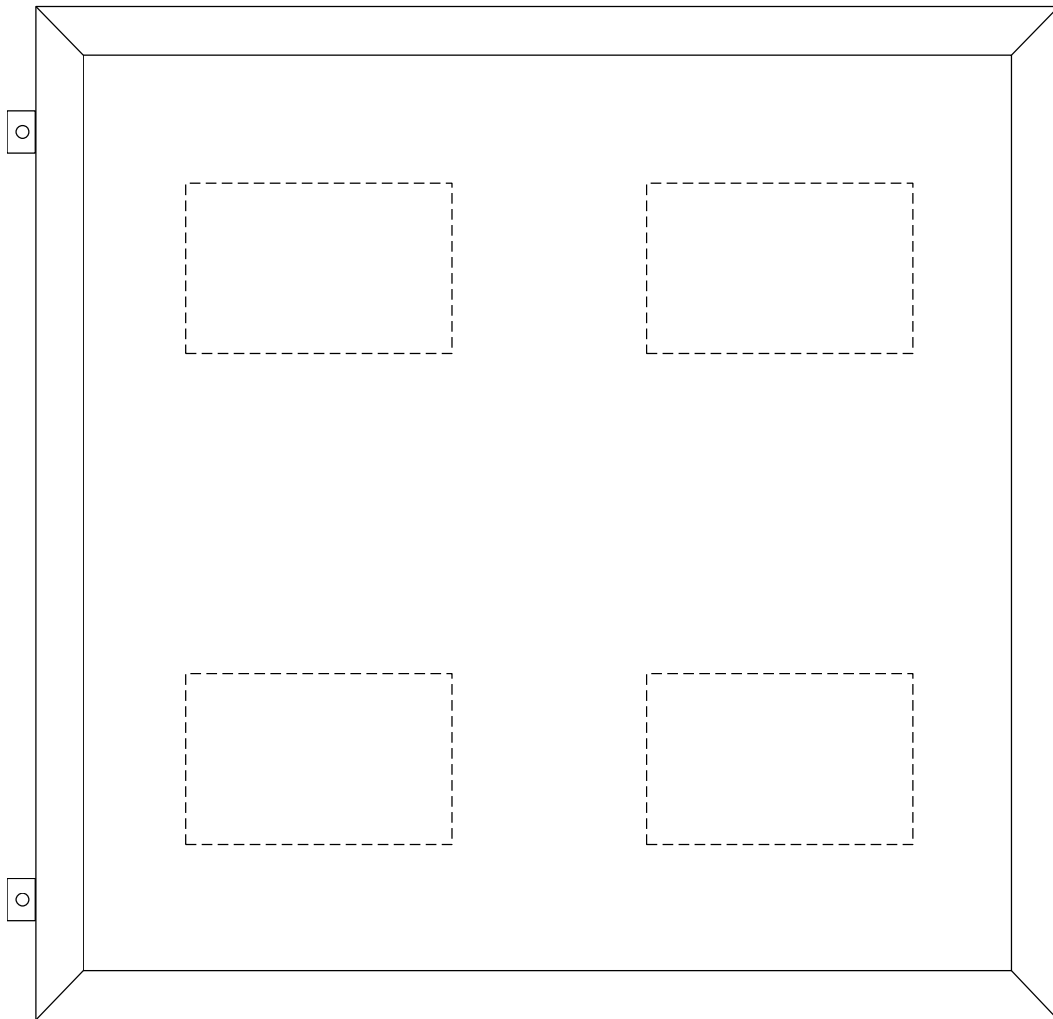
15 year Product Workmanship Warranty
25 year Power Warranty
2% first year degradation
0.55% Annual Power Attenuation

(Please refer to product warranty for details)

PACKAGING CONFIGURATION

Modules per box: 36 pieces
Modules per 40' container: 936 pieces

Appendix B (continued)



 COTSWOLD VALE PLANNING Respoke Planning Services	© Cotswold Vale Planning Ltd Registered in England 13362643 57 Springfields, Dursley, Gloucestershire GL11 6PL	Site: Land at 4 Beaufort Close, Redfield, Bristol BS5 8DJ
	web: www.cotswoldvaleplanning.co.uk	Proposal: Erection of 1 residential unit, incorporating associated works
	email: info@cotswoldvaleplanning.co.uk	Title: Proposed solar PV Location
phone: 07871643075	Scale: 1:50 @A4	Date: April 2024
		Dwg. No. PV01



Energy & Sustainability Statement

For

4 Beaufort Close, Redfield, Bristol, BS5 8DJ

Prepared on behalf of:
MMC Homebuilding Ltd

RS Energy Ltd, Larch Close,
Ringwood, Hampshire, BH24 2PR
01425-472973 info@rsenergy.co.uk

Date	Version	Notes
16.01.2024	V1	

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Executive Summary

This report has been produced on behalf MMC Homebuilding Ltd to demonstrate how the application for the proposed relocatable 1-bedroom dwelling at Beaufort Close, Redfield, Bristol, BS5 8DJ will address the carbon reduction and sustainability requirements set by Bristol City Council.

The Energy Assessment demonstrates that the proposed specification achieves an 83.38% reduction in carbon emissions beyond Part L of the 2021 Building Regulations

The carbon savings by the proposed development are shown in the table below.

A sustainability statement has been prepared to demonstrate a commitment to enhance the environmental performance of the development. This includes specification of materials, waste reduction, biodiversity and internal water use limited by design to 105 litres/per person/per day.

Introduction to the Proposed Development

The proposed one-bedroom dwelling will be situated on Beaufort Close which is within a residential area. The dwelling will be a detached single storey building.

The location is within a well-established housing estate which is served by local amenities and transport links



Energy & Sustainability Statement – 4 Beaufort Close, Redfield, Bristol, BS5 8DJ

Energy Assessment

This assessment outlines the measures and specification proposed to meet the requirements outlined in Bristol City Council local plan BCS14.

The proposed dwelling has been modelled using SAP 10.2 and is designed to achieve an 83.38% reduction in carbon emissions beyond Part L 2021 Building Regulations.

NO DISTRICT HEAT CONNECTION	Regulated Energy Demand (MWh/yr)	Regulated CO2 emissions (tonnes/yr)	CO2 saved (tonnes/yr)	%CO2 reduction
Baseline – Part L TER		552.6979		
Proposed scheme after energy efficiency measures		274.6403	552.6979 – 274.6403 = 278.0576	278.0576/552.6979 = 0.50 x 100 = 50.31
Residual emissions Proposed scheme after energy efficiency measures and CHP		274.6403	274.6403 - 274.6403 = 0	274.6403 - 274.6403 = 0 / 274.6403 = 0 x 100 = 0
Proposed scheme after on-site renewables		91.8411	274.6403 – 91.8411 = 182.7992	182.7992 / 274.6403 = 0.67 x 100 = 66.56
Total CO2 reduction beyond Part L TER			552.6979 – 91.8411 = 460.8568	460.8568 / 552.6979 = 0.834 x 100 = 83.38%

On Site Renewables

	Plot 1	Total
Renewable energy from heat pump	3524.44	3524.44
Renewable energy from wood burner	0.00	0.00
Renewable energy from PV	1416.34	1416.34
Total renewable energy use	4940.78	4940.78
Total dwelling energy use	4690.86	4690.86
% renewable energy	105.3%	105.3%

Appendix A & B

This has been achieved based on the following design specification.

Proposed Design Specification

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

Active design measures to reduce the energy demand include high efficiency lighting and ventilation. Other possible measures include enhanced U-values, air tightness improvement and the development approach to limiting thermal bridges. The specification for the proposal is listed below.

Demand Reduction Measures	Specification
Building Fabric – U-Values (W/m ² K)	
Walls	0.16
Ground floor	0.17
Roofs	0.11
External opaque doors (whole frame)	1
Glazing (windows (whole frame) triple glazed)	0.8
Glazing (glazed doors)	1
Building Fabric – Other	
Air permeability (m ³ /hm ²)	3.0
Thermal bridging	thermal bridging details i.e., ROI Steel frame
Services	
Ventilation	Natural with extracts
Low energy lighting	100%

It is proposed that the heating will be provided by an air source heat pump.

Cooling and Overheating

The developer will address the following as a matter of priority to reduce overheating risk and the requirement for active cooling:

1. Minimise internal heat generation through energy efficient design
For example, heat distribution infrastructure within the building will be designed to minimise pipe lengths and adopting pipe configurations which minimise heat loss e.g. twin pipes.
2. Reduce the amount of heat entering the building in summer
For example, through use of carefully designed shading measures, including balconies, louvres, internal or external blinds, shutters, trees and vegetation.
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
Increasing the amount of exposed thermal mass can help to absorb excess heat within the building.
4. Passive ventilation
For example, through the use of openable windows, shallow floorplates, dual aspect units, designing in the 'stack effect'.
5. Mechanical ventilation
Mechanical ventilation can be used to make use of 'free cooling' where the outside air temperature is below that in the building during summer months. This will require a by-pass on the heat recovery system for summer mode operation.
6. Active cooling systems
If air conditioning is necessary, the lowest carbon options should be used.

Overheating Risk Analysis

An overheating analysis will be carried out at design stage using either the Simplified Method or Dynamic Thermal Modelling to demonstrate compliance with the Approved Document Part O 2021

Renewable Energy

The use of renewable technology in the proposed design of this dwelling have been fully considered.

An air source heat pump has been identified suitable to provide space heating.

An ASHP operates by converting the energy of the outside air to heat, creating a comfortable temperature inside the building as well as supplying energy for the hot water system.

Due to limited roof space, solar hot water cannot be used effectively alongside photovoltaic arrays. Accordingly, it is considered preferable to install photovoltaic arrays, in the available space identified as these represent a greater carbon saving.

The dwelling will benefit from a photovoltaic array. A total of 1.64kWp is designed which will face south. Battery storage has also been incorporated in to the design.

Monitoring

The applicant will consider options for post occupancy monitoring of the dwelling. It is the intention of the applicant to provide smart meters at the development to support the growth of demand side response.

Sustainability Statement

The report so far has sought to address the energy targets outlined in Bristol City Council Policy BCS14.

The following section of this reports looks to address additional sustainability measures.

Internal Water Use

It is the intention of the applicant to reduce the consumption of potable water within the proposed dwellings from all sources, using efficient fittings and flow restrictors where required.

Performance in domestic properties is assessed under the methodologies set out in Part G of the Building Regulations and the former Code for Sustainable Homes, achieving a maximum internal water use of 105 L/p/d (litres per person per day) by design.

Although a variety of specifications are available to meet this target, the proposed flow rate criteria for dwellings at the development has been chosen as follows:

Fitting	Flow Rate / Capacity
Sanitary Fittings	
Dual Flush WC	6 litres per flush (full) 2.6 litres per flush (part)
Taps (main)	5 litres per minute
Bath (if present)	170 litres to overflow
Shower	8 litres per minute
Taps (kitchen/utility)	6 litres per minute
Appliances	
Washing Machine	8.17 litres per kilogram (dry load)
Dishwasher	1.25 litres per place setting

Appendix D

This specification of fittings achieves an internal water consumption rate of 104 litres per person per day, meeting the required result of 105 litres per person per day.

The developer will minimise the use of mains water by:

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

Flood Risk

Flood risk from rivers or the sea

Using GOV.UK's map, the development has been found to be in a Flood Zone 1 (there is less than a 0.1 per cent chance of flooding occurring each year). As the development is also less than 1 hectare, a Flood Risk Assessment is not required.



Flood risk from surface water

Using the GOV.UK's map, the development is within an area of very low flood risk from surface water.



Materials and Waste Reduction

Sustainable Specification

Materials will be chosen to lower the environmental impact of the development wherever possible. BRE's Green Guide will be consulted when finalising specifications of products and element build types. This applies primarily to:

- Roofs
- External walls
- Internal walls (including separating walls)
- Upper and ground floors (including separating floors)
- Windows

In all cases, it is the applicant's intention to secure Green Guide ratings of between A+ and D, exceeding the requirements of the former Code for Sustainable Homes. All timber used during the development will come from a 'legal source' and will not be on the CITES list, or in the case of Appendix III of the CITES list, it will not have been sourced from a country seeking to protect this species as listed in Appendix III.

To promote the reduction of emissions of gases with high Global Warming Potential (GWP) associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials, products will be chosen with a GWP of <5 wherever possible. They may also be chosen to comply with additional voluntary industry standards for responsible sourcing, including FSC Chain of Custody and BES 6001:2008 Framework Standard for Responsible Sourcing of Construction Products certifications where applicable. Products such as paints and varnishes will be sourced to minimise the use of Volatile Organic Compounds (Formaldehyde, VCM, etc.).

Minimising Site Waste

A Site Waste Management Plan (SWMP) will be created to include procedures, commitments for waste minimisation and diversion from landfill, as well as setting target benchmarks for resource efficiency in accordance with guidance from:

- DEFRA (Department for Environment, Food and Rural Affairs)
- BRE (Building Research Establishment)
- Envirowise
- WRAP (Waste & Resources Action Programme)
- Environmental performance indicators and/or key performance indicators (KPI) from Envirowise or Constructing Excellence.

The applicant will seek to establish a 'take back' scheme from suppliers in order to avoid the unnecessary waste of excess materials. Care will also be taken to minimise loss through breakage etc. following guidance from the Waste and Resources Action Programme (WRAP) and others.

Biodiversity

The presence of any significant ecological features as defined using guidance from BRE will be noted, and the appropriate measures for protection and conservation undertaken before works begin. Features to promote biodiversity, such as bird and bat boxes, will be incorporated into the design wherever feasible.

Additional planting will be carried out to ensure a net gain in vegetation.

Conclusion

This report outlines how a variety of sustainability criteria have been considered and solution successfully incorporated into the proposed design of the development.

Based on the modelling undertaken, it has been demonstrated that it is possible to reduce regulated on-site carbon dioxide emissions of the proposed dwelling at Beaufort Close by 83.38% beyond the requirements of Part L 2021 of the Building Regulations, where the building and services specification described in this report are implemented.

Fabric performance has been improved to meet and surpass the requirements of Part L of the Building Regulations, whilst heating, hot water equipment and controls have been chosen to maximize carbon savings. An air source heat pump will provide space heating and photovoltaic panels will be installed.

Additional efforts to enhance the environmental performance of the development include the specification of materials, waste reduction, biodiversity and internal water use limited by design to 105 Litres/per person/per day.

Appendices

Appendix A – TER/DER

Appendix B – TER/DER after PV

Appendix C – SAP worksheets and PEA

Appendix D – Water calculations

Full SAP Calculation Printout



Property Reference	Beaufort Close		Issued on Date	17/01/2024	
Assessment Reference	00001_updated design cool ene	Prop Type Ref			
Property	4, Beaufort Close, Redfield, Bristol, BS5 8DJ				
SAP Rating	79 C	DER	7.22	TER	14.53
Environmental	96 A	% DER < TER		50.31	
CO ₂ Emissions (t/year)	0.25	DFEE	49.93	TFEE	50.16
Compliance Check	See BREEL	% DFEE < TFEE		0.44	
% DPER < TPER	3.06	DPER	75.35	TPER	77.73
Assessor Details	Ms. Natalie Wheeler		Assessor ID	AX45-0001	
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)
Ground floor	38.0300 (1b)	2.4000 (2b)	91.2720 (1b) - (3b)
Total floor area TFA = (1a) + (1b) + (1c) + (1d) + (1e) ... (1n)	38.0300		91.2720 (4)
Dwelling volume			(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 91.2720 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a) + (6b) + (6c) + (6d) + (6e) + (6f) + (6g) + (7a) + (7b) + (7c) =	20.0000 / (5) = 0.2191 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.3691 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3691 (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	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3414	0.3691	0.3968	0.4153	0.4337 (22b)
Effective ac	0.6107	0.6064	0.6022	0.5624	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (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
Front door			2.1700	1.0000	2.1700		(26)
Windows (U _w = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (U _w = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements A _{um} (A, m ²)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		1982.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495

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E16 Corner (normal) 12.0000 0.0750 0.9000
 E17 Corner (inverted - internal area greater than external area) 2.4000 -0.0450 -0.1080
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges (36a) = 10.5109 (36)
 Total fabric heat loss (33) + (36) + (36a) = 37.6537 (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	18.3956	18.2661	18.1391	17.5428	17.4312	16.9118	16.9118	16.8156	17.1118	17.4312	17.6569	17.8929 (38)
Average = Sum(39)m / 12 =	56.0493	55.9197	55.7928	55.1964	55.0849	54.5655	54.5655	54.4693	54.7655	55.0849	55.3106	55.5465 (39)
H ₁ P	1.4738	1.4704	1.4671	1.4514	1.4485	1.4348	1.4348	1.4323	1.4401	1.4485	1.4544	1.4606 (40)
H ₁ F (average)												1.4514
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3550 (42)												
Hot water usage for mixer showers												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage	75.2610	74.1300	72.4819	69.3285	67.0013	64.4062	62.9310	64.5667	66.3597	69.1461	72.3673	74.9727 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067 (42c)
Average daily hot water use (litres/day)												95.3034 (43)
Daily hot water use	103.7678	101.6001	98.9154	94.7254	91.3616	87.7298	86.2547	88.9270	91.7566	95.5796	99.8374	103.4794 (44)
Energy content (annual)	164.3428	144.6772	152.0293	129.6743	122.9903	107.8741	104.3176	110.1102	113.1451	129.7007	142.2367	162.0237 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6514	21.7016	22.8044	19.4511	18.4485	16.1811	15.6476	16.5165	16.9718	19.4551	21.3355	24.3036 (46)
Water storage loss:												98.0000 (47)
Store volume												1.1000 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.5940 (55)
Enter (49) or (54) in (55)												
Total storage loss	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (56)
If cylinder contains dedicated solar storage	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (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	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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (64)
Total per year (kWh/year)												1799.9319 (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 =												1800 (64)
Heat gains from water heating, kWh/month	54.6440	48.1052	50.5497	43.1167	40.8943	35.8681	34.6856	36.6116	37.6207	43.1255	47.2937	53.8729 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751 (69)
Pumps, fans	5.4763	5.4763	5.4763	5.4763	5.4763	0.0000	0.0000	0.0000	0.0000	5.4763	5.4763	5.4763 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)	73.4462	71.5851	67.9432	59.8843	54.9654	49.8168	46.6204	49.2092	52.2510	57.9643	65.6857	72.4098 (72)
Total internal gains	299.1766	304.9880	291.8343	279.2943	264.1703	247.8541	237.5019	238.8806	246.9823	262.6531	280.5796	292.9950 (73)

