

26 Sheldon Avenue
Haringey Council

Energy & Sustainability Statement

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Executive Summary

INTRODUCTION

The proposed residential scheme at “26 Sheldon Avenue” is required to make carbon emission reductions in accordance with the Haringey council policy DM21 and the London Plan 2021’s policy SI 2 ‘Minimising Greenhouse Gas Emissions’ – using the energy hierarchy and target of 35% beyond building regulations as a minimum on site - with 20% from renewables and a local policy target overall of 100% CO2 reduction - or zero carbon.

AIM OF THIS STUDY

The aim of this study is to assess the feasible carbon emission reductions through building fabric, efficient services and low or zero carbon technologies to meet Haringey Council target of zero carbon (100% reduction over Part L). With 35% carbon reduction on-site target as per London Plan, with at least 10% coming from fabric and energy efficiency measures first before renewables are implemented with a minimum 20% CO2 saving from renewables. The remainder of carbon emissions then need to be off-set using the council’s hierarchy of carbon charges to encourage extremely low carbon development. This report demonstrates how the site has followed the London Plan’s energy hierarchy by reducing energy demand through passive design, energy efficiency measures, i.e. ‘Be Lean’ and generating renewable energy to further reduce the overall carbon emissions of the development i.e. ‘Be Green’ and then offsetting.

METHODOLOGY

The methodology followed in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed on the following “GLA Energy Team Guidance on Planning Energy Assessments”, 2021.

Energy consumption figures are based on SAP modelling data produced under Building Regulations Part L compliant software (SAP 10). Analysis of the house has been undertaken to demonstrate compliance with the Building Regulations Part L. The baseline scenario in this study is the proposed to notional Part L standards, or the Target Emission Rate (TER)

SITE DESCRIPTION

The proposed scheme is a new build house, with the existing house being demolished.

The house is oriented primarily North-West from the front facade. The scheme is of traditional design and in-keeping with the local area.

RECOMMENDATION

The energy strategy for the proposed scheme is to use a highly efficient Air Source Heat Pump (ASHP) as main heating and DHW system, alongside advanced energy efficiency fabric measures and a 7.02 kWp Solar PV array over three roofs to meet the carbon emissions reductions target.

The proposal is to use advanced fabric efficiency standards, surpassing Part L requirements. The thermal performance targets of the dwelling are the following: U-Values of 0.10 W/m²K for the ground floor, 0.11 W/m²K for the roof, 0.15 W/m²K for walls and high-performance triple-glazed windows of 0.95 W/m². A maximum air permeability of 2.5 m³/m²/hr at 50 pa is targeted, and to be achieved on site. Thermal bridging will also be kept to a minimum, with an average Y-value of 0.06, following LABC details, thus going beyond accredited construction details as a minimum.

In addition, full MVHR ventilation will keep the house well ventilated and surpass Part F requirements.

CO₂ SAVINGS SUMMARY

The baseline carbon emissions for the scheme are **5,602 kgCO₂/yr**. Following implementation of measures within this report; a total saving of **4,536 kgCO₂/yr** will be made, a **81%** overall carbon reduction before offsetting the remainder. These measures include:

- **Be Lean** (10% savings over baseline): Energy efficiency measures to improve the building fabric and services: Very high-performance U-Values (0.15 for walls, 0.11 for roof, 0.10 for the ground floor and 0.95 for windows in W/m²K), best practice air tightness (maximum of 2.5 m³/m²/hr at 50 Pa), MVHR and best practice attention to thermal bridging at an average Y-value of 0.06.

- **Be Clean** (0% savings over Lean case); No further savings through the use of heat networks are planned.

- **Be Green** (71.2% savings over clean case): Low carbon heating and hot water through ASHP for clean heating and hot water for the scheme and a 7.02kWp Solar PV array with associated battery storage.

- **Offset** (19% savings): A payment of **£3,198** is required to pay Haringey council to be 100% zero carbon, as per their offset scheme.

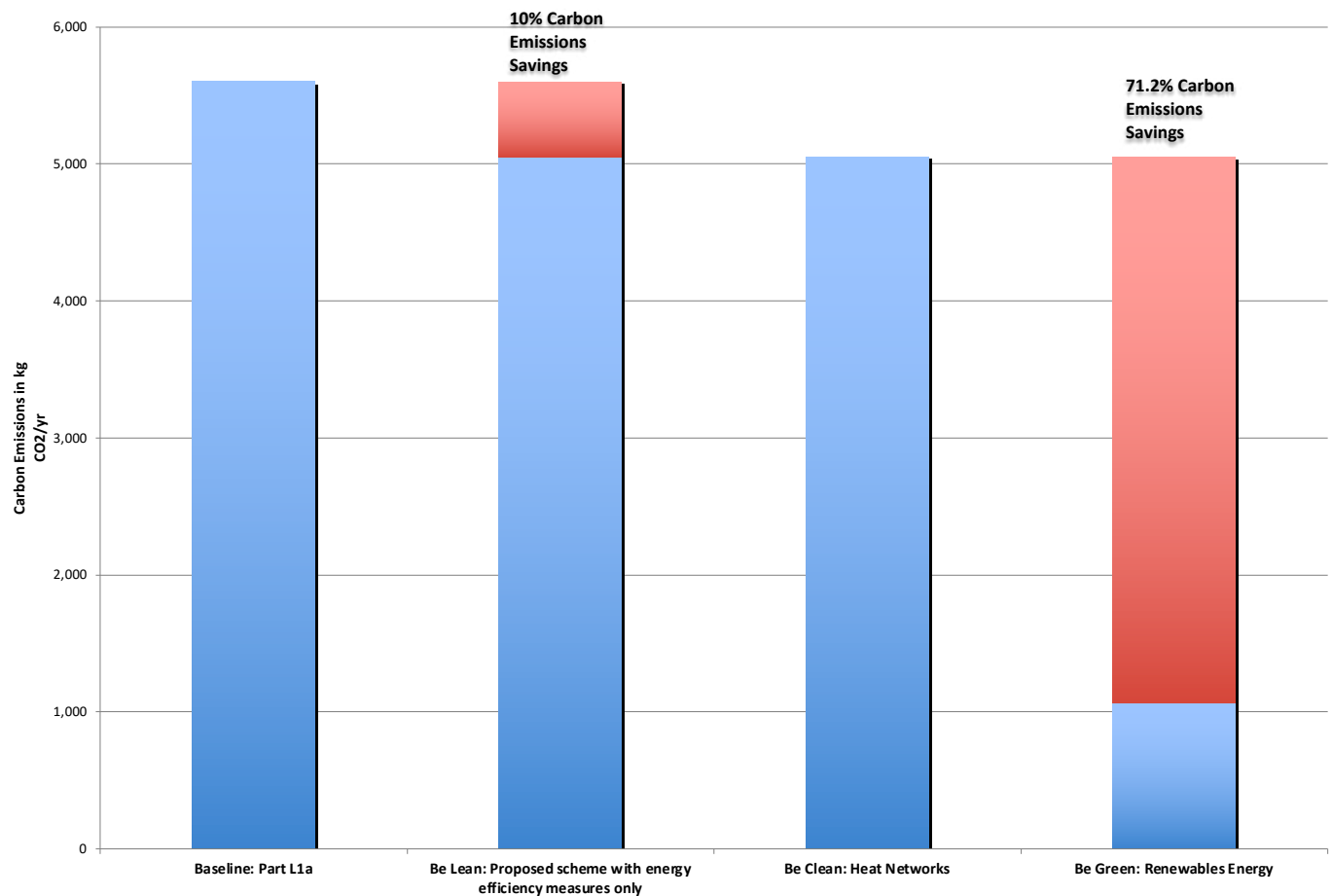
Part L / EUI / GLA

The scheme meets Building Regulations Part L and subsequent revisions. The scheme has Energy usage Intensity of 24.4 kWh/m²/yr and space heating demand of 13.1 kWh/m²/yr – both inside the GLA targets of 35 and 15 kWh/m²/yr, respectively.

GLA's Energy Hierarchy

	Baseline	Be Lean: Energy Efficiency Measures	Be Clean: Heat Networks	Be Green: Renewable
Carbon emissions in kgCO ₂ /yr	5,602	5,055	-	1,066
Carbon emission savings in kgCO ₂ /yr	-	547	-	3,989
Percentage reduction in carbon emissions over the previous stage	-	10%	0%	71.2%

Energy Hierarchy



Planning Requirements

PLANNING REQUIREMENT

The latest London Plan 2021, Policy SI 2 'Greenhouse Gas Emissions' requires developments to achieve 35% minimum carbon reduction on site through fabric efficiency and implementations of renewables.

The 2021 London Plan also requires a 10% reduction through fabric and energy efficiency enhancements only, and then a further 20% minimum carbon reduction through the use of local heat networks 'Be Clean' or on-site renewable energy technologies 'Be Green'.

Haringey Local Policy DM21, Local Plan SP4 and the July 2021 submission validation checklist note that the requirement is zero carbon developments, or 100% CO₂ savings over Part L – achieved through the London Plan energy hierarchy and achieved on-site where possible, with remaining emissions offset under the boroughs offset payment scheme.

REQUIREMENTS FOR AN ENERGY STATEMENT

The Greater London Authority defines in the London Plan Supplementary Planning Guidance that applications for major developments should be accompanied by an energy statement, which provides information as set out below:

- Calculation of baseline energy demand and carbon dioxide emissions showing the contribution of emissions from building regulations
- Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services;
- Proposals to further reduce carbon dioxide emissions through the use of decentralized energy where feasible, such as district heating and cooling;
- Proposals to further reduce carbon dioxide emissions through the use of on-site low or zero carbon technologies, and;
- The development should propose to Offset the remaining emissions to reduce the site to Zero Carbon.
- In addition, major developments (over 1000m²) should report their building performance to the GLA.

An assessment of the feasibility of different renewable technologies on the site and the potential contribution to CO₂ reduction from each option, explaining which technologies have been investigated and why any technologies have been ruled out.

We will also assess the likelihood of overheating in the project and measures to reduce, where necessary.

Methodology

METHODOLOGY

The methodology followed in this report follows the guidance set out in GLA Energy Team Guidance on Planning Energy Assessments, 2020, as set out below.

Energy consumption figures are based on SAP modeling data produced under Building Regulations Part L compliant software (SAP 10) – including new emissions figures under Part L 2021 update (enforced from 15th June 2022)

The analysis of the house has been undertaken to show the compliance with the Building Regulations Part L1a 2013.

LONDON PLAN ENERGY HIERARCHY

Taken from GLA Energy Assessment Guidance , 2020

The London Plan's energy hierarchy takes a 'whole energy' approach and addresses energy efficiency use, energy supply efficiency and use of low or zero carbon technologies. The purpose is to demonstrate that climate change mitigation measures are integral to the scheme's design and evolution, and that they are appropriate to the context of the development. The below summarises the guidance for each stage.

BASELINE CALCULATIONS

See overleaf for the details of the baseline calculations in line with the Part L SAP Target Emissions Rate (TER).

BE LEAN

Demand reduction (Be Lean) measures specific to the scheme are encouraged at the earliest design stage of a development and aim to reduce to demand for energy. Measures typically include passive design: both architectural and building fabric measures, active design and energy efficient services. Building Regulations (Part L) should be exceeded by 10% through demand reduction (Be Lean) measures alone.

BE CLEAN

A 'clean' energy supply refers to utilising the energy efficiency of heating infrastructure networks. Planning applications should demonstrate how the their energy systems will exploit local energy resources and secondary heat to minimize CO₂ emissions in accordance with the order of preference in Policy SI 3 – Heating Infrastructure, using the Heat Network Priority Areas (HNPA).

BE GREEN

Use of Low Zero Carbon technologies in developments is encouraged at the 'Be Green' third stage. Each low or zero carbon technologies in the London Plan should be deemed to be technically feasible or not.

OFFSET

After carbon emissions are reduced through 'Be Lean, Be Clean and Be Green' – the residual carbon emissions on site are to be calculated and offset through the Haringey borough's Offset scheme at a recommended cost of £1000/tonne/year for a 0-60% carbon reduction, £300/tonne/year for a 60-80% carbon reduction and £100/tonne/year for a 80-100% reduction

BE SEEN

For larger, major developments, a final step of 'Be Seen' is required – which asks for monitoring and data to be done at planning stage, development stage and by the owner – data is uploaded to a portal to check KPI's and feedback to the GLA.

“Be Lean” Energy Efficiency measures

ENERGY EFFICIENCY TARGETS

Energy efficiency measures for the building fabric will be incorporated to reduce the energy demand and carbon footprint of the proposed scheme. The below measures reach the minimum 10% carbon saving from this step of the London Plan.

In order to surpass the target and use best practice principals to work, all u-values have been pushed far beyond Part L minimum standards.

U-VALUES TARGETED ACROSS SITE

Element	Building Regulations Part L max U-Value (W/m ² K)	Proposed U-Value (W/m ² K)
Roof	0.16	0.11
Floor	0.18	0.10
Walls	0.26	0.15
Window	1.6	0.95

AIR-TIGHTNESS

In addition to excellent u-values, a high-performance development is proposed with excellent air tightness levels is to be achieved such that the proposed scheme does not exceed an air permeability level of 2.5 m³/hr/m² at 50pa during testing.

This will be achieved through ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed and all punctures through the seal are airtight. In particular, attention will be paid to openings such as services and down lighters at roof level. Calculated PSI details will be followed to ensure that the average Y-Value across site will be no greater than 0.06. Each thermal bridge will be required to be calculated and shown that the 0.06 overall values are met.

ENERGY EFFICIENCY

In this scenario, a highly efficient gas boiler (SEDBUK 90%) is specified, with interlock and weather compensator included. Heating will be delivered via efficient under floor heating and radiator mix.

In addition, 100% of internal lighting will be energy efficient.

VENTILATION

Full mechanical ventilation with heat recovery, the Ectaire Maxi Plus BY – ceiling-mounted MVHR, will be implemented in the house and to meet the full requirements of Part F. The main MVHR unit will be placed in the basement - see drawing no. 26SA-PA-03-B.

“Be Clean” Use of heat networks

USE OF DECENTRALIZED POWER & HEAT NETWORKS



Inline with London Plan Policy SI 3, Heat Infrastructure, major development should aim to use waste heat or secondary heat, exploit existing heat / cooling networks where possible or future proof utility infrastructure to minimize the impact from roadworks.

There are various heating networks already established in London and the mayor has identified Heat Network Priority areas (HNPA) – these will be assessed to determine if the site should be considered, alongside combined heat and power (CHP) on site also:

Connection to existing CCHP/CHP/Heat networks

This option is deemed infeasible in this instance due to the lack of an existing CCHP/CHP/Heat networks in the vicinity of the proposed development.

Site wide CCHP/CHP/Heat generation powered by renewables

CCHP/CHP/Heat generation powered through renewables such as biomass is considered infeasible in this instance due to issues relating to air quality. The site is not communal and too small for this.

Heat Network Priority Area (HNPA)

The site sits outside of the HNPA. The local borough was contacted and is not applicable in this instance.

FRAMEWORK TO ANALYSE MICRO CHP ON SITE

A micro CHP on site has been analysed along the following points:

- The technical feasibility of CHP on a site-wide basis and for portions of the scheme.
- The viability of the CHP in terms of capital expenditure per unit.
- The carbon emissions reductions from the CHP as compared to an alternative system.

CHP ANALYSIS

Combined heat and power (CHP) has been assessed in terms of feasibility. It is considered that CHP unit is inappropriate for this development, as there is not a sufficient heat load and DHW requirements. This is primarily due to the fabric first approach to energy saving, pushing the heating demand down.

“Be Green” renewable energy target

INTRODUCTION

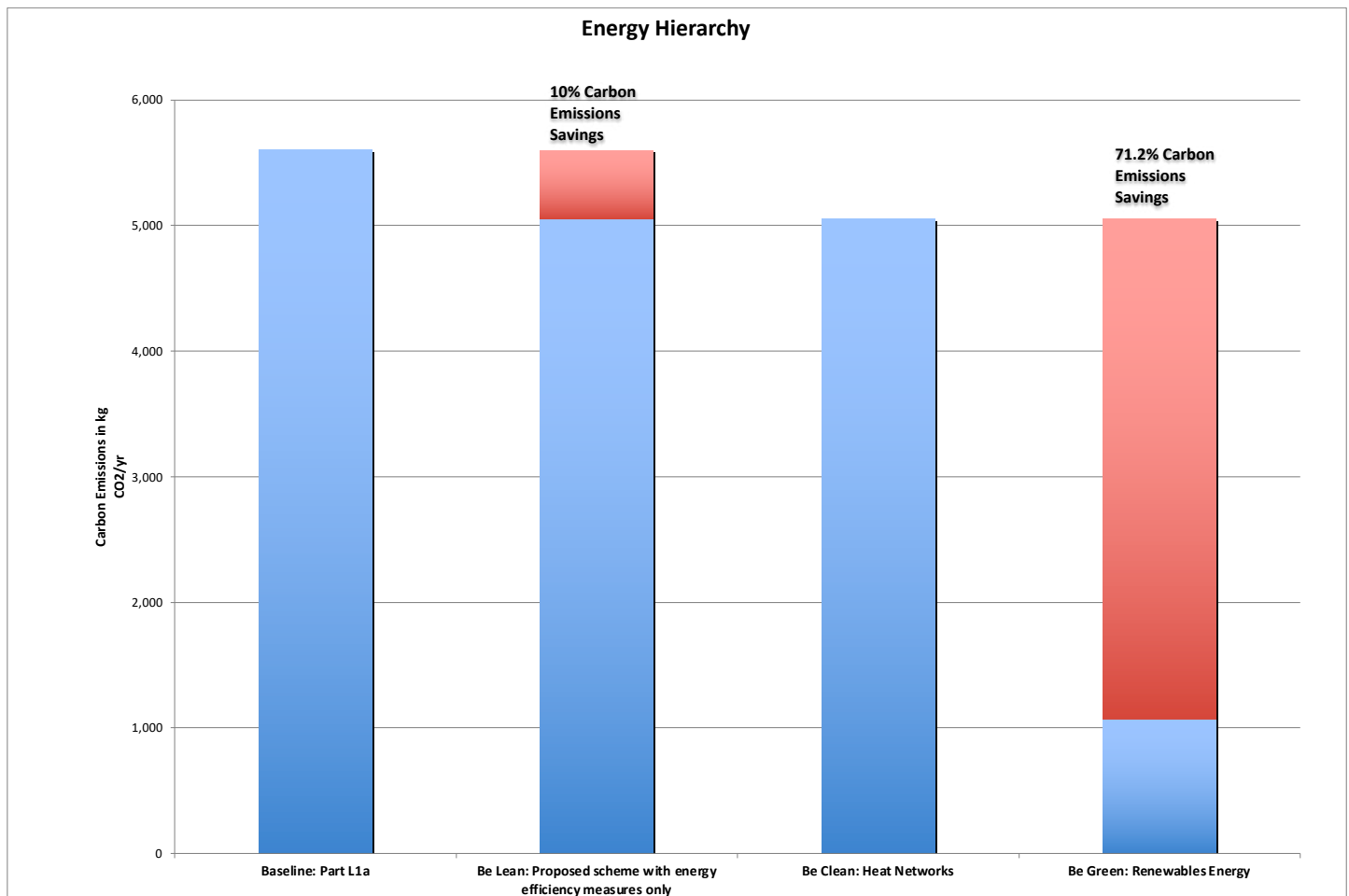
The predicted carbon emissions of the proposed scheme following energy efficiency measures and fabric values will be 5,055 kgCO₂/yr or 10% in line with the methodology and details provided in this report, in addition to local policy.

In addition, a further CO₂ emissions reduction is required to meet 100% Carbon Emission savings and 35% on-site minimum savings on-site, with 20% from renewables. This is through the use of on-site renewable technologies. Air Source Heat Pump (ASHP) and Solar PV has been identified as the ideal renewable energy sources for the following reasons:

- ASHP operate like regular boilers for the end user, but are 250-400% efficient.
- As the grid green ASHP will be carbon neutral
- Solar PV offers on site clean energy generation

RENEWABLES & OVERALL EMISSIONS REDUCTION

The renewable solutions will give a 3,989 kg/CO₂/yr saving, which gives a total project saving of 4,536 kg/CO₂/yr or **81%** carbon saving over baseline building regulations overall.



Feasible Renewable Energy technologies

FEASIBLE LOW OR ZERO CARBON TECHNOLOGIES

A reduction in carbon emissions through the use of on-site low or zero carbon technologies can be achieved through several technologies to generate either heat or power. Following the analysis of the carbon emissions related to the scheme, the objective of this section is to determine the feasible low or zero carbon technologies options that provide cost-effective and practical emissions reductions. The low or zero carbon technologies options for the proposed scheme are provided in the table below. Each technology is also assessed as either feasible or rejected based on its implications for the scheme in terms of their implementation, cost-effectiveness, site-related constraints, planning issues or others. The following sections will explore the feasible technologies in depth and explain why certain technologies have been rejected.

Technology and feasibility	Rationale
BIOMASS / REJECTED	Biomass would be able to provide a 35% overall reduction in carbon emissions. However, this technology would have a significant impact on local air quality in the Borough and development access restraints preclude the possibility of biomass pellet delivery.
LIQUID BIOFUEL/ REJECTED	Although biofuel has the capability to heat the house, as with solid biomass, liquid biofuel has air quality implications in addition to delivery and sourcing issues in a city location such as this.
AIR SOURCE HEAT PUMP (ASHP) / ACCEPTED	An air source heat pump can supply heating and hot water to the proposed scheme. There is space in the plant room to house the cylinder required for the Air Source Heat Pump (ASHP) and suitable space outdoors for the external unit also. The high efficiency and electrical source of ASHP makes this a great choice to lower carbon emissions now and further in the future.
GROUND SOURCE HEAT PUMP / FEASIBLE – NOT ACCEPTED	A ground source heat pump would be capable of heating the house and providing hot water with slightly better efficiency than ASHP; however capital cost unknowns and land type for drilling boreholes make this technology require more investigation at detailed design to implement on the site.
PHOTOVOLTAIC (PV) / FEASIBLE – ACCEPTED	There is roof area available for PV. This could potentially surpass the 80% renewable target for better offset fees. The Solar PV array would feed the ASHP, creating a more self-sustaining home. A 7.02 kWp system with 13.8 KW battery could be maximised on site. With the front and rear main pitched roofs still clear to minimise impact on the local conservation area.
SOLAR HOT WATER (SHW) / FEASIBLE – NOT ACCEPTED	As with Solar PV, Roof mounted SHW units could be located on the roof space area. If the roof space available were covered with solar collectors as appose to Solar PV, the carbon savings would be far less.
WIND TURBINE / REJECTED	Turbulence created from surrounding buildings makes this an inefficient solution and it would make a large visible impact.

“Be Green” renewable energy target

INTRODUCTION

It is proposed that in order to meet the London Plan requirements on production of clean ‘Green’ energy and the local Haringey policy towards zero carbon, an Air Source Heat Pump (ASHP) and Solar Photovoltaic (PV) panels are deemed the feasible and viable solution.

AIR SOURCE HEAT PUMPS

An air source heat pump (ASHP) absorbs heat from outside a building and release it inside using the vapor-compression refrigeration process, in the opposite direction. The heat usually goes to a buffer tank before radiators or UFH distribution. ASHP’s are around 250-400% efficient (meaning 2.5-4KW of power for every 1KW put in) and are best suited to modern, well insulated properties.

POTENTIAL SPECIFICATION



A suggested specification for the Air Source Heat Pump (ASHP) would consist of a Samsung air-to-water heat pump and underfloor heating distribution throughout the house. Dutypoint 500 Litre cylinder will be specified for consistent hot water and storage. The condenser will be located in housing to the rear of the garden.

In Addition, Re-coup Shower Waste Heat Recovery units (SWWHR) will be installed to save waste heat otherwise lost from showers.

SOLAR PV

A JA Solar MONO 7.02kWp Solar Photovoltaic system is proposed over three roofs. The East roof and top and first floor flat roofs will house the 18 panels, for maximum efficiency to the south. A large 13.8kWp battery is also specified. There are no panels on the front or rear main roof pitches, to maintain the heritage value of the area.

DISCLAIMER

Note that ASHP and Solar PV installation require full design and installation from the electric sub-contractor and/or a renewables installer.

Carbon Emission Offset

INTRODUCTION

Haringey Borough Energy Policy notes that 100% of carbon emissions should be mitigated for all new developments – major or minor, first through on-site fabric improvements, on-site renewables and finally remaining emissions offset through the council offset scheme.

There are 3 levels to the offset scheme, with the cost dependent upon the on-site savings achieved. The price is calculated over 30 years – with 1 tonne of CO₂ per year (tCO₂/y) is priced as follows:

On-site CO ₂ reduction	Offset cost (tCO ₂ /y)
0 – 60%	£1000
60 – 80%	£300
80 - 100%	£100

Example: a site with 50% CO₂ reduction, passing London Plan and an average of 1 tonne/year remaining to offset. would be required to pay £1000 x 30 = £30,000 offset payment.

OFFSET COST

The 26 Sheldon Avenue on-site carbon reductions total 81%, therefore the tariff is £100 per tCO₂/y*

Outstanding carbon emissions are 1,066 kg/CO₂ per year, over 30 years, which equals 31,980 kg/CO₂ or 31.98 tCO₂/y.

31.98 x £100 = **£3,198** to pay Haringey council to meet the zero carbon, 100% reduction over Part L policy.

*The Haringey climate officer (noted in feedback 28/08/23) stated that the fee is £95 per tCO₂/y – if this is correct and the above Haringey specific policy is incorrect / not yet enforced - then the fee will be 31.98 x £95 = **£3,038**

Overheating Analysis

INTRODUCTION

Climate change and the heat-island effect is making overheating a much larger problem in London in recent years and a potential huge problem in decades to come. Under London Plan policy SI 2 'Minimising greenhouse gas emissions' & SI 4 'Managing Heat Risk', it is noted that the GHA overheating risk tool and the 'overheating hierarchy' should be followed in design to reduce unneeded overheating.

ANALYSIS

Overheating Hierarchy. The below measures have been taken into account in the design:

- 1) reduce the amount of heat entering a building through shading, high albedo materials, insulation and more
 - The property is has excellent u-values and full MVHR. The triple glazing has a low 0.40 G-value to limit the amount of heat radiation. The top roof is painted white to reflect heat. Green roof provided to the rear 1st floor flat roof.
- 2) minimise heat generation through energy efficient design
 - Glazing ratio is 22.3%, which is acceptable for this building type. The property has additional overhangs and green roof.
- 3) manage the heat within the building through exposed internal thermal mass and high ceilings
 - Thermal mass to rear floors with solar gains.
- 4) provide passive ventilation
 - Openable windows and extract throughout.
- 5) provide mechanical ventilation
 - Full mechanical ventilation with heat recovery specified.
- 6) provide active cooling systems.
 - There will be no active cooling.

The outline overheating assessment determines the site is at LOW/ MED risk from overheating and key rooms will pass CIBSE criteria.

Water Requirement

INTRODUCTION

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

The water efficiency measures included in the house will ensure that the water use target of Part G 125 litres per person AND the recommended level of 110 litres per person per day will be achieved using the measures described below.

RECOMMENDATION

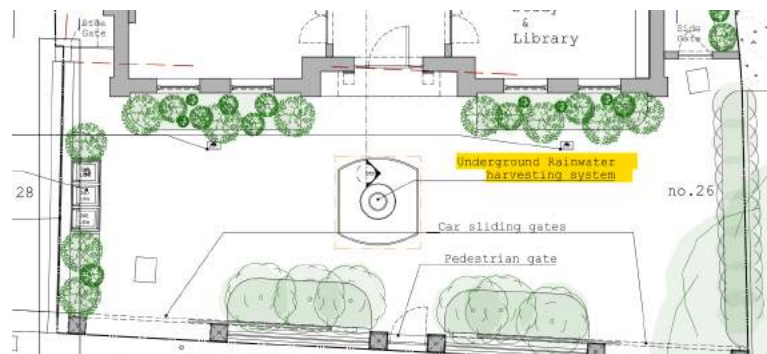
The following water fittings will be provided for all dwellings:

- 4/2 litre dual flush WC 's
- Kitchen taps flow aerated taps with flow rate of 4 litres
- Flow aerated taps with flow rate of 3.5 litres
- Showers are average max flow rate mix of max. 8 litres/minute at supplied pressure.
- Bath 180 litres to overflow
- A/A+ rated washing machines (6kg per litre) and dishwashers (0.9 litre / place).

The above specification will equate to less approx. **103.2 litres per person per day**.

RAINWATER HARVESTING

A Rainwater Harvesting tank will be specified and installed in the front garden. This will be used for external watering – further reducing potable water use and reducing the surface water run-off. The rainwater harvesting tank is shown on the drawing qR_26SA-PA-03-B in the appendix.



Materials

INTRODUCTION

The typical UK construction material supply chain is out-dated, carbon intensive and uses many synthetic materials. Environmentally-friendly materials have lower emissions in their production and a low environmental impact.

LIFECYCLE CARBON AND MATERIALS

The embodied carbon emissions of the proposed development will be kept to a minimum wherever possible, with increased use of timber over steel (where feasible) to reduce carbon emissions, and furthermore sequester a significant amount of CO₂ in its use. The system will also use low carbon insulation, which helps with overheating and is low pollution.

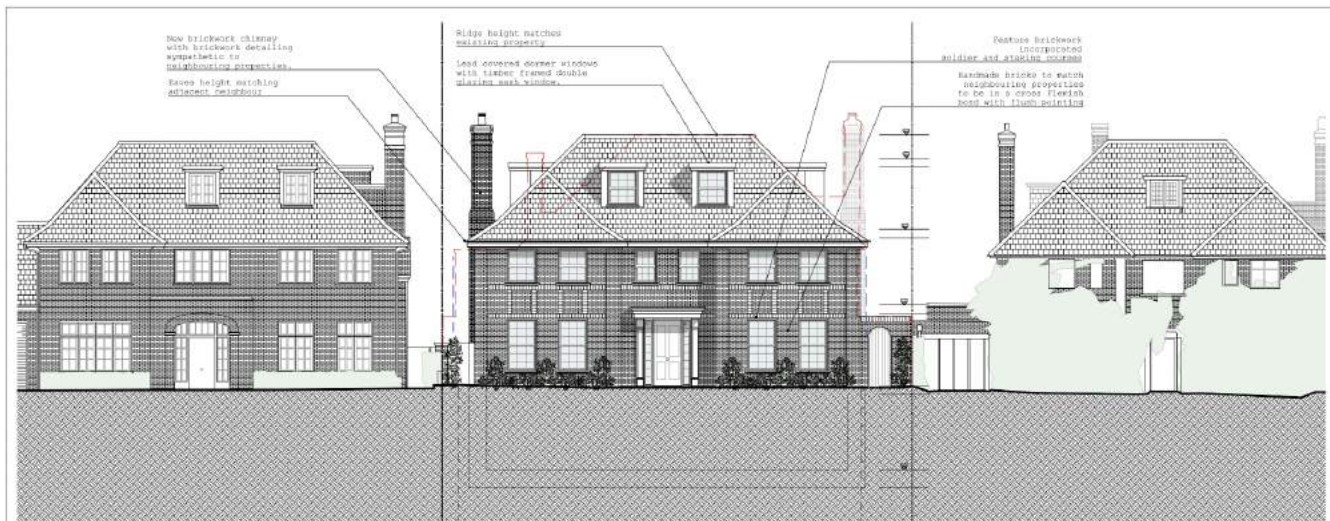
Some recycled bricks and aggregate from the demolition will be used as aggregate in the foundations and substructure (target of 20%), pushing down materials carbon emissions for these areas.

The rear 1st floor roof will utilise a green roofing system to the rear that encourages local wildlife to thrive and provide further insulation to the roof.

MATERIALS CERTIFICATION

The dwelling, wherever possible, will use BRE Green Guide 'A' rated materials and manufacturers will be chosen that can demonstrate their products are sustainably sourced and manufactured.

All Timber used will be FSC or PEFC certified timber. All concrete, steel and windows used in the development will be ISO14001 certified.



Waste Management & Circular Economy

INTRODUCTION

Local Haringey and London Plan planning policy states that both construction waste and operational waste should be minimized. Furthermore 'The Circular Economy' method of pre-planning how materials will be re-used so to reduce waste and in-turn the need for virgin building materials. Therefore the site aims to practice both the Waste Hierarchy and the principles of the circular economy, within both the design and construction of the development. In addition a site waste management plan will be implemented to ensure minimal waste on site.

PREVENTION/ REDUCTION

- Recycled and/or natural insulation will be used where possible
- The project will use standard sizes and quantities of materials, and plan ahead to reduce off cuts.
- Over-ordering will be kept to a minimum through detailed quantity surveying as part of the SWMP requirements.
- Deliveries will be arranged to match work stages, to avoid materials being stored on site longer than necessary.
- All storage areas on site will be safe, secure and weatherproof.
- A site induction will aim to brief the construction team on minimising rework from errors and poor workmanship.

REUSE OF MATERIALS.

The following items will be considered in design for circular use:

Layer	Constituent elements	Strategies
Site	The geographical setting, urban location and external works	Retain and reuse
Substructure	Excavations, foundations, basements and ground floors	Longevity – durable and resilient; readiness for alternative technologies
Superstructure	Load-bearing elements above plinth including roof supporting structure	Adaptability – how the current needs might change in the future
Shell/Skin	The layer keeping out water, wind, heat, cold, direct sunlight and noise	Flexibility – potential for reconfiguration/future refurbishment of non-structural parts
Services	Installations to ensure comfort, practicality, accessibility and safety	Reusability – designed to be redeployed or reused as kit of parts
Space	The layout internal walls, ceilings, floors, finishes, doors, fitted furniture	Recoverability – designed to be deconstructed and reused/recycled
Stuff	Anything that could fall if the building was turned upside down	Not applicable
Construction Stuff	Any temporary installations/works/ materials, packaging and equipment	Reusability – Use of re-usable hoardings and scaffolding Waste minimisation, material optimisation

RECYCLING / FACILITIES

The site will provide appropriate facilities for the storage of separate waste streams – black (landfill waste) and grouped recycling – metal, plastics, paper and glass. These will be safe and convenient to access for deposit and collection, with sufficient capacity for current and projected future use.

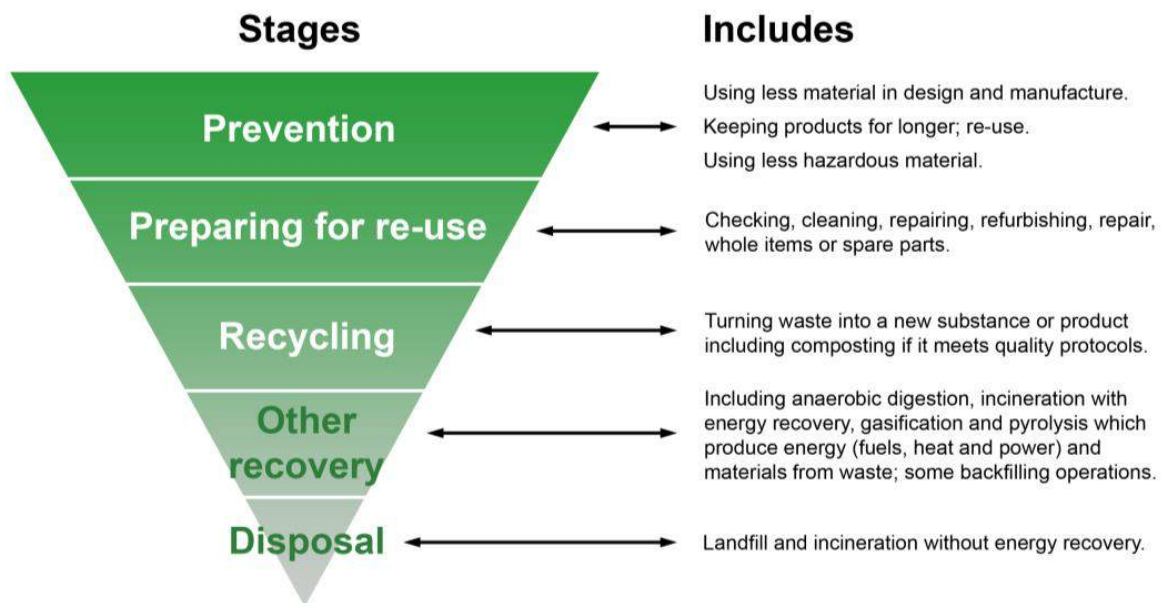
SITE TARGETS

The design team and construction team will aim to procure:

- a Sustainable Procurement Plan,
- a bespoke Site Waste Management Plan,
- 20% of demolition waste into new scheme
- a target to divert 95% of construction waste and 95% of the demolition/excavation waste from going into the landfill.
- a benchmark target for a resource efficiency of 13.3m³ (or 11.1 tonnes) of waste per 100m² of GIA; Potentially aspiring for a target of 7.5 m³ (or 6.5 tonnes) of waste per 100m² GIA.

WASTE HIERARCHY

The Waste hierarchy will be followed in design and construction.



Further Sustainability Issues

INTRODUCTION	Policy DM21 of the Haringey Development Management Document requires developments to demonstrate wider sustainable design considerations. In addition to the sustainable design parameters, energy strategy, water strategy, materials and waste issues already addressed in this report – further issues are considered below to ensure the holistic sustainability of the site.
DESIGN	Efficient orientation, advanced u-values, Air Source Heat-Pump, Solar Photovoltaics, mechanical ventilation with heat recovery (MVHR), cross-ventilation and low glazing G values will be implemented to ensure that both energy demand and overheating are minimal.
TRANSPORT / CYCLES	The site is an existing site and will have no greater transport impact on the local area. Cycle storage will be provided on site to sufficient requirements, moving away from localised use of cars. The space is internal, which is lockable and covered, with accessibility. Six spaces are specified. See drawing no. 26SA-PA-03-B. Two electrical vehicle charging hook up will be installed, for clean transport energy use and lower pollution. The POS solo and Easee one units will be installed to cover all electrical vehicle types. qR architects have shown the 2x EV charging stations on drawing no. 26SA-PA-03-B, attached to this report.
BIODIVERSITY & URBAN GREENING	The garden is rich in diversity with large trees retained. Further local species of fauna will be added to enhance the ecological value of the current site by 20%. Bird and bat boxes are specified in the garden area to increase local animal populations on site. qR architects have shown Bird and Bat Boxes within the trees on drawing no. 26SA-PA-03-B, attached to this report. The rear 1st floor flat roof will be a living green roof, further increasing urban greening and attracting local wildlife.
SURFACE WATER RUNOFF	Surface water run-off will be separate from dwelling wastewater and flow into a rainwater storage tank to ensure peak run-off rates cannot cause further flood risk. This rainwater will be available for use to water external.
LOCAL SOURCING	Materials and site workforce will be sought locally.

Appendix A

Energy calculations

Area	TER CO2	Lean CO2	Clean CO2	Green CO2
692.50	8.09	7.30	7.30	1.54

TER CO2	Lean CO2	Clean CO2	Green CO2
5,602.33	5,055.25	5,055.25	1,066.45

Full SAP results are on the following page, both 'Lean' case (which is also TER case) and the Proposed 'Green' case.

Appendix B – further supporting information

Water Calculations

Annotated Architect drawings

Air Source Heat Pump Specification

Full Solar PV calculations and specifications

Electric vehicle Specifications

Full SAP Calculation Printout



Property Reference	Sheldon Avenue	Issued on Date	21/09/2023
Assessment Reference	Lean Rev A	Prop Type Ref	
Property	26, Sheldon Avenue, London, N6 4JT		
SAP Rating	88 B	DER	7.30
Environmental	91 B	TER	8.05
CO ₂ Emissions (t/year)	4.5	% DER < TER	9.32
Compliance Check	See BREL	DFEE	42.08
% DPER < TPER	-6.34	TFEE	43.93
Assessor Details	Mr. Nicholas Bowen	% DFEE < TFEE	4.21
Client	Green Tiger, Ross Standaft	TPER	43.12
Assessor ID	D719-0001		

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2047.7624 (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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

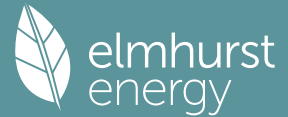
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0098 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.5000	(17)
Infiltration rate		0.1348	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1146	(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	0.1461	0.1432	0.1403	0.1260	0.1231	0.1088	0.1088	0.1060	0.1146	0.1231	0.1289	0.1346 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												75.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2681	0.2652	0.2623	0.2480	0.2451	0.2308	0.2308	0.2280	0.2366	0.2451	0.2509	0.2566 (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
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Windows (Uw = 1.00)	139.2300	0.9615	133.8750		(27)
Doors	3.2400	1.0000	3.2400		(26)
Basement floor	248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000 23.7600	200.6400	0.1500	60.0000	12038.4000 (29a)
External Walls	361.4700 106.9500	254.5200	0.1500	38.1780	60.0000 15271.2000 (29a)
Dwarf walls	42.5000	42.5000	0.1400	5.9500	9.0000 382.5000 (29a)
Dormers	30.8000 11.7600	19.0400	0.1000	1.9040	9.0000 171.3600 (29a)
Flat SF	22.8000	22.8000	0.1100	2.5080	9.0000 205.2000 (30)
Flat Base	44.7800	44.7800	0.1100	4.9258	9.0000 403.0200 (30)
Flat GF	41.0300	41.0300	0.1100	4.5133	9.0000 369.2700 (30)
Ceiling FF	86.9400	86.9400	0.1100	9.5634	9.0000 782.4600 (30)
Pitch	36.2600	36.2600	0.1100	3.9886	9.0000 326.3400 (30)
Dormer	25.9000	25.9000	0.1100	2.8490	9.0000 233.1000 (30)
Total net area of external elements Aum(A, m2)	1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	266.4871		(33)
Basement	414.6000			75.0000	31095.0000 (32c)
GF	183.2000			75.0000	13740.0000 (32c)
GF	101.5000			9.0000	913.5000 (32c)
FF	128.5000			75.0000	9637.5000 (32c)
FF	142.0000			9.0000	1278.0000 (32c)
SF	81.6000			9.0000	734.4000 (32c)
GF	204.1800			18.0000	3675.2400 (32d)
FF	163.1500			18.0000	2936.7000 (32d)
Internal Floor 3	76.2100			18.0000	1371.7800 (32d)
Basement	204.1800			9.0000	1837.6200 (32e)
GF	163.1500			9.0000	1468.3500 (32e)
FF	76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges					
K1 Element	Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940		
E3 Sill	63.5000	0.0230	1.4605		
E4 Jamb	190.2400	0.0180	3.4243		
E5 Ground floor (normal)	74.8000	0.0480	3.5904		
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530		
E16 Corner (normal)	73.6000	0.0400	2.9440		
E14 Flat roof	62.9000	0.1600	10.0640		
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050		
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880		
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880		
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				33.9192	(36)
Point Thermal bridges				(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =	300.4063 (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)
Heat transfer coeff	181.1402	179.2050	177.2698	167.5936	165.6583	155.9821	155.9821	154.0469	159.8526	165.6583	169.5288	173.3993	(39)
Average = Sum(39)m / 12 =	481.5466	479.6113	477.6761	467.9999	466.0646	456.3884	456.3884	454.4532	460.2589	466.0646	469.9351	473.8056	(39)
												467.5161	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.6954	0.6926	0.6898	0.6758	0.6730	0.6590	0.6590	0.6563	0.6646	0.6730	0.6786	0.6842	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	(42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)													159.9599 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	(44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Distribution loss (46)m = 0.15 x (45)m													2656.9005
	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9000 (48)
Temperature factor from Table 2b													0.7930 (49)
Enter (49) or (54) in (55)													1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(56)
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686	(62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441	(63a)

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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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2477.4708 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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)
(66)m	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	377.4413	417.8814	377.4413	390.0227	377.4413	390.0227	377.4413	377.4413	390.0227	377.4413	390.0227	377.4413	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	(71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753	(72)
Total internal gains	1361.3844	1406.2203	1340.5712	1299.1020	1227.0093	1179.7924	1129.7295	1126.5146	1163.2940	1203.8781	1280.6140	1327.4630	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	17.9300	11.2829	0.4000	0.7000	0.7700	39.2549 (75)
Southeast	56.5800	36.7938	0.4000	0.7000	0.7700	403.9515 (77)
Southwest	19.2000	36.7938	0.4000	0.7000	0.7700	137.0779 (79)
Northwest	45.5200	11.2829	0.4000	0.7000	0.7700	99.6588 (81)

Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524 (83)
Total gains	2041.3275	2610.5566	3110.9569	3698.1252	4101.6219	4116.0952	3926.3151	3555.6799	3149.3933	2567.9717	2103.4320	1903.9154 (84)

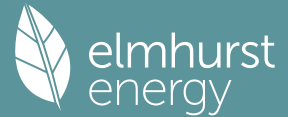
7. Mean internal temperature (heating season)

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	73.2261	73.5216	73.8195	75.3457	75.6586	77.2627	77.2627	77.5917	76.6129	75.6586	75.0354	74.4225
alpha	5.8817	5.9014	5.9213	6.0230	6.0439	6.1508	6.1508	6.1728	6.1075	6.0439	6.0024	5.9615
util living area	0.9998	0.9989	0.9952	0.9719	0.8806	0.6823	0.5074	0.5786	0.8629	0.9898	0.9992	0.9998 (86)
MIT	19.9608	20.1062	20.3171	20.6067	20.8292	20.9308	20.9469	20.9442	20.8732	20.5675	20.2169	19.9496 (87)
Th 2	20.3449	20.3474	20.3499	20.3622	20.3647	20.3772	20.3772	20.3796	20.3722	20.3647	20.3598	20.3548 (88)
util rest of house	0.9997	0.9986	0.9939	0.9643	0.8513	0.6251	0.4375	0.5048	0.8193	0.9860	0.9990	0.9998 (89)
MIT 2	19.0780	19.2664	19.5383	19.9149	20.1828	20.2988	20.3111	20.3121	20.2418	19.8705	19.4186	19.0716 (90)
Living area fraction	19.1217	19.3080	19.5769	19.9492	20.2148	20.3301	20.3426	20.3434	20.2730	19.9050	19.4581	19.1150 (92)
Temperature adjustment	19.0217	19.2080	19.4769	19.8492	20.1148	20.2301	20.2426	20.2434	20.1730	19.8050	19.3581	-0.1000
adjusted MIT	19.0217	19.2080	19.4769	19.8492	20.1148	20.2301	20.2426	20.2434	20.1730	19.8050	19.3581	19.0150 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9995	0.9979	0.9915	0.9566	0.8381	0.6109	0.4222	0.4881	0.8033	0.9814	0.9985	0.9997	(94)
Useful gains	2040.3674	2605.1572	3084.5912	3537.5413	3437.5822	2514.3893	1657.5581	1735.5565	2529.8535	2520.3319	2100.2716	1903.3344	(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													
	7089.1940	6862.2689	6198.7359	5124.2180	3921.8616	2569.5032	1662.4197	1746.6680	2795.1741	4290.1453	5760.5088	7019.4518	(97)
Space heating kWh	3756.3270	2860.7791	2316.9237	1142.4072	360.3039	0.0000	0.0000	0.0000	0.0000	1316.7411	2635.3708	3806.3913	(98a)
Space heating requirement - total per year (kWh/year)												18195.2441	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	

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Space heating kWh	3756.3270	2860.7791	2316.9237	1142.4072	360.3039	0.0000	0.0000	0.0000	0.0000	1316.7411	2635.3708	3806.3913 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												18195.2441
Space heating per m2												(98c) / (4) = 26.2747 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												88.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	3756.3270	2860.7791	2316.9237	1142.4072	360.3039	0.0000	0.0000	0.0000	0.0000	1316.7411	2635.3708	3806.3913 (98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000 (210)
Space heating fuel (main heating system)	3819.9936	2909.2669	2356.1936	1161.7700	366.4107	0.0000	0.0000	0.0000	0.0000	1339.0588	2680.0381	3870.9064 (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)	417.3697	317.8643	257.4360	126.9341	40.0338	0.0000	0.0000	0.0000	0.0000	146.3046	292.8190	422.9324 (215)
Water heating												
Water heating requirement	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Efficiency of water heater	87.8312	87.7337	87.5204	86.8815	84.8692	79.5000	79.5000	79.5000	79.5000	87.0406	87.6661	79.5000 (216)
Fuel for water heating, kWh/month	277.5884	245.3653	261.4241	233.1013	232.1046	224.2955	222.7199	231.4014	233.6298	236.7001	248.1695	274.8292 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	238.3701	215.3021	238.3701	230.6808	238.3701	230.6808	238.3701	238.3701	230.6808	238.3701	230.6808	238.3701 (231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719 (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												18503.6380 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												2021.6938 (215)
Efficiency of water heater												79.5000
Water heating fuel used												2921.3290 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)												
mechanical ventilation fans (SFP = 1.0890)												2720.6162 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												2806.6162 (231)
Electricity for lighting (calculated in Appendix L)												770.8784 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												27024.1554 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	18503.6380	0.2100	3885.7640 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	2021.6938	0.0280	56.6074 (263)
Water heating (other fuel)	2921.3290	0.2100	613.4791 (264)
Space and water heating			4555.8505 (265)

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Pumps, fans and electric keep-hot	2806.6162	0.1387	389.3123 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Total CO ₂ , kg/year			5056.4243 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.3000 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	18503.6380	1.1300	20909.1110 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Space heating - secondary	2021.6938	1.0460	2114.6917 (277)
Water heating (other fuel)	2921.3290	1.1300	3301.1018 (278)
Space and water heating			26324.9045 (279)
Pumps, fans and electric keep-hot	2806.6162	1.5128	4245.8489 (281)
Energy for lighting	770.8784	1.5338	1182.3990 (282)
Total Primary energy kWh/year			31753.1524 (286)
Dwelling Primary energy Rate (DPER)			45.8500 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2047.7624 (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	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

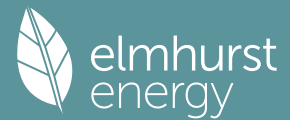
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0195 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.2695 (18)	
Number of sides sheltered		2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2291 (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	0.2921	0.2864	0.2807	0.2520	0.2463	0.2176	0.2176	0.2119	0.2291	0.2463	0.2577	0.2692 (22b)
Effective ac	0.5427	0.5410	0.5394	0.5318	0.5303	0.5237	0.5237	0.5225	0.5262	0.5303	0.5332	0.5362 (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			3.2400	1.0000	3.2400		(26)
TER Opening Type (U _w = 1.20)			139.2300	1.1450	159.4237		(27)

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Basement floor			248.9600	0.1300	32.3648	(28a)
Basement walls	224.4000	23.7600	200.6400	0.1800	36.1152	(29a)
External Walls	361.4700	106.9500	254.5200	0.1800	45.8136	(29a)
Dwarf walls	42.5000		42.5000	0.1800	7.6500	(29a)
Dormers	30.8000	11.7600	19.0400	0.1800	3.4272	(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	(30)
Flat Base	44.7800		44.7800	0.1100	4.9258	(30)
Flat GF	41.0300		41.0300	0.1100	4.5133	(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	(30)
Pitch	36.2600		36.2600	0.1100	3.9886	(30)
Dormer	25.9000		25.9000	0.1100	2.8490	(30)
Total net area of external elements Aum(A, m2)			1165.8400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		316.3826	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0500	3.2350
E3 Sill	63.5000	0.0500	3.1750
E4 Jamb	190.2400	0.0500	9.5120
E5 Ground floor (normal)	74.8000	0.1600	11.9680
E6 Intermediate floor within a dwelling	153.0000	0.0000	0.0000
E16 Corner (normal)	73.6000	0.0900	6.6240
E14 Flat roof	62.9000	0.0800	5.0320
E10 Eaves (insulation at ceiling level)	51.0000	0.0600	3.0600
R8 Roof to wall (rafter)	37.4000	0.0600	2.2440
R9 Roof to wall (flat ceiling)	8.4000	0.0400	0.3360
R7 Flat ceiling (inverted)	8.4000	0.0400	0.3360

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 45.5220 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 361.9046 (37)