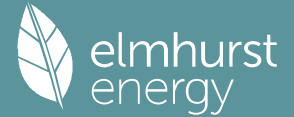
6. Solar gains

[Jan]	Area	Solar flux	Specific data	Specific data	Access	Gains						
	m ²	Table 6a	g	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
East	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)						
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)						
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	339.2721	383.4233	421.0061	467.6836	495.0485	484.1990	462.5119	432.1609	397.2144	355.7232	330.5740	325.9676 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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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	9.8232	9.8459	9.8683	9.9749	9.9951	10.0903	10.0903	10.1081	10.0534	9.9951	9.9543	9.9121
alpha	1.6549	1.6564	1.6579	1.6650	1.6663	1.6727	1.6727	1.6739	1.6702	1.6663	1.6636	1.6608
util living area	0.8725	0.8442	0.8029	0.7299	0.6356	0.5214	0.4182	0.4523	0.6098	0.7618	0.8435	0.8792 (86)
MIT	17.7731	18.0708	18.5712	19.2502	19.8698	20.3536	20.5969	20.5556	20.1663	19.3669	18.4664	17.7225 (87)
Th 2	19.7072	19.7098	19.7123	19.7242	19.7264	19.7368	19.7368	19.7387	19.7328	19.7264	19.7219	19.7172 (88)
util rest of house	0.8588	0.8277	0.7812	0.6986	0.5892	0.4517	0.3225	0.3573	0.5449	0.7272	0.8242	0.8663 (89)
MIT 2	16.1237	16.4821	17.0842	17.8949	18.6115	19.1489	19.3865	19.3556	18.9636	18.0538	16.9749	16.0673 (90)
Living area fraction									fLA = Living area / (4) =			0.4965 (91)
MIT	16.9426	17.2708	17.8224	18.5677	19.2361	19.7470	19.9874	19.9513	19.5667	18.7057	17.7154	16.8890 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9426	17.2708	17.8224	18.5677	19.2361	19.7470	19.9874	19.9513	19.5667	18.7057	17.7154	16.8890 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8205	0.7881	0.7421	0.6653	0.5691	0.4523	0.3430	0.3747	0.5349	0.6937	0.7855	0.8286 (94)
Useful gains	278.3873	302.1728	312.4151	311.1354	281.7335	218.9970	158.6520	161.9419	212.4858	246.7645	259.6706	270.1102 (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	708.6059	691.7707	631.7108	533.6247	415.1272	280.8479	184.8370	193.4380	299.0560	446.5014	587.1427	704.8293 (97)
Space heating kWh	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98a)
Space heating requirement - total per year (kWh/year)												1786.7010
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	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1786.7010
Space heating per m2										(98c) / (4) =		46.9814 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	188.2839	154.0058	139.7388	94.2308	58.3794	0.0000	0.0000	0.0000	0.0000	87.4143	138.6941	190.2535 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (64)
Efficiency of water heater (217)m	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400 (216)
Fuel for water heating, kWh/month	65.6124	57.9124	61.1917	52.9526	50.7663	45.1260	44.0625	46.1421	47.0184	53.1754	57.4627	64.7798 (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	4.6511	4.2010	4.6511	4.5011	4.6511	4.5011	4.6511	4.6511	4.5011	4.6511	4.5011	4.6511 (231)
Lighting	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835 (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												1051.0006 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.5400
Water heating fuel used												646.2023 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
warm air heating system fans												54.7632 (230b)
Total electricity for the above, kWh/year												54.7632 (231)
Electricity for lighting (calculated in Appendix L)												97.2395 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)

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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	1849.2056 (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	1051.0006	0.1539	161.7348 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	646.2023	0.1412	91.2746 (264)
Space and water heating			253.0094 (265)
Pumps, fans and electric keep-hot	54.7632	0.1387	7.5963 (267)
Energy for lighting	97.2395	0.1443	14.0347 (268)
Total CO2, kg/year			274.6403 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.2200 (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	1051.0006	1.5697	1649.7789 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	646.2023	1.5223	983.7137 (278)
Space and water heating			2633.4926 (279)
Pumps, fans and electric keep-hot	54.7632	1.5128	82.8458 (281)
Energy for lighting	97.2395	1.5338	149.1492 (282)
Total Primary energy kWh/year			2865.4875 (286)
Dwelling Primary energy Rate (DPER)			75.3500 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.0300 (1b)	2.4000 (2b)	91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	91.2720 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.2191 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4691 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4691 (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	0.5981	0.5864	0.5747	0.5160	0.5043	0.4457	0.4457	0.4339	0.4691	0.5043	0.5278	0.5512 (22k)
Effective ac	0.6789	0.6719	0.6651	0.6331	0.6272	0.5993	0.5993	0.5942	0.6100	0.6272	0.6393	0.6519 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1700	1.0000	2.1700		(26)
TER Opening Type (Uw = 1.20)			6.6800	1.1450	7.6489		(27)
Heatloss Floor			38.0300	0.1300	4.9439		(28a)

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External Wall	54.4600	8.8500	45.6100	0.1800	8.2098	(29a)
Wall to store	5.5200		5.5200	0.1800	0.9936	(29a)
External Roof	38.0300		38.0300	0.1100	4.1833	(30)
Total net area of external elements Aum(A, m2)			136.0400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		28.1495	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 52.1191 (35)

List of Thermal Bridges				Length	Psi-value	Total
K1 Element						
E1 Steel lintel with perforated steel base plate				5.5100	0.0500	0.2755
E3 Sill				3.0000	0.0500	0.1500
E4 Jamb				13.2000	0.0500	0.6600
E5 Ground floor (normal)				24.9900	0.1600	3.9984
E14 Flat roof				24.9900	0.0800	1.9992
F16 Corner (normal)				12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9471 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 36.0966 (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	20.4478	20.2386	20.0335	19.0703	18.8900	18.0511	18.0511	17.8957	18.3742	18.8900	19.2546	19.6358 (38)
Heat transfer coeff	56.5443	56.3351	56.1300	55.1668	54.9866	54.1476	54.1476	53.9923	54.4708	54.9866	55.3512	55.7323 (39)
Average = Sum(39)m / 12 =												55.1659

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4868	1.4813	1.4759	1.4506	1.4459	1.4238	1.4238	1.4197	1.4323	1.4459	1.4555	1.4655 (40)
HLP (average)												1.4506
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3550 (42)
Hot water usage for mixer showers												
60.2088	59.3040	57.9855	55.4628	53.6011	51.5249	50.3448	51.6534	53.0877	55.3169	57.8938	59.9781	59.9781 (42a)
Hot water usage for baths												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses												
28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067	28.5067 (42c)
Average daily hot water use (litres/day)												81.4257 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	88.7155	86.7741	84.4190	80.8597	77.9614	74.8486	73.6685	76.0137	78.4847	81.7504	85.3639	88.4849 (44)
Energy conte	140.5037	123.5652	129.7489	110.6929	104.9510	92.0351	89.0957	94.1208	96.7794	110.9345	121.6166	138.5459 (45)
Energy content (annual)										Total = Sum(45)m =		1352.5897
Distribution loss (46)m = 0.15 x (45)m												
21.0756	18.5348	19.4623	16.6039	15.7426	13.8053	13.3644	14.1181	14.5169	16.6402	18.2425	20.7819	20.7819 (46)

Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (56)

If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
187.0986	165.6509	176.3438	155.7847	151.5459	137.1269	135.6906	140.7157	141.8713	157.5294	166.7084	185.1408	185.1408 (62)
WWHRS	-27.5250	-24.3433	-25.4909	-21.1075	-19.6714	-16.8330	-15.7782	-16.7786	-20.5316	-23.2598	-27.0152	-27.0152 (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												
159.5737	141.3076	150.8529	134.6772	131.8745	120.2940	119.9124	123.9371	124.4552	136.9979	143.4486	158.1256	158.1256 (64)
Total per year (kWh/year) = Sum(64)m =												1645.4567 (64)
12Total per year (kWh/year)												1645 (64)

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

Heat gains from water heating, kWh/month												
83.9934	74.7540	80.4174	72.8789	72.1721	66.6751	66.9002	68.5711	68.2526	74.1617	76.5110	83.3424	83.3424 (65)

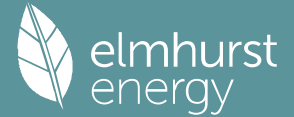
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674	111.4674 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751 (69)
Pumps, fans												
3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)												
112.8944	111.2411	108.0879	101.2206	97.0055	92.6044	89.9197	92.1654	94.7953	99.6796	106.2653	112.0194	112.0194 (72)
Total internal gains												
336.1485	342.1677	329.5028	318.1543	303.7341	290.6417	280.8012	281.8368	289.5266	301.8921	318.6829	330.1283	330.1283 (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	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)

Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	376.2440	420.6030	458.6745	506.5436	534.6123	526.9866	505.8111	475.1171	439.7587	394.9622	368.6772	363.1008 (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	9.7371	9.7733	9.8090	9.9803	10.0130	10.1681	10.1681	10.1974	10.1078	10.0130	9.9470	9.8790
alpha	1.6491	1.6516	1.6539	1.6654	1.6675	1.6779	1.6779	1.6798	1.6739	1.6675	1.6631	1.6586
util living area	0.8555	0.8267	0.7838	0.7075	0.6112	0.4924	0.3897	0.4209	0.5762	0.7340	0.8216	0.8616 (86)
MIT	17.0713	17.4604	18.1168	19.0143	19.8112	20.4333	20.7324	20.6845	20.2062	19.1847	18.0107	17.0240 (87)
Th 2	19.6974	19.7015	19.7056	19.7247	19.7283	19.7451	19.7451	19.7482	19.7386	19.7283	19.7211	19.7135 (88)
util rest of house	0.8404	0.8088	0.7607	0.6751	0.5643	0.4242	0.2987	0.3302	0.5112	0.6975	0.8005	0.8472 (89)
MIT 2	15.3806	15.8471	16.6339	17.7000	18.6167	19.3021	19.5904	19.5556	19.0791	17.9271	16.5280	15.3286 (90)
Living area fraction												FLA = Living area / (4) =
MIT	16.2199	16.6480	17.3701	18.3525	19.2097	19.8637	20.1574	20.1161	19.6387	18.5514	17.2641	16.1703 (92)
Temperature adjustment												0.0000
adjusted MIT	16.2199	16.6480	17.3701	18.3525	19.2097	19.8637	20.1574	20.1161	19.6387	18.5514	17.2641	16.1703 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.7853	0.7535	0.7084	0.6339	0.5429	0.4311	0.3303	0.3586	0.5055	0.6565	0.7474	0.7927 (94)
Ext temp.	295.4491	316.9274	324.9291	321.0742	290.2152	227.2073	167.0926	170.3967	222.2950	259.2881	275.5322	287.8307 (95)
Heat loss rate W	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)
Space heating kWh	674.0051	661.8252	610.1364	521.4624	412.9325	285.0166	192.6231	200.6389	301.6948	437.2199	562.5944	667.1328 (97)
Space heating requirement - total per year (kWh/year)	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (98a)
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)
Space heating kWh	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1582.4592
Space heating per m2												(98c) / (4) =
												41.6108 (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	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (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)	305.1416	251.1065	229.8962	156.3158	98.9184	0.0000	0.0000	0.0000	0.0000	143.4250	223.9272	305.7430 (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	159.5737	141.3076	150.8529	134.6772	131.8745	120.2940	119.9124	123.9371	124.4552	136.9979	143.4486	158.1256 (64)
Efficiency of water heater (217)m	85.3199	85.1621	84.8249	84.2145	83.2519	79.8000	79.8000	79.8000	79.8000	83.9830	84.8781	79.8000 (216)
Fuel for water heating, kWh/month	187.0299	165.9278	177.8404	159.9216	158.4042	150.7443	150.2661	155.3097	155.9589	163.1258	169.0055	185.2814 (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	12.5325	10.0540	9.0525	6.6323	5.1230	4.1855	4.6733	6.0746	7.8903	10.3525	11.6931	12.8808 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-31.3992	-41.8929	-57.0922	-60.8618	-63.1004	-58.1751	-57.5835	-55.6345	-51.7646	-46.4171	-33.7282	-27.4489 (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)	-25.7484	-52.9908	-103.1803	-151.9310	-197.9847	-197.7576	-195.2875	-166.5157	-123.7371	-74.5242	-33.9638	-20.4362 (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												1714.4737 (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												1978.8158 (219)

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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)	101.1445 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1929.1555 (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	1951.2784 (238)

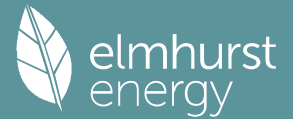
 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1714.4737	0.2100	360.0395 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1978.8158	0.2100	415.5513 (264)
Space and water heating			775.5908 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	101.1445	0.1443	14.5983 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-585.0983	0.1357	-79.3875
PV Unit electricity exported	-1344.0572	0.1265	-170.0329
Total			-249.4204 (269)
Total CO2, kg/year			552.6979 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5300 (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	1714.4737	1.1300	1937.3552 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1978.8158	1.1300	2236.0619 (278)
Space and water heating			4173.4171 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	101.1445	1.5338	155.1388 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-585.0983	1.5015	-878.5356
PV Unit electricity exported	-1344.0572	0.4644	-624.1764
Total			-1502.7120 (283)
Total Primary energy kWh/year			2955.9447 (286)
Target Primary Energy Rate (TPER)			77.7300 (287)

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Property Reference	Beaufort Close		Issued on Date	17/01/2024	
Assessment Reference	00001_updated design cool ene	Prop Type Ref			
Property	4, Beaufort Close, Redfield, Bristol, BS5 8DJ				
SAP Rating	92 A	DER	2.41	TER	14.53
Environmental	99 A	% DER < TER	83.41		
CO ₂ Emissions (t/year)	0.05	DFEE	49.93	TFEE	50.16
Compliance Check	See BREEL	% DFEE < TFEE	0.44		
% DPER < TPER	60.95	DPER	30.36	TPER	77.73
Assessor Details	Ms. Natalie Wheeler			Assessor ID	AX45-0001
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)
Ground floor	38.0300 (1b)	2.4000 (2b)	91.2720 (1b) - (3b)
Total floor area TFA = (1a) + (1b) + (1c) + (1d) + (1e) ... (1n)	38.0300		91.2720 (4)
Dwelling volume			(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) = 91.2720 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a) + (6b) + (6c) + (6d) + (6e) + (6f) + (6g) + (7a) + (7b) + (7c) =	20.0000 / (5) = 0.2191 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.3691 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3691 (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	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3414	0.3691	0.3968	0.4153	0.4337 (22b)
Effective ac	0.6107	0.6064	0.6022	0.5624	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (25)

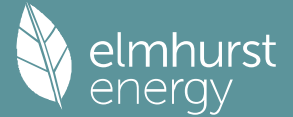
3. Heat losses and heat loss parameter

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
Front door			2.1700	1.0000	2.1700		(26)
Windows (U _w = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (U _w = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements A _{um} (A, m ²)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26) ... (30) + (32) = 27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)
Heat capacity Cm = Sum(A x k)					(28) ... (30) + (32) + (32a) ... (32e) =		1982.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495

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E16 Corner (normal)															
E17 Corner (inverted - internal area greater than external area)															
Thermal bridges (Sum(L x Psi) calculated using Appendix K)															
Point Thermal bridges													(36a) =	10.5109 (36)	
Total fabric heat loss													(33) + (36) + (36a) =	37.6537 (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	18.3956	18.2661	18.1391	17.5428	17.4312	16.9118	16.9118	16.8156	17.1118	17.4312	17.6569	17.8929	(39)		
Average = Sum(39)m / 12 =	56.0493	55.9197	55.7928	55.1964	55.0849	54.5655	54.5655	54.4693	54.7655	55.0849	55.3106	55.5465	55.1959		
H.P	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
H.P (average)	1.4738	1.4704	1.4671	1.4514	1.4485	1.4348	1.4348	1.4323	1.4401	1.4485	1.4544	1.4606	(40)		
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	31		

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3550 (42)	
Hot water usage for mixer showers													74.9727 (42a)	
Hot water usage for baths													0.0000 (42b)	
Hot water usage for other uses													28.5067 (42c)	
Average daily hot water use (litres/day)													95.3034 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	103.7678	101.6001	99.9154	94.7254	91.3616	87.7298	86.2547	88.9270	91.7566	95.5796	99.8374	103.4794	(44)	
Distribution loss (46)m = 0.15 x (45)m	164.3428	144.6772	152.0293	129.6743	122.9903	107.8741	104.3176	110.1102	113.1451	129.7037	142.2367	162.0237	(45)	
Water storage loss:	24.6514	21.7016	22.8044	19.4511	18.4485	16.1811	15.6476	16.5165	16.9718	19.4551	21.3355	24.3036	(46)	
Store volume													98.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):													1.1000 (48)	
Temperature factor from Table 2b													0.5400 (49)	
Enter (49) or (54) in (55)													0.5940 (55)	
Total storage loss	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140	(56)	
If cylinder contains dedicated solar storage	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140	(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	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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377	(62)	
WWHS	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)	
FGHS	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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377	(64)	
12Total per year (kWh/year)													1799.9319 (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	54.6440	48.1052	50.5497	43.1167	40.8943	35.8681	34.6856	36.6116	37.6207	43.1255	47.2937	53.8729	(65)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(66)m	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	(66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161	(67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674	(68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	(69)	
Pumps, fans	5.4763	5.4763	5.4763	5.4763	5.4763	0.0000	0.0000	0.0000	0.0000	5.4763	5.4763	5.4763	(70)	
Losses e.g. evaporation (negative values) (Table 5)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	(71)	
Water heating gains (Table 5)	73.4462	71.5851	67.9432	59.8843	54.9654	49.8168	46.6204	49.2092	52.2510	57.9643	65.6857	72.4098	(72)	
Total internal gains	299.1766	304.9880	291.8343	279.2943	264.1703	247.8541	237.5019	238.8806	246.9823	262.6531	280.5796	292.9950	(73)	

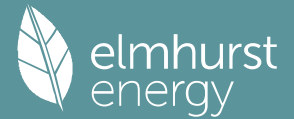
6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W								
East	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)								
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)								
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726	(83)	
Total gains	339.2721	383.4233	421.0061	467.6836	495.0485	484.1990	462.5119	432.1609	397.2144	355.7232	330.5740	325.9676	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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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	9.8232	9.8459	9.8683	9.9749	9.9951	10.0903	10.0903	10.1081	10.0534	9.9951	9.9543	9.9121
alpha	1.6549	1.6564	1.6579	1.6650	1.6663	1.6727	1.6727	1.6739	1.6702	1.6663	1.6636	1.6608
util living area	0.8725	0.8442	0.8029	0.7299	0.6356	0.5214	0.4182	0.4523	0.6098	0.7618	0.8435	0.8792 (86)
MIT	17.7731	18.0708	18.5712	19.2502	19.8698	20.3536	20.5969	20.5556	20.1663	19.3669	18.4664	17.7225 (87)
Th 2	19.7072	19.7098	19.7123	19.7242	19.7264	19.7368	19.7368	19.7387	19.7328	19.7264	19.7219	19.7172 (88)
util rest of house	0.8588	0.8277	0.7812	0.6986	0.5892	0.4517	0.3225	0.3573	0.5449	0.7272	0.8242	0.8663 (89)
MIT 2	16.1237	16.4821	17.0842	17.8949	18.6115	19.1489	19.3865	19.3556	18.9636	18.0538	16.9749	16.0673 (90)
Living area fraction									fLA = Living area / (4) =			0.4965 (91)
MIT	16.9426	17.2708	17.8224	18.5677	19.2361	19.7470	19.9874	19.9513	19.5667	18.7057	17.7154	16.8890 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9426	17.2708	17.8224	18.5677	19.2361	19.7470	19.9874	19.9513	19.5667	18.7057	17.7154	16.8890 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8205	0.7881	0.7421	0.6653	0.5691	0.4523	0.3430	0.3747	0.5349	0.6937	0.7855	0.8286 (94)
Useful gains	278.3873	302.1728	312.4151	311.1354	281.7335	218.9970	158.6520	161.9419	212.4858	246.7645	259.6706	270.1102 (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	708.6059	691.7707	631.7108	533.6247	415.1272	280.8479	184.8370	193.4380	299.0560	446.5014	587.1427	704.8293 (97)
Space heating kWh	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98a)
Space heating requirement - total per year (kWh/year)												1786.7010
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	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1786.7010
Space heating per m2										(98c) / (4) =		46.9814 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	188.2839	154.0058	139.7388	94.2308	58.3794	0.0000	0.0000	0.0000	0.0000	87.4143	138.6941	190.2535 (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)
Space heating fuel used, main 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)
Water heating requirement	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (64)
Efficiency of water heater (217)m	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400 (216)
Fuel for water heating, kWh/month	65.6124	57.9124	61.1917	52.9526	50.7663	45.1260	44.0625	46.1421	47.0184	53.1754	57.4627	64.7798 (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	4.6511	4.2010	4.6511	4.5011	4.6511	4.5011	4.6511	4.6511	4.5011	4.6511	4.5011	4.6511 (231)
Lighting	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.0566	-62.3935	-99.9110	-121.8055	-135.2191	-114.8788	-113.3102	-105.6995	-90.9885	-75.3352	-45.3433	-32.9254 (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	-2.0144	-6.1421	-16.8129	-34.6275	-58.0408	-75.1265	-74.1841	-58.1151	-37.3112	-12.2785	-3.3727	-1.4439 (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												1051.0006 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.5400
Water heating fuel used												646.2023 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans: warm air heating system fans												54.7632 (230b)
Total electricity for the above, kWh/year												54.7632 (231)
Electricity for lighting (calculated in Appendix L)												97.2395 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1416.3363 (233)
Wind generation												0.0000 (234)

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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	432.8693 (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	1051.0006	0.1539	161.7348 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	646.2023	0.1412	91.2746 (264)
Space and water heating			253.0094 (265)
Pumps, fans and electric keep-hot	54.7632	0.1387	7.5963 (267)
Energy for lighting	97.2395	0.1443	14.0347 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1036.8667	0.1337	-138.6638
PV Unit electricity exported	-379.4696	0.1163	-44.1355
Total			-182.7993 (269)
Total CO2, kg/year			91.8411 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.4100 (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	1051.0006	1.5697	1649.7789 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	646.2023	1.5223	983.7137 (278)
Space and water heating			2633.4926 (279)
Pumps, fans and electric keep-hot	54.7632	1.5128	82.8458 (281)
Energy for lighting	97.2395	1.5338	149.1492 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1036.8667	1.4942	-1549.3201
PV Unit electricity exported	-379.4696	0.4262	-161.7224
Total			-1711.0425 (283)
Total Primary energy kWh/year			1154.4451 (286)
Dwelling Primary energy Rate (DPER)			30.3600 (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)
Ground floor	38.0300 (1b)	x 2.4000 (2k)	= 91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.2720 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2191 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.4691 (18)	
Number of sides sheltered		0 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.4691 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 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	0.5981 0.5864 0.5747 0.5160 0.5043 0.4457 0.4457 0.4339 0.4691 0.5043 0.5278 0.5512 (22b)		
Effective ac	0.6789 0.6719 0.6651 0.6331 0.6272 0.5993 0.5993 0.5942 0.6100 0.6272 0.6393 0.6519 (25)		

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.1700	1.0000	2.1700		(26)
TER Opening Type (Uw = 1.20)			6.6800	1.1450	7.6489		(27)
Heatloss Floor			38.0300	0.1300	4.9439		(28a)
External Wall	54.4600	8.8500	45.6100	0.1800	8.2098		(29a)
Wall to store	5.5200		5.5200	0.1800	0.9936		(29a)
External Roof	38.0300		38.0300	0.1100	4.1833		(30)
Total net area of external elements $\sum(A, m^2)$			136.0400				(31)
Fabric heat loss, $W/K = \sum(A \times U)$					(26)...(30) + (32) =	28.1495	(33)

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

52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0500	0.2755
E3 Sill	3.0000	0.0500	0.1500
E4 Jamb	13.2000	0.0500	0.6600
E5 Ground floor (normal)	24.9900	0.1600	3.9984
E14 Flat roof	24.9900	0.0800	1.9992
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160

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

7.9471 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 36.0966 (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	20.4478	20.2386	20.0335	19.0703	18.8900	18.0511	18.0511	17.8957	18.3742	18.8900	19.2546	19.6358 (38)
Average - Sum(39)m / 12 -	56.5443	56.3351	56.1300	55.1668	54.9866	54.1476	54.1476	53.9923	54.4708	54.9866	55.3512	55.7323 (39)
												55.1659

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4868	1.4813	1.4759	1.4506	1.4459	1.4238	1.4238	1.4197	1.4323	1.4459	1.4555	1.4655 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

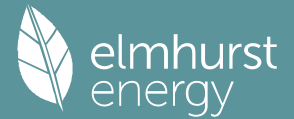
4. Water heating energy requirements (kWh/year)

Assumed occupancy	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage for mixer showers	60.2088	59.3040	57.9855	55.4628	53.6011	51.5249	50.3448	51.6534	53.0877	55.3169	57.8938	59.9781 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067 (42c)
Average daily hot water use (litres/day)												81.4257 (43)
Daily hot water use	88.7155	86.7741	84.4190	80.8597	77.9614	74.8486	73.6685	76.0137	78.4847	81.7504	85.3639	88.4849 (44)
Energy content (annua-)	140.5037	123.5652	129.7489	110.6929	104.9510	92.0351	89.0957	94.1208	96.7794	110.9345	121.6166	138.5459 (45)
Distribution loss (46)m = 0.15 x (45)m	21.0756	18.5348	19.4623	16.6039	15.7426	13.8053	13.3644	14.1181	14.5169	16.6402	18.2425	20.7819 (46)
Water storage loss:												150.0000 (47)
Store volume												1.3938 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7527 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage												
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	187.0986	165.6509	176.3438	155.7847	151.5459	137.1269	135.6906	140.7157	141.8713	157.5294	166.7084	185.1408 (62)
WWHRS	-27.5250	-24.3433	-25.4909	-21.1075	-19.6714	-16.8330	-15.7782	-16.7786	-17.4160	-20.5316	-23.2598	-27.0152 (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	159.5737	141.3076	150.8529	134.6772	131.8745	120.2940	119.9124	123.9371	124.4552	136.9979	143.4486	158.1256 (64)
Total per year (kWh/year)												1645.4567 (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	83.9934	74.7540	80.4174	72.8789	72.1721	66.6751	66.9002	68.5711	68.2526	74.1617	76.5110	83.3424 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)	112.8944	111.2411	108.0879	101.2206	97.0055	92.6044	89.9197	92.1654	94.7953	99.6796	106.2653	112.0194 (72)
Total internal gains	336.1485	342.1677	329.5028	318.1543	303.7341	290.6417	280.8012	281.8368	289.5266	301.8921	318.6829	330.1283 (73)

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6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
East					1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)		
West					5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)		
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	376.2440	420.6030	458.6745	506.5436	534.6123	526.9866	505.8111	475.1171	439.7587	394.9622	368.6772	363.1008 (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	9.7371	9.7733	9.8090	9.9803	10.0130	10.1681	10.1681	10.1974	10.1078	10.0130	9.9470	9.8790
alpha	1.6491	1.6516	1.6539	1.6654	1.6675	1.6779	1.6779	1.6798	1.6739	1.6675	1.6631	1.6586
util living area	0.8555	0.8267	0.7838	0.7075	0.6112	0.4924	0.3897	0.4209	0.5762	0.7340	0.8216	0.8616 (86)
MIT	17.0713	17.4604	18.1168	19.0143	19.8112	20.4333	20.7324	20.6845	20.2062	19.1847	18.0107	17.0240 (87)
Th 2	19.6974	19.7015	19.7056	19.7247	19.7283	19.7451	19.7451	19.7482	19.7386	19.7283	19.7211	19.7135 (88)
util rest of house	0.8404	0.8088	0.7607	0.6751	0.5643	0.4242	0.2987	0.3302	0.5112	0.6975	0.8005	0.8472 (89)
MIT 2	15.3806	15.8471	16.6339	17.7000	18.6167	19.3021	19.5904	19.5556	19.0791	17.9271	16.5280	15.3286 (90)
Living area fraction	fLA = Living area / (4) = 0.4965 (91)											
MIT	16.2199	16.6480	17.3701	18.3525	19.2097	19.8637	20.1574	20.1161	19.6387	18.5514	17.2641	16.1703 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.2199	16.6480	17.3701	18.3525	19.2097	19.8637	20.1574	20.1161	19.6387	18.5514	17.2641	16.1703 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7853	0.7535	0.7084	0.6339	0.5429	0.4311	0.3303	0.3586	0.5055	0.6565	0.7474	0.7927 (94)
Useful gains	295.4491	316.9274	324.9291	321.0742	290.2152	227.2073	167.0926	170.3967	222.2950	259.2881	275.5322	287.8307 (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	674.0051	661.8252	610.1364	521.4624	412.9325	285.0166	192.6231	200.6389	301.6948	437.2199	562.5944	667.1328 (97)
Space heating kWh	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (98a)
Space heating requirement - total per year (kWh/year)	1582.4592											
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	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1582.4592											
Space heating per m ²	(98c) / (4) = 41.6108 (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	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (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)	305.1416	251.1065	229.8962	156.3158	98.9184	0.0000	0.0000	0.0000	0.0000	143.4250	223.9272	305.7430 (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	159.5737	141.3076	150.8529	134.6772	131.8745	120.2940	119.9124	123.9371	124.4552	136.9979	143.4486	158.1256 (64)
Efficiency of water heater												
(217)m	85.3199	85.1621	84.8249	84.2145	83.2519	79.8000	79.8000	79.8000	79.8000	83.9830	84.8781	85.3435 (217)
Fuel for water heating, kWh/month	187.0299	165.9278	177.8404	159.9216	158.4042	150.7443	150.2661	155.3097	155.9589	163.1258	169.0055	185.2814 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041 (231)
Lighting	12.5325	10.0540	9.0525	6.6323	5.1230	4.1855	4.6733	6.0746	7.8903	10.3525	11.6931	12.8808 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-31.3992	-41.8929	-57.0922	-60.8618	-63.1004	-58.1751	-57.5835	-55.6345	-51.7646	-46.4171	-33.7282	-27.4489 (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 M) (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	-25.7484	-52.9908	-103.1803	-151.9310	-197.9847	-197.7576	-195.2875	-166.5157	-123.7371	-74.5242	-33.9638	-20.4362 (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)

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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												1714.4737 (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												1978.8158 (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 T)												101.1445 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1929.1555 (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												1951.2784 (238)

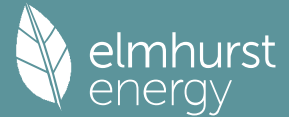
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1714.4737	0.2100	360.0395 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1978.8158	0.2100	415.5513 (264)
Space and water heating			775.5908 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	101.1445	0.1443	14.5983 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-585.0983	0.1357	-79.3875
PV Unit electricity exported	-344.0572	0.1265	-170.0329
Total			-249.4204 (269)
Total CO2, kg/year			552.6979 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5300 (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	1714.4737	1.1300	1937.3552 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1978.8158	1.1300	2236.0619 (278)
Space and water heating			4173.4171 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	101.1445	1.5338	155.1388 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-585.0983	1.5015	-878.5356
PV Unit electricity exported	-344.0572	0.4644	-624.1764
Total			-1502.7120 (283)
Total Primary energy kWh/year			2955.9447 (286)
Target Primary Energy Rate (TPER)			77.7300 (287)

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Property Reference	Beaufort Close		Issued on Date	17/01/2024	
Assessment Reference	00001_updated design cool ene	Prop Type Ref			
Property	4, Beaufort Close, Redfield, Bristol, BS5 8DJ				
SAP Rating	92 A	DER	2.41	TER	14.53
Environmental	99 A	% DER < TER			83.41
CO ₂ Emissions (t/year)	0.05	DFEE	49.93	TFEE	50.16
Compliance Check	See BREL	% DFEE < TFEE			0.44
% DPER < TPER	60.95	DPER	30.36	TPER	77.73
Assessor Details	Ms. Natalie Wheeler			Assessor ID	AX45-0001
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)
Ground floor	38.0300 (1b)	2.4000 (2b)	91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		91.2720 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 91.2720 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2191 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3691 (18)
Number of sides sheltered		0 (19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3691 (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	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3414	0.3691	0.3968	0.4153	0.4337 (22b)
Effective ac	0.6107	0.6064	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (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
Front door			2.1700	1.0000	2.1700		(26)
Windows (Uw = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (Uw = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements Aum(A, m ²)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.1428	(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	1982.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495

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E16 Corner (normal) 12.0000 0.0750 0.9000
 E17 Corner (inverted - internal area greater than external area) 2.4000 -0.0450 -0.1080
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5109 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 37.6537 (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
 18.3956 18.2661 18.1391 17.5428 17.4312 16.9118 16.9118 16.8156 17.1118 17.4312 17.6569 17.8929 (38)
 Heat transfer coeff 56.0493 55.9197 55.7928 55.1964 55.0849 54.5655 54.5655 54.4693 54.7655 55.0849 55.3106 55.5465 (39)
 Average = Sum(39)m / 12 = 55.1959

HLP Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 1.4738 1.4704 1.4671 1.4514 1.4485 1.4348 1.4348 1.4323 1.4401 1.4485 1.4544 1.4606 (40)
 HLP (average) 1.4514
 Days in mont 31 28 31 30 31 30 31 31 30 31 30 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 1.3550 (42)
 Hot water usage for mixer showers 75.2610 74.1300 72.4819 69.3285 67.0013 64.4062 62.9310 64.5667 66.3597 69.1461 72.3673 74.9727 (42a)
 Hot water usage for baths 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)
 Hot water usage for other uses 28.5067 27.4701 26.4335 25.3969 24.3603 23.3237 23.3237 24.3603 25.3969 26.4335 27.4701 28.5067 (42c)
 Average daily hot water use (litres/day) 95.3034 (43)
 Daily hot water use Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 103.7678 101.6001 98.9154 94.7254 91.3616 87.7298 86.2547 88.9270 91.7566 95.5796 99.8374 103.4794 (44)
 Energy content (annual) 164.3428 144.6772 152.0293 129.6743 122.9903 107.8741 104.3176 110.1102 113.1451 129.7007 142.2367 162.0237 (45)
 Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 1583.1219
 24.6514 21.7016 22.8044 19.4511 18.4485 16.1811 15.6476 16.5165 16.9718 19.4551 21.3355 24.3036 (46)
 Water storage loss:
 Store volume 98.0000 (47)
 a) If manufacturer declared loss factor is known (kWh/day): 1.1000 (48)
 Temperature factor from Table 2b 0.5400 (49)
 Enter (49) or (54) in (55) 0.5940 (55)
 Total storage loss 18.4140 16.6320 18.4140 17.8200 18.4140 17.8200 18.4140 18.4140 17.8200 18.4140 17.8200 18.4140 (56)
 If cylinder contains dedicated solar storage 18.4140 16.6320 18.4140 17.8200 18.4140 17.8200 18.4140 18.4140 17.8200 18.4140 17.8200 18.4140 (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 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 182.7568 161.3092 170.4433 147.4943 141.4043 125.6941 122.7316 128.5242 130.9651 148.1147 160.0567 180.4377 (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 182.7568 161.3092 170.4433 147.4943 141.4043 125.6941 122.7316 128.5242 130.9651 148.1147 160.0567 180.4377 (64)
 Total per year (kWh/year) = Sum(64)m = 1799.9319 (64)
 1800 (64)
 12Total per year (kWh/year)
 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 54.6440 48.1052 50.5497 43.1167 40.8943 35.8681 34.6856 36.6116 37.6207 43.1255 47.2937 53.8729 (65)

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

Metabolic gains (Table 5), Watts Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
 (66)m 67.7509 67.7509 67.7509 67.7509 67.7509 67.7509 67.7509 67.7509 67.7509 67.7509 67.7509 (66)
 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 60.3161 66.7786 60.3161 62.3267 60.3161 62.3267 60.3161 60.3161 62.3267 60.3161 62.3267 60.3161 (67)
 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 116.6127 117.8228 114.7734 108.2817 100.0871 92.3853 87.2401 86.0300 89.0793 95.5711 103.7657 111.4674 (68)
 Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 29.7751 (69)
 Pumps, fans 5.4763 5.4763 5.4763 5.4763 5.4763 0.0000 0.0000 0.0000 0.0000 5.4763 5.4763 5.4763 (70)
 Losses e.g. evaporation (negative values) (Table 5) -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 -54.2007 (71)
 Water heating gains (Table 5) 73.4462 71.5851 67.9432 59.8843 54.9654 49.8168 46.6204 49.2092 52.2510 57.9643 65.6857 72.4098 (72)
 Total internal gains 299.1766 304.9880 291.8343 279.2943 264.1703 247.8541 237.5019 238.8806 246.9823 262.6531 280.5796 292.9950 (73)

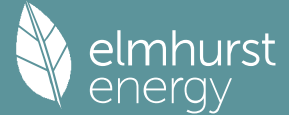
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)						
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)						
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	339.2721	383.4233	421.0061	467.6836	495.0485	484.1990	462.5119	432.1609	397.2144	355.7232	330.5740	325.9676 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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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	9.8232	9.8459	9.8683	9.9749	9.9951	10.0903	10.0903	10.1081	10.0534	9.9951	9.9543	9.9121
alpha	1.6549	1.6564	1.6579	1.6650	1.6663	1.6727	1.6727	1.6739	1.6702	1.6663	1.6636	1.6608
util living area	0.8725	0.8442	0.8029	0.7299	0.6356	0.5214	0.4182	0.4523	0.6098	0.7618	0.8435	0.8792 (86)
MIT	17.7731	18.0708	18.5712	19.2502	19.8698	20.3536	20.5969	20.5556	20.1663	19.3669	18.4664	17.7225 (87)
Th 2	19.7072	19.7098	19.7123	19.7242	19.7264	19.7368	19.7368	19.7387	19.7328	19.7264	19.7219	19.7172 (88)
util rest of house	0.8588	0.8277	0.7812	0.6986	0.5892	0.4517	0.3225	0.3573	0.5449	0.7272	0.8242	0.8663 (89)
MIT 2	16.1237	16.4821	17.0842	17.8949	18.6115	19.1489	19.3865	19.3556	18.9636	18.0538	16.9749	16.0673 (90)
Living area fraction									FLA = Living area / (4) =			0.4965 (91)
MIT	16.9426	17.2708	17.8224	18.5677	19.2361	19.7470	19.9874	19.9513	19.5607	18.7057	17.7154	16.8890 (92)
Temperature adjustment												0.0000
adjusted MIT	16.9426	17.2708	17.8224	18.5677	19.2361	19.7470	19.9874	19.9513	19.5607	18.7057	17.7154	16.8890 (93)