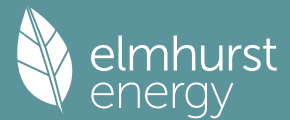
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	366.7110	365.5915	364.4941	359.3399	358.3756	353.8865	353.8865	353.0552	355.6156	358.3756	360.3264	362.3659	(38)
Average = Sum(39)m / 12 =	728.6155	727.4960	726.3987	721.2445	720.2802	715.7910	715.7910	714.9597	717.5202	720.2802	722.2310	724.2705	(39)
												721.2399	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0522	1.0505	1.0490	1.0415	1.0401	1.0336	1.0336	1.0324	1.0361	1.0401	1.0429	1.0459	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	(42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)												159.9599	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	(44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Distribution loss (46)m = 0.15 x (45)m													2656.9005
Water storage loss:	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	(46)
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.1947	284.5907	301.3839	262.6091	252.9734	226.2118	221.9476	231.7022	235.2955	264.4666	283.7861	318.3564	(62)
WWHRS	-38.9899	-34.4829	-36.1086	-29.8993	-27.8651	-23.8443	-22.3503	-23.7673	-24.6703	-29.0835	-32.9481	-38.2678	(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	283.2048	250.1077	265.2754	232.7097	225.1084	202.3675	199.5973	207.9349	210.6252	235.3831	250.8379	280.0886	(64)
Total per year (kWh/year)												2843.2405	(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	128.9128	114.3015	121.9933	108.3979	105.8968	96.2959	95.5807	98.8241	99.3162	109.7183	115.4393	127.6366	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	370.5541	410.2563	370.5541	382.9059	370.5541	382.9059	370.5541	370.5541	382.9059	370.5541	382.9059	370.5541 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	173.2699	170.0915	163.9694	150.5527	142.3344	133.7443	128.4687	132.8281	137.9391	147.4708	160.3324	171.5546 (72)
Total internal gains	1354.3765	1398.4745	1333.5633	1291.8645	1220.0015	1172.5550	1122.7216	1119.5068	1156.0566	1196.8703	1273.3766	1320.4552 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				17.9300	11.2829	0.6300	0.7000		0.7700		61.8265 (75)	
Southeast				56.5800	36.7938	0.6300	0.7000		0.7700		636.2236 (77)	
Southwest				19.2000	36.7938	0.6300	0.7000		0.7700		215.8977 (79)	
Northwest				45.5200	11.2829	0.6300	0.7000		0.7700		156.9627 (81)	
Solar gains	1070.9105	1896.8296	2788.3574	3778.4616	4527.5147	4624.6768	4404.6224	3825.9353	3128.1064	2148.4473	1295.9384	907.9125 (83)
Total gains	2425.2870	3295.3041	4121.9207	5070.3261	5747.5162	5797.2318	5527.3440	4945.4421	4284.1630	3345.3176	2569.3150	2228.3677 (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	48.3956	48.4701	48.5433	48.8902	48.9557	49.2627	49.2627	49.3200	49.1440	48.9557	48.8234	48.6859
alpha	4.2264	4.2313	4.2362	4.2593	4.2637	4.2842	4.2842	4.2880	4.2763	4.2637	4.2549	4.2457
util living area	0.9991	0.9966	0.9885	0.9560	0.8664	0.7053	0.5466	0.6212	0.8641	0.9819	0.9977	0.9994 (86)
MIT	19.0443	19.3078	19.7028	20.2194	20.6541	20.9007	20.9741	20.9563	20.7484	20.1535	19.4964	19.0020 (87)
Th 2	20.0401	20.0414	20.0427	20.0489	20.0500	20.0554	20.0554	20.0564	20.0533	20.0500	20.0477	20.0453 (88)
util rest of house	0.9989	0.9957	0.9853	0.9432	0.8279	0.6274	0.4395	0.5118	0.8093	0.9748	0.9970	0.9992 (89)
MIT 2	17.7105	18.0489	18.5540	19.2075	19.7257	19.9862	20.0440	20.0349	19.8454	19.1343	18.2954	17.6597 (90)
Living area fraction	17.7766	18.1113	18.6109	19.2576	19.7717	20.0315	20.0900	20.0806	19.8901	19.1848	18.3548	17.7262 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7766	18.1113	18.6109	19.2576	19.7717	20.0315	20.0900	20.0806	19.8901	19.1848	18.3548	17.7262 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9980	0.9929	0.9782	0.9291	0.8146	0.6253	0.4436	0.5148	0.7978	0.9652	0.9949	0.9986 (94)
Useful gains	2420.3312	3271.8565	4031.9590	4710.8649	4682.1575	3624.7241	2451.8531	2546.1262	3417.9612	3228.8587	2556.2065	2225.1636 (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	9819.2252	9611.1369	8797.3731	7470.3596	5813.8773	3887.7875	2498.1335	2631.4626	4154.4995	6183.4542	8128.6000	9796.5931 (97)
Space heating kWh	5504.7771	4259.9965	3545.4681	1986.8362	841.9995	0.0000	0.0000	0.0000	0.0000	2198.2191	4012.1233	5633.1436 (98a)
Space heating requirement - total per year (kWh/year)												27982.5633
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	5504.7771	4259.9965	3545.4681	1986.8362	841.9995	0.0000	0.0000	0.0000	0.0000	2198.2191	4012.1233	5633.1436 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27982.5633
Space heating per m2										(98c) / (4) =		40.4080 (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)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5504.7771	4259.9965	3545.4681	1986.8362	841.9995	0.0000	0.0000	0.0000	0.0000	2198.2191	4012.1233	5633.1436	(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)	5964.0055	4615.3808	3841.2438	2152.5852	912.2421	0.0000	0.0000	0.0000	0.0000	2381.6025	4346.8292	6103.0808	(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	283.2048	250.1077	265.2754	232.7097	225.1084	202.3675	199.5973	207.9349	210.6252	235.3831	250.8379	280.0886	(64)
Efficiency of water heater	88.3127	88.2481	88.1083	87.7622	86.7364	79.8000	79.8000	79.8000	79.8000	87.8418	88.2146	88.3281	(216)
Fuel for water heating, kWh/month	320.6843	283.4144	301.0789	265.1593	259.5316	253.5933	250.1220	260.5701	263.9413	267.9626	284.3497	317.1000	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	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	76.9938	61.7673	55.6146	40.7456	31.4731	25.7138	28.7108	37.3194	48.4742	63.6008	71.8370	79.1337	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-191.8796	-252.0445	-337.4944	-352.1153	-357.3561	-324.9062	-319.7859	-311.6851	-295.8506	-273.1743	-203.7237	-168.0328	(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)	-172.6469	-353.1885	-684.8326	-1005.2221	-1308.0232	-1307.6073	-1293.1981	-1105.3406	-823.6191	-498.2722	-228.0617	-137.4113	(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												30316.9700	(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												3327.5075	(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)												621.3842	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-12305.4718	(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												22046.3899	(238)

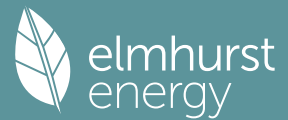
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	30316.9700	0.2100	6366.5637 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3327.5075	0.2100	698.7766 (264)
Space and water heating			7065.3403 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	621.3842	0.1443	89.6849 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3388.0484	0.1362	-461.5544
PV Unit electricity exported	-8917.4234	0.1266	-1128.6736
Total			-1590.2281 (269)
Total CO2, kg/year			5576.7264 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.0500 (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	30316.9700	1.1300	34258.1761 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3327.5075	1.1300	3760.0834 (278)

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Space and water heating			38018.2595 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	621.3842	1.5338	953.0999 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3388.0484	1.5036	-5094.1808
PV Unit electricity exported	-8917.4234	0.4646	-4143.2600
Total			-9237.4408 (283)
Total Primary energy kWh/year			29864.0194 (286)
Target Primary Energy Rate (TPER)			43.1200 (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)	
Basement floor	248.9600 (1a)	x	3.0000 (2a)	=	746.8800 (1a)	-
Ground floor	204.1800 (1b)	x	3.2500 (2b)	=	663.5850 (1b)	-
First floor	163.1500 (1c)	x	3.0000 (2c)	=	489.4500 (1c)	-
Second floor	76.2100 (1d)	x	1.9400 (2d)	=	147.8474 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624	(5)

2. Ventilation rate

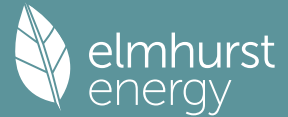
		m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0195 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	2.5000 (17)		
Infiltration rate	0.1445 (18)		
Number of sides sheltered	2 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1229 (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	0.1566	0.1536	0.1505	0.1351	0.1321	0.1167	0.1167	0.1136	0.1229	0.1321	0.1382	0.1444	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23b)
Effective ac	0.5123	0.5118	0.5113	0.5091	0.5087	0.5068	0.5068	0.5065	0.5075	0.5087	0.5096	0.5104	(23c)
													(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	
Windows (Uw = 1.00)			139.2300	0.9615	133.8750			(27)
Doors			3.2400	1.0000	3.2400			(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000	(28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000	(29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000	(29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000	(29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600	(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000	(30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200	(30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700	(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600	(30)

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Pitch	36.2600	36.2600	0.1100	3.9886	9.0000	326.3400 (30)
Dormer	25.9000	25.9000	0.1100	2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m2)		1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	266.4871			(33)
Basement		414.6000			75.0000	31095.0000 (32c)
GF		183.2000			75.0000	13740.0000 (32c)
GF		101.5000			9.0000	913.5000 (32c)
FF		128.5000			75.0000	9637.5000 (32c)
FF		142.0000			9.0000	1278.0000 (32c)
SF		81.6000			9.0000	734.4000 (32c)
GF		204.1800			18.0000	3675.2400 (32d)
FF		163.1500			18.0000	2936.7000 (32d)
Internal Floor 3		76.2100			18.0000	1371.7800 (32d)
Basement		204.1800			9.0000	1837.6200 (32e)
GF		163.1500			9.0000	1468.3500 (32e)
FF		76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940			
E3 Sill	63.5000	0.0230	1.4605			
E4 Jamb	190.2400	0.0180	3.4243			
E5 Ground floor (normal)	74.8000	0.0480	3.5904			
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530			
E16 Corner (normal)	73.6000	0.0400	2.9440			
E14 Flat roof	62.9000	0.1600	10.0640			
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050			
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880			
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880			
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 300.4063 (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	346.1709	345.8490	345.5334	344.0513	343.7741	342.4832	342.4832	342.2442	342.9804	343.7741	344.3350	344.9215 (38)	
Average = Sum(39)m / 12 =	646.5772	646.2553	645.9397	644.4577	644.1804	642.8895	642.8895	642.6505	643.3867	644.1804	644.7413	645.3278 (39)	644.4563

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9337	0.9332	0.9328	0.9306	0.9302	0.9284	0.9284	0.9280	0.9291	0.9302	0.9310	0.9319 (40)	0.9306
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (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	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752 (42b)	
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296 (42c)	
Average daily hot water use (litres/day)													81.3277 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	88.7292	86.2943	83.6363	80.3289	77.3780	74.3115	73.6750	76.3276	79.0481	82.1972	85.5338	88.6048 (44)	
Energy content (annual)	140.5253	122.8819	128.5459	109.9663	104.1657	91.3746	89.1036	94.5095	97.4742	111.5408	121.8586	138.7336 (45)	
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 (46)	
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)	
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)	
Combi loss	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	119.4465	104.4496	109.2640	93.4713	88.5408	77.6684	75.7380	80.3331	82.8531	94.8097	103.5798	117.9236 (62)	
WVHRS	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	119.4465	104.4496	109.2640	93.4713	88.5408	77.6684	75.7380	80.3331	82.8531	94.8097	103.5798	117.9236 (64)	
12Total per year (kWh/year)													1148 (64)
Electric shower(s)	68.3010	60.8568	66.4533	63.4155	64.6055	61.6274	63.6816	64.6055	63.4155	66.4533	65.2037	68.3010 (64a)	
Heat gains from water heating, kWh/month	46.9369	41.3266	43.9293	39.2217	38.2866	34.8239	34.8549	36.2347	36.5672	40.3157	42.1959	46.5562 (65)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													776.9201 (64a)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	377.4413	417.8814	377.4413	390.0227	377.4413	390.0227	377.4413	377.4413	390.0227	377.4413	390.0227	377.4413 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109 (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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	63.0872	61.4979	59.0448	54.4746	51.4605	48.3666	46.8480	48.7025	50.7877	54.1878	58.6054	62.5755 (72)
Total internal gains	1248.0810	1294.5061	1232.5259	1199.9032	1133.0148	1094.2941	1047.9882	1042.2684	1076.0219	1107.4745	1175.7664	1215.3632 (73)

6. Solar gains

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

Northeast				17.9300	11.2829	0.4000	0.7000	0.7700	39.2549 (75)			
Southeast				56.5800	36.7938	0.4000	0.7000	0.7700	403.9515 (77)			
Southwest				19.2000	36.7938	0.4000	0.7000	0.7700	137.0779 (79)			
Northwest				45.5200	11.2829	0.4000	0.7000	0.7700	99.6588 (81)			

Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524 (83)
Total gains	1928.0241	2498.8424	3002.9115	3598.9264	4007.6273	4030.5969	3844.5738	3471.4337	3062.1212	2471.5680	1998.5844	1791.8157 (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	54.5361	54.5632	54.5899	54.7154	54.7390	54.8489	54.8489	54.8693	54.8065	54.7390	54.6914	54.6417	
alpha	4.6357	4.6375	4.6393	4.6477	4.6493	4.6566	4.6566	4.6580	4.6538	4.6493	4.6461	4.6428	
util living area	0.9997	0.9990	0.9965	0.9850	0.9431	0.8316	0.6792	0.7514	0.9372	0.9939	0.9993	0.9998 (86)	
MIT	19.1685	19.3669	19.6837	20.1212	20.5430	20.8423	20.9551	20.9281	20.6756	20.1232	19.5610	19.1306 (87)	
Th 2	20.1390	20.1394	20.1397	20.1415	20.1419	20.1435	20.1435	20.1438	20.1429	20.1419	20.1412	20.1405 (88)	
util rest of house	0.9996	0.9987	0.9955	0.9801	0.9226	0.7691	0.5703	0.6490	0.9056	0.9913	0.9990	0.9998 (89)	
MIT 2	18.4224	18.6210	18.9376	19.3735	19.7821	20.0475	20.1258	20.1121	19.9124	19.3780	18.8165	18.3856 (90)	
Living area fraction	fLA = Living area / (4) =												0.0495 (91)
MIT	18.4593	18.6579	18.9745	19.4105	19.8198	20.0869	20.1668	20.1525	19.9502	19.4149	18.8534	18.4225 (92)	
Temperature adjustment													0.0000
adjusted MIT	18.4593	18.6579	18.9745	19.4105	19.8198	20.0869	20.1668	20.1525	19.9502	19.4149	18.8534	18.4225 (93)	

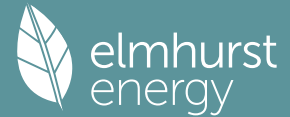
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9994	0.9980	0.9935	0.9745	0.9129	0.7643	0.5735	0.6501	0.8964	0.9881	0.9985	0.9996 (94)
Useful gains	1926.9120	2493.8481	2983.5052	3507.0997	3658.4256	3080.6242	2204.9297	2256.9455	2744.7581	2442.1078	1995.5734	1791.0826 (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	9155.1066	8891.1461	8057.8029	6773.5699	5230.6341	3527.4793	2293.0857	2411.5564	3763.9525	5678.3817	7577.9071	9178.1883 (97)
Space heating kWh	5377.7768	4298.9843	3775.2774	2351.8585	1169.7232	0.0000	0.0000	0.0000	0.0000	2407.7878	4019.2802	5496.0067 (98a)
Space heating requirement - total per year (kWh/year)												28896.6949
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	5377.7768	4298.9843	3775.2774	2351.8585	1169.7232	0.0000	0.0000	0.0000	0.0000	2407.7878	4019.2802	5496.0067 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												28896.6949
Space heating per m2												(98c) / (4) = 41.7281 (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	6043.1616	4757.3825	4884.1437	0.0000	0.0000	0.0000	0.0000 (100)

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6864	0.7792	0.7165	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	4147.8528	3706.9064	3499.6243	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4509.8650	4299.6317	3871.4285	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	260.6488	440.9876	276.6223	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	65.1622	110.2469	69.1556	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												244.5647 (107)
Energy for space heating												41.7281 (99)
Energy for space cooling												0.3532 (108)
Total												42.0812 (109)
Fabric Energy Efficiency (DFEE)												42.1 (109)

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)	
Basement floor	248.9600 (1a)	x	3.0000 (2a)	=	746.8800 (1a)	-
Ground floor	204.1800 (1b)	x	3.2500 (2b)	=	663.5850 (1b)	-
First floor	163.1500 (1c)	x	3.0000 (2c)	=	489.4500 (1c)	-
Second floor	76.2100 (1d)	x	1.9400 (2d)	=	147.8474 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624	(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	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0195 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.2695	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2291	(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	0.2921	0.2864	0.2807	0.2520	0.2463	0.2176	0.2176	0.2119	0.2291	0.2463	0.2577	0.2692	(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	0.5427	0.5410	0.5394	0.5318	0.5303	0.5237	0.5237	0.5225	0.5262	0.5303	0.5332	0.5362	(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			3.2400	1.0000	3.2400			(26)
TER Opening Type (Uw = 1.20)			139.2300	1.1450	159.4237			(27)
Basement floor			248.9600	0.1300	32.3648			(28a)
Basement walls	224.4000	23.7600	200.6400	0.1800	36.1152			(29a)
External Walls	361.4700	106.9500	254.5200	0.1800	45.8136			(29a)
Dwarf walls	42.5000		42.5000	0.1800	7.6500			(29a)

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Dormers	30.8000	11.7600	19.0400	0.1800	3.4272	(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	(30)
Flat Base	44.7800		44.7800	0.1100	4.9258	(30)
Flat GF	41.0300		41.0300	0.1100	4.5133	(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	(30)
Pitch	36.2600		36.2600	0.1100	3.9886	(30)
Dormer	25.9000		25.9000	0.1100	2.8490	(30)
Total net area of external elements Aum(A, m2)			1165.8400			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	316.3826		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0500	3.2350
E3 Sill	63.5000	0.0500	3.1750
E4 Jamb	190.2400	0.0500	9.5120
E5 Ground floor (normal)	74.8000	0.1600	11.9680
E6 Intermediate floor within a dwelling	153.0000	0.0000	0.0000
E16 Corner (normal)	73.6000	0.0900	6.6240
E14 Flat roof	62.9000	0.0800	5.0320
E10 Eaves (insulation at ceiling level)	51.0000	0.0600	3.0600
R8 Roof to wall (rafter)	37.4000	0.0600	2.2440
R9 Roof to wall (flat ceiling)	8.4000	0.0400	0.3360
R7 Flat ceiling (inverted)	8.4000	0.0400	0.3360

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 45.5220 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 361.9046 (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	366.7110	365.5915	364.4941	359.3399	358.3756	353.8865	353.8865	353.0552	355.6156	358.3756	360.3264	362.3659	(38)
Heat transfer coeff	728.6155	727.4960	726.3987	721.2445	720.2802	715.7910	715.7910	714.9597	717.5202	720.2802	722.2310	724.2705	(39)
Average = Sum(39)m / 12 =												721.2399	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0522	1.0505	1.0490	1.0415	1.0401	1.0336	1.0336	1.0324	1.0361	1.0401	1.0429	1.0459	(40)
HLP (average)												1.0415	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (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	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)												81.3277	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.7292	86.2943	83.6363	80.3289	77.3780	74.3115	73.6750	76.3276	79.0481	82.1972	85.5338	88.6048	(44)
Energy conte	140.5253	122.8819	128.5459	109.9663	104.1657	91.3746	89.1036	94.5095	97.4742	111.5408	121.8586	138.7336	(45)
Energy content (annual)												1350.6800	
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	(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

119.4465 104.4496 109.2640 93.4713 88.5408 77.6684 75.7380 80.3331 82.8531 94.8097 103.5798 117.9236 (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

119.4465 104.4496 109.2640 93.4713 88.5408 77.6684 75.7380 80.3331 82.8531 94.8097 103.5798 117.9236 (64)

Total per year (kWh/year) = Sum(64)m = 1148.0780 (64)

Electric shower(s)

68.3010 60.8568 66.4533 63.4155 64.6055 61.6274 63.6816 64.6055 63.4155 66.4533 65.2037 68.3010 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 776.9201 (64a)

Heat gains from water heating, kWh/month

46.9369 41.3266 43.9293 39.2217 38.2866 34.8239 34.8549 36.2347 36.5672 40.3157 42.1959 46.5562 (65)

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

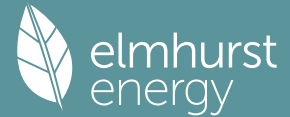
Metabolic gains (Table 5), Watts

(66)m 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 182.1090 (66)

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

370.5541 410.2563 370.5541 382.9059 370.5541 382.9059 370.5541 370.5541 382.9059 370.5541 382.9059 370.5541 (67)

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Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109 (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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	63.0872	61.4979	59.0448	54.4746	51.4605	48.3666	46.8480	48.7025	50.7877	54.1878	58.6054	62.5755 (72)
Total internal gains	1241.1938	1286.8810	1225.6387	1192.7864	1126.1276	1087.1774	1041.1010	1035.3812	1068.9051	1100.5873	1168.6496	1208.4760 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W	
Northeast				17.9300	11.2829	0.6300	0.7000				0.7700	61.8265 (75)	
Southeast				56.5800	36.7938	0.6300	0.7000				0.7700	636.2236 (77)	
Southwest				19.2000	36.7938	0.6300	0.7000				0.7700	215.8977 (79)	
Northwest				45.5200	11.2829	0.6300	0.7000				0.7700	156.9627 (81)	
Solar gains	1070.9105	1896.8296	2788.3574	3778.4616	4527.5147	4624.6768	4404.6224	3825.9353	3128.1064	2148.4473	1295.9384	907.9125	(83)
Total gains	2312.1043	3183.7106	4013.9961	4971.2480	5653.6423	5711.8541	5445.7233	4861.3165	4197.0115	3249.0346	2464.5880	2116.3886	(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	48.3956	48.4701	48.5433	48.8902	48.9557	49.2627	49.2627	49.3200	49.1440	48.9557	48.8234	48.6859
alpha	4.2264	4.2313	4.2362	4.2593	4.2637	4.2842	4.2842	4.2880	4.2763	4.2637	4.2549	4.2457
util living area	0.9993	0.9971	0.9895	0.9587	0.8718	0.7124	0.5536	0.6296	0.8708	0.9837	0.9981	0.9995 (86)
MIT	19.0216	19.2857	19.6823	20.2030	20.6438	20.8968	20.9729	20.9540	20.7389	20.1356	19.4756	18.9795 (87)
Th 2	20.0401	20.0414	20.0427	20.0489	20.0500	20.0554	20.0554	20.0564	20.0533	20.0500	20.0477	20.0453 (88)
util rest of house	0.9991	0.9963	0.9866	0.9465	0.8342	0.6347	0.4456	0.5197	0.8175	0.9772	0.9975	0.9994 (89)
MIT 2	18.2020	18.4667	18.8623	19.3777	19.7888	19.9990	20.0460	20.0387	19.8840	19.3191	18.6613	18.1637 (90)
Living area fraction	fLA = Living area / (4) = 0.0495 (91)											
MIT	18.2426	18.5072	18.9029	19.4186	19.8311	20.0435	20.0919	20.0840	19.9264	19.3595	18.7016	18.2041 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2426	18.5072	18.9029	19.4186	19.8311	20.0435	20.0919	20.0840	19.9264	19.3595	18.7016	18.2041 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	2308.6752	3165.8900	3940.4823	4653.7113	4658.7686	3619.1028	2450.5816	2543.2017	3394.8575	3153.0902	2455.0403	2114.2279 (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	10158.7990	9899.2048	9009.4621	7586.4791	5856.6811	3896.3982	2499.4777	2633.9284	4180.5390	6309.3161	8379.0600	10142.7745 (97)
Space heating kwh	5840.4921	4524.7876	3771.3210	2111.5929	891.2469	0.0000	0.0000	0.0000	0.0000	2348.2320	4265.2942	5973.2387 (98a)
Space heating requirement - total per year (kWh/year)	29726.2054											
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	5840.4921	4524.7876	3771.3210	2111.5929	891.2469	0.0000	0.0000	0.0000	0.0000	2348.2320	4265.2942	5973.2387 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	29726.2054											
Space heating per m2	(98c) / (4) = 42.9259 (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	6728.4358	5296.8537	5433.6939	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7954	0.8675	0.8160	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5351.6176	4594.8720	4433.9356	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	6482.6866	6178.5041	5503.1704	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	814.3697	1178.2222	795.5108	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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	203.5924	294.5556	198.8777	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												697.0257 (107)
Energy for space heating												42.9259 (99)
Energy for space cooling												1.0065 (108)
Total												43.9325 (109)
Fabric Energy Efficiency (TFEE)												43.9 (109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2047.7624 (5)

2. Ventilation rate

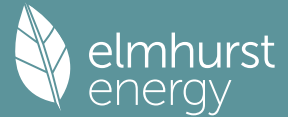
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0098 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1348 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1146 (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	3.7000	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	0.1461	0.1432	0.1403	0.1260	0.1231	0.1088	0.1088	0.1060	0.1146	0.1231	0.1289	0.1346 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.0000 (23c)
Effective ac	0.2681	0.2652	0.2623	0.2480	0.2451	0.2308	0.2308	0.2280	0.2366	0.2451	0.2509	0.2566 (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
Windows (Uw = 1.00)			139.2300	0.9615	133.8750		(27)
Doors			3.2400	1.0000	3.2400		(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000 (29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000 (29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000 (29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600 (29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000 (30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200 (30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700 (30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600 (30)

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Pitch	36.2600	36.2600	0.1100	3.9886	9.0000	326.3400 (30)
Dormer	25.9000	25.9000	0.1100	2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m2)		1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	266.4871			(33)
Basement		414.6000			75.0000	31095.0000 (32c)
GF		183.2000			75.0000	13740.0000 (32c)
GF		101.5000			9.0000	913.5000 (32c)
FF		128.5000			75.0000	9637.5000 (32c)
FF		142.0000			9.0000	1278.0000 (32c)
SF		81.6000			9.0000	734.4000 (32c)
GF		204.1800			18.0000	3675.2400 (32d)
FF		163.1500			18.0000	2936.7000 (32d)
Internal Floor 3		76.2100			18.0000	1371.7800 (32d)
Basement		204.1800			9.0000	1837.6200 (32e)
GF		163.1500			9.0000	1468.3500 (32e)
FF		76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges						
K1 Element	Length	Psi-value	Total			
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940			
E3 Sill	63.5000	0.0230	1.4605			
E4 Jamb	190.2400	0.0180	3.4243			
E5 Ground floor (normal)	74.8000	0.0480	3.5904			
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530			
E16 Corner (normal)	73.6000	0.0400	2.9440			
E14 Flat roof	62.9000	0.1600	10.0640			
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050			
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880			
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880			
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 300.4063 (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)
Heat transfer coeff	181.1402	179.2050	177.2698	167.5936	165.6583	155.9821	155.9821	154.0469	159.8526	165.6583	169.5288	173.3993	(38)
Average = Sum(39)m / 12 =	481.5466	479.6113	477.6761	467.9999	466.0646	456.3884	456.3884	454.4532	460.2589	466.0646	469.9351	473.8056	(39)
												467.5161	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.6954	0.6926	0.6898	0.6758	0.6730	0.6590	0.6590	0.6563	0.6646	0.6730	0.6786	0.6842	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers													
85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	84.9607	(42a)
Hot water usage for baths													
36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	36.6752	(42b)
Hot water usage for other uses													
51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	51.9296	(42c)
Average daily hot water use (litres/day)													159.9599 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	173.5654	(44)
Energy conte	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													Total = Sum(45)m = 2656.9005
41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	40.7642	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9000 (48)
Temperature factor from Table 2b													0.7930 (49)
Enter (49) or (54) in (55)													1.5067 (55)
Total storage loss													
46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	(56)
If cylinder contains dedicated solar storage													
46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	(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													
322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686	318.4686	(62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441	(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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245	(64)
													Total per year (kWh/year) = Sum(64)m = 2477.4708 (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	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													
129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264	127.7264	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753 (72)
Total internal gains	1508.2878	1504.2130	1451.5027	1358.2892	1258.4470	1167.9564	1117.6451	1122.9008	1174.6001	1266.9285	1371.4140	1461.5367 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W	
Northeast				17.9300	11.2829	0.4000	0.7000				0.7700	39.2549 (75)	
Southeast				56.5800	36.7938	0.4000	0.7000				0.7700	403.9515 (77)	
Southwest				19.2000	36.7938	0.4000	0.7000				0.7700	137.0779 (79)	
Northwest				45.5200	11.2829	0.4000	0.7000				0.7700	99.6588 (81)	
Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524	(83)
Total gains	2188.2309	2708.5492	3221.8884	3757.3124	4133.0595	4104.2591	3914.2307	3552.0661	3160.6994	2631.0221	2194.2320	2037.9891	(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	73.2261	73.5216	73.8195	75.3457	75.6586	77.2627	77.2627	77.5917	76.6129	75.6586	75.0354	74.4225
alpha	5.8817	5.9014	5.9213	6.0230	6.0439	6.1508	6.1508	6.1728	6.1075	6.0439	6.0024	5.9615
util living area	0.9997	0.9987	0.9942	0.9699	0.8776	0.6839	0.5089	0.5791	0.8613	0.9885	0.9990	0.9998 (86)
MIT	19.9849	20.1222	20.3347	20.6150	20.8317	20.9306	20.9468	20.9442	20.8740	20.5772	20.2318	19.9716 (87)
Th 2	20.3449	20.3474	20.3499	20.3622	20.3647	20.3772	20.3772	20.3796	20.3722	20.3647	20.3598	20.3548 (88)
util rest of house	0.9996	0.9983	0.9927	0.9618	0.8479	0.6266	0.4388	0.5053	0.8175	0.9843	0.9988	0.9997 (89)
MIT 2	19.1089	19.2869	19.5608	19.9250	20.1855	20.2986	20.3110	20.3121	20.2426	19.8827	19.4376	19.0999 (90)
Living area fraction									fLA = Living area / (4) =			0.0495 (91)
MIT	19.1523	19.3282	19.5991	19.9592	20.2175	20.3299	20.3425	20.3434	20.2738	19.9171	19.4770	19.1431 (92)
Temperature adjustment												-0.1000
adjusted MIT	19.0523	19.2282	19.4991	19.8592	20.1175	20.2299	20.2425	20.2434	20.1738	19.8171	19.3770	19.0431 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9993	0.9975	0.9900	0.9538	0.8347	0.6124	0.4234	0.4886	0.8015	0.9793	0.9981	0.9996 (94)
Useful gains	2186.7438	2701.7948	3189.6903	3583.5811	3449.9559	2513.5571	1657.4658	1735.4899	2533.4144	2576.6292	2190.1217	2037.0899 (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	7103.9175	6871.9866	6209.3621	5128.8896	3923.1222	2569.4179	1662.4092	1746.6607	2795.5399	4295.7816	5769.3858	7032.7223 (97)
Space heating kWh	3658.3773	2802.3689	2246.6358	1112.6221	352.0358	0.0000	0.0000	0.0000	0.0000	1279.0494	2577.0701	3716.7505 (98a)
Space heating requirement - total per year (kWh/year)												17744.9098
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	3658.3773	2802.3689	2246.6358	1112.6221	352.0358	0.0000	0.0000	0.0000	0.0000	1279.0494	2577.0701	3716.7505 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												17744.9098
Space heating per m ²										(98c) / (4) =		25.6244 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000 (201)
Fraction of space heat from main system(s)	0.9000 (202)

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Efficiency of main space heating system 1 (in %)												88.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	3658.3773	2802.3689	2246.6358	1112.6221	352.0358	0.0000	0.0000	0.0000	0.0000	1279.0494	2577.0701	3716.7505 (98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000 (210)
Space heating fuel (main heating system)	3720.3837	2849.8667	2284.7143	1131.4801	358.0025	0.0000	0.0000	0.0000	0.0000	1300.7282	2620.7493	3779.7463 (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)	406.4864	311.3743	249.6262	123.6247	39.1151	0.0000	0.0000	0.0000	0.0000	142.1166	286.3411	412.9723 (215)
Water heating												
Water heating requirement	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Efficiency of water heater	87.8146	87.7191	87.4931	86.8461	84.8188	79.5000	79.5000	79.5000	79.5000	87.0048	87.6491	79.5000 (216)
Fuel for water heating, kWh/month	277.6407	245.4061	261.5054	233.1962	232.2425	224.2955	222.7199	231.4014	233.6298	236.7977	248.2179	274.8749 (217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	238.3701	215.3021	238.3701	230.6808	238.3701	230.6808	238.3701	238.3701	230.6808	238.3701	230.6808	238.3701 (231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719 (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												18045.6710 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												1971.6566 (215)
Efficiency of water heater												79.5000
Water heating fuel used												2921.9279 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)												
mechanical ventilation fans (SFP = 1.0890)												2720.6162 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												2806.6162 (231)
Electricity for lighting (calculated in Appendix L)												770.8784 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												0.0000 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												26516.7501 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	18045.6710	3.6400	656.8624 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	1971.6566	5.1200	100.9488 (242)
Water heating (other fuel)	2921.9279	3.6400	106.3582 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	2806.6162	16.4900	462.8110 (249)
Energy for lighting	770.8784	16.4900	127.1178 (250)
Additional standing charges			92.0000 (251)
Total energy cost			1546.0983 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600 (256)
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Energy cost factor (ECF)
SAP value
SAP rating (Section 12)
SAP band

$[(255) \times (256)] / [(4) + 45.0] = 0.7547 (257)$
87.7662
88 (258)
B

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	18045.6710	0.2100	3789.5909 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	1971.6566	0.0280	55.2064 (263)
Water heating (other fuel)	2921.9279	0.2100	613.6049 (264)
Space and water heating			4458.4022 (265)
Pumps, fans and electric keep-hot	2806.6162	0.1387	389.3123 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Total CO2, kg/year			4958.9760 (272)
CO2 emissions per m2			7.1600 (273)
EI value			90.9898
EI rating			91 (274)
EI band			B

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)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0098 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	2.5000	(17)
Infiltration rate	0.1348	(18)
Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1146 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	4.8000	4.8000	4.3000	4.3000	3.9000	4.0000	4.0000	4.1000	4.4000	4.3000	4.7000 (22)
Wind factor	1.2500	1.2000	1.2000	1.0750	1.0750	0.9750	1.0000	1.0000	1.0250	1.1000	1.0750	1.1750 (22a)
Adj infilt rate	0.1432	0.1375	0.1375	0.1231	0.1231	0.1117	0.1146	0.1146	0.1174	0.1260	0.1231	0.1346 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												75.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2652	0.2595	0.2595	0.2451	0.2451	0.2337	0.2366	0.2366	0.2394	0.2480	0.2451	0.2566 (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
Windows (Uw = 1.00)			139.2300	0.9615	133.8750		(27)
Doors			3.2400	1.0000	3.2400		(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000 (29a)
External walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000 (29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000 (29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600 (29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000 (30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200 (30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700 (30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600 (30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400 (30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m2)			1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	266.4871		(33)
Basement			414.6000			75.0000	31095.0000 (32c)
GF			183.2000			75.0000	13740.0000 (32c)
GF			101.5000			9.0000	913.5000 (32c)
FF			128.5000			75.0000	9637.5000 (32c)
FF			142.0000			9.0000	1278.0000 (32c)
SF			81.6000			9.0000	734.4000 (32c)
GF			204.1800			18.0000	3675.2400 (32d)
FF			163.1500			18.0000	2936.7000 (32d)
Internal Floor 3			76.2100			18.0000	1371.7800 (32d)
Basement			204.1800			9.0000	1837.6200 (32e)
GF			163.1500			9.0000	1468.3500 (32e)
FF			76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 300.4063 (37)

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

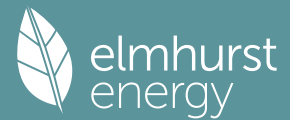
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	179.2050	175.3345	175.3345	165.6583	165.6583	157.9173	159.8526	159.8526	161.7878	167.5936	165.6583	173.3993 (38)
Heat transfer coeff	479.6113	475.7408	475.7408	466.0646	466.0646	458.3237	460.2589	460.2589	462.1941	467.9999	466.0646	473.8056 (39)
Average = Sum(39)m / 12 =												467.6773

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6926	0.6870	0.6870	0.6730	0.6730	0.6618	0.6646	0.6646	0.6674	0.6758	0.6730	0.6842 (40)
HLP (average)												0.6753
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607 (42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752 (42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296 (42c)
Average daily hot water use (litres/day)												159.9599 (43)
Daily hot water use	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654 (44)
Energy conte	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615 (45)
Energy content (annual)												Total = Sum(45)m = 2656.9005
Distribution loss (46)m = 0.15 x (45)m	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642 (46)
Water storage loss:												
Store volume												500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (56)
If cylinder contains dedicated solar storage												

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Primary loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686 (62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Total per year (kWh/year) = Sum(64)m =												2477.4708 (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	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	(71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753	(72)
Total internal gains	1508.2878	1504.2130	1451.5027	1358.2892	1258.4470	1167.9564	1117.6451	1122.9008	1174.6001	1266.9285	1371.4140	1461.5367	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific FF or Table 6c	Access factor Table 6d	Gains W
Northeast	17.9300	12.4928	0.4000	0.7000	0.7700	43.4641 (75)
Southeast	56.5800	39.1209	0.4000	0.7000	0.7700	429.5001 (77)
Southwest	19.2000	39.1209	0.4000	0.7000	0.7700	145.7476 (79)
Northwest	45.5200	12.4928	0.4000	0.7000	0.7700	110.3449 (81)

Solar gains	729.0567	1161.8148	1721.8849	2421.3774	2832.6074	3091.9754	2936.3027	2625.3759	2125.5309	1439.3668	911.5603	606.5486 (83)
Total gains	2237.3445	2666.0277	3173.3876	3779.6665	4091.0544	4259.9318	4053.9478	3748.2768	3300.1309	2706.2954	2282.9743	2068.0853 (84)

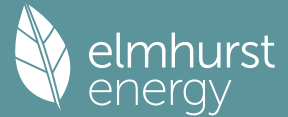
7. Mean internal temperature (heating season)

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	73.5216	74.1197	74.1197	75.6586	75.6586	76.9364	76.6129	76.6129	76.2922	75.3457	75.6586	74.4225
alpha	5.9014	5.9413	5.9413	6.0439	6.0439	6.1291	6.1075	6.1075	6.0861	6.0230	6.0439	5.9615
util living area	0.9995	0.9985	0.9926	0.9546	0.8153	0.5323	0.3290	0.3800	0.7470	0.9776	0.9983	0.9997 (86)
MIT	20.0530	20.1637	20.4008	20.6899	20.8837	20.9454	20.9490	20.9488	20.9210	20.6665	20.3237	20.0391 (87)
Th 2	20.3474	20.3523	20.3523	20.3647	20.3647	20.3747	20.3722	20.3722	20.3697	20.3622	20.3647	20.3548 (88)
util rest of house	0.9994	0.9982	0.9905	0.9422	0.7731	0.4682	0.2579	0.3034	0.6819	0.9690	0.9978	0.9996 (89)
MIT 2	19.1982	19.3442	19.6472	20.0196	20.2416	20.3074	20.3069	20.3068	20.2845	19.9927	19.5595	19.1864 (90)
Living area fraction	fLA = Living area / (4) =											0.0495 (91)
MIT	19.2405	19.3848	19.6845	20.0528	20.2734	20.3390	20.3387	20.3386	20.3161	20.0260	19.5974	19.2286 (92)
Temperature adjustment												-0.1000
adjusted MIT	19.1405	19.2848	19.5845	19.9528	20.1734	20.2390	20.2387	20.2386	20.2161	19.9260	19.4974	19.1286 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9990	0.9973	0.9872	0.9323	0.7591	0.4540	0.2428	0.2871	0.6647	0.9612	0.9967	0.9994 (94)
Useful gains	2235.1876	2658.7657	3132.7162	3523.8513	3105.4872	1934.2154	984.2261	1075.9950	2193.5803	2601.2321	2275.4075	2066.7849 (95)
Ext temp.	5.0000	5.4000	7.4000	9.9000	13.0000	16.0000	18.1000	17.9000	15.3000	11.7000	8.0000	5.0000 (96)
Heat loss rate W	6781.9611	6605.5552	5796.6813	4685.2662	3343.2813	1942.8409	984.3573	1076.3713	2272.1725	3849.7831	5358.5158	6694.2098 (97)
Space heating kWh												

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3382.7994	2652.2425	1981.9901	836.2187	176.9188	0.0000	0.0000	0.0000	0.0000	928.9220	2219.8380	3442.8041	(98a)
Space heating requirement - total per year (kWh/year)											15621.7336	
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												
3382.7994	2652.2425	1981.9901	836.2187	176.9188	0.0000	0.0000	0.0000	0.0000	928.9220	2219.8380	3442.8041	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)											15621.7336	
Space heating per m2											(98c) / (4) =	22.5585 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000	(201)
Fraction of space heat from main system(s)	0.9000	(202)
Efficiency of main space heating system 1 (in %)	88.5000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	90.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3382.7994	2652.2425	1981.9901	836.2187	176.9188	0.0000	0.0000	0.0000	0.0000	928.9220	2219.8380	3442.8041	(98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating system)	3440.1350	2697.1958	2015.5831	850.3919	179.9174	0.0000	0.0000	0.0000	0.0000	944.6664	2257.4624	3501.1567	(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)	375.8666	294.6936	220.2211	92.9132	19.6576	0.0000	0.0000	0.0000	0.0000	103.2136	246.6487	382.5338	(215)
Water heating													
Water heating requirement	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245	(64)
Efficiency of water heater (217)m	87.7633	87.6789	87.3755	86.4254	83.2860	79.5000	79.5000	79.5000	79.5000	86.5625	87.5269	79.5000	(216)
Fuel for water heating, kWh/month	277.8029	245.5186	261.8575	234.3313	236.5167	224.2955	222.7199	231.4014	233.6298	238.0075	248.5642	275.0284	(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	238.3701	215.3021	238.3701	230.6808	238.3701	230.6808	238.3701	238.3701	230.6808	238.3701	230.6808	238.3701	(231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												15886.5088	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												1735.7482	(215)
Efficiency of water heater												79.5000	
Water heating fuel used												2929.6735	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:			
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)			
mechanical ventilation fans (SFP = 1.0890)		2720.6162	(230a)
central heating pump		41.0000	(230c)
main heating flue fan		45.0000	(230e)
Total electricity for the above, kWh/year		2806.6162	(231)
Electricity for lighting (calculated in Appendix L)		770.8784	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		0.0000 (233)
Wind generation		0.0000 (234)
Hydro-electric generation (Appendix N)		0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)		0.0000 (235)
Appendix Q - special features		
Energy saved or generated		-0.0000 (236)
Energy used		0.0000 (237)
Total delivered energy for all uses		24129.4250 (238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
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Space heating - main system 1	15886.5088	4.8000	762.5524 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	1735.7482	7.7200	133.9998 (242)
Water heating (other fuel)	2929.6735	4.8000	140.6243 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	2806.6162	21.5100	603.7031 (249)
Energy for lighting	770.8784	21.5100	165.8159 (250)
Additional standing charges			98.0000 (251)
Total energy cost			1904.6956 (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	15886.5088	0.2100	3336.1668 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	1735.7482	0.0280	48.6009 (263)
Water heating (other fuel)	2929.6735	0.2100	615.2314 (264)
Space and water heating			3999.9992 (265)
Pumps, fans and electric keep-hot	2806.6162	0.1387	389.3123 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Total CO2, kg/year			4500.5731 (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	15886.5088	1.1300	17951.7549 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	1735.7482	1.0460	1815.5926 (277)
Water heating (other fuel)	2929.6735	1.1300	3310.5311 (278)
Space and water heating			23077.8786 (279)
Pumps, fans and electric keep-hot	2806.6162	1.5128	4245.8489 (281)
Energy for lighting	770.8784	1.5338	1182.3990 (282)
Total Primary energy kWh/year			28506.1265 (286)

SAP 10 EPC IMPROVEMENTS

Lean Rev A

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 91

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Recommended
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 1.5	-£ 251	-154 kg (3.4%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.2	-£ 30	-195 kg (4.3%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£251	0.22 kg/m²	B 89
Total Savings	£251	0.22 kg/m²	B 91

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£770	£770	£0
Mains gas	£1001	£1001	£0
Wood	£134	£134	£0
Space heating	£1598	£1598	£0
Water heating	£141	£141	£0
Lighting	£166	£166	£0
Generated (PV)	-£0	-£251	£251
Total cost of fuels	£1905	£1654	£251
Total cost of uses	£1905	£1654	£251
Delivered energy	35 kWh/m²	33 kWh/m²	2 kWh/m²
Carbon dioxide emissions	4.5 tonnes	4.3 tonnes	0.2 tonnes

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CO2 emissions per m² 6 kg/m² 6 kg/m² 0 kg/m²
 Primary energy 41 kWh/m² 39 kWh/m² 3 kWh/m²

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)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (5)

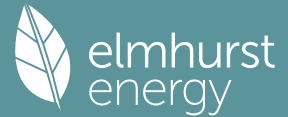
2. Ventilation rate

	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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0098 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1348 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1146 (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	0.1461 0.1432 0.1403 0.1260 0.1231 0.1088 0.1088 0.1060 0.1146 0.1231 0.1289 0.1346 (22b)
Balanced mechanical ventilation with heat recovery	
If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.6000 (23c)
Effective ac	0.2681 0.2652 0.2623 0.2480 0.2451 0.2308 0.2308 0.2280 0.2366 0.2451 0.2509 0.2566 (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
Windows (Uw = 1.00)			139.2300	0.9615	133.8750		(27)
Doors			3.2400	1.0000	3.2400		(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000 (29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000 (29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000 (29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600 (29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000 (30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200 (30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700 (30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600 (30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400 (30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m ²)			1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	266.4871	(33)

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Basement	414.6000	75.0000	31095.0000 (32c)
GF	183.2000	75.0000	13740.0000 (32c)
GF	101.5000	9.0000	913.5000 (32c)
FF	128.5000	75.0000	9637.5000 (32c)
FF	142.0000	9.0000	1278.0000 (32c)
SF	81.6000	9.0000	734.4000 (32c)
GF	204.1800	18.0000	3675.2400 (32d)
FF	163.1500	18.0000	2936.7000 (32d)
Internal Floor 3	76.2100	18.0000	1371.7800 (32d)
Basement	204.1800	9.0000	1837.6200 (32e)
GF	163.1500	9.0000	1468.3500 (32e)
FF	76.2100	9.0000	685.8900 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)
 Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080

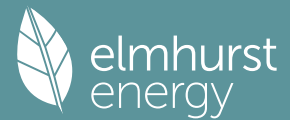
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 300.4063 (37)

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	181.1402	179.2050	177.2698	167.5936	165.6583	155.9821	155.9821	154.0469	159.8526	165.6583	169.5288	173.3993 (38)
Heat transfer coeff	481.5466	479.6113	477.6761	467.9999	466.0646	456.3884	456.3884	454.4532	460.2589	466.0646	469.9351	473.8056 (39)
Average = Sum(39)m / 12 =												467.5161
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.6954	0.6926	0.6898	0.6758	0.6730	0.6590	0.6590	0.6563	0.6646	0.6730	0.6786	0.6842 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607 (42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752 (42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296 (42c)
Average daily hot water use (litres/day)												159.9599 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654 (44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615 (45)
Distribution loss (46)m = 0.15 x (45)m	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642 (46)
Water storage loss:												
Store volume												500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (56)
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686 (62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
	Total per year (kWh/year) = Sum(64)m =											2477.4708 (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	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753 (72)
Total internal gains	1508.2878	1504.2130	1451.5027	1358.2892	1258.4470	1167.9564	1117.6451	1122.9008	1174.6001	1266.9285	1371.4140	1461.5367 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				17.9300	11.2829	0.4000	0.7000	0.7700	39.2549 (75)			
Southeast				56.5800	36.7938	0.4000	0.7000	0.7700	403.9515 (77)			
Southwest				19.2000	36.7938	0.4000	0.7000	0.7700	137.0779 (79)			
Northwest				45.5200	11.2829	0.4000	0.7000	0.7700	99.6588 (81)			
Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524 (83)
Total gains	2188.2309	2708.5492	3221.8884	3757.3124	4133.0595	4104.2591	3914.2307	3552.0661	3160.6994	2631.0221	2194.2320	2037.9891 (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	73.2261	73.5216	73.8195	75.3457	75.6586	77.2627	77.2627	77.5917	76.6129	75.6586	75.0354	74.4225
alpha	5.8817	5.9014	5.9213	6.0230	6.0439	6.1508	6.1508	6.1728	6.1075	6.0439	6.0024	5.9615
util living area	0.9997	0.9987	0.9942	0.9699	0.8776	0.6839	0.5089	0.5791	0.8613	0.9885	0.9990	0.9998 (86)
MIT	19.9849	20.1222	20.3347	20.6150	20.8317	20.9306	20.9468	20.9442	20.8740	20.5772	20.2318	19.9716 (87)
Th 2	20.3449	20.3474	20.3499	20.3622	20.3647	20.3772	20.3772	20.3796	20.3722	20.3647	20.3598	20.3548 (88)
util rest of house	0.9996	0.9983	0.9927	0.9618	0.8479	0.6266	0.4388	0.5053	0.8175	0.9843	0.9988	0.9997 (89)
MIT 2	19.1089	19.2869	19.5608	19.9250	20.1855	20.2986	20.3110	20.3121	20.2426	19.8827	19.4376	19.0999 (90)
Living area fraction	19.1523	19.3282	19.5991	19.9592	20.2175	20.3299	20.3425	20.3434	20.2738	19.9171	19.4770	0.0495 (91)
MIT	19.1523	19.3282	19.5991	19.9592	20.2175	20.3299	20.3425	20.3434	20.2738	19.9171	19.4770	19.1431 (92)
Temperature adjustment	19.0523	19.2282	19.4991	19.8592	20.1175	20.2299	20.2425	20.2434	20.1738	19.8171	19.3770	-0.1000
adjusted MIT	19.0523	19.2282	19.4991	19.8592	20.1175	20.2299	20.2425	20.2434	20.1738	19.8171	19.3770	19.0431 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9993	0.9975	0.9900	0.9538	0.8347	0.6124	0.4234	0.4886	0.8015	0.9793	0.9981	0.9996 (94)
Useful gains	2186.7438	2701.7948	3189.6903	3583.5811	3449.9559	2513.5571	1657.4658	1735.4899	2533.4144	2576.6292	2190.1217	2037.0899 (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	7103.9175	6871.9866	6209.3621	5128.8896	3923.1222	2569.4179	1662.4092	1746.6607	2795.5399	4295.7816	5769.3858	7032.7223 (97)
Space heating kWh	3658.3773	2802.3689	2246.6358	1112.6221	352.0358	0.0000	0.0000	0.0000	0.0000	1279.0494	2577.0701	3716.7505 (98a)
Space heating requirement - total per year (kWh/year)												17744.9098
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	3658.3773	2802.3689	2246.6358	1112.6221	352.0358	0.0000	0.0000	0.0000	0.0000	1279.0494	2577.0701	3716.7505 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												17744.9098
Space heating per m2										(98c) / (4) =		25.6244 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.1000 (201)
Fraction of space heat from main system(s)	0.9000 (202)
Efficiency of main space heating system 1 (in %)	88.5000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	90.0000 (208)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	3658.3773	2802.3689	2246.6358	1112.6221	352.0358	0.0000	0.0000	0.0000	0.0000	1279.0494	2577.0701	3716.7505	(98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000	(210)
Space heating fuel (main heating system)	3720.3837	2849.8667	2284.7143	1131.4801	358.0025	0.0000	0.0000	0.0000	0.0000	1300.7282	2620.7493	3779.7463	(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)	406.4864	311.3743	249.6262	123.6247	39.1151	0.0000	0.0000	0.0000	0.0000	142.1166	286.3411	412.9723	(215)
Water heating													
Water heating requirement	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245	(64)
Efficiency of water heater	87.8146	87.7191	87.4931	86.8461	84.8188	79.5000	79.5000	79.5000	79.5000	87.0048	87.6491	79.5000	(216)
Fuel for water heating, kWh/month	277.6407	245.4061	261.5054	233.1962	232.2425	224.2955	222.7199	231.4014	233.6298	236.7977	248.2179	274.8749	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	238.3701	215.3021	238.3701	230.6808	238.3701	230.6808	238.3701	238.3701	230.6808	238.3701	230.6808	238.3701	(231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-40.7721	-63.0521	-99.6016	-123.5923	-144.0322	-138.8106	-137.3342	-124.2134	-103.0280	-77.0236	-46.8182	-34.6388	(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												18045.6710	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												1971.6566	(215)
Efficiency of water heater												79.5000	
Water heating fuel used												2921.9279	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)													
mechanical ventilation fans (SFP = 1.0890)												2720.6162	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												2806.6162	(231)
Electricity for lighting (calculated in Appendix L)												770.8784	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1132.9170	(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												25383.8331	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	18045.6710	3.6400	656.8624 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	1971.6566	5.1200	100.9488 (242)
Water heating (other fuel)	2921.9279	3.6400	106.3582 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	2806.6162	16.4900	462.8110 (249)
Energy for lighting	770.8784	16.4900	127.1178 (250)
Additional standing charges			92.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1132.9170	16.4900	-186.8180
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-186.8180 (252)
Total energy cost			1359.2803 (255)

11a. SAP rating - Individual heating systems

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Energy cost deflator (Table 12):
Energy cost factor (ECF)
SAP value
SAP rating (Section 12)
SAP band

$$\begin{aligned} & [(255) \times (256)] / [(4) + 45.0] = 0.3600 \quad (256) \\ & 0.6635 \quad (257) \\ & 89.2445 \\ & 89 \quad (258) \\ & B \end{aligned}$$

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	18045.6710	0.2100	3789.5909 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	1971.6566	0.0280	55.2064 (263)
Water heating (other fuel)	2921.9279	0.2100	613.6049 (264)
Space and water heating			4458.4022 (265)
Pumps, fans and electric keep-hot	2806.6162	0.1387	389.3123 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1132.9170	0.1326	-150.2327
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-150.2327 (269)
Total CO2, kg/year			4808.7433 (272)
CO2 emissions per m2			6.9400 (273)
EI value			91.2628
EI rating			91 (274)
EI band			B

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

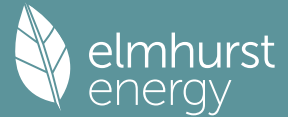
	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0098 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1348 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1146 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.0000	4.8000	4.8000	4.3000	4.3000	3.9000	4.0000	4.0000	4.1000	4.4000	4.3000	4.7000 (22)
Wind factor	1.2500	1.2000	1.2000	1.0750	1.0750	0.9750	1.0000	1.0000	1.0250	1.1000	1.0750	1.1750 (22a)
Adj infilt rate	0.1432	0.1375	0.1375	0.1231	0.1231	0.1117	0.1146	0.1146	0.1174	0.1260	0.1231	0.1346 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												