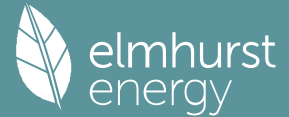
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8205	0.7881	0.7421	0.6653	0.5691	0.4523	0.3430	0.3747	0.5349	0.6937	0.7855	0.8286 (94)
Useful gains	278.3873	302.1728	312.4151	311.1354	281.7335	218.9970	158.6520	161.9419	212.4858	246.7645	259.6706	270.1102 (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	708.6059	691.7707	631.7108	533.6247	415.1272	280.8479	184.8370	193.4380	299.0560	446.5014	587.1427	704.8293 (97)
Space heating kWh	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98a)
Space heating requirement - total per year (kWh/year)												1786.7010
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	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1786.7010
Space heating per m2											(98c) / (4) =	46.9814 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	320.0827	261.8098	237.5560	160.1923	99.2450	0.0000	0.0000	0.0000	0.0000	148.6043	235.7799	323.4310 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	188.2839	154.0058	139.7388	94.2308	58.3794	0.0000	0.0000	0.0000	0.0000	87.4143	138.6941	190.2535 (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)
Space heating fuel used, main 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)
Water heating												
Water heating requirement	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (64)
Efficiency of water heater	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400 (216)
Fuel for water heating, kWh/month	65.6124	57.9124	61.1917	52.9526	50.7663	45.1260	44.0625	46.1421	47.0184	53.1754	57.4627	64.7798 (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	4.6511	4.2010	4.6511	4.5011	4.6511	4.5011	4.6511	4.6511	4.5011	4.6511	4.5011	4.6511 (231)
Lighting	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-39.0566	-62.3935	-99.9110	-121.8055	-135.2191	-114.8788	-113.3102	-105.6995	-90.9885	-75.3352	-45.3433	-32.9254 (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	-2.0144	-6.1421	-16.8129	-34.6275	-58.0408	-75.1265	-74.1841	-58.1151	-37.3112	-12.2785	-3.3727	-1.4439 (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												1051.0006 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.5400
Water heating fuel used												646.2023 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
warm air heating system fans												54.7632 (230b)
Total electricity for the above, kWh/year												54.7632 (231)
Electricity for lighting (calculated in Appendix L)												97.2395 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1416.3363 (233)
Wind generation												0.0000 (234)

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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	432.8693 (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	1051.0006	0.1539	161.7348 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	646.2023	0.1412	91.2746 (264)
Space and water heating			253.0094 (265)
Pumps, fans and electric keep-hot	54.7632	0.1387	7.5963 (267)
Energy for lighting	97.2395	0.1443	14.0347 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1036.8667	0.1337	-138.6638
PV Unit electricity exported	-379.4696	0.1163	-44.1355
Total			-182.7993 (269)
Total CO2, kg/year			91.8411 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.4100 (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	1051.0006	1.5697	1649.7789 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	646.2023	1.5223	983.7137 (278)
Space and water heating			2633.4926 (279)
Pumps, fans and electric keep-hot	54.7632	1.5128	82.8458 (281)
Energy for lighting	97.2395	1.5338	149.1492 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1036.8667	1.4942	-1549.3201
PV Unit electricity exported	-379.4696	0.4262	-161.7224
Total			-1711.0425 (283)
Total Primary energy kWh/year			1154.4451 (286)
Dwelling Primary energy Rate (DPER)			30.3600 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.0300 (1b)	x 2.4000 (2b)	= 91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.2720 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.2191 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4691 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4691 (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	0.5981	0.5864	0.5747	0.5160	0.5043	0.4457	0.4457	0.4339	0.4691	0.5043	0.5278	0.5512 (22b)
Effective ac	0.6789	0.6719	0.6651	0.6331	0.6272	0.5993	0.5993	0.5942	0.6100	0.6272	0.6393	0.6519 (25)

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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			2.1700	1.0000	2.1700			(26)					
TER Opening Type (Uw = 1.20)			6.6800	1.1450	7.6489			(27)					
Heatloss Floor			38.0300	0.1300	4.9439			(28a)					
External Wall	54.4600	8.8500	45.6100	0.1800	8.2098			(29a)					
Wall to store	5.5200		5.5200	0.1800	0.9936			(29a)					
External Roof	38.0300		38.0300	0.1100	4.1833			(31)					
Total net area of external elements Aum(A, m ²)			136.0400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.1495		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K								52.1191 (35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value	Total							
E1 Steel lintel with perforated steel base plate				5.5100	0.0500	0.2755							
E3 Sill				3.0000	0.0500	0.1500							
E4 Jamb				13.2000	0.0500	0.6600							
E5 Ground floor (normal)				24.9900	0.1600	3.9984							
E14 Flat roof				24.9900	0.0800	1.9992							
E16 Corner (normal)				12.0000	0.0900	1.0800							
E17 Corner (inverted - internal area greater than external area)				2.4000	-0.0900	-0.2160							
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								7.9471 (36)					
Point Thermal bridges							(36a) =	0.0000					
Total fabric heat loss							(33) + (36) + (36a) =	36.0966 (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	20.4478	20.2386	20.0335	19.0703	18.8900	18.0511	18.0511	17.8957	18.3742	18.8900	19.2546	19.6358	(38)
Average = Sum(39)m / 12 =	56.5443	56.3351	56.1300	55.1668	54.9866	54.1476	54.1476	53.9923	54.4708	54.9866	55.3512	55.7323	(39)
	55.1659												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.4868	1.4813	1.4759	1.4506	1.4459	1.4238	1.4238	1.4197	1.4323	1.4459	1.4555	1.4655	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
													1.4506

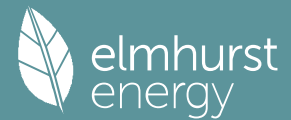
4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3550 (42)
Hot water usage for mixer showers													
	60.2088	59.3040	57.9855	55.4628	53.6011	51.5249	50.3448	51.6534	53.0877	55.3169	57.8938	59.9781	42a)
Hot water usage for baths													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	42b)
Hot water usage for other uses													
	28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067	42c)
Average daily hot water use (litres/day)													81.4257 (43)
Daily hot water use													
	88.7155	86.7741	84.4190	80.8597	77.9614	74.8486	73.6685	76.0137	78.4847	81.7504	85.3639	88.4849	44)
Energy conte	140.5037	123.5652	129.7489	110.6929	104.9510	92.0351	89.0957	94.1208	96.7794	110.9345	121.6166	138.5459	45)
Energy content (annual)													Total = Sum(45)m = 1352.5897
Distribution loss (46)m = 0.15 x (45)m													
	21.0756	18.5348	19.4623	16.6039	15.7426	13.8053	13.3644	14.1181	14.5169	16.6402	18.2425	20.7819	46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													
Temperature factor from Table 2b													1.3938 (48)
Enter (49) or (54) in (55)													0.5400 (49)
Total storage loss													0.7527 (55)
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	61)
Total heat required for water heating calculated for each month													
	187.0986	165.6509	176.3438	155.7847	151.5459	137.1269	135.6906	140.7157	141.8713	157.5294	166.7084	185.1408	62)
WWHRS	-27.5250	-24.3433	-25.4909	-21.1075	-19.6714	-16.8330	-15.7782	-16.7786	-17.4160	-20.5316	-23.2598	-27.0152	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	159.5737	141.3076	150.8529	134.6772	131.8745	120.2940	119.9124	123.9371	124.4552	136.9979	143.4486	158.1256	64)
												Total per year (kWh/year) = Sum(64)m =	1645.4567 (64)
													1645 (64)
12Total per year (kWh/year)													
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													
	83.9934	74.7540	80.4174	72.8789	72.1721	66.6751	66.9002	68.5711	68.2526	74.1617	76.5110	83.3424	65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161	67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674	68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	70)
Losses e.g. evaporation (negative values) (Table 5)													
	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	71)
Water heating gains (Table 5)													
	112.8944	111.2411	108.0879	101.2206	97.0055	92.6044	89.9197	92.1654	94.7953	99.6796	106.2653	112.0194	72)
Total internal gains	336.1485	342.1677	329.5028	318.1543	303.7341	290.6417	280.8012	281.8368	289.5266	301.8921	318.6829	330.1283	73)

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6. Solar gains

[Jan]			Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East			1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)				
West			5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)				
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	376.2440	420.6030	458.6745	506.5436	534.6123	526.9866	505.8111	475.1171	439.7587	394.9622	368.6772	363.1008 (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	9.7371	9.7733	9.8090	9.9803	10.0130	10.1681	10.1681	10.1974	10.1078	10.0130	9.9470	9.8790
alpha	1.6491	1.6516	1.6539	1.6654	1.6675	1.6779	1.6779	1.6798	1.6739	1.6675	1.6631	1.6586
util living area	0.8555	0.8267	0.7838	0.7075	0.6112	0.4924	0.3897	0.4209	0.5762	0.7340	0.8216	0.8616 (86)
MIT	17.0713	17.4604	18.1168	19.0143	19.8112	20.4333	20.7324	20.6845	20.2062	19.1847	18.0107	17.0240 (87)
Th 2	19.6974	19.7015	19.7056	19.7247	19.7283	19.7451	19.7451	19.7482	19.7386	19.7283	19.7211	19.7135 (88)
util rest of house	0.8404	0.8088	0.7607	0.6751	0.5643	0.4242	0.2987	0.3302	0.5112	0.6975	0.8005	0.8472 (89)
MIT 2	15.3806	15.8471	16.6339	17.7000	18.6167	19.3021	19.5904	19.5556	19.0791	17.9271	16.5280	15.3286 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	16.2199	16.6480	17.3701	18.3525	19.2097	19.8637	20.1574	20.1161	19.6387	18.5514	17.2641	16.1703 (91)
Temperature adjustment	0.0000											
adjusted MIT	16.2199	16.6480	17.3701	18.3525	19.2097	19.8637	20.1574	20.1161	19.6387	18.5514	17.2641	16.1703 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7853	0.7535	0.7084	0.6339	0.5429	0.4311	0.3303	0.3586	0.5055	0.6565	0.7474	0.7927 (94)
Useful gains	295.4491	316.9274	324.9291	321.0742	290.2152	227.2073	167.0926	170.3967	222.2950	259.2881	275.5322	287.8307 (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	674.0051	661.8252	610.1364	521.4624	412.9325	285.0166	192.6231	200.6389	301.6948	437.2199	562.5944	667.1328 (97)
Space heating kWh	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (98a)
Space heating requirement - total per year (kWh/year)	1582.4592											
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	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1582.4592											
Space heating per m ²	(98c) / (4) = 41.6108 (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)

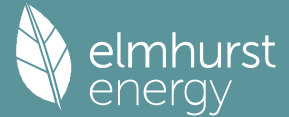
Efficiency of main space heating system 1 (in %) 92.3000 (206)

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	281.6457	231.7713	212.1942	144.2795	91.3017	0.0000	0.0000	0.0000	0.0000	132.3812	206.6848	282.2008 (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)	305.1416	251.1065	229.8962	156.3158	98.9184	0.0000	0.0000	0.0000	0.0000	143.4250	223.9272	305.7430 (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	159.5737	141.3076	150.8529	134.6772	131.8745	120.2940	119.9124	123.9371	124.4552	136.9979	143.4486	158.1256 (64)
Efficiency of water heater	79.8000 (216)											
(217)m	85.3199	85.1621	84.8249	84.2145	83.2519	79.8000	79.8000	79.8000	79.8000	83.9830	84.8781	85.3435 (217)
Fuel for water heating, kWh/month	187.0299	165.9278	177.8404	159.9216	158.4042	150.7443	150.2661	155.3097	155.9589	163.1258	169.0055	185.2814 (219)
Space cooling fuel requirement	0.0000 (221)											
(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	12.5325	10.0540	9.0525	6.6323	5.1230	4.1855	4.6733	6.0746	7.8903	10.3525	11.6931	12.8808 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-31.3992	-41.8929	-57.0922	-60.8618	-63.1004	-58.1751	-57.5835	-55.6345	-51.7646	-46.4171	-33.7282	-27.4489 (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)	-25.7484	-52.9908	-103.1803	-151.9310	-197.9847	-197.7576	-195.2875	-166.5157	-123.7371	-74.5242	-33.9638	-20.4362 (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)

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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											1714.4737	(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											1978.8158	(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)											101.1445	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-1929.1555	(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											1951.2784	(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	1714.4737	0.2100	360.0395 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1978.8158	0.2100	415.5513 (264)
Space and water heating			775.5908 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	101.1445	0.1443	14.5983 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-585.0983	0.1357	-79.3875
PV Unit electricity exported	-1344.0572	0.1265	-170.0329
Total			-249.4204 (269)
Total CO2, kg/year			552.6979 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.5300 (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	1714.4737	1.1300	1937.3552 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1978.8158	1.1300	2236.0619 (278)
Space and water heating			4173.4171 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	101.1445	1.5338	155.1388 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-585.0983	1.5015	-878.5356
PV Unit electricity exported	-1344.0572	0.4644	-624.1764
Total			-1502.7120 (283)
Total Primary energy kWh/year			2955.9447 (286)
Target Primary Energy Rate (TPER)			77.7300 (287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF FABRIC ENERGY EFFICIENCY

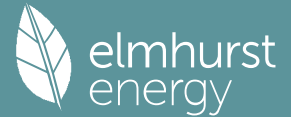
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300	x 2.4000 (2b)	= 91.2720 (1b) - (3b)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.2720 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 20.0000 / (5) = 0.2191 (8)
Pressure test	Yes

Full SAP Calculation Printout



Pressure Test Method												Blower Door
Measured/design AP50												3.0000 (17)
Infiltration rate												0.3691 (18)
Number of sides sheltered												0 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3691 (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 infiltr rate	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3414	0.3691	0.3968	0.4153	0.4337 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6107	0.6064	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (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
Front door			2.1700	1.0000	2.1700		(26)
Windows (Uw = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (Uw = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements Aum(A, m ²)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) = 1982.0900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495
E16 Corner (normal)	12.0000	0.0750	0.9000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080

Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.5109 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		37.6537 (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	18.3956	18.2661	18.1391	17.5428	17.4312	16.9118	16.9118	16.8156	17.1118	17.4312	17.6569	17.8929 (38)
Average = Sum(39)m / 12 =	56.0493	55.9197	55.7928	55.1964	55.0849	54.5655	54.5655	54.4693	54.7655	55.0849	55.3106	55.5465 (39)
HLP	1.4738	1.4704	1.4671	1.4514	1.4485	1.4348	1.4348	1.4323	1.4401	1.4485	1.4544	1.4606 (40)
HLP (average)												1.4514
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3550 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	20.3084	20.0068	19.5820	18.7989	18.2125	17.5623	17.2111	17.6328	18.0921	18.7878	19.5871	20.2397	20.2397 (42b)
Hot water usage for other uses	28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067	28.5067 (42c)
Average daily hot water use (litres/day)													44.7443 (43)
Daily hot water use	48.8151	47.4769	46.0155	44.1958	42.5728	40.8860	40.5348	41.9931	43.4890	45.2213	47.0572	48.7464	48.7464 (44)
Energy conte	77.3112	67.6064	70.7242	60.5019	57.3112	50.2741	49.0233	51.9963	53.6262	61.3649	67.0416	76.3251	76.3251 (45)
Energy content (annual)										Total = Sum(45)m =			743.1064
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	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	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	0.0000 (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	0.0000 (61)
Total heat required for water heating calculated for each month	65.7145	57.4655	60.1155	51.4266	48.7145	42.7330	41.6698	44.1968	45.5823	52.1602	56.9853	64.8764	64.8764 (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	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	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	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	0.0000 (63d)
Output from w/h	65.7145	57.4655	60.1155	51.4266	48.7145	42.7330	41.6698	44.1968	45.5823	52.1602	56.9853	64.8764	64.8764 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =			631.6404 (64)
Electric shower(s)	37.5900	33.4930	36.5731	34.9012	35.5561	33.9171	35.0477	35.5561	34.9012	36.5731	35.8853	37.5900	37.5900 (64a)
Heat gains from water heating, kWh/month	25.8261	22.7396	24.1722	21.5819	21.0677	19.1625	19.1794	19.9382	20.1209	22.1833	23.2177	25.6166	25.6166 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66m)	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751 (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)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)	34.7125	33.8387	32.4894	29.9749	28.3167	26.6146	25.7787	26.7987	27.9457	29.8163	32.2468	34.4309 (72)
Total internal gains	254.9666	261.7653	250.9043	243.9086	232.0453	224.6519	216.6602	216.4701	222.6770	229.0287	241.6644	249.5397 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
East	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)						
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)						
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	295.0621	340.2006	380.0761	432.2979	462.9234	460.9968	441.6702	409.7504	372.9091	322.0988	291.6587	282.5123 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	9.8232	9.8459	9.8683	9.9749	9.9951	10.0903	10.0903	10.1081	10.0534	9.9951	9.9543	9.9121
tau	1.6549	1.6564	1.6579	1.6650	1.6663	1.6727	1.6727	1.6739	1.6702	1.6663	1.6636	1.6608
util living area	0.8937	0.8658	0.8250	0.7509	0.6562	0.5372	0.4323	0.4689	0.6296	0.7863	0.8661	0.9000 (86)
MIT	16.7296	17.1460	17.8428	18.7958	19.6592	20.3425	20.6817	20.6214	20.0761	18.9447	17.6902	16.6600 (87)
Th 2	19.7072	19.7098	19.7123	19.7242	19.7264	19.7368	19.7368	19.7387	19.7328	19.7264	19.7219	19.7172 (88)
util rest of house	0.8818	0.8510	0.8049	0.7208	0.6105	0.4670	0.3347	0.3723	0.5652	0.7538	0.8489	0.8889 (89)
MIT 2	15.8748	16.2828	16.9644	17.8888	18.7007	19.3160	19.5858	19.5487	19.1019	18.0548	16.8332	15.8125 (90)
Living area fraction	16.2991	16.7113	17.4005	18.3391	19.1765	19.8256	20.1298	20.0813	19.5856	18.4966	17.2586	16.2332 (92)
MIT	16.2991	16.7113	17.4005	18.3391	19.1765	19.8256	20.1298	20.0813	19.5856	18.4966	17.2586	0.0000
Temperature adjustment	16.2991	16.7113	17.4005	18.3391	19.1765	19.8256	20.1298	20.0813	19.5856	18.4966	17.2586	16.2332 (93)
adjusted MIT	16.2991	16.7113	17.4005	18.3391	19.1765	19.8256	20.1298	20.0813	19.5856	18.4966	17.2586	16.2332 (93)

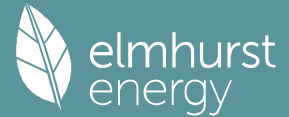
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8383	0.8049	0.7588	0.6816	0.5880	0.4724	0.3672	0.4007	0.5567	0.7146	0.8043	0.8463 (94)
Useful gains	247.3469	273.8362	288.4107	294.6499	272.2067	217.7872	162.1960	164.1850	207.6048	230.1727	234.5871	239.0994 (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	672.5430	660.4857	608.1666	521.0020	411.8442	285.1385	192.6077	200.5158	300.4196	434.9833	561.8803	668.4055 (97)
Space heating kWh	316.3459	259.8284	237.8984	162.9735	103.8903	0.0000	0.0000	0.0000	0.0000	152.3791	235.6511	319.4037 (98a)
Space heating requirement - total per year (kWh/year)												1788.3704
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	316.3459	259.8284	237.8984	162.9735	103.8903	0.0000	0.0000	0.0000	0.0000	152.3791	235.6511	319.4037 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1788.3704
Space heating per m ²												(98c) / (4) = 47.0253 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	512.9153	403.7844	413.9664	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6287	0.6885	0.6586	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	322.4671	278.0154	272.6578	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	517.6134	496.2744	460.1114	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	140.5053	162.3846	139.4655	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.1263	40.5962	34.8664	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												110.5889 (107)
Energy for space heating												47.0253 (99)
Energy for space cooling												2.9079 (108)
Total												49.9332 (109)
Fabric Energy Efficiency (DFEE)												49.9 (109)

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0300 (1b)	x 2.4000 (2b)	= 91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.2720 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.2191 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4691 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.4691 (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 infiltr rate	0.5981	0.5864	0.5747	0.5160	0.5043	0.4457	0.4457	0.4339	0.4691	0.5043	0.5278	0.5512 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000 (23c)
Effective ac	0.6789	0.6719	0.6651	0.6331	0.6272	0.5993	0.5993	0.5942	0.6100	0.6272	0.6393	0.6519 (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			2.1700	1.0000	2.1700		(26)
TER Opening Type (Uw = 1.20)			6.6800	1.1450	7.6489		(27)
Heatloss Floor			38.0300	0.1300	4.9439		(28a)
External Wall	54.4600	8.8500	45.6100	0.1800	8.2098		(29a)
Wall to store	5.5200		5.5200	0.1800	0.9936		(29a)
External Roof	38.0300		38.0300	0.1100	4.1833		(30)
Total net area of external elements Aum(A, m ²)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 28.1495		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0500	0.2755
E3 Sill	3.0000	0.0500	0.1500
E4 Jamb	13.2000	0.0500	0.6600
E5 Ground floor (normal)	24.9900	0.1600	3.9984
E14 Flat roof	24.9900	0.0800	1.9992
E16 Corner (normal)	12.0000	0.0900	1.0800
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0900	-0.2160

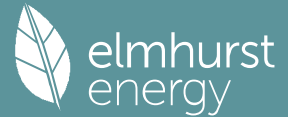
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.9471 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 36.0966 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	20.4478	20.2386	20.0335	19.0703	18.8900	18.0511	18.0511	17.8957	18.3742	18.8900	19.2546	19.6358 (38)
Heat transfer coeff	56.5443	56.3351	56.1300	55.1668	54.9866	54.1476	54.1476	53.9923	54.4708	54.9866	55.3512	55.7323 (39)
Average = Sum(39)m / 12 =												55.1659
HLP	1.4868	1.4813	1.4759	1.4506	1.4459	1.4238	1.4238	1.4197	1.4323	1.4459	1.4555	1.4655 (40)
HLP (average)												1.4506
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.3550 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	20.3084	20.0068	19.5820	18.7989	18.2125	17.5623	17.2111	17.6328	18.0921	18.7878	19.5871	20.2397 (42b)

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Hot water usage for other uses												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	48.8151	47.4769	46.0155	44.1958	42.5728	40.8860	40.5348	41.9931	43.4890	45.2213	47.0572	48.7464 (44)
Energy content (annual)	77.3112	67.6064	70.7242	60.5019	57.3112	50.2741	49.0233	51.9963	53.6262	61.3649	67.0416	76.3251 (45)
Distribution loss (46) _m = 0.15 x (45) _m											743.1064	
Water 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 (46)
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												
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 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	65.7145	57.4655	60.1155	51.4266	48.7145	42.7330	41.6698	44.1968	45.5823	52.1602	56.9853	64.8764 (62)
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	65.7145	57.4655	60.1155	51.4266	48.7145	42.7330	41.6698	44.1968	45.5823	52.1602	56.9853	64.8764 (64)
Total per year (kWh/year) = Sum(64) _m =											631.6404 (64)	
12Total per year (kWh/year)												
Electric shower(s)												
	37.5900	33.4930	36.5731	34.9012	35.5561	33.9171	35.0477	35.5561	34.9012	36.5731	35.8853	37.5900 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a) _m =											427.5838 (64a)	
Heat gains from water heating, kWh/month												
	25.8261	22.7396	24.1722	21.5819	21.0677	19.1625	19.1794	19.9382	20.1209	22.1833	23.2177	25.6166 (65)

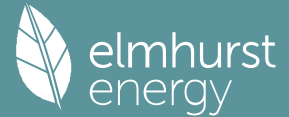
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66) _m	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509	67.7509 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	60.3161	66.7786	60.3161	62.3267	60.3161	62.3267	60.3161	60.3161	62.3267	60.3161	62.3267	60.3161 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	116.6127	117.8228	114.7734	108.2817	100.0871	92.3853	87.2401	86.0300	89.0793	95.5711	103.7657	111.4674 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751	29.7751 (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)												
	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)												
	34.7125	33.8387	32.4894	29.9749	28.3167	26.6146	25.7787	26.7987	27.9457	29.8163	32.2468	34.4309 (72)
Total internal gains	254.9666	261.7653	250.9043	243.9086	232.0453	224.6519	216.6602	216.4701	222.6770	229.0287	241.6644	249.5397 (73)

6. Solar gains												
[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)						
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)						
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)
Total gains	295.0621	340.2006	380.0761	432.2979	462.9234	460.9968	441.6702	409.7504	372.9091	322.0988	291.6587	282.5123 (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	9.7371	9.7733	9.8090	9.9803	10.0130	10.1681	10.1681	10.1974	10.1078	10.0130	9.9470	9.8790
alpha	1.6491	1.6516	1.6539	1.6654	1.6675	1.6779	1.6779	1.6798	1.6739	1.6675	1.6631	1.6586
util living area	0.8942	0.8663	0.8256	0.7508	0.6558	0.5353	0.4303	0.4667	0.6285	0.7860	0.8662	0.9002 (86)
MIT	16.7050	17.1252	17.8268	18.7970	19.6623	20.3507	20.6864	20.6275	20.0830	18.9482	17.6884	16.6507 (87)
Th 2	19.6974	19.7015	19.7056	19.7247	19.7283	19.7451	19.7451	19.7482	19.7386	19.7283	19.7211	19.7135 (88)
util rest of house												
	0.8823	0.8515	0.8055	0.7208	0.6102	0.4656	0.3337	0.3710	0.5643	0.7535	0.8490	0.8890 (89)
MIT 2	15.8452	16.2578	16.9450	17.8903	18.7048	19.3289	19.5959	19.5607	19.1118	18.0593	16.8310	15.8013 (90)
Living area fraction fLA = Living area / (4) =												
MIT	16.2721	16.6884	17.3828	18.3404	19.1801	19.8362	20.1373	20.0903	19.5939	18.5006	17.2566	16.2230 (92)
Temperature adjustment												0.0000
adjusted MIT	16.2721	16.6884	17.3828	18.3404	19.1801	19.8362	20.1373	20.0903	19.5939	18.5006	17.2566	16.2230 (93)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8387	0.8054	0.7593	0.6815	0.5878	0.4711	0.3660	0.3993	0.5559	0.7144	0.8044	0.8465 (94)
Useful gains	247.4687	273.9924	288.5988	294.6234	272.0867	217.1942	161.6447	163.5953	207.3058	230.1164	234.6002	239.1400 (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	676.9529	664.1000	610.8514	520.7985	411.3072	283.5275	191.5350	199.2471	299.2589	434.4266	562.1820	670.0681 (97)
Space heating kWh	319.5362	262.1524	239.7560	162.8461	103.5801	0.0000	0.0000	0.0000	0.0000	152.0068	235.8589	320.6105 (98a)
Space heating requirement - total per year (kWh/year)												1796.3469
Solar heating kWh												

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Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	319.5362	262.1524	239.7560	162.8461	103.5801	0.0000	0.0000	0.0000	0.0000	152.0068	235.8589	320.6105	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1796.3469	
Space heating per m2													(98c) / (4) = 47.2350 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6318	0.6916	0.6622	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	321.5907	277.1036	271.7247	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	517.6134	496.2744	460.1114	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh													0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	141.1363	163.0631	140.1597	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.2841	40.7658	35.0399	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement													111.0898 (107)
Energy for space heating													47.2350 (99)
Energy for space cooling													2.9211 (108)
Total													50.1561 (109)
Fabric Energy Efficiency (TFEE)													50.2 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	38.0300 (1b)	x 2.4000 (2b)	= 91.2720 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 91.2720 (5)	

2. Ventilation rate

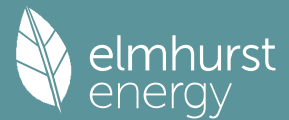
		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)		20.0000 / (5) =	0.2191 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.3691	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3691 (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													
Effective ac	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3414	0.3691	0.3968	0.4153	0.4337	(22b)
	0.6107	0.6064	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front door			2.1700	1.0000	2.1700			(26)
Windows (Uw = 0.80)			1.5000	0.7752	1.1628			(27)
Patio doors (Uw = 1.00)			5.1800	0.9615	4.9808			(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000	(28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400	(29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800	(29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700	(30)
Total net area of external elements Aum(A, m2)			136.0400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000	(32c)

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Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 1982.0900 (34)
 List of Thermal Bridges 52.1191 (35)

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495
E16 Corner (normal)	12.0000	0.0750	0.9000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5109 (36)
 Point Thermal bridges 0.0000 (36a) =
 Total fabric heat loss (33) + (36) + (36a) = 37.6537 (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	18.3956	18.2661	18.1391	17.5428	17.4312	16.9118	16.9118	16.8156	17.1118	17.4312	17.6569	17.8929 (38)
Average = Sum(39)m / 12 =	56.0493	55.9197	55.7928	55.1964	55.0849	54.5655	54.5655	54.4693	54.7655	55.0849	55.3106	55.5465 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4738	1.4704	1.4671	1.4514	1.4485	1.4348	1.4348	1.4323	1.4401	1.4485	1.4544	1.4606 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												1.3550 (42)
Hot water usage for mixer showers	75.2610	74.1300	72.4819	69.3285	67.0013	64.4062	62.9310	64.5667	66.3597	69.1461	72.3673	74.9727 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067 (42c)
Average daily hot water use (litres/day)												95.3034 (43)
Daily hot water use	103.7678	101.6001	98.9154	94.7254	91.3616	87.7298	86.2547	88.9270	91.7566	95.5796	99.8374	103.4794 (44)
Energy conte	164.3428	144.6772	152.0293	129.6743	122.9903	107.8741	104.3176	110.1102	113.1451	129.7007	142.2367	162.0237 (45)
Energy content (annual)												Total = Sum(45)m = 1583.1219
Distribution loss (46)m = 0.15 x (45)m	24.6514	21.7016	22.8044	19.4511	18.4485	16.1811	15.6476	16.5165	16.9718	19.4551	21.3355	24.3036 (46)
Water storage loss:												
Store volume												98.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5940 (55)
Total storage loss	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (56)
If cylinder contains dedicated solar storage	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (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	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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (64)
Total per year (kWh/year) = Sum(64)m =												1799.9319 (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	54.6440	48.1052	50.5497	43.1167	40.8943	35.8681	34.6856	36.6116	37.6207	43.1255	47.2937	53.8729 (65)

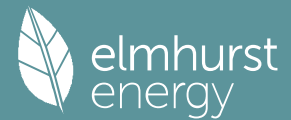
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.7653	12.2262	9.9430	7.5275	5.6269	4.7505	5.1330	6.6721	8.9553	11.3708	13.2714	14.1478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0488	175.8549	171.3036	161.6145	149.3837	137.8886	130.2091	128.4030	132.9542	142.6434	154.8741	166.3693 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851 (69)
Pumps, fans	5.4763	5.4763	5.4763	5.4763	5.4763	0.0000	0.0000	0.0000	0.0000	5.4763	5.4763	5.4763 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)	73.4462	71.5851	67.9432	59.8843	54.9654	49.8168	46.6204	49.2092	52.2510	57.9643	65.6857	72.4098 (72)
Total internal gains	338.3221	336.7279	326.2516	306.0881	287.0379	264.0413	253.5480	255.8698	265.7460	289.0403	310.8930	329.9887 (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	1.5000	19.6403	0.6300	0.7000	0.7700	9.0035 (76)						
West	5.1800	19.6403	0.6300	0.7000	0.7700	31.0920 (80)						
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726 (83)

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Total gains 378.4176 415.1632 455.4234 494.4774 517.9160 500.3862 478.5580 449.1500 415.9781 382.1104 360.8874 362.9613 (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	9.8232	9.8459	9.8683	9.9749	9.9951	10.0903	10.0903	10.1081	10.0534	9.9951	9.9543	9.9121
alpha	1.6549	1.6564	1.6579	1.6650	1.6663	1.6727	1.6727	1.6739	1.6702	1.6663	1.6636	1.6608
util living area	0.8537	0.8286	0.7846	0.7144	0.6215	0.5109	0.4080	0.4403	0.5952	0.7432	0.8260	0.8614 (86)
MIT	17.9019	18.1676	18.6636	19.3077	19.9047	20.3690	20.6057	20.5669	20.1922	19.4296	18.5590	17.8475 (87)
Th 2	19.7072	19.7098	19.7123	19.7242	19.7264	19.7368	19.7368	19.7387	19.7328	19.7264	19.7219	19.7172 (88)
util rest of house	0.8385	0.8109	0.7617	0.6823	0.5748	0.4415	0.3137	0.3466	0.5301	0.7072	0.8052	0.8470 (89)
MIT 2	16.2762	16.5956	17.1906	17.9584	18.6472	19.1622	19.3922	19.3633	18.9878	18.1226	17.0827	16.2156 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.0833	17.3760	17.9219	18.6283	19.2715	19.7613	19.9947	19.9608	19.5857	18.7714	17.8156	17.0258 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0833	17.3760	17.9219	18.6283	19.2715	19.7613	19.9947	19.9608	19.5857	18.7714	17.8156	17.0258 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7990	0.7709	0.7232	0.6503	0.5561	0.4430	0.3344	0.3645	0.5216	0.6750	0.7663	0.8080 (94)
Useful gains	302.3692	320.0537	329.3445	321.5368	288.0201	221.6465	160.0308	163.7315	216.9640	257.9341	276.5586	293.2889 (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	716.4940	697.6557	637.2600	536.9651	417.0752	281.6282	185.2315	193.9552	300.4289	450.1222	592.6873	712.4265 (97)
Space heating kWh	308.1088	253.7485	229.0891	155.1084	96.0170	0.0000	0.0000	0.0000	0.0000	142.9879	227.6127	311.8384 (98a)
Space heating requirement - total per year (kWh/year)	1724.5108											
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	308.1088	253.7485	229.0891	155.1084	96.0170	0.0000	0.0000	0.0000	0.0000	142.9879	227.6127	311.8384 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1724.5108											
Space heating per m2	(98c) / (4) = 45.3461 (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)
 Fraction of main heating from main system 2 0.0000 (203)
 Fraction of total heating from main system 1 1.0000 (204)
 Fraction of total heating from main system 2 0.0000 (205)
 Efficiency of main space heating system 1 (in %) 170.0000 (206)
 Efficiency of main space heating system 2 (in %) 0.0000 (207)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	308.1088	253.7485	229.0891	155.1084	96.0170	0.0000	0.0000	0.0000	0.0000	142.9879	227.6127	311.8384 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	181.2405	149.2639	134.7583	91.2402	56.4806	0.0000	0.0000	0.0000	0.0000	84.1106	133.8898	183.4343 (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)
Space heating fuel used, main system 2	0.0000 (213)											
Water heating												
Water heating requirement	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (64)
Efficiency of water heater (217)m	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400 (216)
Fuel for water heating, kWh/month	65.6124	57.9124	61.1917	52.9526	50.7663	45.1260	44.0625	46.1421	47.0184	53.1754	57.4627	64.7798 (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	4.6511	4.2010	4.6511	4.5011	4.6511	4.5011	4.6511	4.6511	4.5011	4.6511	4.5011	4.6511 (231)
Lighting	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.0246	-62.3192	-99.7036	-121.5051	-134.8633	-114.8788	-113.3102	-105.6995	-90.9885	-75.2053	-45.2991	-32.9029 (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	-2.0463	-6.2164	-17.0204	-34.9280	-58.3966	-75.1265	-74.1841	-58.1151	-37.3112	-12.4083	-3.4170	-1.4664 (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												1014.4181 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.5400
Water heating fuel used												646.2023 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:		
warm air heating system fans		54.7632 (230b)
Total electricity for the above, kWh/year		54.7632 (231)
Electricity for lighting (calculated in Appendix L)		97.2395 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-1416.3363 (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		396.2868 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1014.4181	16.4900	167.2775 (240)
Space heating - main system 2	0.0000	16.4900	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	646.2023	16.4900	106.5588 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	54.7632	16.4900	9.0305 (249)
Energy for lighting	97.2395	16.4900	16.0348 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1035.7001	16.4900	-170.7869
PV Unit electricity exported	-380.6362	5.5900	-21.2776
Total			-192.0645 (252)
Total energy cost			106.8370 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4632 (257)
SAP value		92.4912
SAP rating (Section 12)		92 (258)
SAP band		A

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	1014.4181	0.1539	156.1014 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	646.2023	0.1412	91.2746 (264)
Space and water heating			247.3760 (265)
Pumps, fans and electric keep-hot	54.7632	0.1387	7.5963 (267)
Energy for lighting	97.2395	0.1443	14.0347 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1035.7001	0.1337	-138.4970
PV Unit electricity exported	-380.6362	0.1164	-44.3139
Total			-182.8109 (269)
Total CO2, kg/year			86.1961 (272)
CO2 emissions per m2			2.2700 (273)
EI value			98.6089
EI rating			99 (274)
EI band			A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

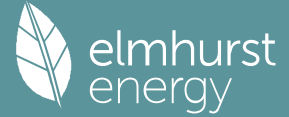
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.0300 (1b)	x 2.4000 (2b)	= 91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	91.2720 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)

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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) =	Air changes per hour	20.0000 / (5) = 0.2191 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50			3.0000 (17)
Infiltration rate			0.3691 (18)
Number of sides sheltered			0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3691 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	3.9000	3.7000	3.8000	3.7000	3.7000	3.3000	3.4000	3.1000	3.1000	3.3000	3.2000	3.5000 (22)
Wind factor	0.9750	0.9250	0.9500	0.9250	0.9250	0.8250	0.8500	0.7750	0.7750	0.8250	0.8000	0.8750 (22a)
Adj infiltr rate												
Effective ac	0.3599	0.3414	0.3507	0.3414	0.3414	0.3045	0.3138	0.2861	0.2861	0.3045	0.2953	0.3230 (22b)
	0.5648	0.5583	0.5615	0.5583	0.5583	0.5464	0.5492	0.5409	0.5409	0.5464	0.5436	0.5522 (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
Front door			2.1700	1.0000	2.1700		(26)
Windows (Uw = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (Uw = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements Aum(A, m ²)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 1982.0900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495
E16 Corner (normal)	12.0000	0.0750	0.9000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.5109 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 37.6537 (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	17.0105	16.8156	16.9118	16.8156	16.8156	16.4565	16.5424	16.2923	16.2923	16.4565	16.3731	16.6309 (38)
Average = Sum(39)m / 12 =	54.6642	54.4693	54.5655	54.4693	54.4693	54.1102	54.1961	53.9460	53.9460	54.1102	54.0268	54.2846 (39)
												54.2714