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If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 75.6000 (23c)

Effective ac 0.2652 0.2595 0.2595 0.2451 0.2451 0.2337 0.2366 0.2366 0.2394 0.2480 0.2451 0.2566 (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
Windows (Uw = 1.00)			139.2300	0.9615	133.8750		(27)
Doors			3.2400	1.0000	3.2400		(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000 (29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000 (29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000 (29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600 (29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000 (30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200 (30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700 (30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600 (30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400 (30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m2)			1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)					266.4871		(26)...(30) + (32) = (33)
Basement			414.6000			75.0000	31095.0000 (32c)
GF			183.2000			75.0000	13740.0000 (32c)
GF			101.5000			9.0000	913.5000 (32c)
FF			128.5000			75.0000	9637.5000 (32c)
FF			142.0000			9.0000	1278.0000 (32c)
SF			81.6000			9.0000	734.4000 (32c)
GF			204.1800			18.0000	3675.2400 (32d)
FF			163.1500			18.0000	2936.7000 (32d)
Internal Floor 3			76.2100			18.0000	1371.7800 (32d)
Basement			204.1800			9.0000	1837.6200 (32e)
GF			163.1500			9.0000	1468.3500 (32e)
FF			76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 300.4063 (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	179.2050	175.3345	175.3345	165.6583	165.6583	157.9173	159.8526	159.8526	161.7878	167.5936	165.6583	173.3993 (38)
Heat transfer coeff	479.6113	475.7408	475.7408	466.0646	466.0646	458.3237	460.2589	460.2589	462.1941	467.9999	466.0646	473.8056 (39)
Average = Sum(39)m / 12 =												467.6773

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.6926	0.6870	0.6870	0.6730	0.6730	0.6618	0.6646	0.6646	0.6674	0.6758	0.6730	0.6842 (40)
HLP (average)												0.6753
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.6422 (42)

Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607 (42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752 (42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296 (42c)
Average daily hot water use (litres/day)												159.9599 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654 (44)
Energy conte	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615 (45)
Energy content (annual)												Total = Sum(45)m = 2656.9005
Distribution loss (46)m = 0.15 x (45)m	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642 (46)
Water storage loss:												
Store volume												500.0000 (47)

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a) If manufacturer declared loss factor is known (kwh/day):												1.9000 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.5067 (55)
Total storage loss												
	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (56)
If cylinder contains dedicated solar storage												
	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (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												
	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686 (62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441 (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												
	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Total per year (kwh/year) = Sum(64)m =												2477.4708 (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												
	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	(71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753	(72)
Total internal gains	1508.2878	1504.2130	1451.5027	1358.2892	1258.4470	1167.9564	1117.6451	1122.9008	1174.6001	1266.9285	1371.4140	1461.5367	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				17.9300	12.4928	0.4000	0.7000	0.7700	43.4641 (75)			
Southeast				56.5800	39.1209	0.4000	0.7000	0.7700	429.5001 (77)			
Southwest				19.2000	39.1209	0.4000	0.7000	0.7700	145.7476 (79)			
Northwest				45.5200	12.4928	0.4000	0.7000	0.7700	110.3449 (81)			
Solar gains	729.0567	1161.8148	1721.8849	2421.3774	2832.6074	3091.9754	2936.3027	2625.3759	2125.5309	1439.3668	911.5603	606.5486 (83)
Total gains	2237.3445	2666.0277	3173.3876	3779.6665	4091.0544	4259.9318	4053.9478	3748.2768	3300.1309	2706.2954	2282.9743	2068.0853 (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	73.5216	74.1197	74.1197	75.6586	75.6586	76.9364	76.6129	76.6129	76.2922	75.3457	75.6586	74.4225	
alpha	5.9014	5.9413	5.9413	6.0439	6.0439	6.1291	6.1075	6.1075	6.0861	6.0230	6.0439	5.9615	
util living area	0.9995	0.9985	0.9926	0.9546	0.8153	0.5323	0.3290	0.3800	0.7470	0.9776	0.9983	0.9997	(86)
MIT	20.0530	20.1637	20.4008	20.6899	20.8837	20.9454	20.9490	20.9488	20.9210	20.6665	20.3237	20.0391	(87)
Th 2	20.3474	20.3523	20.3523	20.3647	20.3647	20.3747	20.3722	20.3722	20.3697	20.3622	20.3647	20.3548	(88)
util rest of house	0.9994	0.9982	0.9905	0.9422	0.7731	0.4682	0.2579	0.3034	0.6819	0.9690	0.9978	0.9996	(89)
MIT 2	19.1982	19.3442	19.6472	20.0196	20.2416	20.3074	20.3069	20.3068	20.2845	19.9927	19.5595	19.1864	(90)
Living area fraction	19.2405	19.3848	19.6845	20.0528	20.2734	20.3390	20.3387	20.3386	20.3161	20.0260	19.5974	19.2286	(91)
MIT	19.1405	19.2848	19.5845	19.9528	20.1734	20.2390	20.2387	20.2386	20.2161	19.9260	19.4974	19.1286	(92)
Temperature adjustment												-0.1000	(93)
adjusted MIT													

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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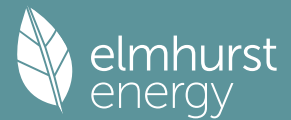


Utilisation	0.9990	0.9973	0.9872	0.9323	0.7591	0.4540	0.2428	0.2871	0.6647	0.9612	0.9967	0.9994 (94)
Useful gains	2235.1876	2658.7657	3132.7162	3523.8513	3105.4872	1934.2154	984.2261	1075.9950	2193.5803	2601.2321	2275.4075	2066.7849 (95)
Ext temp.	5.0000	5.4000	7.4000	9.9000	13.0000	16.0000	18.1000	17.9000	15.3000	11.7000	8.0000	5.0000 (96)
Heat loss rate W	6781.9611	6605.5552	5796.6813	4685.2662	3343.2813	1942.8409	984.3573	1076.3713	2272.1725	3849.7831	5358.5158	6694.2098 (97)
Space heating kWh	3382.7994	2652.2425	1981.9901	836.2187	176.9188	0.0000	0.0000	0.0000	0.0000	928.9220	2219.8380	3442.8041 (98a)
Space heating requirement - total per year (kWh/year)												15621.7336
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	3382.7994	2652.2425	1981.9901	836.2187	176.9188	0.0000	0.0000	0.0000	0.0000	928.9220	2219.8380	3442.8041 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												15621.7336
Space heating per m2										(98c) / (4) =		22.5585 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												88.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	3382.7994	2652.2425	1981.9901	836.2187	176.9188	0.0000	0.0000	0.0000	0.0000	928.9220	2219.8380	3442.8041 (98)
Space heating efficiency (main heating system 1)	88.5000	88.5000	88.5000	88.5000	88.5000	0.0000	0.0000	0.0000	0.0000	88.5000	88.5000	88.5000 (210)
Space heating fuel (main heating system)	3440.1350	2697.1958	2015.5831	850.3919	179.9174	0.0000	0.0000	0.0000	0.0000	944.6664	2257.4624	3501.1567 (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)	375.8666	294.6936	220.2211	92.9132	19.6576	0.0000	0.0000	0.0000	0.0000	103.2136	246.6487	382.5338 (215)
Water heating												
Water heating requirement	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Efficiency of water heater	87.7633	87.6789	87.3755	86.4254	83.2860	79.5000	79.5000	79.5000	79.5000	86.5625	87.5269	79.5000 (216)
Fuel for water heating, kWh/month	277.8029	245.5186	261.8575	234.3313	236.5167	224.2955	222.7199	231.4014	233.6298	238.0075	248.5642	275.0284 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	238.3701	215.3021	238.3701	230.6808	238.3701	230.6808	238.3701	238.3701	230.6808	238.3701	230.6808	238.3701 (231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-43.8025	-61.6236	-97.8076	-124.5627	-142.2244	-143.8655	-142.0759	-131.6251	-108.9551	-81.0762	-51.6691	-36.6178 (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												15886.5088 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												1735.7482 (215)
Efficiency of water heater												79.5000
Water heating fuel used												2929.6735 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)												
mechanical ventilation fans (SFP = 1.0890)												2720.6162 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												2806.6162 (231)
Electricity for lighting (calculated in Appendix L)												770.8784 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-1165.9055 (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												22963.5195 (238)

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10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	15886.5088	4.8000	762.5524 (240)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	1735.7482	7.7200	133.9998 (242)
Water heating (other fuel)	2929.6735	4.8000	140.6243 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	2806.6162	21.5100	603.7031 (249)
Energy for lighting	770.8784	21.5100	165.8159 (250)
Additional standing charges			98.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1165.9055	21.5100	-250.7863
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-250.7863 (252)
Total energy cost			1653.9093 (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	15886.5088	0.2100	3336.1668 (261)
Total CO2 associated with community systems			0.0000 (373)
Space heating - secondary	1735.7482	0.0280	48.6009 (263)
Water heating (other fuel)	2929.6735	0.2100	615.2314 (264)
Space and water heating			3999.9992 (265)
Pumps, fans and electric keep-hot	2806.6162	0.1387	389.3123 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1165.9055	0.1324	-154.4162
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-154.4162 (269)
Total CO2, kg/year			4346.1569 (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	15886.5088	1.1300	17951.7549 (275)
Total CO2 associated with community systems			0.0000 (473)
Space heating - secondary	1735.7482	1.0460	1815.5926 (277)
Water heating (other fuel)	2929.6735	1.1300	3310.5311 (278)
Space and water heating			23077.8786 (279)
Pumps, fans and electric keep-hot	2806.6162	1.5128	4245.8489 (281)
Energy for lighting	770.8784	1.5338	1182.3990 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1165.9055	1.4894	-1736.4424
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1736.4424 (283)
Total Primary energy kWh/year			26769.6841 (286)

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Property Reference	Sheldon Avenue	Issued on Date	21/09/2023
Assessment Reference	Proposed no cooling	Prop Type Ref	
Property	26, Sheldon Avenue, London, N6 4JT		
SAP Rating	92 A	DER	1.52
Environmental	98 A	TER	8.05
CO ₂ Emissions (t/year)	0.9	% DER < TER	81.12
Compliance Check	See BREL	DFEE	42.08
% DPER < TPER	65.08	TFEE	43.93
		% DFEE < TFEE	4.21
		DPER	15.06
		TPER	43.12
Assessor Details	Mr. Nicholas Bowen	Assessor ID	D719-0001
Client	Green Tiger, Ross Standaloft		

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2047.7624 (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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

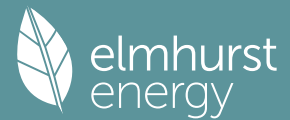
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0098 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.5000	(17)
Infiltration rate		0.1348	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1146	(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	0.1461	0.1432	0.1403	0.1260	0.1231	0.1088	0.1088	0.1060	0.1146	0.1231	0.1289	0.1346 (22b)
Balanced mechanical ventilation with heat recovery												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												75.6000 (23c)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2681	0.2652	0.2623	0.2480	0.2451	0.2308	0.2308	0.2280	0.2366	0.2451	0.2509	0.2566 (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
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Windows (Uw = 1.00)	139.2300	0.9615	133.8750	(27)
Doors	3.2400	1.0000	3.2400	(26)
Basement floor	248.9600	0.1000	24.8960	110.0000 27385.6000 (28a)
Basement walls	224.4000 23.7600	200.6400	0.1500 30.0960	60.0000 12038.4000 (29a)
External Walls	361.4700 106.9500	254.5200	0.1500 38.1780	60.0000 15271.2000 (29a)
Dwarf walls	42.5000	42.5000	0.1400 5.9500	9.0000 382.5000 (29a)
Dormers	30.8000 11.7600	19.0400	0.1000 1.9040	9.0000 171.3600 (29a)
Flat SF	22.8000	22.8000	0.1100 2.5080	9.0000 205.2000 (30)
Flat Base	44.7800	44.7800	0.1100 4.9258	9.0000 403.0200 (30)
Flat GF	41.0300	41.0300	0.1100 4.5133	9.0000 369.2700 (30)
Ceiling FF	86.9400	86.9400	0.1100 9.5634	9.0000 782.4600 (30)
Pitch	36.2600	36.2600	0.1100 3.9886	9.0000 326.3400 (30)
Dormer	25.9000	25.9000	0.1100 2.8490	9.0000 233.1000 (30)
Total net area of external elements Aum(A, m2)	1165.8400			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	266.4871	(33)
Basement	414.6000		75.0000	31095.0000 (32c)
GF	183.2000		75.0000	13740.0000 (32c)
GF	101.5000		9.0000	913.5000 (32c)
FF	128.5000		75.0000	9637.5000 (32c)
FF	142.0000		9.0000	1278.0000 (32c)
SF	81.6000		9.0000	734.4000 (32c)
GF	204.1800		18.0000	3675.2400 (32d)
FF	163.1500		18.0000	2936.7000 (32d)
Internal Floor 3	76.2100		18.0000	1371.7800 (32d)
Basement	204.1800		9.0000	1837.6200 (32e)
GF	163.1500		9.0000	1468.3500 (32e)
FF	76.2100		9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges				
K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940	
E3 Sill	63.5000	0.0230	1.4605	
E4 Jamb	190.2400	0.0180	3.4243	
E5 Ground floor (normal)	74.8000	0.0480	3.5904	
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530	
E16 Corner (normal)	73.6000	0.0400	2.9440	
E14 Flat roof	62.9000	0.1600	10.0640	
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050	
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880	
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880	
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			33.9192	(36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	300.4063 (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)
Heat transfer coeff	181.1402	179.2050	177.2698	167.5936	165.6583	155.9821	155.9821	154.0469	159.8526	165.6583	169.5288	173.3993	(39)
Average = Sum(39)m / 12 =	481.5466	479.6113	477.6761	467.9999	466.0646	456.3884	456.3884	454.4532	460.2589	466.0646	469.9351	473.8056	(39)
												467.5161	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.6954	0.6926	0.6898	0.6758	0.6730	0.6590	0.6590	0.6563	0.6646	0.6730	0.6786	0.6842	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	(42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)													159.9599 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	(44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Distribution loss (46)m = 0.15 x (45)m													2656.9005
	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9000 (48)
Temperature factor from Table 2b													0.7930 (49)
Enter (49) or (54) in (55)													1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(56)
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686	(62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441	(63a)

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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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)	
Total per year (kWh/year) = Sum(64)m =												2477.4708 (64)	
12Total per year (kWh/year)													2477 (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	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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)
(66)m	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	377.4413	417.8814	377.4413	390.0227	377.4413	390.0227	377.4413	377.4413	390.0227	377.4413	390.0227	377.4413	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	(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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	(71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753	(72)
Total internal gains	1358.3844	1403.2203	1337.5712	1296.1020	1224.0093	1179.7924	1129.7295	1126.5146	1163.2940	1200.8781	1277.6140	1324.4630	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				17.9300	11.2829		0.4000		0.7000		0.7700		39.2549 (75)
Southeast				56.5800	36.7938		0.4000		0.7000		0.7700		403.9515 (77)
Southwest				19.2000	36.7938		0.4000		0.7000		0.7700		137.0779 (79)
Northwest				45.5200	11.2829		0.4000		0.7000		0.7700		99.6588 (81)
Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524	(83)
Total gains	2038.3275	2607.5566	3107.9569	3695.1252	4098.6219	4116.0952	3926.3151	3555.6799	3149.3933	2564.9717	2100.4320	1900.9154	(84)

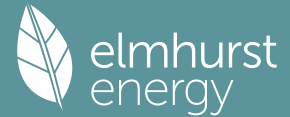
7. Mean internal temperature (heating season)

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	73.2261	73.5216	73.8195	75.3457	75.6586	77.2627	77.2627	77.5917	76.6129	75.6586	75.0354	74.4225	
alpha	5.8817	5.9014	5.9213	6.0230	6.0439	6.1508	6.1508	6.1728	6.1075	6.0439	6.0024	5.9615	
util living area	0.9998	0.9989	0.9952	0.9720	0.8809	0.6823	0.5074	0.5786	0.8629	0.9898	0.9993	0.9999	(86)
Living	19.9603	20.1057	20.3166	20.6063	20.8289	20.9308	20.9469	20.9442	20.8732	20.5670	20.2164	19.9491	
Non living	19.0774	19.2658	19.5377	19.9144	20.1826	20.2988	20.3111	20.3121	20.2418	19.8699	19.4179	19.0709	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	24	
16 / 9	0	28	31	0	0	0	0	0	0	0	26	7	
MIT	21.0000	20.4935	20.6129	20.6063	20.8289	20.9308	20.9469	20.9442	20.8732	20.5670	20.5109	20.8656	(87)
Th 2	20.3449	20.3474	20.3499	20.3622	20.3647	20.3772	20.3772	20.3796	20.3722	20.3647	20.3598	20.3548	(88)
util rest of house	0.9997	0.9986	0.9939	0.9644	0.8516	0.6251	0.4375	0.5048	0.8193	0.9861	0.9990	0.9998	(89)
MIT 2	20.3449	19.8700	19.9914	19.9144	20.1826	20.2988	20.3111	20.3121	20.2418	19.8699	19.8739	20.2269	(90)
Living area fraction	fLA = Living area / (4) =												0.0495 (91)
MIT	20.3774	19.9009	20.0222	19.9487	20.2146	20.3301	20.3426	20.3434	20.2730	19.9045	19.9055	20.2585	(92)
Temperature adjustment													-0.1000
adjusted MIT	20.2774	19.8009	19.9222	19.8487	20.1146	20.2301	20.2426	20.2434	20.1730	19.8045	19.8055	20.1585	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9997	0.9983	0.9929	0.9567	0.8384	0.6109	0.4222	0.4881	0.8033	0.9815	0.9988	0.9998	(94)
Useful gains	2037.7213	2603.2367	3085.8128	3535.1890	3436.3880	2514.3893	1657.5581	1735.5565	2529.8535	2517.6369	2097.8562	1900.5365	(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	7693.8466	7146.6228	6411.4486	5123.9794	3921.7399	2569.5032	1662.4197	1746.6680	2795.1741	4289.8757	5970.7394	7561.2225	(97)
Space heating kWh													

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4208.1572	3053.1554	2474.2730	1143.9291	361.1018	0.0000	0.0000	0.0000	0.0000	1318.5457	2788.4760	4211.5503	(98a)
Space heating requirement - total per year (kWh/year)												19559.1886
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												
4208.1572	3053.1554	2474.2730	1143.9291	361.1018	0.0000	0.0000	0.0000	0.0000	1318.5457	2788.4760	4211.5503	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19559.1886
Space heating per m2												(98c) / (4) = 28.2443 (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 %)	339.1440	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	90.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4208.1572	3053.1554	2474.2730	1143.9291	361.1018	0.0000	0.0000	0.0000	0.0000	1318.5457	2788.4760	4211.5503	(98)
Space heating efficiency (main heating system 1)	339.1440	339.1440	339.1440	339.1440	339.1440	0.0000	0.0000	0.0000	0.0000	339.1440	339.1440	339.1440	(210)
Space heating fuel (main heating system)	1240.8171	900.2533	729.5641	337.2989	106.4745	0.0000	0.0000	0.0000	0.0000	388.7863	822.2100	1241.8176	(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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245	(64)
Efficiency of water heater (217)m	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	(216)
Fuel for water heating, kWh/month	164.0325	144.8303	153.9340	136.2548	132.5299	119.9686	119.1259	123.7693	124.9613	138.6119	146.3728	162.4282	(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	231.0660	208.7048	231.0660	223.6123	231.0660	223.6123	231.0660	231.0660	223.6123	231.0660	223.6123	231.0660	(231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-88.2512	-165.7824	-328.5388	-501.2626	-665.5016	-670.7757	-653.9942	-541.0553	-380.8093	-224.6519	-108.3951	-71.2992	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												5767.2219	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												148.6346	
Water heating fuel used												1666.8195	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)													
mechanical ventilation fans (SFP = 1.0890)												2720.6162	(230a)
Total electricity for the above, kWh/year												2720.6162	(231)
Electricity for lighting (calculated in Appendix L)												770.8784	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-4400.3172	(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												6525.2187	(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	5767.2219	0.1560	899.6503	(261)
Total CO2 associated with community systems			0.0000	(273)

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Water heating (other fuel)	1666.8195	0.1407	234.5964 (264)
Space and water heating			1134.2467 (265)
Pumps, fans and electric keep-hot	2720.6162	0.1387	377.3830 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)

Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4400.3172	0.1294	-569.3888
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-569.3888 (269)
Total CO ₂ , kg/year			1053.5025 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.5200 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	5767.2219	1.5775	9097.8572 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	1666.8195	1.5204	2534.2583 (278)
Space and water heating			11632.1155 (279)
Pumps, fans and electric keep-hot	2720.6162	1.5128	4115.7481 (281)
Energy for lighting	770.8784	1.5338	1182.3990 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4400.3172	1.4779	-6503.2945
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-6503.2945 (283)
Total Primary energy kWh/year			10426.9681 (286)
Dwelling Primary energy Rate (DPER)			15.0600 (287)

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

1. Overall dwelling characteristics

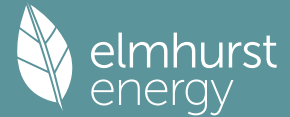
	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2047.7624 (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	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0195 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2695 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2291 (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	0.2921	0.2864	0.2807	0.2520	0.2463	0.2176	0.2176	0.2119	0.2291	0.2463	0.2577	0.2692 (22b)
Effective ac	0.5427	0.5410	0.5394	0.5318	0.5303	0.5237	0.5237	0.5225	0.5262	0.5303	0.5332	0.5362 (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			3.2400	1.0000	3.2400			(26)
TER Opening Type (Uw = 1.20)			139.2300	1.1450	159.4237			(27)
Basement floor			248.9600	0.1300	32.3648			(28a)
Basement walls	224.4000	23.7600	200.6400	0.1800	36.1152			(29a)
External Walls	361.4700	106.9500	254.5200	0.1800	45.8136			(29a)
Dwarf walls	42.5000		42.5000	0.1800	7.6500			(29a)
Dormers	30.8000	11.7600	19.0400	0.1800	3.4272			(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080			(30)
Flat Base	44.7800		44.7800	0.1100	4.9258			(30)
Flat GF	41.0300		41.0300	0.1100	4.5133			(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634			(30)
Pitch	36.2600		36.2600	0.1100	3.9886			(30)
Dormer	25.9000		25.9000	0.1100	2.8490			(30)
Total net area of external elements Aum(A, m2)			1165.8400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	316.3826		(33)

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

183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	64.7000	0.0500	3.2350	
E3 Sill	63.5000	0.0500	3.1750	
E4 Jamb	190.2400	0.0500	9.5120	
E5 Ground floor (normal)	74.8000	0.1600	11.9680	
E6 Intermediate floor within a dwelling	153.0000	0.0000	0.0000	
E16 Corner (normal)	73.6000	0.0900	6.6240	
E14 Flat roof	62.9000	0.0800	5.0320	
E10 Eaves (insulation at ceiling level)	51.0000	0.0600	3.0600	
R8 Roof to wall (rafter)	37.4000	0.0600	2.2440	
R9 Roof to wall (flat ceiling)	8.4000	0.0400	0.3360	
R7 Flat ceiling (inverted)	8.4000	0.0400	0.3360	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				45.5220 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	361.9046 (37)

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

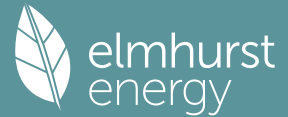
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	366.7110	365.5915	364.4941	359.3399	358.3756	353.8865	353.8865	353.0552	355.6156	358.3756	360.3264	362.3659	(38)
Heat transfer coeff	728.6155	727.4960	726.3987	721.2445	720.2802	715.7910	715.7910	714.9597	717.5202	720.2802	722.2310	724.2705	(39)
Average = Sum(39)m / 12 =												721.2399	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0522	1.0505	1.0490	1.0415	1.0401	1.0336	1.0336	1.0324	1.0361	1.0401	1.0429	1.0459	(40)
HLP (average)												1.0415	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	(42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)												159.9599	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	(44)
Energy conte	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Energy content (annual)										Total = Sum(45)m =		2656.9005	
Distribution loss (46)m = 0.15 x (45)m	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	322.1947	284.5907	301.3839	262.6091	252.9734	226.2118	221.9476	231.7022	235.2955	264.4666	283.7861	318.3564	(62)
WWHRS	-38.9899	-34.4829	-36.1086	-29.8993	-27.8651	-23.8443	-22.3503	-23.7673	-24.6703	-29.0835	-32.9481	-38.2678	(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													

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283.2048	250.1077	265.2754	232.7097	225.1084	202.3675	199.5973	207.9349	210.6252	235.3831	250.8379	280.0886 (64)
Total per year (kWh/year) = Sum(64)m =											2843.2405 (64)
12Total per year (kWh/year)											2843 (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											
128.9128	114.3015	121.9933	108.3979	105.8968	96.2959	95.5807	98.8241	99.3162	109.7183	115.4393	127.6366 (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	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	370.5541	410.2563	370.5541	382.9059	370.5541	382.9059	370.5541	370.5541	382.9059	370.5541	382.9059	370.5541 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)												
	173.2699	170.0915	163.9694	150.5527	142.3344	133.7443	128.4687	132.8281	137.9391	147.4708	160.3324	171.5546 (72)
Total internal gains												
	1354.3765	1398.4745	1333.5633	1291.8645	1220.0015	1172.5550	1122.7216	1119.5068	1156.0566	1196.8703	1273.3766	1320.4552 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast			17.9300	11.2829	0.6300	0.7000	0.7700	61.8265 (75)				
Southeast			56.5800	36.7938	0.6300	0.7000	0.7700	636.2236 (77)				
Southwest			19.2000	36.7938	0.6300	0.7000	0.7700	215.8977 (79)				
Northwest			45.5200	11.2829	0.6300	0.7000	0.7700	156.9627 (81)				
Solar gains	1070.9105	1896.8296	2788.3574	3778.4616	4527.5147	4624.6768	4404.6224	3825.9353	3128.1064	2148.4473	1295.9384	907.9125 (83)
Total gains	2425.2870	3295.3041	4121.9207	5070.3261	5747.5162	5797.2318	5527.3440	4945.4421	4284.1630	3345.3176	2569.3150	2228.3677 (84)

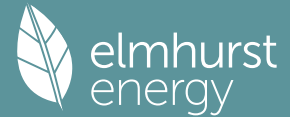
7. Mean internal temperature (heating season)

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	48.3956	48.4701	48.5433	48.8902	48.9557	49.2627	49.2627	49.3200	49.1440	48.9557	48.8234	48.6859
alpha	4.2264	4.2313	4.2362	4.2593	4.2637	4.2842	4.2842	4.2880	4.2763	4.2637	4.2549	4.2457
util living area												
	0.9991	0.9966	0.9885	0.9560	0.8664	0.7053	0.5466	0.6212	0.8641	0.9819	0.9977	0.9994 (86)
MIT	19.0443	19.3078	19.7028	20.2194	20.6541	20.9007	20.9741	20.9563	20.7484	20.1535	19.4964	19.0020 (87)
Th 2	20.0401	20.0414	20.0427	20.0489	20.0500	20.0554	20.0554	20.0564	20.0533	20.0500	20.0477	20.0453 (88)
util rest of house												
	0.9989	0.9957	0.9853	0.9432	0.8279	0.6274	0.4395	0.5118	0.8093	0.9748	0.9970	0.9992 (89)
MIT 2	17.7105	18.0489	18.5540	19.2075	19.7257	19.9862	20.0440	20.0349	19.8454	19.1343	18.2954	17.6597 (90)
Living area fraction												
	fLA = Living area / (4) =											0.0495 (91)
MIT	17.7766	18.1113	18.6109	19.2576	19.7717	20.0315	20.0900	20.0806	19.8901	19.1848	18.3548	17.7262 (92)
Temperature adjustment												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	17.7766	18.1113	18.6109	19.2576	19.7717	20.0315	20.0900	20.0806	19.8901	19.1848	18.3548	17.7262 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9980	0.9929	0.9782	0.9291	0.8146	0.6253	0.4436	0.5148	0.7978	0.9652	0.9949	0.9986 (94)
Useful gains	2420.3312	3271.8565	4031.9590	4710.8649	4682.1575	3624.7241	2451.8531	2546.1262	3417.9612	3228.8587	2556.2065	2225.1636 (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												
	9819.2252	9611.1369	8797.3731	7470.3596	5813.8773	3887.7875	2498.1335	2631.4626	4154.4995	6183.4542	8128.6000	9796.5931 (97)
Space heating kWh												
	5504.7771	4259.9965	3545.4681	1986.8362	841.9995	0.0000	0.0000	0.0000	0.0000	2198.2191	4012.1233	5633.1436 (98a)
Space heating requirement - total per year (kWh/year)												27982.5633
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												
	5504.7771	4259.9965	3545.4681	1986.8362	841.9995	0.0000	0.0000	0.0000	0.0000	2198.2191	4012.1233	5633.1436 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												27982.5633
Space heating per m2												(98c) / (4) =
												40.4080 (99)

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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	5504.7771	4259.9965	3545.4681	1986.8362	841.9995	0.0000	0.0000	0.0000	0.0000	2198.2191	4012.1233	5633.1436	(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)	5964.0055	4615.3808	3841.2438	2152.5852	912.2421	0.0000	0.0000	0.0000	0.0000	2381.6025	4346.8292	6103.0808	(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	283.2048	250.1077	265.2754	232.7097	225.1084	202.3675	199.5973	207.9349	210.6252	235.3831	250.8379	280.0886	(64)
Efficiency of water heater	88.3127	88.2481	88.1083	87.7622	86.7364	79.8000	79.8000	79.8000	79.8000	87.8418	88.2146	88.3281	(216)
Fuel for water heating, kWh/month	320.6843	283.4144	301.0789	265.1593	259.5316	253.5933	250.1220	260.5701	263.9413	267.9626	284.3497	317.1000	(217)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	76.9938	61.7673	55.6146	40.7456	31.4731	25.7138	28.7108	37.3194	48.4742	63.6008	71.8370	79.1337	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-191.8796	-252.0445	-337.4944	-352.1153	-357.3561	-324.9062	-319.7859	-311.6851	-295.8506	-273.1743	-203.7237	-168.0328	(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)	-172.6469	-353.1885	-684.8326	-1005.2221	-1308.0232	-1307.6073	-1293.1981	-1105.3406	-823.6191	-498.2722	-228.0617	-137.4113	(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												30316.9700	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	(216)
Water heating fuel used												3327.5075	(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)												621.3842	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-12305.4718	(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												22046.3899	(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	30316.9700	0.2100	6366.5637 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	3327.5075	0.2100	698.7766 (264)
Space and water heating			7065.3403 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	621.3842	0.1443	89.6849 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3388.0484	0.1362	-461.5544
PV Unit electricity exported	-8917.4234	0.1266	-1128.6736
Total			-1590.2281 (269)
Total CO2, kg/year			5576.7264 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.0500 (273)

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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	30316.9700	1.1300	34258.1761 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3327.5075	1.1300	3760.0834 (278)
Space and water heating			38018.2595 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	621.3842	1.5338	953.0999 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3388.0484	1.5036	-5094.1808
PV Unit electricity exported	-8917.4234	0.4646	-4143.2600
Total			-9237.4408 (283)
Total Primary energy kWh/year			29864.0194 (286)
Target Primary Energy Rate (TPER)			43.1200 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2047.7624 (5)

2. Ventilation rate

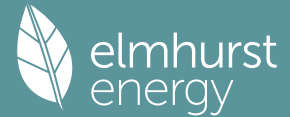
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0195 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1445 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1229 (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	0.1566	0.1536	0.1505	0.1351	0.1321	0.1167	0.1167	0.1136	0.1229	0.1321	0.1382	0.1444 (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	0.5123	0.5118	0.5113	0.5091	0.5087	0.5068	0.5068	0.5065	0.5075	0.5087	0.5096	0.5104 (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
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Windows (Uw = 1.00)			139.2300	0.9615	133.8750			(27)
Doors			3.2400	1.0000	3.2400			(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000	(28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000	(29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000	(29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000	(29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600	(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000	(30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200	(30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700	(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600	(30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400	(30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000	(30)
Total net area of external elements Aum(A, m2)			1165.8400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	266.4871			(33)
Basement			414.6000			75.0000	31095.0000	(32c)
GF			183.2000			75.0000	13740.0000	(32c)
GF			101.5000			9.0000	913.5000	(32c)
FF			128.5000			75.0000	9637.5000	(32c)
FF			142.0000			9.0000	1278.0000	(32c)
SF			81.6000			9.0000	734.4000	(32c)
GF			204.1800			18.0000	3675.2400	(32d)
FF			163.1500			18.0000	2936.7000	(32d)
Internal Floor 3			76.2100			18.0000	1371.7800	(32d)
Basement			204.1800			9.0000	1837.6200	(32e)
GF			163.1500			9.0000	1468.3500	(32e)
FF			76.2100			9.0000	685.8900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 300.4063 (37)

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

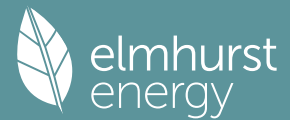
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
(38)m	346.1709	345.8490	345.5334	344.0513	343.7741	342.4832	342.4832	342.2442	342.9804	343.7741	344.3350	344.9215	
Heat transfer coeff	646.5772	646.2553	645.9397	644.4577	644.1804	642.8895	642.8895	642.6505	643.3867	644.1804	644.7413	645.3278	(39)
Average = Sum(39)m / 12 =												644.4563	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.9337	0.9332	0.9328	0.9306	0.9302	0.9284	0.9284	0.9280	0.9291	0.9302	0.9310	0.9319	
HLP (average)												0.9306	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (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													
36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	36.6752	(42b)
Hot water usage for other uses													
51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	51.9296	(42c)
Average daily hot water use (litres/day)													81.3277 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.7292	86.2943	83.6363	80.3289	77.3780	74.3115	73.6750	76.3276	79.0481	82.1972	85.5338	88.6048	(44)
Energy conte	140.5253	122.8819	128.5459	109.9663	104.1657	91.3746	89.1036	94.5095	97.4742	111.5408	121.8586	138.7336	(45)
Energy content (annual)													
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	(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													
119.4465	104.4496	109.2640	93.4713	88.5408	77.6684	75.7380	80.3331	82.8531	94.8097	103.5798	117.9236	117.9236	(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													

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119.4465	104.4496	109.2640	93.4713	88.5408	77.6684	75.7380	80.3331	82.8531	94.8097	103.5798	117.9236 (64)
Total per year (kWh/year) = Sum(64)m =											1148.0780 (64)
Electric shower(s)											1148 (64)
68.3010	60.8568	66.4533	63.4155	64.6055	61.6274	63.6816	64.6055	63.4155	66.4533	65.2037	68.3010 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											776.9201 (64a)
Heat gains from water heating, kWh/month											
46.9369	41.3266	43.9293	39.2217	38.2866	34.8239	34.8549	36.2347	36.5672	40.3157	42.1959	46.5562 (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	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	377.4413	417.8814	377.4413	390.0227	377.4413	390.0227	377.4413	377.4413	390.0227	377.4413	390.0227	377.4413 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109 (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)												
	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)												
	63.0872	61.4979	59.0448	54.4746	51.4605	48.3666	46.8480	48.7025	50.7877	54.1878	58.6054	62.5755 (72)
Total internal gains												
	1248.0810	1294.5061	1232.5259	1199.9032	1133.0148	1094.2941	1047.9882	1042.2684	1076.0219	1107.4745	1175.7664	1215.3632 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				17.9300	11.2829	0.4000	0.7000	0.7700	39.2549 (75)			
Southeast				56.5800	36.7938	0.4000	0.7000	0.7700	403.9515 (77)			
Southwest				19.2000	36.7938	0.4000	0.7000	0.7700	137.0779 (79)			
Northwest				45.5200	11.2829	0.4000	0.7000	0.7700	99.6588 (81)			
Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524 (83)
Total gains	1928.0241	2498.8424	3002.9115	3598.9264	4007.6273	4030.5969	3844.5738	3471.4337	3062.1212	2471.5680	1998.5844	1791.8157 (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	54.5361	54.5632	54.5899	54.7154	54.7390	54.8489	54.8489	54.8693	54.8065	54.7390	54.6914	54.6417
alpha	4.6357	4.6375	4.6393	4.6477	4.6493	4.6566	4.6566	4.6580	4.6538	4.6493	4.6461	4.6428
util living area												
	0.9997	0.9990	0.9965	0.9850	0.9431	0.8316	0.6792	0.7514	0.9372	0.9939	0.9993	0.9998 (86)
MIT	19.1685	19.3669	19.6837	20.1212	20.5430	20.8423	20.9551	20.9281	20.6756	20.1232	19.5610	19.1306 (87)
Th 2	20.1390	20.1394	20.1397	20.1415	20.1419	20.1435	20.1435	20.1438	20.1429	20.1419	20.1412	20.1405 (88)
util rest of house												
	0.9996	0.9987	0.9955	0.9801	0.9226	0.7691	0.5703	0.6490	0.9056	0.9913	0.9990	0.9998 (89)
MIT 2	18.4224	18.6210	18.9376	19.3735	19.7821	20.0475	20.1258	20.1121	19.9124	19.3780	18.8165	18.3856 (90)
Living area fraction												
	fLA = Living area / (4) =											0.0495 (91)
MIT	18.4593	18.6579	18.9745	19.4105	19.8198	20.0869	20.1668	20.1525	19.9502	19.4149	18.8534	18.4225 (92)
Temperature adjustment												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (93)
adjusted MIT	18.4593	18.6579	18.9745	19.4105	19.8198	20.0869	20.1668	20.1525	19.9502	19.4149	18.8534	18.4225 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9994	0.9980	0.9935	0.9745	0.9129	0.7643	0.5735	0.6501	0.8964	0.9881	0.9985	0.9996 (94)
Useful gains	1926.9120	2493.8481	2983.5052	3507.0997	3658.4256	3080.6242	2204.9297	2256.9455	2744.7581	2442.1078	1995.5734	1791.0826 (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												
	9155.1066	8891.1461	8057.8029	6773.5699	5230.6341	3527.4793	2293.0857	2411.5564	3763.9525	5678.3817	7577.9071	9178.1883 (97)
Space heating kWh												
	5377.7768	4298.9843	3775.2774	2351.8585	1169.7232	0.0000	0.0000	0.0000	0.0000	2407.7878	4019.2802	5496.0067 (98a)
Space heating requirement - total per year (kWh/year)												28896.6949
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												
	5377.7768	4298.9843	3775.2774	2351.8585	1169.7232	0.0000	0.0000	0.0000	0.0000	2407.7878	4019.2802	5496.0067 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												28896.6949
Space heating per m2												(98c) / (4) =
												41.7281 (99)

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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	6043.1616	4757.3825	4884.1437	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6864	0.7792	0.7165	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	4147.8528	3706.9064	3499.6243	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	4509.8650	4299.6317	3871.4285	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction						260.6488	440.9876	276.6223	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 (105)
Space cooling kwh	0.0000	0.0000	0.0000	0.0000	0.0000	65.1622	110.2469	69.1556	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												244.5647 (107)
Energy for space heating												41.7281 (99)
Energy for space cooling												0.3532 (108)
Total												42.0812 (109)
Fabric Energy Efficiency (DFEE)												42.1 (109)

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)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2047.7624 (5)

2. Ventilation rate

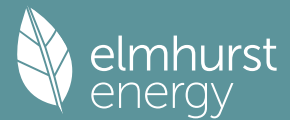
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0195 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.2695	(18)
Number of sides sheltered	2	(19)

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2291 (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	0.2921	0.2864	0.2807	0.2520	0.2463	0.2176	0.2176	0.2119	0.2291	0.2463	0.2577	0.2692 (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	0.5427	0.5410	0.5394	0.5318	0.5303	0.5237	0.5237	0.5225	0.5262	0.5303	0.5332	0.5362 (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			3.2400	1.0000	3.2400			(26)
TER Opening Type (Uw = 1.20)			139.2300	1.1450	159.4237			(27)
Basement floor			248.9600	0.1300	32.3648			(28a)
Basement walls	224.4000	23.7600	200.6400	0.1800	36.1152			(29a)
External Walls	361.4700	106.9500	254.5200	0.1800	45.8136			(29a)
Dwarf walls	42.5000		42.5000	0.1800	7.6500			(29a)
Dormers	30.8000	11.7600	19.0400	0.1800	3.4272			(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080			(30)
Flat Base	44.7800		44.7800	0.1100	4.9258			(30)
Flat GF	41.0300		41.0300	0.1100	4.5133			(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634			(30)
Pitch	36.2600		36.2600	0.1100	3.9886			(30)
Dormer	25.9000		25.9000	0.1100	2.8490			(30)
Total net area of external elements Aum(A, m2)			1165.8400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	316.3826		(33)

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

183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0500	3.2350
E3 Sill	63.5000	0.0500	3.1750
E4 Jamb	190.2400	0.0500	9.5120
E5 Ground floor (normal)	74.8000	0.1600	11.9680
E6 Intermediate floor within a dwelling	153.0000	0.0000	0.0000
E16 Corner (normal)	73.6000	0.0900	6.6240
E14 Flat roof	62.9000	0.0800	5.0320
E10 Eaves (insulation at ceiling level)	51.0000	0.0600	3.0600
R8 Roof to wall (rafter)	37.4000	0.0600	2.2440
R9 Roof to wall (flat ceiling)	8.4000	0.0400	0.3360
R7 Flat ceiling (inverted)	8.4000	0.0400	0.3360

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

45.5220 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 361.9046 (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	366.7110	365.5915	364.4941	359.3399	358.3756	353.8865	353.8865	353.0552	355.6156	358.3756	360.3264	362.3659	(38)
Heat transfer coeff	728.6155	727.4960	726.3987	721.2445	720.2802	715.7910	715.7910	714.9597	717.5202	720.2802	722.2310	724.2705	(39)
Average = Sum(39)m / 12 =												721.2399	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0522	1.0505	1.0490	1.0415	1.0401	1.0336	1.0336	1.0324	1.0361	1.0401	1.0429	1.0459	(40)
HLP (average)												1.0415	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (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													
36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	36.6752	(42b)
Hot water usage for other uses													
51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	51.9296	(42c)
Average daily hot water use (litres/day)												81.3277	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	88.7292	86.2943	83.6363	80.3289	77.3780	74.3115	73.6750	76.3276	79.0481	82.1972	85.5338	88.6048	(44)
Energy conte	140.5253	122.8819	128.5459	109.9663	104.1657	91.3746	89.1036	94.5095	97.4742	111.5408	121.8586	138.7336	(45)
Energy content (annual)													
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	(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													
119.4465	104.4496	109.2640	93.4713	88.5408	77.6684	75.7380	80.3331	82.8531	94.8097	103.5798	117.9236	117.9236	(62)
WVHRS	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	119.4465	104.4496	109.2640	93.4713	88.5408	77.6684	75.7380	80.3331	82.8531	94.8097	103.5798	117.9236	(64)
												1148.0780	(64)
12Total per year (kWh/year)													
Electric shower(s)	68.3010	60.8568	66.4533	63.4155	64.6055	61.6274	63.6816	64.6055	63.4155	66.4533	65.2037	68.3010	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												776.9201	(64a)
Heat gains from water heating, kWh/month													
46.9369	41.3266	43.9293	39.2217	38.2866	34.8239	34.8549	36.2347	36.5672	40.3157	42.1959	46.5562	46.5562	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090	182.1090 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	370.5541	410.2563	370.5541	382.9059	370.5541	382.9059	370.5541	370.5541	382.9059	370.5541	382.9059	370.5541 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	729.9198	737.4940	718.4071	677.7732	626.4803	578.2722	546.0662	538.4919	557.5788	598.2127	649.5056	697.7138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109	41.2109 (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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	63.0872	61.4979	59.0448	54.4746	51.4605	48.3666	46.8480	48.7025	50.7877	54.1878	58.6054	62.5755 (72)
Total internal gains	1241.1938	1286.8810	1225.6387	1192.7864	1126.1276	1087.1774	1041.1010	1035.3812	1068.9051	1100.5873	1168.6496	1208.4760 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				17.9300	11.2829	0.6300	0.7000	0.7700	61.8265 (75)			
Southeast				56.5800	36.7938	0.6300	0.7000	0.7700	636.2236 (77)			
Southwest				19.2000	36.7938	0.6300	0.7000	0.7700	215.8977 (79)			
Northwest				45.5200	11.2829	0.6300	0.7000	0.7700	156.9627 (81)			
Solar gains	1070.9105	1896.8296	2788.3574	3778.4616	4527.5147	4624.6768	4404.6224	3825.9353	3128.1064	2148.4473	1295.9384	907.9125 (83)
Total gains	2312.1043	3183.7106	4013.9961	4971.2480	5653.6423	5711.8541	5445.7233	4861.3165	4197.0115	3249.0346	2464.5880	2116.3886 (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	48.3956	48.4701	48.5433	48.8902	48.9557	49.2627	49.2627	49.3200	49.1440	48.9557	48.8234	48.6859
alpha	4.2264	4.2313	4.2362	4.2593	4.2637	4.2842	4.2842	4.2880	4.2763	4.2637	4.2549	4.2457
util living area	0.9993	0.9971	0.9895	0.9587	0.8718	0.7124	0.5536	0.6296	0.8708	0.9837	0.9981	0.9995 (86)
MIT	19.0216	19.2857	19.6823	20.2030	20.6438	20.8968	20.9729	20.9540	20.7389	20.1356	19.4756	18.9795 (87)
Th 2	20.0401	20.0414	20.0427	20.0489	20.0500	20.0554	20.0554	20.0564	20.0533	20.0500	20.0477	20.0453 (88)
util rest of house	0.9991	0.9963	0.9866	0.9465	0.8342	0.6347	0.4456	0.5197	0.8175	0.9772	0.9975	0.9994 (89)
MIT 2	18.2020	18.4667	18.8623	19.3777	19.7888	19.9990	20.0460	20.0387	19.8840	19.3191	18.6613	18.1637 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2426	18.5072	18.9029	19.4186	19.8311	20.0435	20.0919	20.0840	19.9264	19.3595	18.7016	18.2041 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.2426	18.5072	18.9029	19.4186	19.8311	20.0435	20.0919	20.0840	19.9264	19.3595	18.7016	18.2041 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9985	0.9944	0.9817	0.9361	0.8240	0.6336	0.4500	0.5232	0.8089	0.9705	0.9961	0.9990 (94)
Useful gains	2308.6752	3165.8900	3940.4823	4653.7113	4658.7686	3619.1028	2450.5816	2543.2017	3394.8575	3153.0902	2455.0403	2114.2279 (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	10158.7990	9899.2048	9009.4621	7586.4791	5856.6811	3896.3982	2499.4777	2633.9284	4180.5390	6309.3161	8379.0600	10142.7745 (97)
Space heating kWh	5840.4921	4524.7876	3771.3210	2111.5929	891.2469	0.0000	0.0000	0.0000	0.0000	2348.2320	4265.2942	5973.2387 (98a)
Space heating requirement - total per year (kWh/year)	29726.2054											
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	5840.4921	4524.7876	3771.3210	2111.5929	891.2469	0.0000	0.0000	0.0000	0.0000	2348.2320	4265.2942	5973.2387 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	29726.2054											
Space heating per m ²	(98c) / (4) = 42.9259 (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
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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	6728.4358	5296.8537	5433.6939	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7954	0.8675	0.8160	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5351.6176	4594.8720	4433.9356	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	6482.6866	6178.5041	5503.1704	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	814.3697	1178.2222	795.5108	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	203.5924	294.5556	198.8777	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												697.0257 (107)
Energy for space heating												42.9259 (99)
Energy for space cooling												1.0065 (108)
Total												43.9325 (109)
Fabric Energy Efficiency (TFEE)												43.9 (109)

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)	
Basement floor	248.9600 (1a)	x	3.0000 (2a)	=	746.8800 (1a)	-
Ground floor	204.1800 (1b)	x	3.2500 (2b)	=	663.5850 (1b)	-
First floor	163.1500 (1c)	x	3.0000 (2c)	=	489.4500 (1c)	-
Second floor	76.2100 (1d)	x	1.9400 (2d)	=	147.8474 (1d)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (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	2 * 10 =	20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

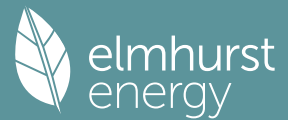
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.0098 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		2.5000	(17)
Infiltration rate		0.1348	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1146	(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	0.1461	0.1432	0.1403	0.1260	0.1231	0.1088	0.1088	0.1060	0.1146	0.1231	0.1289	0.1346 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												75.6000 (23c)
Effective ac	0.2681	0.2652	0.2623	0.2480	0.2451	0.2308	0.2308	0.2280	0.2366	0.2451	0.2509	0.2566 (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
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Windows (Uw = 1.00)	139.2300	0.9615	133.8750		(27)
Doors	3.2400	1.0000	3.2400		(26)
Basement floor	248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000 23.7600	200.6400	0.1500 30.0960	60.0000	12038.4000 (29a)
External Walls	361.4700 106.9500	254.5200	0.1500 38.1780	60.0000	15271.2000 (29a)
Dwarf walls	42.5000	42.5000	0.1400 5.9500	9.0000	382.5000 (29a)
Dormers	30.8000 11.7600	19.0400	0.1000 1.9040	9.0000	171.3600 (29a)
Flat SF	22.8000	22.8000	0.1100 2.5080	9.0000	205.2000 (30)
Flat Base	44.7800	44.7800	0.1100 4.9258	9.0000	403.0200 (30)
Flat GF	41.0300	41.0300	0.1100 4.5133	9.0000	369.2700 (30)
Ceiling FF	86.9400	86.9400	0.1100 9.5634	9.0000	782.4600 (30)
Pitch	36.2600	36.2600	0.1100 3.9886	9.0000	326.3400 (30)
Dormer	25.9000	25.9000	0.1100 2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m2)	1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =	266.4871		(33)
Basement	414.6000			75.0000	31095.0000 (32c)
GF	183.2000			75.0000	13740.0000 (32c)
GF	101.5000			9.0000	913.5000 (32c)
FF	128.5000			75.0000	9637.5000 (32c)
FF	142.0000			9.0000	1278.0000 (32c)
SF	81.6000			9.0000	734.4000 (32c)
GF	204.1800			18.0000	3675.2400 (32d)
FF	163.1500			18.0000	2936.7000 (32d)
Internal Floor 3	76.2100			18.0000	1371.7800 (32d)
Basement	204.1800			9.0000	1837.6200 (32e)
GF	163.1500			9.0000	1468.3500 (32e)
FF	76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges					
K1 Element	Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940		
E3 Sill	63.5000	0.0230	1.4605		
E4 Jamb	190.2400	0.0180	3.4243		
E5 Ground floor (normal)	74.8000	0.0480	3.5904		
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530		
E16 Corner (normal)	73.6000	0.0400	2.9440		
E14 Flat roof	62.9000	0.1600	10.0640		
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050		
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880		
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880		
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				33.9192	(36)
Point Thermal bridges				(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =	300.4063 (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)
Heat transfer coeff	181.1402	179.2050	177.2698	167.5936	165.6583	155.9821	155.9821	154.0469	159.8526	165.6583	169.5288	173.3993	(39)
Average = Sum(39)m / 12 =	481.5466	479.6113	477.6761	467.9999	466.0646	456.3884	456.3884	454.4532	460.2589	466.0646	469.9351	473.8056	(39)
													467.5161
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	0.6954	0.6926	0.6898	0.6758	0.6730	0.6590	0.6590	0.6563	0.6646	0.6730	0.6786	0.6842	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	(42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)													159.9599 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	(44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Distribution loss (46)m = 0.15 x (45)m													2656.9005
	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9000 (48)
Temperature factor from Table 2b													0.7930 (49)
Enter (49) or (54) in (55)													1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(56)
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686	(62)
WVHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441	(63a)

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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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Total per year (kWh/year) = Sum(64)m =												2477.4708 (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	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	(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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	(71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753	(72)
Total internal gains	1505.2878	1501.2130	1448.5027	1355.2892	1255.4470	1167.9564	1117.6451	1122.9008	1174.6001	1263.9285	1368.4140	1458.5367	(73)

6. Solar gains

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

Northeast				17.9300	11.2829	0.4000	0.7000	0.7700	39.2549 (75)			
Southeast				56.5800	36.7938	0.4000	0.7000	0.7700	403.9515 (77)			
Southwest				19.2000	36.7938	0.4000	0.7000	0.7700	137.0779 (79)			
Northwest				45.5200	11.2829	0.4000	0.7000	0.7700	99.6588 (81)			

Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524 (83)
Total gains	2185.2309	2705.5492	3218.8884	3754.3124	4130.0595	4104.2591	3914.2307	3552.0661	3160.6994	2628.0221	2191.2320	2034.9891 (84)