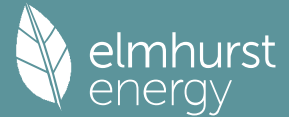
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4374	1.4323	1.4348	1.4323	1.4323	1.4228	1.4251	1.4185	1.4185	1.4228	1.4206	1.4274 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.3550 (42)	
Hot water usage for mixer showers														
	75.2610	74.1300	72.4819	69.3285	67.0013	64.4062	62.9310	64.5667	66.3597	69.1461	72.3673	74.9727 (42a)		
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)		
Hot water usage for other uses	28.5067	27.4701	26.4335	25.3969	24.3603	23.3237	23.3237	24.3603	25.3969	26.4335	27.4701	28.5067 (42c)		
Average daily hot water use (litres/day)													95.3034 (43)	

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	103.7678	101.6001	98.9154	94.7254	91.3616	87.7298	86.2547	88.9270	91.7566	95.5796	99.8374	103.4794 (44)	
Energy content (annual)	164.3428	144.6772	152.0293	129.6743	122.9903	107.8741	104.3176	110.1102	113.1451	129.7007	142.2367	162.0237 (45)	
Distribution loss (46)m = 0.15 x (45)m													
	24.6514	21.7016	22.8044	19.4511	18.4485	16.1811	15.6476	16.5165	16.9718	19.4551	21.3355	24.3036 (46)	
Water storage loss:													
Store volume													98.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.1000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5940 (55)
Total storage loss													
	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (56)	
If cylinder contains dedicated solar storage													
	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (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	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													
	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (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													
	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (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 per year (kWh/year) = Sum(64)m = 1799.9319 (64)

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Heat gains from water heating, kWh/month	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
54.6440 48.1052 50.5497 43.1167 40.8943 35.8681 34.6856 36.6116 37.6207 43.1255 47.2937 53.8729 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.7653	12.2262	9.9430	7.5275	5.6269	4.7505	5.1330	6.6721	8.9553	11.3708	13.2714	14.1478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0488	175.8549	171.3036	161.6145	149.3837	137.8886	130.2091	128.4030	132.9542	142.6434	154.8741	166.3693 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851 (69)
Pumps, fans	5.4763	5.4763	5.4763	5.4763	5.4763	0.0000	0.0000	0.0000	0.0000	5.4763	5.4763	5.4763 (70)
Losses e.g. evaporation (negative values) (Table 5)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)	73.4462	71.5851	67.9432	59.8843	54.9654	49.8168	46.6204	49.2092	52.2510	57.9643	65.6857	72.4098 (72)
Total internal gains	338.3221	336.7279	326.2516	306.0881	287.0379	264.0413	253.5480	255.8698	265.7460	289.0403	310.8930	329.9887 (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	1.5000	23.8018	0.6300	0.7000	0.7700	10.9112 (76)						
West	5.1800	23.8018	0.6300	0.7000	0.7700	37.6800 (80)						
Solar gains	48.5912	83.0259	135.4958	206.3150	237.2990	267.4629	245.7057	214.6057	169.1059	104.2918	59.6827	38.6435 (83)
Total gains	386.9132	419.7539	461.7474	512.4031	524.3368	531.5042	499.2537	470.4755	434.8520	393.3321	370.5757	368.6322 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	1.6715	1.6739	1.6727	1.6739	1.6739	1.6783	1.6773	1.6804	1.6804	1.6783	1.6794	1.6762
tau	10.0720	10.1081	10.0903	10.1081	10.1081	10.1752	10.1590	10.2061	10.2061	10.1752	10.1909	10.1425
alpha	0.8354	0.8097	0.7585	0.6739	0.5712	0.4188	0.3221	0.3523	0.5324	0.7041	0.7995	0.8442 (86)
MIT	18.2291	18.4774	18.9738	19.5896	20.1346	20.5631	20.7092	20.6848	20.3730	19.6924	18.8915	18.1872 (87)
Th 2	19.7348	19.7387	19.7368	19.7387	19.7387	19.7459	19.7442	19.7492	19.7492	19.7459	19.7475	19.7424 (88)
util rest of house	0.8180	0.7897	0.7322	0.6368	0.5167	0.3378	0.2170	0.2470	0.4579	0.6618	0.7750	0.8276 (89)
MIT 2	16.6847	16.9831	17.5735	18.2938	18.9102	19.3556	19.4786	19.4678	19.1859	18.4382	17.4943	16.6393 (90)
Living area fraction	17.4514	17.7250	18.2687	18.9371	19.5180	19.9550	20.0896	20.0720	19.7753	19.0609	18.1879	17.4077 (92)
Temperature adjustment	17.4514	17.7250	18.2687	18.9371	19.5180	19.9550	20.0896	20.0720	19.7753	19.0609	18.1879	17.4077 (93)
adjusted MIT	17.4514	17.7250	18.2687	18.9371	19.5180	19.9550	20.0896	20.0720	19.7753	19.0609	18.1879	17.4077 (93)

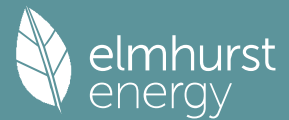
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.7786	0.7505	0.6959	0.6099	0.5062	0.3523	0.2476	0.2760	0.4596	0.6348	0.7374	0.7884 (94)	
Useful gains	301.2315	315.0250	321.3518	312.5036	265.4034	187.2226	123.6146	129.8456	199.8524	249.6749	273.2665	290.6262 (95)
Ext temp.	5.3000	5.9000	7.6000	10.0000	12.9000	15.9000	17.6000	17.4000	15.0000	11.6000	8.2000	5.3000 (96)
Heat loss rate W	664.2473	644.0978	582.1427	486.7973	360.4780	219.4189	134.9247	144.1423	257.6066	403.7084	539.6164	657.2631 (97)
Space heating kWh	270.0837	221.1369	194.0285	125.4915	70.7355	0.0000	0.0000	0.0000	0.0000	114.6009	191.7719	272.7779 (98a)
Space heating requirement - total per year (kWh/year)												1460.6268
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	270.0837	221.1369	194.0285	125.4915	70.7355	0.0000	0.0000	0.0000	0.0000	114.6009	191.7719	272.7779 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1460.6268
Space heating per m2												(98c) / (4) = 38.4072 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	270.0837	221.1369	194.0285	125.4915	70.7355	0.0000	0.0000	0.0000	0.0000	114.6009	191.7719	272.7779 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	158.8728	130.0805	114.1344	73.8185	41.6091	0.0000	0.0000	0.0000	0.0000	67.4123	112.8070	160.4576 (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)

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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	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	0.0000	(215)	
Space heating fuel used, main system 2													0.0000	(213)	
Water heating															
Water heating requirement	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377	180.4377	(64)	
Efficiency of water heater (217)m	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	(216)	
Fuel for water heating, kWh/month	65.6124	57.9124	61.1917	52.9526	50.7663	45.1260	44.0625	46.1421	47.0184	53.1754	57.4627	64.7798	64.7798	(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	0.0000	(221)	
Pumps and Fa	4.6511	4.2010	4.6511	4.5011	4.6511	4.5011	4.6511	4.5011	4.6511	4.5011	4.6511	4.5011	4.6511	(231)	
Lighting	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835	12.3835	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)															
(233a)m	-46.0085	-64.4737	-101.9262	-127.3031	-133.9067	-121.9936	-118.2676	-111.8150	-97.7811	-81.1152	-52.3711	-37.6340	-37.6340	(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	0.0000	(234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)															
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)															
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)	
Electricity generated by PVs (Appendix M) (negative quantity)															
(233b)m	-3.0271	-7.0966	-19.2309	-42.8832	-63.9665	-92.4404	-85.8172	-69.1022	-45.3475	-15.8377	-4.9422	-2.0392	-2.0392	(233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)															
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)															
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)															
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)	
Annual totals kWh/year															
Space heating fuel - main system 1													859.1922	(211)	
Space heating fuel - main system 2													0.0000	(213)	
Space heating fuel - secondary													0.0000	(215)	
Efficiency of water heater													278.5400	(216)	
Water heating fuel used													646.2023	(219)	
Space cooling fuel													0.0000	(221)	
Electricity for pumps and fans:															
warm air heating system fans															
Total electricity for the above, kWh/year													54.7632	(230b)	
Electricity for lighting (calculated in Appendix L)													54.7632	(231)	
													97.2395	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)															
PV generation														-1546.3266	(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														111.0707	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	859.1922	25.1600	216.1728	(240)
Space heating - main system 2	0.0000	25.1600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	646.2023	25.1600	162.5845	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	54.7632	25.1600	13.7784	(249)
Energy for lighting	97.2395	25.1600	24.4655	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1094.5959	25.1600	-275.4003	
PV Unit electricity exported	-451.7307	5.8100	-26.2456	
Total			-301.6459	(252)
Total energy cost			115.3553	(255)

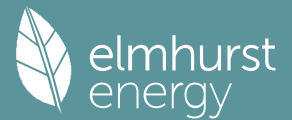
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	859.1922	0.1543	132.5767	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	646.2023	0.1412	91.2746	(264)
Space and water heating			223.8512	(265)
Pumps, fans and electric keep-hot	54.7632	0.1387	7.5963	(267)
Energy for lighting	97.2395	0.1443	14.0347	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1094.5959	0.1339	-146.5835	
PV Unit electricity exported	-451.7307	0.1166	-52.6510	
Total			-199.2345	(269)
Total CO2, kg/year			46.2477	(272)

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	859.1922	1.5713	1350.0257	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	646.2023	1.5223	983.7137	(278)
Space and water heating			2333.7394	(279)

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Pumps, fans and electric keep-hot	54.7632	1.5128	82.8458 (281)
Energy for lighting	97.2395	1.5338	149.1492 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1094.5959	1.4949	-1636.3115
PV Unit electricity exported			-192.9363
Total	-451.7307	0.4271	-1829.2478 (283)
Total Primary energy kWh/year			736.4865 (286)

SAP 10 EPC IMPROVEMENTS

00001_updated design cool ene

Current energy efficiency rating: A 92
 Current environmental impact rating: A 99

N Solar water heating			Recommended
U Solar photovoltaic panels			Already installed
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-18 kg (38.1%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£29	0.46 kg/m ²	A 94	A 99
Total Savings	£29	0.46 kg/m ²		

Potential energy efficiency rating: A 94
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
 Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Severn Valley):

	Current	Potential	Saving
Electricity	£417	£380	£37
Space heating	£230	£250	-£20
Water heating	£163	£105	£57
Lighting	£24	£24	£0
Generated (PV)	-£302	-£293	-£9
Total cost of fuels	£115	£87	£28
Total cost of uses	£115	£86	£28
Delivered energy	3 kWh/m ²	-1 kWh/m ²	4 kWh/m ²
Carbon dioxide emissions	0.0 tonnes	0.0 tonnes	0.0 tonnes
CO2 emissions per m ²	1 kg/m ²	1 kg/m ²	0 kg/m ²
Primary energy	19 kWh/m ²	15 kWh/m ²	4 kWh/m ²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

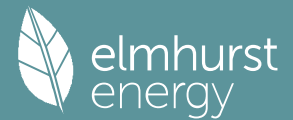
1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0300 (1b)	2.4000 (2b)	91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 91.2720 (5)

2. Ventilation rate

		m3 per hour
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.2191 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		3.0000 (17)
Infiltration rate		0.3691 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3691 (21)

Full SAP Calculation Printout



	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 infiltr rate												
Effective ac	0.4706	0.4614	0.4522	0.4060	0.3968	0.3507	0.3507	0.3414	0.3691	0.3968	0.4153	0.4337 (22b)
	0.6107	0.6064	0.6022	0.5824	0.5787	0.5615	0.5615	0.5583	0.5681	0.5787	0.5862	0.5941 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front door			2.1700	1.0000	2.1700		(26)
Windows (Uw = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (Uw = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements Aum(A, m2)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) = 1982.0900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							52.1191 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495
E16 Corner (normal)	12.0000	0.0750	0.9000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.5109 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 37.6537 (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	18.3956	18.2661	18.1391	17.5428	17.4312	16.9118	16.9118	16.8156	17.1118	17.4312	17.6569	17.8929 (38)
Heat transfer coeff	56.0493	55.9197	55.7928	55.1964	55.0849	54.5655	54.5655	54.4693	54.7655	55.0849	55.3106	55.5465 (39)
Average = Sum(39)m / 12 =												55.1959

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4738	1.4704	1.4671	1.4514	1.4485	1.4348	1.4348	1.4323	1.4401	1.4485	1.4544	1.4606 (40)
HLP (average)												1.4514
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.3550 (42)	
Hot water usage for mixer showers													74.9727 (42a)
Hot water usage for baths													0.0000 (42b)
Hot water usage for other uses													28.5067 (42c)
Average daily hot water use (litres/day)													95.3034 (43)
Daily hot water use	103.7678	101.6001	98.9154	94.7254	91.3616	87.7298	86.2547	88.9270	91.7566	95.5796	99.8374	103.4794 (44)	
Energy conte	164.3428	144.6772	152.0293	129.6743	122.9903	107.8741	104.3176	110.1102	113.1451	129.7007	142.2367	162.0237 (45)	
Energy content (annual)													Total = Sum(45)m = 1583.1219
Distribution loss (46)m = 0.15 x (45)m	24.6514	21.7016	22.8044	19.4511	18.4485	16.1811	15.6476	16.5165	16.9718	19.4551	21.3355	24.3036 (46)	
Water storage loss:													98.0000 (47)
Store volume													1.1000 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.5940 (55)
Enter (49) or (54) in (55)													
Total storage loss	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (56)	
If cylinder contains dedicated solar storage	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (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	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	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (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)	
Aperture area of solar collector												3.0000 (H1)	
Zero-loss collector efficiency												0.8000 (H2)	
Collector linear heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0000 (H4)	
Collector loop efficiency												0.9000 (H5)	
Incidence angle modifier												1.0000 (H6)	
Overshading factor												0.8000 (H8)	
Overall heat loss coefficient of system												6.5000 (H10)	
Heat loss coefficient of collector loop												3.9667 (H11)	
Dedicated solar storage volume												75.0000 (H12)	
Effective solar volume												75.0000 (H14)	
Reference volume												225.0000 (H15)	
Storage tank correction coefficient												1.3161 (H16)	
Heat delivered to hot water												560.8379 (H24)	
Heat delivered to space heating												0.0000 (H29)	
Solar input												560.8379	
Solar input	-0.0000	-16.3375	-54.9929	-73.0579	-92.5583	-84.4309	-83.2231	-74.6772	-53.3478	-28.2122	-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	182.7568	144.9717	115.4504	74.4364	48.8460	41.2631	39.5085	53.8470	77.6172	119.9025	160.0567	180.4377 (64)	
Total per year (kWh/year) = Sum(64)m =												1239.0940 (64)	

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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	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	54.6440	48.1052	50.5497	43.1167	40.8943	35.8681	34.6856	36.6116	37.6207	43.1255	47.2937	53.8729	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	13.7653	12.2262	9.9430	7.5275	5.6269	4.7505	5.1330	6.6721	8.9553	11.3708	13.2714	14.1478	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	174.0488	175.8549	171.3036	161.6145	149.3837	137.8886	130.2091	128.4030	132.9542	142.6434	154.8741	166.3693	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	(69)
Pumps, fans	5.4763	5.4763	5.4763	5.4763	5.4763	0.0000	0.0000	0.0000	0.0000	5.4763	5.4763	5.4763	(70)
Losses e.g. evaporation (negative values) (Table 5)	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	(71)
Water heating gains (Table 5)	73.4462	71.5851	67.9432	59.8843	54.9654	49.8168	46.6204	49.2092	52.2510	57.9643	65.6857	72.4098	(72)
Total internal gains	338.3221	336.7279	326.2516	306.0881	287.0379	264.0413	253.5480	255.8698	265.7460	289.0403	310.8930	329.9887	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
East	1.5000	19.6403	0.6300	0.7000	0.7700	0.7700	9.0035 (76)						
West	5.1800	19.6403	0.6300	0.7000	0.7700	0.7700	31.0920 (80)						
Solar gains	40.0955	78.4353	129.1718	188.3893	230.8782	236.3449	225.0100	193.2802	150.2321	93.0701	49.9944	32.9726	(83)
Total gains	378.4176	415.1632	455.4234	494.4774	517.9160	500.3862	478.5580	449.1500	415.9781	382.1104	360.8874	362.9613	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area, nil,m (see Table 9a)	9.8232	9.8459	9.8683	9.9749	9.9951	10.0903	10.0903	10.1081	10.0534	9.9951	9.9543	9.9121	21.0000 (85)
tau	1.6549	1.6564	1.6579	1.6650	1.6663	1.6727	1.6727	1.6739	1.6702	1.6663	1.6636	1.6608	
util living area	0.8537	0.8286	0.7846	0.7144	0.6215	0.5109	0.4080	0.4403	0.5952	0.7432	0.8260	0.8614	(86)
MIT	17.9019	18.1676	18.6636	19.3077	19.9047	20.3690	20.6057	20.5669	20.1922	19.4296	18.5590	17.8475	(87)
Th 2	19.7072	19.7098	19.7123	19.7242	19.7264	19.7368	19.7368	19.7387	19.7328	19.7264	19.7219	19.7172	(88)
util rest of house	0.8385	0.8109	0.7617	0.6823	0.5748	0.4415	0.3137	0.3466	0.5301	0.7072	0.8052	0.8470	(89)
MIT 2	16.2762	16.5956	17.1906	17.9584	18.6472	19.1622	19.3922	19.3633	18.9878	18.1226	17.0827	16.2156	(90)
Living area fraction	17.0833	17.3760	17.9219	18.6283	19.2715	19.7613	19.9947	19.9608	19.5857	18.7714	17.8156	17.0258	(91)
MIT	17.0833	17.3760	17.9219	18.6283	19.2715	19.7613	19.9947	19.9608	19.5857	18.7714	17.8156	17.0258	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0833	17.3760	17.9219	18.6283	19.2715	19.7613	19.9947	19.9608	19.5857	18.7714	17.8156	17.0258	(93)

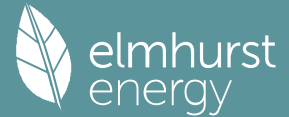
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.7990	0.7709	0.7232	0.6503	0.5561	0.4430	0.3344	0.3645	0.5216	0.6750	0.7663	0.8080	(94)
Useful gains	302.3692	320.0537	329.3445	321.5368	288.0201	221.6465	160.0308	163.7315	216.9640	257.9341	276.5586	293.2889	(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	716.4940	697.6557	637.2600	536.9651	417.0752	281.6282	185.2315	193.9552	300.4289	450.1222	592.6873	712.4265	(97)
Space heating kWh	308.1088	253.7485	229.0891	155.1084	96.0170	0.0000	0.0000	0.0000	0.0000	142.9879	227.6127	311.8384	(98a)
Space heating requirement - total per year (kWh/year)												1724.5108	
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	308.1088	253.7485	229.0891	155.1084	96.0170	0.0000	0.0000	0.0000	0.0000	142.9879	227.6127	311.8384	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1724.5108	
Space heating per m2												45.3461	(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)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													170.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	308.1088	253.7485	229.0891	155.1084	96.0170	0.0000	0.0000	0.0000	0.0000	142.9879	227.6127	311.8384	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	181.2405	149.2639	134.7583	91.2402	56.4806	0.0000	0.0000	0.0000	0.0000	84.1106	133.8898	183.4343	(211)