7. Mean internal temperature (heating season)

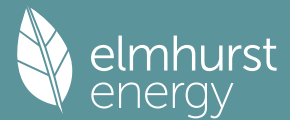
Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	21.0000 (85)
tau	73.2261	73.5216	73.8195	75.3457	75.6586	77.2627	77.2627	77.5917	76.6129	75.6586	75.0354	74.4225	
alpha	5.8817	5.9014	5.9213	6.0230	6.0439	6.1508	6.1508	6.1728	6.1075	6.0439	6.0024	5.9615	
util living area	0.9997	0.9987	0.9942	0.9700	0.8779	0.6839	0.5089	0.5791	0.8613	0.9885	0.9991	0.9998	(86)
Living	19.9844	20.1217	20.3343	20.6145	20.8315	20.9306	20.9468	20.9442	20.8740	20.5768	20.2313	19.9711	
Non living	19.1083	19.2862	19.5602	19.9245	20.1853	20.2986	20.3110	20.3121	20.2426	19.8822	19.4370	19.0992	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	0	0	0	0	0	0	0	0	0	0	24	
16 / 9	0	28	31	0	0	0	0	0	0	0	26	7	
MIT	21.0000	20.5026	20.6229	20.6145	20.8315	20.9306	20.9468	20.9442	20.8740	20.5768	20.5202	20.8684	(87)
Th 2	20.3449	20.3474	20.3499	20.3622	20.3647	20.3772	20.3772	20.3796	20.3722	20.3647	20.3598	20.3548	(88)
util rest of house	0.9996	0.9983	0.9927	0.9619	0.8482	0.6266	0.4388	0.5053	0.8175	0.9844	0.9988	0.9997	(89)
MIT 2	20.3449	19.8790	20.0013	19.9245	20.1853	20.2986	20.3110	20.3121	20.2426	19.8822	19.8838	20.2297	(90)
Living area fraction									fLA = Living area / (4) =			0.0495	(91)
MIT	20.3774	19.9099	20.0321	19.9587	20.2173	20.3299	20.3425	20.3434	20.2738	19.9166	19.9153	20.2613	(92)
Temperature adjustment												-0.1000	
adjusted MIT	20.2774	19.8099	19.9321	19.8587	20.1173	20.2299	20.2425	20.2434	20.1738	19.8166	19.8153	20.1613	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9996	0.9980	0.9915	0.9539	0.8350	0.6124	0.4234	0.4886	0.8015	0.9794	0.9985	0.9997	(94)
Useful gains	2184.2776	2700.1131	3191.6586	3581.2646	3448.7862	2513.5571	1657.4658	1735.4899	2533.4144	2573.9657	2187.8623	2034.3951	(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	7693.8466	7150.9597	6416.1919	5128.6544	3923.0031	2569.4179	1662.4092	1746.6607	2795.5399	4295.5147	5975.3566	7562.5597	(97)
Space heating kWh	4099.1193	2990.9689	2399.0528	1114.1207	352.8174	0.0000	0.0000	0.0000	0.0000	1280.8325	2726.9959	4112.9545	(98a)

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Space heating requirement - total per year (kWh/year)	19076.8619										
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 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000										
Space heating kWh	4099.1193	2990.9689	2399.0528	1114.1207	352.8174	0.0000	0.0000	0.0000	1280.8325	2726.9959	4112.9545 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											19076.8619
Space heating per m2	(98c) / (4) =										27.5478 (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 %)												339.1440 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	4099.1193	2990.9689	2399.0528	1114.1207	352.8174	0.0000	0.0000	0.0000	0.0000	1280.8325	2726.9959	4112.9545 (98)
Space heating efficiency (main heating system 1)	339.1440	339.1440	339.1440	339.1440	339.1440	0.0000	0.0000	0.0000	0.0000	339.1440	339.1440	339.1440 (210)
Space heating fuel (main heating system)	1208.6662	881.9170	707.3846	328.5096	104.0317	0.0000	0.0000	0.0000	0.0000	377.6662	804.0819	1212.7457 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Efficiency of water heater	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346 (216)
(217)m	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346 (217)
Fuel for water heating, kWh/month	164.0325	144.8303	153.9340	136.2548	132.5299	119.9686	119.1259	123.7693	124.9613	138.6119	146.3728	162.4282 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(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	231.0660	208.7048	231.0660	223.6123	231.0660	223.6123	231.0660	231.0660	223.6123	231.0660	223.6123	231.0660 (231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-88.2510	-165.7812	-328.5284	-501.2342	-665.4723	-670.7757	-653.9942	-541.0553	-380.8093	-224.6480	-108.3947	-71.2991 (233a)
(233a)m	-88.2510	-165.7812	-328.5284	-501.2342	-665.4723	-670.7757	-653.9942	-541.0553	-380.8093	-224.6480	-108.3947	-71.2991 (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)
(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)	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)
(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)	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)
(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)	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)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)
(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)	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)
(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)	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)
(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												5625.0030 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												148.6346
Water heating fuel used												1666.8195 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)												
mechanical ventilation fans (SFP = 1.0890)												2720.6162 (230a)
Total electricity for the above, kWh/year												2720.6162 (231)
Electricity for lighting (calculated in Appendix L)												770.8784 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4400.2433 (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												6383.0738 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5625.0030	16.4900	927.5630 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1666.8195	16.4900	274.8585 (247)

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Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	2720.6162	16.4900	448.6296 (249)
Energy for lighting	770.8784	16.4900	127.1178 (250)
Additional standing charges			0.0000 (251)

Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4400.2433	16.4900	-725.6001
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-725.6001 (252)
Total energy cost			1052.5689 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5138 (257)
SAP value		91.6714
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	5625.0030	0.1560	877.5148 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1666.8195	0.1407	234.5964 (264)
Space and water heating			1112.1111 (265)
Pumps, fans and electric keep-hot	2720.6162	0.1387	377.3830 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4400.2433	0.1294	-569.3784
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-569.3784 (269)
Total CO2, kg/year			1031.3773 (272)
CO2 emissions per m2			1.4900 (273)
EI value			98.1260
EI rating			98 (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

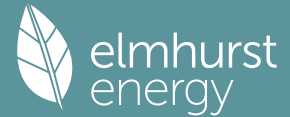
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =
Pressure test	20.0000 / (5) = 0.0098 (8)
Pressure Test Method	Yes Blower Door

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Measured/design AP50 2.5000 (17)
 Infiltration rate 0.1348 (18)
 Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
 Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1146 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.0000	4.8000	4.8000	4.3000	4.3000	3.9000	4.0000	4.0000	4.1000	4.4000	4.3000	4.7000	(22)
Wind factor	1.2500	1.2000	1.2000	1.0750	1.0750	0.9750	1.0000	1.0000	1.0250	1.1000	1.0750	1.1750	(22a)
Adj infilt rate	0.1432	0.1375	0.1375	0.1231	0.1231	0.1117	0.1146	0.1146	0.1174	0.1260	0.1231	0.1346	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													75.6000 (23c)
Effective ac	0.2652	0.2595	0.2595	0.2451	0.2451	0.2337	0.2366	0.2366	0.2394	0.2480	0.2451	0.2566	(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	
Windows (Uw = 1.00)			139.2300	0.9615	133.8750			(27)
Doors			3.2400	1.0000	3.2400			(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000	(28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000	(29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000	(29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000	(29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600	(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000	(30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200	(30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700	(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600	(30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400	(30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000	(30)
Total net area of external elements Aum(A, m2)			1165.8400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 266.4871			(33)
Basement			414.6000			75.0000	31095.0000	(32c)
GF			183.2000			75.0000	13740.0000	(32c)
GF			101.5000			9.0000	913.5000	(32c)
FF			128.5000			75.0000	9637.5000	(32c)
FF			142.0000			9.0000	1278.0000	(32c)
SF			81.6000			9.0000	734.4000	(32c)
GF			204.1800			18.0000	3675.2400	(32d)
FF			163.1500			18.0000	2936.7000	(32d)
Internal Floor 3			76.2100			18.0000	1371.7800	(32d)
Basement			204.1800			9.0000	1837.6200	(32e)
GF			163.1500			9.0000	1468.3500	(32e)
FF			76.2100			9.0000	685.8900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)
 Point Thermal bridges (36a) = 0.0000
 Total fabric heat loss (33) + (36) + (36a) = 300.4063 (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	179.2050	175.3345	175.3345	165.6583	165.6583	157.9173	159.8526	159.8526	161.7878	167.5936	165.6583	173.3993	(38)
Heat transfer coeff	479.6113	475.7408	475.7408	466.0646	466.0646	458.3237	460.2589	460.2589	462.1941	467.9999	466.0646	473.8056	(39)
Average = Sum(39)m / 12 =												467.6773	
HLP	0.6926	0.6870	0.6870	0.6730	0.6730	0.6618	0.6646	0.6646	0.6674	0.6758	0.6730	0.6842	(40)
HLP (average)												0.6753	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.6422 (42)
 Hot water usage for mixer showers

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Hot water usage for baths	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607 (42a)
Hot water usage for other uses	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752 (42b)
Average daily hot water use (litres/day)	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296 (42c)
												159.9599 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654 (44)
Distribution loss (46)m = 0.15 x (45)m	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615 (45)
Water storage loss:												
Store volume												500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.5067 (55)
Total storage loss												
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (56)
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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686 (62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953 (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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753 (72)
Total internal gains	1505.2878	1501.2130	1448.5027	1355.2892	1255.4470	1167.9564	1117.6451	1122.9008	1174.6001	1263.9285	1368.4140	1458.5367 (73)

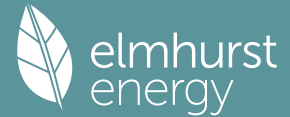
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				17.9300	12.4928	0.4000	0.7000	0.7700	43.4641 (75)			
Southeast				56.5800	39.1209	0.4000	0.7000	0.7700	429.5001 (77)			
Southwest				19.2000	39.1209	0.4000	0.7000	0.7700	145.7476 (79)			
Northwest				45.5200	12.4928	0.4000	0.7000	0.7700	110.3449 (81)			
Solar gains	729.0567	1161.8148	1721.8849	2421.3774	2832.6074	3091.9754	2936.3027	2625.3759	2125.5309	1439.3668	911.5603	606.5486 (83)
Total gains	2234.3445	2663.0277	3170.3876	3776.6665	4088.0544	4259.9318	4053.9478	3748.2768	3300.1309	2703.2954	2279.9743	2065.0853 (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	73.5216	74.1197	74.1197	75.6586	75.6586	76.9364	76.6129	76.6129	76.2922	75.3457	75.6586	74.4225
alpha	5.9014	5.9413	5.9413	6.0439	6.0439	6.1291	6.1075	6.1075	6.0861	6.0230	6.0439	5.9615
util living area	0.9995	0.9985	0.9926	0.9548	0.8157	0.5323	0.3290	0.3800	0.7470	0.9777	0.9983	0.9997 (86)
Living	20.0525	20.1633	20.4003	20.6895	20.8835	20.9454	20.9490	20.9488	20.9210	20.6661	20.3232	20.0386

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Non living	19.1976	19.3436	19.6466	20.0192	20.2415	20.3074	20.3069	20.3068	20.2845	19.9921	19.5589	19.1857
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	25
16 / 9	0	28	31	0	0	0	0	0	0	0	27	6
MIT	21.0000	20.5261	20.6604	20.6895	20.8835	20.9454	20.9490	20.9488	20.9210	20.6661	20.5874	20.8946 (87)
Th 2	20.3474	20.3523	20.3523	20.3647	20.3647	20.3747	20.3722	20.3722	20.3697	20.3622	20.3647	20.3548 (88)
util rest of house	0.9994	0.9982	0.9905	0.9424	0.7735	0.4682	0.2579	0.3034	0.6819	0.9692	0.9978	0.9996 (89)
MIT 2	20.3474	19.9071	20.0408	20.0192	20.2415	20.3074	20.3069	20.3068	20.2845	19.9921	19.9640	20.2549 (90)
Living area fraction									flA =	Living area	/ (4) =	0.0495 (91)
MIT	20.3797	19.9377	20.0715	20.0524	20.2733	20.3390	20.3387	20.3386	20.3161	20.0255	19.9949	20.2866 (92)
Temperature adjustment												-0.1000
adjusted MIT	20.2797	19.8377	19.9715	19.9524	20.1733	20.2390	20.2387	20.2386	20.2161	19.9255	19.8949	20.1866 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9994	0.9978	0.9890	0.9325	0.7595	0.4540	0.2428	0.2871	0.6647	0.9614	0.9973	0.9996 (94)
Useful gains	2232.9415	2657.1647	3135.6535	3521.7929	3104.7735	1934.2154	984.2261	1075.9950	2193.5803	2598.8196	2273.7157	2064.2218 (95)
Ext temp.	5.0000	5.4000	7.4000	9.9000	13.0000	16.0000	18.1000	17.9000	15.3000	11.7000	8.0000	5.0000 (96)
Heat loss rate W	7328.3251	6868.6240	5980.7906	4685.0569	3343.2084	1942.8409	984.3573	1076.3713	2272.1725	3849.5378	5543.7943	7195.5079 (97)
Space heating kWh	3790.9654	2830.1007	2116.7820	837.5501	177.3956	0.0000	0.0000	0.0000	0.0000	930.5344	2354.4565	3817.6768 (98a)
Space heating requirement - total per year (kWh/year)												16855.4614
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	3790.9654	2830.1007	2116.7820	837.5501	177.3956	0.0000	0.0000	0.0000	0.0000	930.5344	2354.4565	3817.6768 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16855.4614
Space heating per m2										(98c) / (4) =		24.3400 (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 %)												339.1548 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	3790.9654	2830.1007	2116.7820	837.5501	177.3956	0.0000	0.0000	0.0000	0.0000	930.5344	2354.4565	3817.6768 (98)
Space heating efficiency (main heating system 1)	339.1548	339.1548	339.1548	339.1548	339.1548	0.0000	0.0000	0.0000	0.0000	339.1548	339.1548	339.1548 (210)
Space heating fuel (main heating system)	1117.7685	834.4569	624.1345	246.9521	52.3052	0.0000	0.0000	0.0000	0.0000	274.3686	694.2129	1125.6443 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Efficiency of water heater	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349 (216)
Fuel for water heating, kWh/month	164.0322	144.8300	153.9337	136.2545	132.5296	119.9684	119.1257	123.7691	124.9610	138.6117	146.3725	162.4279 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	231.0660	208.7048	231.0660	223.6123	231.0660	223.6123	231.0660	231.0660	223.6123	231.0660	223.6123	231.0660 (231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-98.4369	-165.9379	-329.1047	-515.3460	-662.9117	-711.1545	-692.3192	-592.8693	-417.6449	-245.2977	-124.8483	-78.0705 (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												4969.8431 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												148.6349
Water heating fuel used												1666.8164 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)	
mechanical ventilation fans (SFP = 1.0890)	2720.6162 (230a)
Total electricity for the above, kWh/year	2720.6162 (231)
Electricity for lighting (calculated in Appendix L)	770.8784 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-4633.9417 (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	5494.2123 (238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4969.8431	21.5100	1069.0132 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1666.8164	21.5100	358.5322 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	2720.6162	21.5100	585.2045 (249)
Energy for lighting	770.8784	21.5100	165.8159 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4633.9417	21.5100	-996.7609
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-996.7609 (252)
Total energy cost			1181.8051 (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	4969.8431	0.1568	779.0407 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1666.8164	0.1407	234.5959 (264)
Space and water heating			1013.6366 (265)
Pumps, fans and electric keep-hot	2720.6162	0.1387	377.3830 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4633.9417	0.1292	-598.6252
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-598.6252 (269)
Total CO2, kg/year			903.6560 (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	4969.8431	1.5803	7853.9800 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1666.8164	1.5204	2534.2535 (278)
Space and water heating			10388.2335 (279)
Pumps, fans and electric keep-hot	2720.6162	1.5128	4115.7481 (281)
Energy for lighting	770.8784	1.5338	1182.3990 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4633.9417	1.4771	-6844.8023
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-6844.8023 (283)
Total Primary energy kWh/year			8841.5783 (286)

SAP 10 EPC IMPROVEMENTS

Proposed no cooling

Current energy efficiency rating: A 92
Current environmental impact rating: A 98

N Solar water heating

SAP increase too small

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U Solar photovoltaic panels Already installed
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

Measures omitted - SAP change or cost saving too small:
N Solar water heating + 0.4 -£ 77 -45 kg (4.9%)

Recommended measures Typical annual savings Energy Environmental
(none) efficiency impact
Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £2179	Potential £2179	Saving £0
Electricity			
Space heating	£1654	£1654	£0
Water heating	£359	£359	£0
Lighting	£166	£166	£0
Generated (PV)	-£997	-£997	£0
Total cost of fuels	£1182	£1182	£0
Total cost of uses	£1182	£1182	£0
Delivered energy	8 kWh/m²	8 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.9 tonnes	0.0 tonnes
CO2 emissions per m²	1 kg/m²	1 kg/m²	0 kg/m²
Primary energy	13 kWh/m²	13 kWh/m²	0 kWh/m²

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

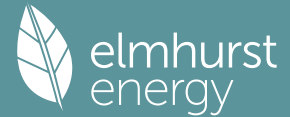
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (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	2 * 10 = 20.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.0098 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.5000 (17)
Infiltration rate	0.1348 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1146 (21)

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	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	0.1461	0.1432	0.1403	0.1260	0.1231	0.1088	0.1088	0.1060	0.1146	0.1231	0.1289	0.1346	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													75.6000 (23c)
Effective ac	0.2681	0.2652	0.2623	0.2480	0.2451	0.2308	0.2308	0.2280	0.2366	0.2451	0.2509	0.2566	(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	
Windows (Uw = 1.00)			139.2300	0.9615	133.8750			(27)
Doors			3.2400	1.0000	3.2400			(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000	(28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000	(29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000	(29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000	(29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600	(29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000	(30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200	(30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700	(30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600	(30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400	(30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000	(30)
Total net area of external elements Aum(A, m2)			1165.8400					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	266.4871		(33)
Basement			414.6000			75.0000	31095.0000	(32c)
GF			183.2000			75.0000	13740.0000	(32c)
GF			101.5000			9.0000	913.5000	(32c)
FF			128.5000			75.0000	9637.5000	(32c)
FF			142.0000			9.0000	1278.0000	(32c)
SF			81.6000			9.0000	734.4000	(32c)
GF			204.1800			18.0000	3675.2400	(32d)
FF			163.1500			18.0000	2936.7000	(32d)
Internal Floor 3			76.2100			18.0000	1371.7800	(32d)
Basement			204.1800			9.0000	1837.6200	(32e)
GF			163.1500			9.0000	1468.3500	(32e)
FF			76.2100			9.0000	685.8900	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 126942.4300 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 183.3104 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 33.9192 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 300.4063 (37)

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

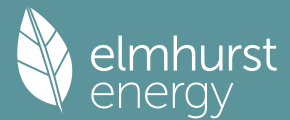
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	181.1402	179.2050	177.2698	167.5936	165.6583	155.9821	155.9821	154.0469	159.8526	165.6583	169.5288	173.3993	(38)
Heat transfer coeff	481.5466	479.6113	477.6761	467.9999	466.0646	456.3884	456.3884	454.4532	460.2589	466.0646	469.9351	473.8056	(39)
Average = Sum(39)m / 12 =												467.5161	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6954	0.6926	0.6898	0.6758	0.6730	0.6590	0.6590	0.6563	0.6646	0.6730	0.6786	0.6842	(40)
HLP (average)												0.6751	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers													
85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	84.9607	(42a)
Hot water usage for baths													
36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	36.6752	(42b)
Hot water usage for other uses													
51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	51.9296	(42c)
Average daily hot water use (litres/day)												159.9599	(43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

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Daily hot water use												
Energy conte	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654 (44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											2656.9005
Water storage loss:	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642 (46)
Store volume												500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9000 (48)
Temperature factor from Table 2b												0.7930 (49)
Enter (49) or (54) in (55)												1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (56)
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071 (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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686 (62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Total per year (kWh/year) = Sum(64)m =											2477.4708	(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	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264 (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	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638 (68)
Pumps, fans	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953 (69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Water heating gains (Table 5)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872 (71)
Total internal gains	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753 (72)
	1505.2878	1501.2130	1448.5027	1355.2892	1255.4470	1167.9564	1117.6451	1122.9008	1174.6001	1263.9285	1368.4140	1458.5367 (73)

6. Solar gains

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

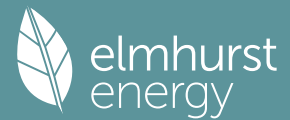
Northeast				17.9300	11.2829	0.4000	0.7000	0.7700	39.2549 (75)			
Southeast				56.5800	36.7938	0.4000	0.7000	0.7700	403.9515 (77)			
Southwest				19.2000	36.7938	0.4000	0.7000	0.7700	137.0779 (79)			
Northwest				45.5200	11.2829	0.4000	0.7000	0.7700	99.6588 (81)			

Solar gains	679.9432	1204.3363	1770.3857	2399.0232	2874.6125	2936.3027	2796.5856	2429.1653	1986.0993	1364.0935	822.8180	576.4524 (83)
Total gains	2185.2309	2705.5492	3218.8884	3754.3124	4130.0595	4104.2591	3914.2307	3552.0661	3160.6994	2628.0221	2191.2320	2034.9891 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	73.2261	73.5216	73.8195	75.3457	75.6586	77.2627	77.2627	77.5917	76.6129	75.6586	75.0354	74.4225
util living area	5.8817	5.9014	5.9213	6.0230	6.0439	6.1508	6.1508	6.1728	6.1075	6.0439	6.0024	5.9615
	0.9997	0.9987	0.9942	0.9700	0.8779	0.6839	0.5089	0.5791	0.8613	0.9885	0.9991	0.9998 (86)
Living	19.9844	20.1217	20.3343	20.6145	20.8315	20.9306	20.9468	20.9442	20.8740	20.5768	20.2313	19.9711
Non living	19.1083	19.2862	19.5602	19.9245	20.1853	20.2986	20.3110	20.3121	20.2426	19.8822	19.4370	19.0992
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	24
16 / 9	0	28	31	0	0	0	0	0	0	0	26	7
MIT	21.0000	20.5026	20.6229	20.6145	20.8315	20.9306	20.9468	20.9442	20.8740	20.5768	20.5202	20.8684 (87)
Th 2	20.3449	20.3474	20.3499	20.3622	20.3647	20.3772	20.3772	20.3796	20.3722	20.3647	20.3598	20.3548 (88)
util rest of house	0.9996	0.9983	0.9927	0.9619	0.8482	0.6266	0.4388	0.5053	0.8175	0.9844	0.9988	0.9997 (89)

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MIT 2	20.3449	19.8790	20.0013	19.9245	20.1853	20.2986	20.3110	20.3121	20.2426	19.8822	19.8838	20.2297 (90)
Living area fraction									fLA = Living area / (4) =			0.0495 (91)
MIT	20.3774	19.9099	20.0321	19.9587	20.2173	20.3299	20.3425	20.3434	20.2738	19.9166	19.9153	20.2613 (92)
Temperature adjustment												-0.1000
adjusted MIT	20.2774	19.8099	19.9321	19.8587	20.1173	20.2299	20.2425	20.2434	20.1738	19.8166	19.8153	20.1613 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9996	0.9980	0.9915	0.9539	0.8350	0.6124	0.4234	0.4886	0.8015	0.9794	0.9985	0.9997	(94)
Useful gains	2184.2776	2700.1131	3191.6586	3581.2646	3448.7862	2513.5571	1657.4658	1735.4899	2533.4144	2573.9657	2187.8623	2034.3951	(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	7693.8466	7150.9597	6416.1919	5128.6544	3923.0031	2569.4179	1662.4092	1746.6607	2795.5399	4295.5147	5975.3566	7562.5597	(97)
Space heating kWh	4099.1193	2990.9689	2399.0528	1114.1207	352.8174	0.0000	0.0000	0.0000	0.0000	1280.8325	2726.9959	4112.9545	(98a)
Space heating requirement - total per year (kWh/year)												19076.8619	
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	4099.1193	2990.9689	2399.0528	1114.1207	352.8174	0.0000	0.0000	0.0000	0.0000	1280.8325	2726.9959	4112.9545	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												19076.8619	
Space heating per m2										(98c) / (4) =		27.5478	(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 %)													339.1440 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4099.1193	2990.9689	2399.0528	1114.1207	352.8174	0.0000	0.0000	0.0000	0.0000	1280.8325	2726.9959	4112.9545	(98)
Space heating efficiency (main heating system 1)	339.1440	339.1440	339.1440	339.1440	339.1440	0.0000	0.0000	0.0000	0.0000	339.1440	339.1440	339.1440	(210)
Space heating fuel (main heating system)	1208.6662	881.9170	707.3846	328.5096	104.0317	0.0000	0.0000	0.0000	0.0000	377.6662	804.0819	1212.7457	(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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245	(64)
Efficiency of water heater	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	148.6346	(216)
Fuel for water heating, kWh/month	164.0325	144.8303	153.9340	136.2548	132.5299	119.9686	119.1259	123.7693	124.9613	138.6119	146.3728	162.4282	(219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	231.0660	208.7048	231.0660	223.6123	231.0660	223.6123	231.0660	231.0660	223.6123	231.0660	223.6123	231.0660	(231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-88.2510	-165.7812	-328.5284	-501.2342	-665.4723	-670.7757	-653.9942	-541.0553	-380.8093	-224.6480	-108.3947	-71.2991	(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												5625.0030	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												148.6346	
Water heating fuel used												1666.8195	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)													
mechanical ventilation fans (SFP = 1.0890)												2720.6162	(230a)
Total electricity for the above, kWh/year												2720.6162	(231)
Electricity for lighting (calculated in Appendix L)												770.8784	(232)

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

PV generation	-4400.2433 (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	6383.0738 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5625.0030	16.4900	927.5630 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1666.8195	16.4900	274.8585 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	2720.6162	16.4900	448.6296 (249)
Energy for lighting	770.8784	16.4900	127.1178 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4400.2433	16.4900	-725.6001
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-725.6001 (252)
Total energy cost			1052.5689 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5138 (257)
SAP value		91.6714
SAP rating (Section 12)		92 (258)
SAP band		A

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

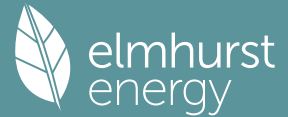
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5625.0030	0.1560	877.5148 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1666.8195	0.1407	234.5964 (264)
Space and water heating			1112.1111 (265)
Pumps, fans and electric keep-hot	2720.6162	0.1387	377.3830 (267)
Energy for lighting	770.8784	0.1443	111.2616 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-4400.2433	0.1294	-569.3784
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-569.3784 (269)
Total CO2, kg/year			1031.3773 (272)
CO2 emissions per m2			1.4900 (273)
EI value			98.1260
EI rating			98 (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)
Basement floor	248.9600 (1a)	x 3.0000 (2a)	= 746.8800 (1a) -
Ground floor	204.1800 (1b)	x 3.2500 (2b)	= 663.5850 (1b) -
First floor	163.1500 (1c)	x 3.0000 (2c)	= 489.4500 (1c) -
Second floor	76.2100 (1d)	x 1.9400 (2d)	= 147.8474 (1d) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	692.5000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2047.7624 (5)