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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	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	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	0.0000	(215)
Space heating fuel used, main system 2													0.0000	(213)
Water heating														
Water heating requirement	182.7568	144.9717	115.4504	74.4364	48.8460	41.2631	39.5085	53.8470	77.6172	119.9025	160.0567	180.4377	180.4377	(64)
Efficiency of water heater (217)m	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	(216)
Fuel for water heating, kWh/month	65.6124	52.0470	41.4484	26.7238	17.5364	14.8141	14.1842	19.3319	27.8657	43.0468	57.4627	64.7798	64.7798	(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	0.0000	(221)
Pumps and Fa	11.4456	10.3380	11.4456	11.0764	11.4456	11.0764	11.4456	11.4456	11.0764	11.4456	11.0764	11.4456	11.4456	(231)
Lighting	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835	12.3835	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-39.0555	-62.3235	-99.1387	-119.3886	-129.4019	-106.2437	-104.9145	-99.9355	-88.6553	-75.0714	-45.3594	-32.9254	-32.9254	(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	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-2.0155	-6.2121	-17.5852	-37.0444	-63.8580	-83.7615	-82.5797	-63.8792	-39.6444	-12.5422	-3.3567	-1.4440	-1.4440	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													1014.4181	(211)
Space heating fuel - main system 2													0.0000	(213)
Space heating fuel - secondary													0.0000	(215)
Efficiency of water heater													278.5400	
Water heating fuel used													444.8531	(219)
Space cooling fuel													0.0000	(221)
Electricity for pumps and fans:														
warm air heating system fans													54.7632	(230b)
pump for solar water heating													80.0000	(230g)
Total electricity for the above, kWh/year													134.7632	(231)
Electricity for lighting (calculated in Appendix L)													97.2395	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-1416.3363	(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													0.0000	
Energy saved or generated													-0.0000	(236)
Energy used													0.0000	(237)
Total delivered energy for all uses													274.9377	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1014.4181	16.4900	167.2775 (240)
Space heating - main system 2	0.0000	16.4900	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	444.8531	16.4900	73.3563 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	54.7632	16.4900	9.0305 (249)
Pump for solar water heating	80.0000	16.4900	13.1920 (249)
Energy for lighting	97.2395	16.4900	16.0348 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1002.4134	16.4900	-165.2980
PV Unit electricity exported	-413.9229	5.5900	-23.1383
Total			-188.4363 (252)
Total energy cost			90.4548 (255)

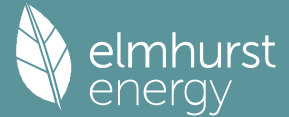
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.3922 (257)
SAP value		93.6426
SAP rating (Section 12)		94 (258)
SAP band		A

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	1014.4181	0.1539	156.1014 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	444.8531	0.1473	65.5075 (264)
Space and water heating			221.6089 (265)
Pumps, fans and electric keep-hot	134.7632	0.1387	18.6933 (267)
Energy for lighting	97.2395	0.1443	14.0347 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1002.4134	0.1342	-134.4889
PV Unit electricity exported	-413.9229	0.1158	-47.9185

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Total	-182.4074 (269)
Total CO2, kg/year	71.9295 (272)
CO2 emissions per m2	1.8900 (273)
EI value	98.8391
EI rating	99 (274)
EI band	A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.0300 (1b)	2.4000 (2b)	91.2720 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	38.0300		91.2720 (4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 91.2720 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	20.0000 / (5) = 0.2191 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.3691 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3691 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	3.9000	3.7000	3.8000	3.7000	3.7000	3.3000	3.4000	3.1000	3.1000	3.3000	3.2000	3.5000 (22)
Wind factor	0.9750	0.9250	0.9500	0.9250	0.9250	0.8250	0.8500	0.7750	0.7750	0.8250	0.8000	0.8750 (22a)
Adj infilt rate	0.3599	0.3414	0.3507	0.3414	0.3414	0.3045	0.3138	0.2861	0.2861	0.3045	0.2953	0.3230 (22b)
Effective ac	0.5648	0.5583	0.5615	0.5583	0.5583	0.5464	0.5492	0.5409	0.5409	0.5464	0.5436	0.5522 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Front door			2.1700	1.0000	2.1700		(26)
Windows (Uw = 0.80)			1.5000	0.7752	1.1628		(27)
Patio doors (Uw = 1.00)			5.1800	0.9615	4.9808		(27)
Heatloss Floor			38.0300	0.1700	6.4651	0.0000	0.0000 (28a)
External Wall	54.4600	8.8500	45.6100	0.1600	7.2976	14.0000	638.5400 (29a)
Wall to store	5.5200		5.5200	0.1600	0.8832	14.0000	77.2800 (29a)
External Roof	38.0300		38.0300	0.1100	4.1833	9.0000	342.2700 (30)
Total net area of external elements Aum(A, m2)			136.0400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 27.1428		(33)
Internal Wall 1			66.0000			14.0000	924.0000 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) = 1982.0900		(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							52.1191 (35)

List of Thermal Bridges

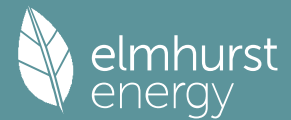
K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	5.5100	0.0060	0.0331
E3 Sill	3.0000	0.0120	0.0360
E4 Jamb	13.2000	0.0230	0.3036
E5 Ground floor (normal)	24.9900	0.3200	7.9968
E14 Flat roof	24.9900	0.0540	1.3495
E16 Corner (normal)	12.0000	0.0750	0.9000
E17 Corner (inverted - internal area greater than external area)	2.4000	-0.0450	-0.1080
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.5109 (36)
Point Thermal bridges			0.0000
Total fabric heat loss			(33) + (36) + (36a) = 37.6537 (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
(38)m	17.0105	16.8156	16.9118	16.8156	16.8156	16.4565	16.5424	16.2923	16.2923	16.4565	16.3731	16.6309 (38)
Heat transfer coeff	54.6642	54.4693	54.5655	54.4693	54.4693	54.1102	54.1961	53.9460	53.9460	54.1102	54.0268	54.2846 (39)
Average = Sum(39)m / 12 =												54.2714

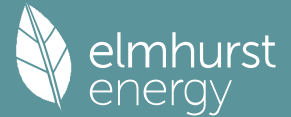
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4374	1.4323	1.4348	1.4323	1.4323	1.4228	1.4251	1.4185	1.4185	1.4228	1.4206	1.4274 (40)
HLP (average)												1.4271
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)												
Assumed occupancy												1.3550 (42)
Hot water usage for mixer showers												74.9727 (42a)
Hot water usage for baths												0.0000 (42b)
Hot water usage for other uses												28.5067 (42c)
Average daily hot water use (litres/day)												95.3034 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	103.7678	101.6001	98.9154	94.7254	91.3616	87.7298	86.2547	88.9270	91.7566	95.5796	99.8374	103.4794 (44)
Energy content (annual)	164.3428	144.6772	152.0293	129.6743	122.9903	107.8741	104.3176	110.1102	113.1451	129.7007	142.2367	162.0237 (45)
Distribution loss (46)m = 0.15 x (45)m												1583.1219
Water storage loss:												
Store volume												98.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5940 (55)
Total storage loss												
	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (56)
If cylinder contains dedicated solar storage												
	18.4140	16.6320	18.4140	17.8200	18.4140	17.8200	18.4140	18.4140	17.8200	18.4140	17.8200	18.4140 (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	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												
	182.7568	161.3092	170.4433	147.4943	141.4043	125.6941	122.7316	128.5242	130.9651	148.1147	160.0567	180.4377 (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)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												635.4766 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												635.4766
Solar input	-2.1267	-19.7052	-59.4361	-81.8529	-95.9958	-95.6741	-90.9982	-83.9818	-62.7964	-36.1693	-6.7400	-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												
	180.6301	141.6040	111.0071	65.6414	45.4085	30.0199	31.7334	44.5424	68.1687	111.9453	153.3166	180.4377 (64)
Electric shower(s)												1164.4553 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	54.6440	48.1052	50.5497	43.1167	40.8943	35.8681	34.6856	36.6116	37.6207	43.1255	47.2937	53.8729 (65)
5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011	81.3011 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	13.7653	12.2262	9.9430	7.5275	5.6269	4.7505	5.1330	6.6721	8.9553	11.3708	13.2714	14.1478 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	174.0488	175.8549	171.3036	161.6145	149.3837	137.8886	130.2091	128.4030	132.9542	142.6434	154.8741	166.3693 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851	44.4851 (69)
Pumps, fans	5.4763	5.4763	5.4763	5.4763	5.4763	0.0000	0.0000	0.0000	0.0000	5.4763	5.4763	5.4763 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007	-54.2007 (71)
Water heating gains (Table 5)												
	73.4462	71.5851	67.9432	59.8843	54.9654	49.8168	46.6204	49.2092	52.2510	57.9643	65.6857	72.4098 (72)
Total internal gains												329.9887 (73)
	338.3221	336.7279	326.2516	306.0881	287.0379	264.0413	253.5480	255.8698	265.7460	289.0403	310.8930	329.9887 (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			1.5000	23.8018	0.6300	0.7000	0.7700	10.9112 (76)				
West			5.1800	23.8018	0.6300	0.7000	0.7700	37.6800 (80)				
Solar gains	48.5912	83.0259	135.4958	206.3150	237.2990	267.4629	245.7057	214.6057	169.1059	104.2918	59.6827	38.6435 (83)
Total gains	386.9132	419.7539	461.7474	512.4031	524.3368	531.5042	499.2537	470.4755	434.8520	393.3321	370.5757	368.6322 (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

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tau	10.0720	10.1081	10.0903	10.1081	10.1081	10.1752	10.1590	10.2061	10.2061	10.1752	10.1909	10.1425
alpha	1.6715	1.6739	1.6727	1.6739	1.6739	1.6783	1.6773	1.6804	1.6804	1.6783	1.6794	1.6762
util living area	0.8354	0.8097	0.7585	0.6739	0.5712	0.4188	0.3221	0.3523	0.5324	0.7041	0.7995	0.8442 (86)
MIT	18.2291	18.4774	18.9738	19.5896	20.1346	20.5631	20.7092	20.6848	20.3730	19.6924	18.8915	18.1872 (87)
Th 2	19.7348	19.7387	19.7368	19.7387	19.7387	19.7459	19.7442	19.7492	19.7492	19.7459	19.7475	19.7424 (88)
util rest of house	0.8180	0.7897	0.7322	0.6368	0.5167	0.3378	0.2170	0.2470	0.4579	0.6618	0.7750	0.8276 (89)
MIT 2	16.6847	16.9831	17.5735	18.2938	18.9102	19.3556	19.4786	19.4678	19.1859	18.4382	17.4943	16.6393 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	17.4514	17.7250	18.2687	18.9371	19.5180	19.9550	20.0896	20.0720	19.7753	19.0609	18.1879	17.4077 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4514	17.7250	18.2687	18.9371	19.5180	19.9550	20.0896	20.0720	19.7753	19.0609	18.1879	17.4077 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7786	0.7505	0.6959	0.6099	0.5062	0.3523	0.2476	0.2760	0.4596	0.6348	0.7374	0.7884 (94)
Useful gains	301.2315	315.0250	321.3518	312.5036	265.4034	187.2226	123.6146	129.8456	199.8524	249.6749	273.2665	290.6262 (95)
Ext temp.	5.3000	5.9000	7.6000	10.0000	12.9000	15.9000	17.6000	17.4000	15.0000	11.6000	8.2000	5.3000 (96)
Heat loss rate W	664.2473	644.0978	582.1427	486.7973	360.4780	219.4189	134.9247	144.1423	257.6066	403.7084	539.6164	657.2631 (97)
Space heating kWh	270.0837	221.1369	194.0285	125.4915	70.7355	0.0000	0.0000	0.0000	0.0000	114.6009	191.7719	272.7779 (98a)
Space heating requirement - total per year (kWh/year)												1460.6268
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	270.0837	221.1369	194.0285	125.4915	70.7355	0.0000	0.0000	0.0000	0.0000	114.6009	191.7719	272.7779 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1460.6268
Space heating per m2										(98c) / (4) =		38.4072 (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)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	270.0837	221.1369	194.0285	125.4915	70.7355	0.0000	0.0000	0.0000	0.0000	114.6009	191.7719	272.7779 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	158.8728	130.0805	114.1344	73.8185	41.6091	0.0000	0.0000	0.0000	0.0000	67.4123	112.8070	160.4576 (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)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	180.6301	141.6040	111.0071	65.6414	45.4085	30.0199	31.7334	44.5424	68.1687	111.9453	153.3166	180.4377 (64)
Efficiency of water heater (217)m	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400	278.5400 (216)
Fuel for water heating, kWh/month	64.8489	50.8380	39.8532	23.5663	16.3023	10.7776	11.3928	15.9914	24.4736	40.1900	55.0429	64.7798 (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 (235b)m	11.4456	10.3380	11.4456	11.0764	11.4456	11.0764	11.4456	11.4456	11.0764	11.4456	11.0764	11.4456 (231)
Lighting (235c)m	12.0486	9.6659	8.7030	6.3762	4.9252	4.0239	4.4929	5.8401	7.5857	9.9528	11.2417	12.3835 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-46.0512	-64.4558	-101.1659	-124.1123	-127.2849	-109.7940	-107.5168	-103.8928	-94.1957	-80.7780	-52.4297	-37.6669 (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	-2.9844	-7.1145	-19.9912	-46.0740	-70.5884	-104.6400	-96.5679	-77.0244	-48.9329	-16.1749	-4.8836	-2.0063 (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												859.1922 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												278.5400
Water heating fuel used												418.0568 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
warm air heating system fans												54.7632 (230b)
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												134.7632 (231)
Electricity for lighting (calculated in Appendix L)												97.2395 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1546.3266 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)

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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	-37.0749 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	859.1922	25.1600	216.1728 (240)
Space heating - main system 2	0.0000	25.1600	0.0000 (241)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	418.0568	25.1600	105.1831 (247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000 (247a)
Pumps, fans and electric keep-hot	54.7632	25.1600	13.7784 (249)
Pump for solar water heating	80.0000	25.1600	20.1280 (249)
Energy for lighting	97.2395	25.1600	24.4655 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1049.3440	25.1600	-264.0149
PV Unit electricity exported	-496.9826	5.8100	-28.8747
Total			-292.8896 (252)
Total energy cost			86.8381 (255)

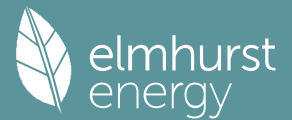
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	859.1922	0.1543	132.5767 (261)
Space heating - main system 2	0.0000	0.0000	0.0000 (262)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	418.0568	0.1483	61.9950 (264)
Space and water heating			194.5717 (265)
Pumps, fans and electric keep-hot	134.7632	0.1387	18.6933 (267)
Energy for lighting	97.2395	0.1443	14.0347 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1049.3440	0.1345	-141.1272
PV Unit electricity exported	-496.9826	0.1158	-57.5651
Total			-198.6923 (269)
Total CO2, kg/year			28.6074 (272)

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	859.1922	1.5713	1350.0257 (275)
Space heating - main system 2	0.0000	0.0000	0.0000 (276)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	418.0568	1.5486	647.4225 (278)
Space and water heating			1997.4481 (279)
Pumps, fans and electric keep-hot	134.7632	1.5128	203.8698 (281)
Energy for lighting	97.2395	1.5338	149.1492 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1049.3440	1.4971	-1570.9399
PV Unit electricity exported	-496.9826	0.4244	-210.9033
Total			-1781.8433 (283)
Total Primary energy kWh/year			568.6239 (286)

Predicted Energy Assessment



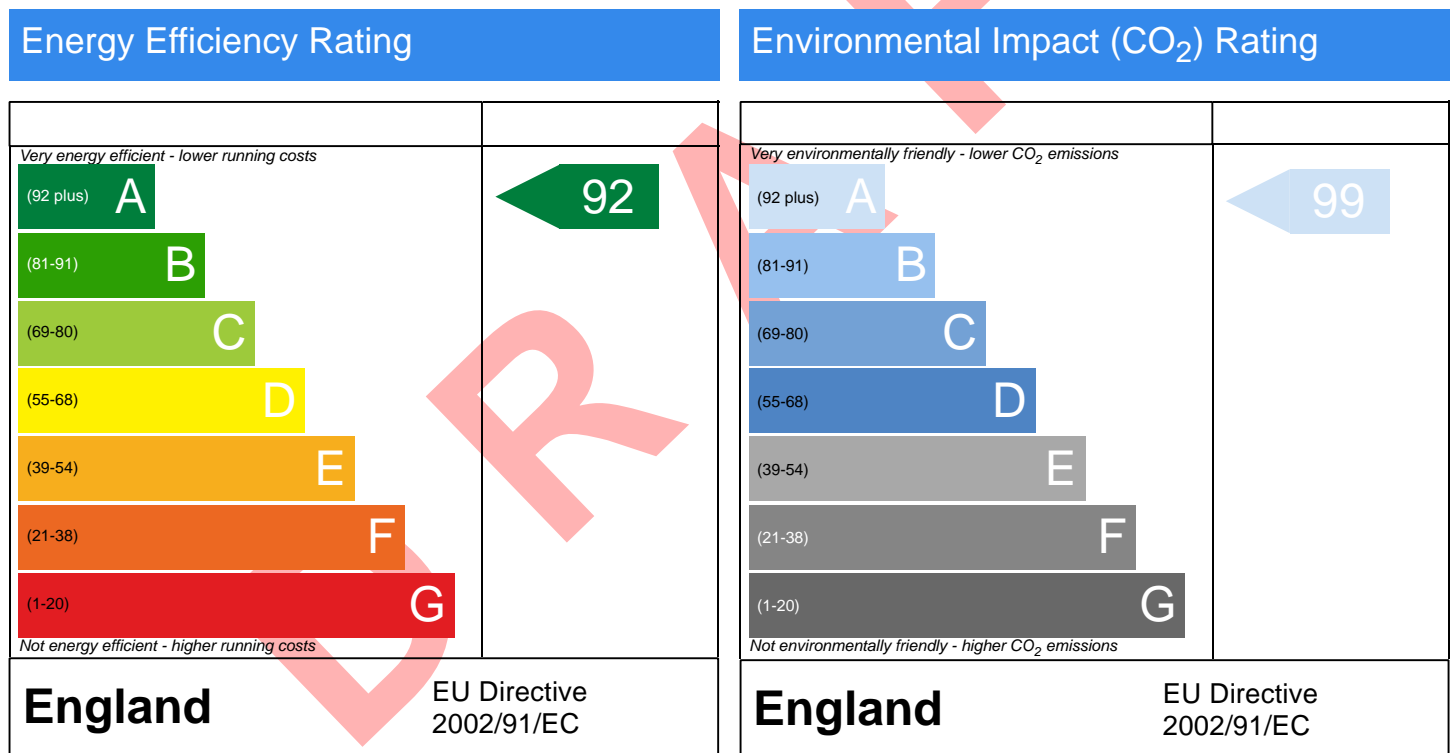
4, Beaufort Close, Redfield, Bristol, BS5 8DJ

Dwelling type:
Date of assessment:
Produced by:
Total floor area:
DRRN:

Bungalow, Detached
17/01/2024
Natalie Wheeler
39.03 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

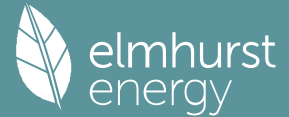
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Summary for Input Data



Property Reference	Beaufort Close	Issued on Date	17/01/2024
Assessment Reference	00001_updated design cool ene	Prop Type Ref	
Property	4, Beaufort Close, Redfield, Bristol, BS5 8DJ		

SAP Rating	92 A	DER	2.41	TER	14.53
Environmental	99 A	% DER < TER			83.41
CO ₂ Emissions (t/year)	0.05	DFEE	49.93	TFEE	50.16
Compliance Check	See BREL	% DFEE < TFEE			0.44
% DPER < TPER	60.95	DPER	30.36	TPER	77.73

Assessor Details	Ms. Natalie Wheeler	Assessor ID	AX45-0001
Client			

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	East
Property Tenure	ND
Transaction Type	6
Terrain Type	Suburban
1.0 Property Type	Bungalow, Detached
2.0 Number of Storeys	1
3.0 Date Built	2024
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown
6.0 Thermal Mass Parameter	Precise calculation

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	Yes
Smart gas meter fitted	Yes

7.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Unheated Space Floor Area	Average Storey Height
Ground floor:	24.99 m	38.03 m ²	1.00 m ²	2.40 m

8.0 Living Area	18.88	m ²
-----------------	-------	----------------

9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res (m ²)	Shelter	Openings	Area Calculation Type
	External Wall	Steel Frame	Steel frame wall (warm frame or hybrid construction)	0.16	14.00	54.46	45.61	0.00	None	8.85	Enter Gross Area
	Wall to store	Steel Frame	Steel frame wall (warm frame or hybrid construction)	0.16	14.00	5.52	5.52	0.00	None	0.00	Enter Gross Area

9.2 Internal Walls	Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Wall 1	Other	14.00	66.00

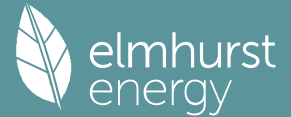
10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof	External Flat Roof	Plasterboard, insulated flat roof	0.11	9.00	38.03	38.03	None	0.00	Enter Gross Area	0.00

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
	Heatloss Floor	Ground Floor - Solid	Lowest occupied	Other	0.17	None	0.00	0.00	38.03

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
	Front door	Manufacturer	Solid Door							1.00
	Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	0.80
	Patio doors	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.00

13.0 Openings

Summary for Input Data



Name	Opening Type	Location	Orientation	Area (m ²)	Pitch
Front door	Front door	External Wall	East	2.17	
Kitchen/Diner	Windows	External Wall	East	1.50	
Lounge	Patio doors	External Wall	West	3.23	
Bedroom	Patio doors	External Wall	West	1.95	

14.0 Conservatory

15.0 Draught Proofing %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E1 Steel lintel with perforated steel base plate	Gov Approved Scheme	5.51	0.01	0.01 ROI 5.19	Yes
E3 Sill	Gov Approved Scheme	3.00	0.01	0.01 ROI 5.21	No
E4 Jamb	Gov Approved Scheme	13.20	0.02	0.02 ROI 5.2	Yes
E5 Ground floor (normal)	Table K1 - Default	24.99	0.32	0.32	Yes
E14 Flat roof	Gov Approved Scheme	24.99	0.05	0.05 ROI 5.17	Yes
E16 Corner (normal)	Gov Approved Scheme	12.00	0.07	0.07 ROI 5.23.1	No
E17 Corner (inverted – internal area greater than external area)	Gov Approved Scheme	2.40	-0.04	-0.04 ROI 5.23.2	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Test Method

19.0 Mechanical Ventilation

Mechanical Ventilation
Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

21.0 Fixed Cooling System

22.0 Lighting

No Fixed Lighting

Name	Efficacy	Power	Capacity	Count
Lighting	90.00	6	540	12

24.0 Main Heating 1

Percentage of Heat %

Fuel Type

SAP Code

In Winter

In Summer

Controls SAP Code

25.0 Main Heating 2

Percentage of Heat %

Database Ref. No.

Fuel Type

In Winter

In Summer

Model Name

Manufacturer

Controls

Flow Temperature

26.0 Heat Networks

Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1									

Summary for Input Data



Heat source 2
Heat source 3
Heat source 4
Heat source 5

28.0 Water Heating

Water Heating	Main Heating 2
SAP Code	914
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	0
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
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28.3 Waste Water Heat Recovery System

29.0 Hot Water Cylinder

Hot Water Cylinder	
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	98.00 L
Loss	1.10 kWh/day
Pipes insulation	Fully insulated primary pipework
In Airing Cupboard	No

31.0 Thermal Store

Thermal Store Pipework	Integrated
	within a single casing

32.0 Photovoltaic Unit

Export Capable Meter?	Yes
Connected To Dwelling	Yes
Diverter	Yes
Battery Capacity [kWh]	5.00

PV Cells kWp	Orientation	Elevation	Overshading	FGHRS	MCS Certificate	Overshading Factor	MCS Certificate Reference	Panel Manufacturer
1.64	South	30°	None Or Little		No	1.00		

34.0 Small-scale Hydro

None											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost	Typical savings per year	Ratings after improvement
£4,000 - £6,000	£29	SAP rating Environmental Impact
		A 94 A 99
		0 0
		0 0



Part G Compliance Report

PROJECT DETAILS

Project Reference: RS2031
Client: MMC Homebuilding Ltd
Property: 4 Beaufort Close
Redfield
Bristol BS5 8DJ

Local Authority:
Agent:

Assessor: Natalie Wheeler
Address: RS Energy
Contact: info@rsenergy.co.uk
Software: G-Calc 2015 version 3.0.2
Prepared on: 17-Jan-24

RESULT SUMMARY

By following the Government's national calculation methodology for assessing water efficiency in new dwellings this 1 bed dwelling, as designed, achieves a water consumption of 109 litres per person per day.

Compliance with Building Regulation 36(1) has been demonstrated.

Table 1: The Water Calculator for New Dwellings					
Installation Type	Unit of measure	Value	Use factor	Fixed use	litres/person/day
WC(single flush)	Flush volume (litres)		4.42	0.00	0
WC(dual flush)	Full flush vol.	6	1.46	0.00	8.76
	Part flush vol.	2.6	2.96	0.00	7.7
WC(multiple fittings)	Average effective Flush vol. (litres)	0	4.42	0.00	0
Taps(excl. Kitchen)	Flow rate (litres/min)	5	1.58	1.58	9.48
Bath (shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (bath also present)	Flow rate (litres/min)	8	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.50	0.00	0
Shower only	Flow rate (litres/minute)		5.6	0.00	0
Kitchen sink taps	Flow rate (litres/minute)	6	0.44	10.36	13
Washing Machine	litres/kg dry load	8.17	2.1	0.0	17.16
Dishwasher	litres/place setting	1.25	3.6	0.0	4.5
Waste disposal	litres/use	0	3.08	0.0	0
Water softener	litres/person/day	0	1.0	0.0	0
Total calculated use (litres/person/day)					114.26
Contribution from greywater (litres/person/day)					-
Contribution from rainwater (litres/person/day)					-
Normalisation factor					0.91
Total Water Consumption. Code for Sustainable Homes (litres/person/day)					104
External water use					5.0
Total Water Consumption. (36(1)) (litres/person/day)					109

Summary of fitting types "As Designed"			
Type	Description	Flow rates, volumes etc.	Qty
Taps	TBC	5 litres/min	1
Baths	TBC	170 litres to overflow	1
Dishwashers	TBC	1.25 litres/place	1
Washing Machines	TBC	8.17 litres/kg	1
Showers	TBC	8 litres/min	1
WC's	TBC	6 / 2.6 litres flush vols.	1
Kitchen/Utility taps	TBC	6 litres/min	1

The lower section of this table is to be filled in by the builder prior to completion. The descriptions, values and quantities should represent the 'as built' specification. Please note the values above represent design values and should not be exceeded without prior consultation with the agent/designer ().
The completed table should be returned to the assessor: Natalie Wheeler (Contact: info@rsenergy.co.uk).

Declaration of fitting types "As Built"			
Type	Make and Model	Flow rates, volumes etc.	Qty
Taps			
Baths			
Dishwashers			
Washing Machines			
Showers			
WC's			
Kitchen/Utility taps			

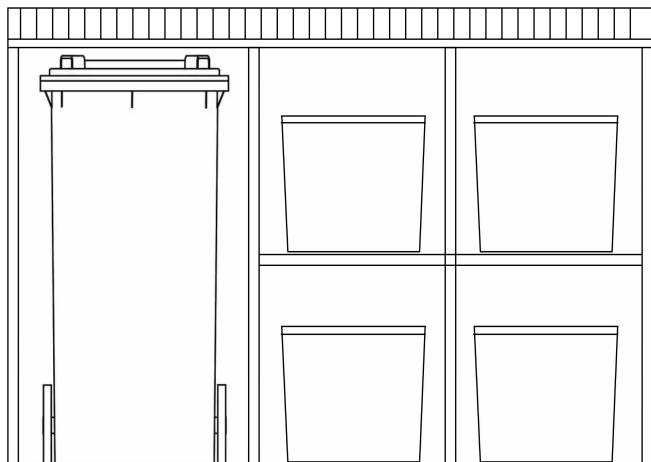
Project ref: RS2031 - 4 Beaufort Close

The above declaration of fittings, values and quantities is a true reflection of those installed on this project.

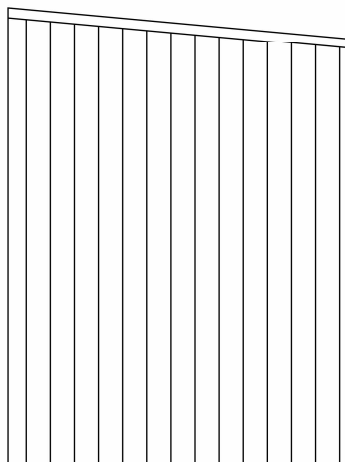
Name: Signature: Date:

-----End of Report-----

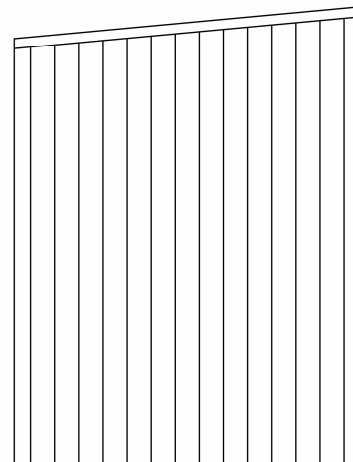
Appendix D



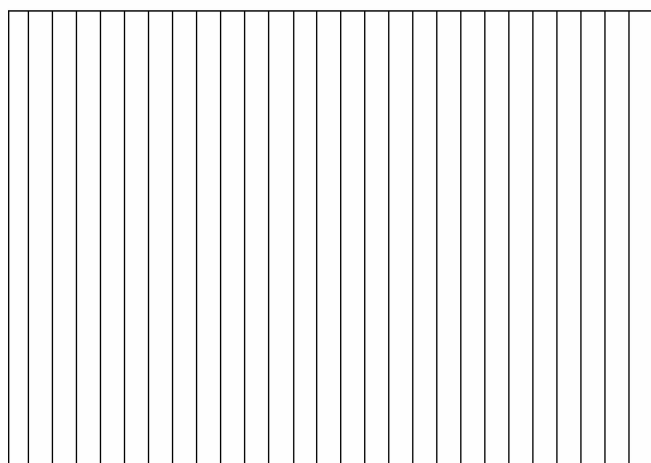
Front Elevation



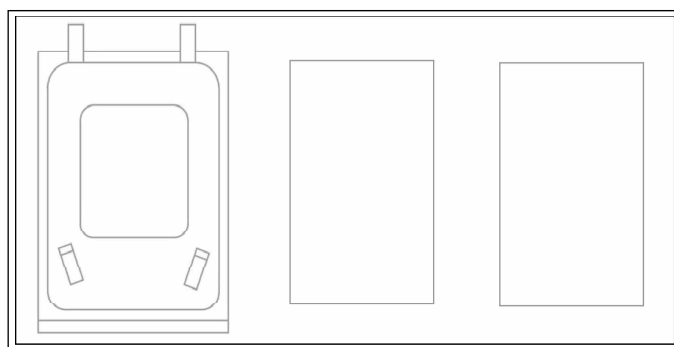
Side Elevation



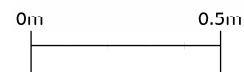
Side Elevation



Rear Elevation



Floor Plan



 COTSWOLD VALE PLANNING <small>Resolute Planning Services</small>	© Cotswold Vale Planning Ltd Registered in England 13362643 57 Springfield, Dursley, Gloucestershire GL11 6PL	Site: Land at 4 Deaufort Close, Redfield, Bristol BS5 0DJ Proposal: erection of 1 residential unit, incorporating associated works Title: Proposed Block Plans and Elevations
	web: www.cotswoldvaleplanning.co.uk	SCALE: 1:11 @A4 DATE: March 2014 DWG. No. HINSTR011
	email: info@cotswoldvaleplanning.co.uk	
	phone: 07871643073	

Habitat Management and Monitoring Plan (HMMP)

Land at 4 Beaufort Close, Redfield, Bristol BS5 8DJ

This HMMP is produced with the intention of ensuring Net Biodiversity Gains provided on site are maintained for a minimum period of 30 years. The HMMP is required in compliance with Condition 6 of application 23/04964/F and in respect of paragraph 174(d) of the National Planning Policy Framework, 2023.

The principal Biodiversity Net Gain identified at the above-mentioned site is secured by the provision of suitable additional landscaping that will be provided on site following the construction of a single residential unit. To this end, landscaping, as per the approved landscaping specification appended to this document, shall be provided on site and maintained as follows:

SITE PREPARATION

Topsoil

Existing topsoil shall be stripped before building works begin. Imported topsoil shall be to BS Specification for Topsoil. Topsoil shall be multi-purpose grade, of medium texture, with a high proportion of fertile loamy material. During storage, topsoil heaps shall be kept free from compaction, contamination and weeds to BS Specification.

Excavation

Excavation shall NOT be undertaken with machinery within the root protection area of any existing trees or shrubs to be retained.

Backfilling with Subsoil

Where excavated areas are lower than the required depths, excavations shall be backfilled with selected subsoil and lightly consolidated to make up levels.

Backfilling with Topsoil

Tree, shrub and hedge pit / trench excavations shall be backfilled, in layers, with clean topsoil, thoroughly mixed with planting compost where appropriate.

Cultivation

If planting / seeding areas are weed infested, weed growth to be strimmed, the clippings removed and re-growth treated with an approved herbicide. Treatment to be undertaken in the growing season preceding planting, at a minimum 4 weeks prior to works to allow for repeat treatment if necessary.

PLANTING

Plant Stock and Timing

Plant material and operations shall conform to necessary British Standard. The planting season shall be from the 1st October to the 31st March, unless suitable conditions allow. Container grown stock may be planted outside this season if accompanied by daily watering, or as necessary to ensure healthy establishment. Planting shall not be carried out during periods of frost, drought, cold drying winds or when the soil is waterlogged or frozen.

Planting

All planting that is within the root protection area of existing trees/shrubs to be retained, shall be undertaken by hand and positions altered should tree roots be encountered, in order to avoid damage to the root system.

All plants shall be set out evenly over the areas as indicated, to the density and quantities shown. All plants shall be planted upright at the same depth as the nursery soil level and evenly spaced, leaving room for growth. All restrictive containers shall be removed with roots not twisted. Immediately following planting, all plants shall be watered-in to field capacity.

Container grown and root balled plants shall be planted in a planting pit sufficient to accommodate the plant without causing root damage. Plants to be firmed, watered-in and dead, damaged or lopsided branches shall be removed after planting. Bare-root plants shall be slit planted, incorporating an approved high phosphate, slow-release fertilizer.

Tree Planting and Support

Trees planted in landscape areas shall be underground guyed, using seven strand galvanised wire, with adjustable grippers, secured to 2 no. sleeper deadmen at the base of the tree pit unless otherwise specified.

All trees to be firmed in after planting. All trees shall have irrigation / aeration system units fitted where necessary to fully surround the root ball.

Hedge Planting

Hedges shall be planted in a double staggered row or single row as per details. Dead, damaged or uneven branches shall be removed after planting. All transplants in hedge and native mixes shall be fitted with individual protection i.e. shrub shelters, spiral guards as specified, or alternatively the planting areas shall be protected with rabbit-proof fencing where appropriate. All shrub shelters / spiral guards shall be black or green, adequately supported and installed to allow for expansion.

Bulb Planting

Bulbs shall be planted according to species and good horticultural practice. Swathes of bulbs shall be randomly planted avoiding straight lines and / or formal layout unless otherwise specified.

Mulching

Prior to the application of mulch the planting areas shall be completely weed free and watered sufficiently to achieve field capacity. The surface of the planting areas shall be mulched with a minimum 75mm depth layer of 15-65mm nominal particle size, dark, matured wood-chip mulch, where appropriate, ensuring that the low branches of trees, shrubs and/or herbaceous plants are not covered.

GRASS AREAS

Turf

Turf shall accord with necessary British Standard. It shall be good quality meadow/cultivated, amenity turf free from weeds and be laid on even, prepared ground, during periods of suitable warm and moist weather conditions. Pre-turfing fertiliser shall be applied to manufacturer's recommendations and turf shall be laid in accordance with appropriate British Standard.

Grass Seeding

Areas of amenity grass shall be seeded with a general amenity grass mix as specified during the period March to May or September to October, during periods of moist, warm weather conditions without significant wind. Pre-seeding fertiliser shall be applied to manufacturer's recommendations. Seed shall be sown on even, prepared ground, as per suppliers recommendations. Water as necessary to avoid shrinkage and achieve satisfactory establishment. Undertake good horticultural practice to ensure establishment of a healthy grass sward.

AFTERCARE

Regular Visits

During the specified Aftercare Period (hereby confirmed as being a minimum of 30 years), maintenance visits shall be carried out, at least monthly from April to September and twice during the dormant season to carry out the following operations to establish healthy growing plants / grass in weed free areas:

watering, firming-up, removal of litter, pest and disease control, general pruning, checking guards, ties and stakes, weed control, grass cutting and autumn tidying. All removed materials shall be removed unless composted on site and the site shall be left clean and tidy at all times.

Watering

All planting and grass areas shall not be allowed to dry out and shall be kept well watered during the growing season, ensuring the soil is kept moist at all times but avoiding water-logging.

Replacement Planting

During each August within the Aftercare Period an inspection shall be made and all plants that have died, are missing, damaged or have failed to thrive, shall be noted and replaced in the following planting season with specimens of the same or similar specification.

Grass Cutting

During the first and subsequent growing seasons amenity grass shall be kept at a height of 25mm to 50mm. Any bare patches are to be resown. Selective weed control shall be undertaken as necessary once the sward is sufficiently established