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2. Ventilation rate

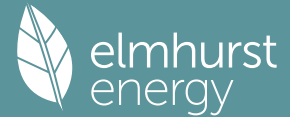
												m3 per hour	
Number of open chimneys												0 * 80 =	0.0000 (6a)
Number of open flues												0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire												2 * 10 =	20.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 =	0.0000 (6d)
Number of flues attached to other heater												0 * 35 =	0.0000 (6e)
Number of blocked chimneys												0 * 20 =	0.0000 (6f)
Number of intermittent extract fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =												20.0000 / (5) =	0.0098 (8)
Pressure test													Yes
Pressure Test Method													Blower Door
Measured/design AP50													2.5000 (17)
Infiltration rate													0.1348 (18)
Number of sides sheltered													2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) =	0.1146 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.0000	4.8000	4.8000	4.3000	4.3000	3.9000	4.0000	4.0000	4.1000	4.4000	4.3000	4.7000	(22)
Wind factor	1.2500	1.2000	1.2000	1.0750	1.0750	0.9750	1.0000	1.0000	1.0250	1.1000	1.0750	1.1750	(22a)
Adj infilt rate	0.1432	0.1375	0.1375	0.1231	0.1231	0.1117	0.1146	0.1146	0.1174	0.1260	0.1231	0.1346	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													75.6000 (23c)
Effective ac	0.2652	0.2595	0.2595	0.2451	0.2451	0.2337	0.2366	0.2366	0.2394	0.2480	0.2451	0.2566	(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
Windows (Uw = 1.00)			139.2300	0.9615	133.8750		(27)
Doors			3.2400	1.0000	3.2400		(26)
Basement floor			248.9600	0.1000	24.8960	110.0000	27385.6000 (28a)
Basement walls	224.4000	23.7600	200.6400	0.1500	30.0960	60.0000	12038.4000 (29a)
External Walls	361.4700	106.9500	254.5200	0.1500	38.1780	60.0000	15271.2000 (29a)
Dwarf walls	42.5000		42.5000	0.1400	5.9500	9.0000	382.5000 (29a)
Dormers	30.8000	11.7600	19.0400	0.1000	1.9040	9.0000	171.3600 (29a)
Flat SF	22.8000		22.8000	0.1100	2.5080	9.0000	205.2000 (30)
Flat Base	44.7800		44.7800	0.1100	4.9258	9.0000	403.0200 (30)
Flat GF	41.0300		41.0300	0.1100	4.5133	9.0000	369.2700 (30)
Ceiling FF	86.9400		86.9400	0.1100	9.5634	9.0000	782.4600 (30)
Pitch	36.2600		36.2600	0.1100	3.9886	9.0000	326.3400 (30)
Dormer	25.9000		25.9000	0.1100	2.8490	9.0000	233.1000 (30)
Total net area of external elements Aum(A, m2)			1165.8400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 266.4871		(33)
Basement			414.6000			75.0000	31095.0000 (32c)
GF			183.2000			75.0000	13740.0000 (32c)
GF			101.5000			9.0000	913.5000 (32c)
FF			128.5000			75.0000	9637.5000 (32c)
FF			142.0000			9.0000	1278.0000 (32c)
SF			81.6000			9.0000	734.4000 (32c)
GF			204.1800			18.0000	3675.2400 (32d)
FF			163.1500			18.0000	2936.7000 (32d)
Internal Floor 3			76.2100			18.0000	1371.7800 (32d)
Basement			204.1800			9.0000	1837.6200 (32e)
GF			163.1500			9.0000	1468.3500 (32e)
FF			76.2100			9.0000	685.8900 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	126942.4300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		183.3104	(35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	64.7000	0.0200	1.2940
E3 Sill	63.5000	0.0230	1.4605
E4 Jamb	190.2400	0.0180	3.4243
E5 Ground floor (normal)	74.8000	0.0480	3.5904
E6 Intermediate floor within a dwelling	153.0000	0.0010	0.1530
E16 Corner (normal)	73.6000	0.0400	2.9440
E14 Flat roof	62.9000	0.1600	10.0640
E10 Eaves (insulation at ceiling level)	51.0000	0.0550	2.8050
R8 Roof to wall (rafter)	37.4000	0.1200	4.4880
R9 Roof to wall (flat ceiling)	8.4000	0.3200	2.6880
R7 Flat ceiling (inverted)	8.4000	0.1200	1.0080
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			33.9192 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	300.4063 (37)

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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	179.2050	175.3345	175.3345	165.6583	165.6583	157.9173	159.8526	159.8526	161.7878	167.5936	165.6583	173.3993	(38)
Heat transfer coeff	479.6113	475.7408	475.7408	466.0646	466.0646	458.3237	460.2589	460.2589	462.1941	467.9999	466.0646	473.8056	(39)
Average = Sum(39)m / 12 =												467.6773	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6926	0.6870	0.6870	0.6730	0.6730	0.6618	0.6646	0.6646	0.6674	0.6758	0.6730	0.6842	(40)
HLP (average)												0.6753	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.6422 (42)
Hot water usage for mixer showers	85.2874	84.0057	82.1380	78.5645	75.9274	72.9865	71.3148	73.1684	75.2002	78.3579	82.0082	84.9607	(42a)
Hot water usage for baths	36.7996	36.2531	35.4835	34.0644	33.0018	31.8236	31.1872	31.9515	32.7836	34.0443	35.4926	36.6752	(42b)
Hot water usage for other uses	51.9296	50.0412	48.1529	46.2645	44.3762	42.4878	42.4878	44.3762	46.2645	48.1529	50.0412	51.9296	(42c)
Average daily hot water use (litres/day)												159.9599	(43)
Daily hot water use	174.0166	170.3000	165.7744	158.8935	153.3054	147.2979	144.9899	149.4960	154.2483	160.5551	167.5419	173.5654	(44)
Energy content (annual)	275.5998	242.5050	254.7890	217.5172	206.3785	181.1200	175.3527	185.1073	190.2036	217.8717	238.6942	271.7615	(45)
Distribution loss (46)m = 0.15 x (45)m	41.3400	36.3757	38.2184	32.6276	30.9568	27.1680	26.3029	27.7661	28.5305	32.6808	35.8041	40.7642	(46)
Water storage loss:													
Store volume													500.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9000 (48)
Temperature factor from Table 2b													0.7930 (49)
Enter (49) or (54) in (55)													1.5067 (55)
Total storage loss	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(56)
If cylinder contains dedicated solar storage	46.7071	42.1871	46.7071	45.2004	46.7071	45.2004	46.7071	46.7071	45.2004	46.7071	45.2004	46.7071	(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	322.3069	284.6920	301.4961	262.7176	253.0856	226.3204	222.0598	231.8144	235.4040	264.5788	283.8946	318.4686	(62)
WWHRS	-78.4977	-69.4240	-72.6969	-60.1959	-56.1004	-48.0055	-44.9975	-47.8503	-49.6683	-58.5535	-66.3340	-77.0441	(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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245	(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	129.0026	114.3826	122.0830	108.4848	105.9866	96.3827	95.6705	98.9139	99.4030	109.8080	115.5262	127.7264	(65)

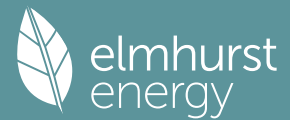
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	218.5308	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1258	96.9246	78.8244	59.6751	44.6078	37.6598	40.6928	52.8940	70.9942	90.1435	105.2107	112.1588	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	1089.4325	1100.7374	1072.2494	1011.6019	935.0452	863.0928	815.0241	803.7192	832.2072	892.8548	969.4114	1041.3638	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	60.4953	(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)	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	-145.6872	(71)
Water heating gains (Table 5)	173.3906	170.2121	164.0901	150.6734	142.4550	133.8649	128.5893	132.9487	138.0598	147.5914	160.4530	171.6753	(72)
Total internal gains	1505.2878	1501.2130	1448.5027	1355.2892	1255.4470	1167.9564	1117.6451	1122.9008	1174.6001	1263.9285	1368.4140	1458.5367	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	17.9300	12.4928	0.4000	0.7000	0.7700	43.4641 (75)
Southeast	56.5800	39.1209	0.4000	0.7000	0.7700	429.5001 (77)
Southwest	19.2000	39.1209	0.4000	0.7000	0.7700	145.7476 (79)

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Northwest	45.5200		12.4928		0.4000		0.7000		0.7700		110.3449 (81)	
Solar gains	729.0567	1161.8148	1721.8849	2421.3774	2832.6074	3091.9754	2936.3027	2625.3759	2125.5309	1439.3668	911.5603	606.5486 (83)
Total gains	2234.3445	2663.0277	3170.3876	3776.6665	4088.0544	4259.9318	4053.9478	3748.2768	3300.1309	2703.2954	2279.9743	2065.0853 (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	73.5216	74.1197	74.1197	75.6586	75.6586	76.9364	76.6129	76.6129	76.2922	75.3457	75.6586	74.4225
alpha	5.9014	5.9413	5.9413	6.0439	6.0439	6.1291	6.1075	6.1075	6.0861	6.0230	6.0439	5.9615
util living area	0.9995	0.9985	0.9926	0.9548	0.8157	0.5323	0.3290	0.3800	0.7470	0.9777	0.9983	0.9997 (86)
Living	20.0525	20.1633	20.4003	20.6895	20.8835	20.9454	20.9490	20.9488	20.9210	20.6661	20.3232	20.0386
Non living	19.1976	19.3436	19.6466	20.0192	20.2415	20.3074	20.3069	20.3068	20.2845	19.9921	19.5589	19.1857
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	0	0	0	0	0	0	0	0	0	0	25
16 / 9	0	28	31	0	0	0	0	0	0	0	27	6
MIT	21.0000	20.5261	20.6604	20.6895	20.8835	20.9454	20.9490	20.9488	20.9210	20.6661	20.5874	20.8946 (87)
Th 2	20.3474	20.3523	20.3523	20.3647	20.3647	20.3747	20.3722	20.3722	20.3697	20.3622	20.3647	20.3548 (88)
util rest of house	0.9994	0.9982	0.9905	0.9424	0.7735	0.4682	0.2579	0.3034	0.6819	0.9692	0.9978	0.9996 (89)
MIT 2	20.3474	19.9071	20.0408	20.0192	20.2415	20.3074	20.3069	20.3068	20.2845	19.9921	19.9640	20.2549 (90)
Living area fraction									fLA = Living area / (4) =			0.0495 (91)
MIT	20.3797	19.9377	20.0715	20.0524	20.2733	20.3390	20.3387	20.3386	20.3161	20.0255	19.9949	20.2866 (92)
Temperature adjustment												-0.1000
adjusted MIT	20.2797	19.8377	19.9715	19.9524	20.1733	20.2390	20.2387	20.2386	20.2161	19.9255	19.8949	20.1866 (93)

8. Space heating requirement												

Utilisation	0.9994	0.9978	0.9890	0.9325	0.7595	0.4540	0.2428	0.2871	0.6647	0.9614	0.9973	Dec 0.9996 (94)
Useful gains	2232.9415	2657.1647	3135.6535	3521.7929	3104.7735	1934.2154	984.2261	1075.9950	2193.5803	2598.8196	2273.7157	2064.2218 (95)
Ext temp.	5.0000	5.4000	7.4000	9.9000	13.0000	16.0000	18.1000	17.9000	15.3000	11.7000	8.0000	5.0000 (96)
Heat loss rate W	7328.3251	6868.6240	5980.7906	4685.0569	3343.2084	1942.8409	984.3573	1076.3713	2272.1725	3849.5378	5543.7943	7195.5079 (97)
Space heating kWh	3790.9654	2830.1007	2116.7820	837.5501	177.3956	0.0000	0.0000	0.0000	0.0000	930.5344	2354.4565	3817.6768 (98a)
Space heating requirement - total per year (kWh/year)												16855.4614
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	3790.9654	2830.1007	2116.7820	837.5501	177.3956	0.0000	0.0000	0.0000	0.0000	930.5344	2354.4565	3817.6768 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16855.4614
Space heating per m2										(98c) / (4) =		24.3400 (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 %)												339.1548 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												90.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	3790.9654	2830.1007	2116.7820	837.5501	177.3956	0.0000	0.0000	0.0000	0.0000	930.5344	2354.4565	3817.6768 (98)
Space heating efficiency (main heating system 1)	339.1548	339.1548	339.1548	339.1548	339.1548	0.0000	0.0000	0.0000	0.0000	339.1548	339.1548	339.1548 (210)
Space heating fuel (main heating system)	1117.7685	834.4569	624.1345	246.9521	52.3052	0.0000	0.0000	0.0000	0.0000	274.3686	694.2129	1125.6443 (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	243.8091	215.2680	228.7993	202.5218	196.9853	178.3149	177.0623	183.9641	185.7357	206.0253	217.5606	241.4245 (64)
Efficiency of water heater	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349	148.6349 (216)
Fuel for water heating, kWh/month	164.0322	144.8300	153.9337	136.2545	132.5296	119.9684	119.1257	123.7691	124.9610	138.6117	146.3725	162.4279 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	231.0660	208.7048	231.0660	223.6123	231.0660	223.6123	231.0660	231.0660	223.6123	231.0660	223.6123	231.0660 (231)
Lighting	95.5172	76.6274	68.9945	50.5483	39.0450	31.9001	35.6181	46.2978	60.1363	78.9020	89.1197	98.1719 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-98.4369	-165.9379	-329.1047	-515.3460	-662.9117	-711.1545	-692.3192	-592.8693	-417.6449	-245.2977	-124.8483	-78.0705 (233a)

10a. Fuel costs - using BEDF prices (526)

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

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

SAP 10 Online 2.9.8

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PV Unit electricity used in dwelling	-4633.9417	1.4771	-6844.8023
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-6844.8023 (283)
Total Primary energy kWh/year			8841.5783 (286)

26 Sheldon Road - Water Calculator

Installation Type	Unit of Measure	Capacity/Flow rate (1)	Use Factor (2)	Fixed use (litres/person/day) (3)	Litres/person/day = [(1)x(2)] + (3) (4)
WC (single flush)	Flush Volume (litres)		4.42	0.00	0
WC (dual flush)	Full flush Volume (litres)	4	1.46	0.00	5.84
	Part flush Volume (litres)	2	2.96	0.00	5.92
WC (multiple fittings)	Average effective flushing Volume (litres)		4.42	0.00	0
Taps (excluding kitchen/utility room taps)	Flow rate (litres/min)	3.50	1.58	1.58	7.11
Bath (where shower also present)	Capacity to overflow(litres)	180.00	0.11	0.00	19.80
Shower (where bath also present)	Flow Rate(litres / minute)	8.00	4.37	0.00	34.96
Bath Only	Capacity to overflow(litres)		0.50	0.00	0
Shower Only	Flow Rate (litres/minute)		5.60	0.00	0
Kitchen/Utility room sink taps	Flow rate (litres/minute)	4.00	0.44	10.36	12.12
Washing Machine	(Litres/kg dry load)	9.00	2.1	0.00	18.90
Dishwasher	(Litres/place setting)	0.90	3.6	0.00	3.24
Waste disposal unit	(Litres/use)	☐ Present	3.08	0.00	0
Water Softener	(Litres/person/day)		1.00	0.00	0
	(5)	Total Calculated use (litres/person/day) =SUM(column 4)			107.89
	(6)	Contribution from greywater (litres/person/day)			0
	(7)	Contribution from rainwater (litres/person/day)			0
	(8)	Normalisation factor			0.91
	(9)	Total water consumption (Code for Sustainable Homes) = [(5)-(6)-(7)]x(8) (litres/person/day)			98.18
	(10)	External water use			5.0
	(11)	Total water consumption (Building Regulation 17.K) =(9)+(10)(litres/person/day)			103.2

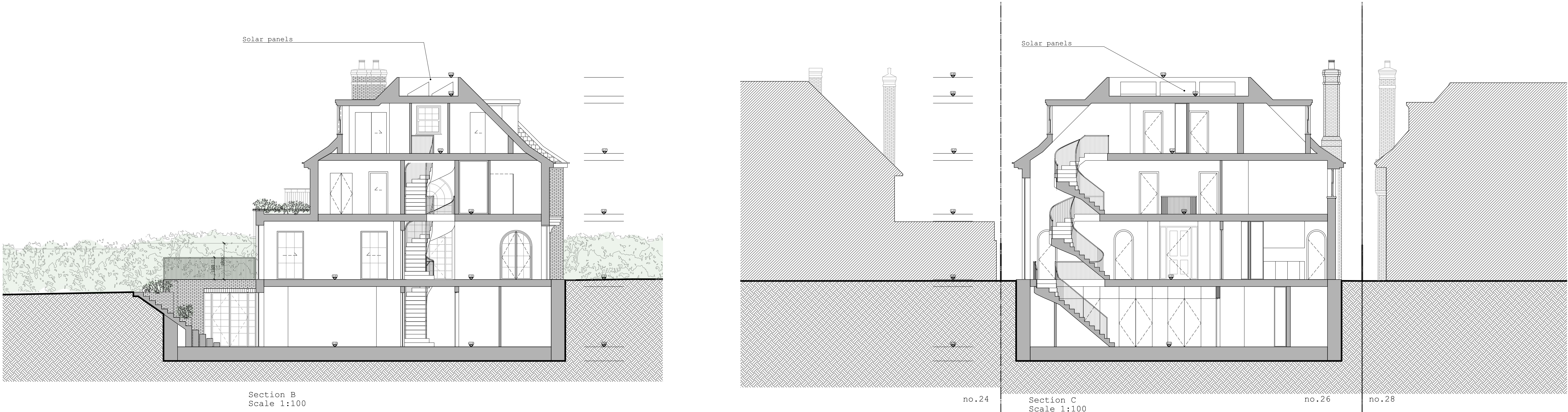
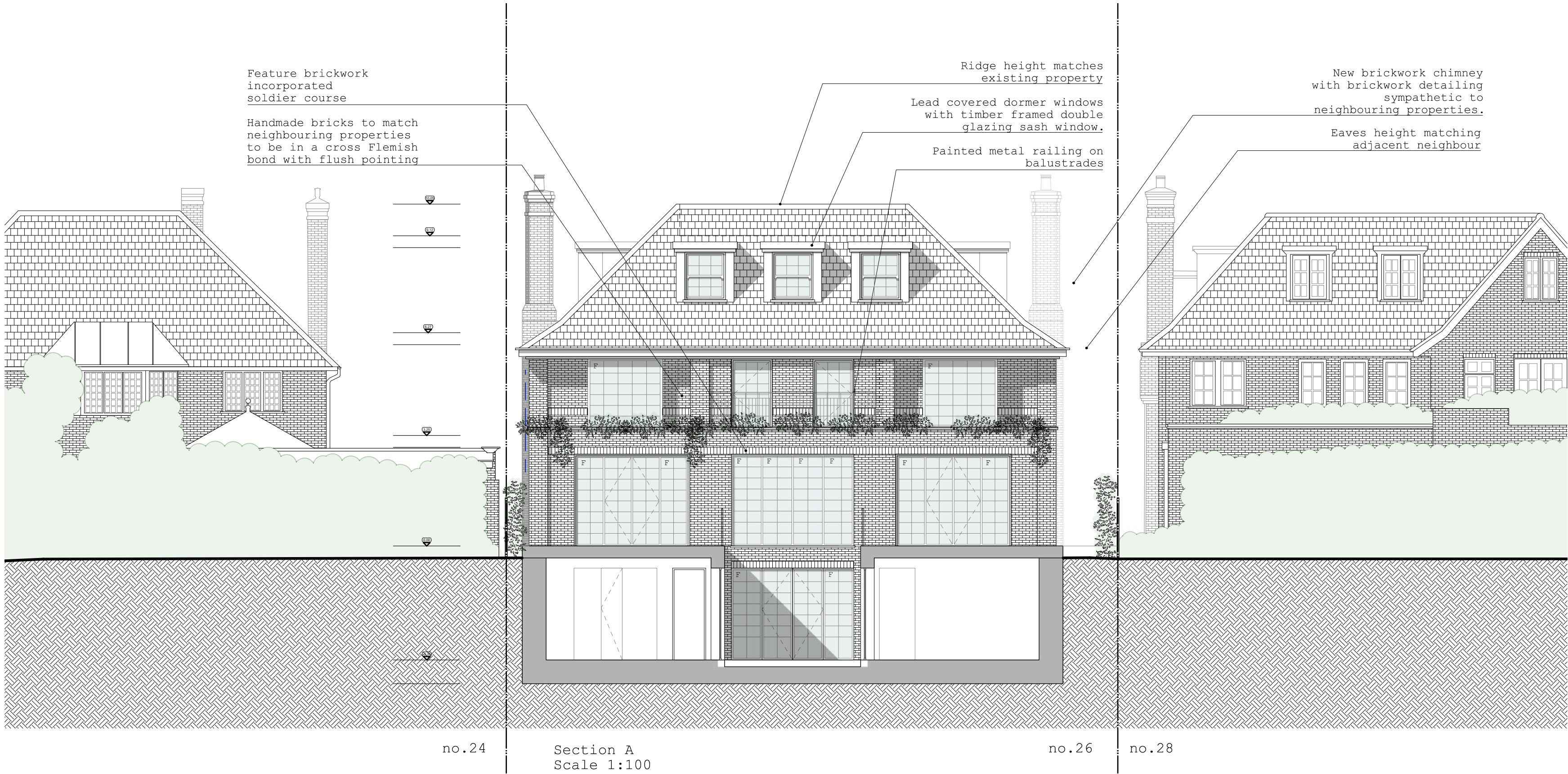
Installation Type	Type	Litres/Person/Day
WC (dual flush)		11.76
Taps		7.11
Baths (shower(s) present)		19.80
Showers (bath(s) present)		34.96
Kitchen Taps		12.12
Washing Machines		18.90
Dishwasher		3.24



WRc-NSF



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Metres 0 1 2 3 4 5 10
1:100

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Project
26 Sheldon Avenue
London N6 4JT

Client
Mr. & Mrs. Patel

Zone	Discipline	Status
A	ARCHITECTURE	PLANNING
Level	Drawing Number	Revision
	26SA-PA-06-B	B
Paper Size	A1 SHEET	
Drawing Title	Proposed section A B and C	
Scale	Date	Drawn
1:100	20/09/23	BMG
Project Title	Checked	
26 Sheldon Avenue	BMG	

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Existing house
footprint ref. lines

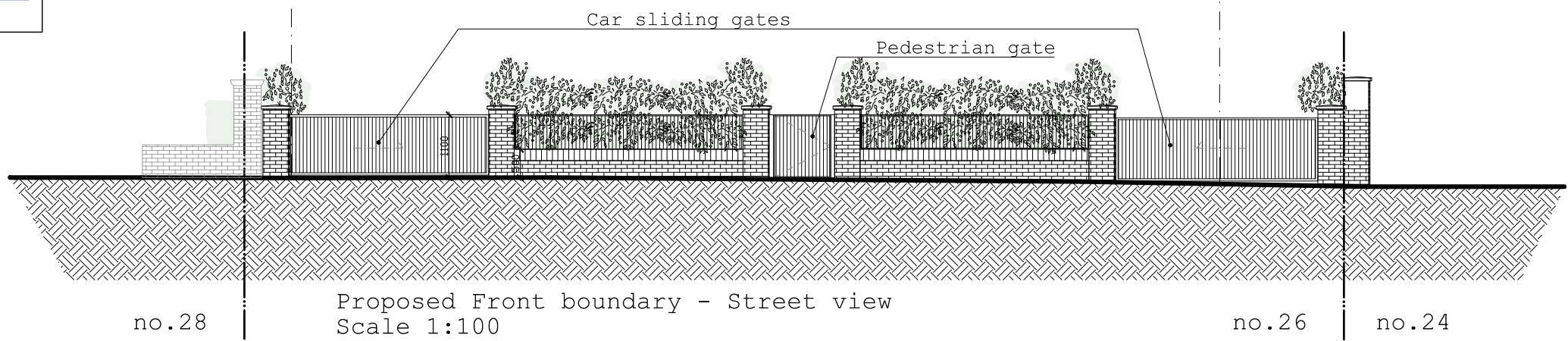
Pre Application house
footprint ref. lines

no.28

Proposed Front Elevation
Scale 1:100

no.26

no.24

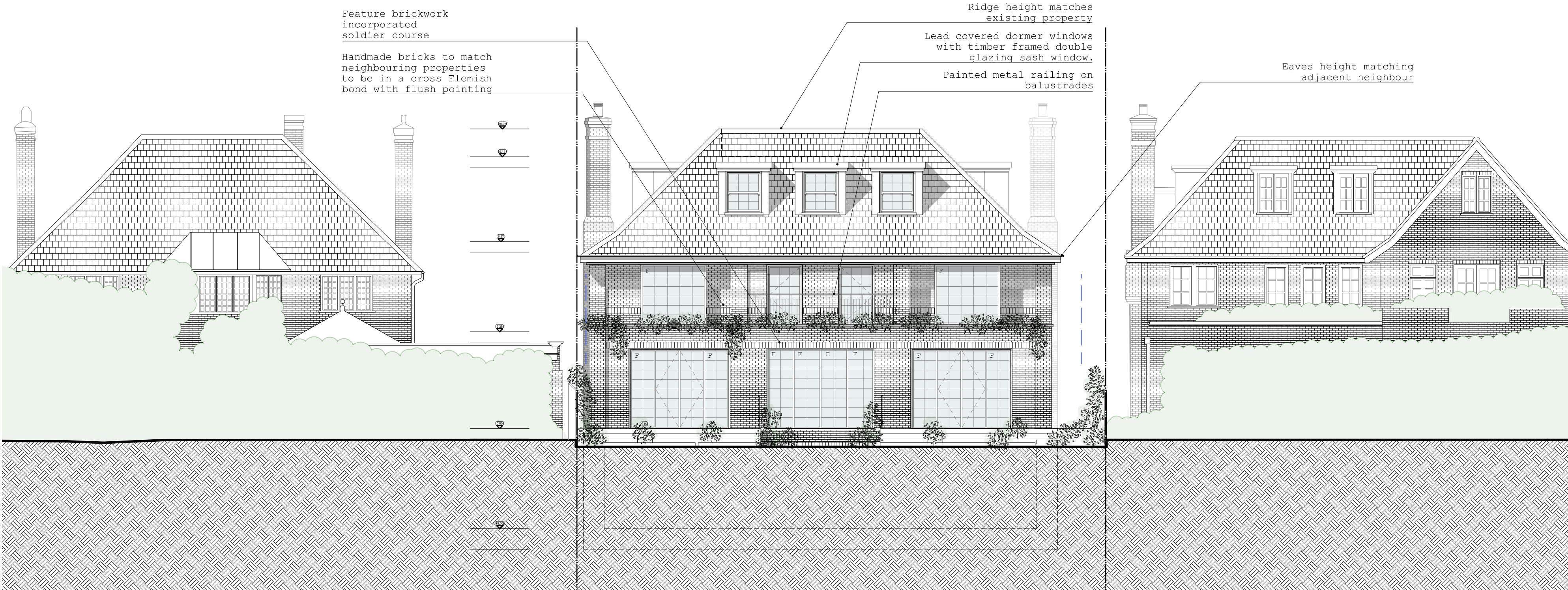


no.28

Proposed Front boundary - Street view
Scale 1:100

no.26

no.24

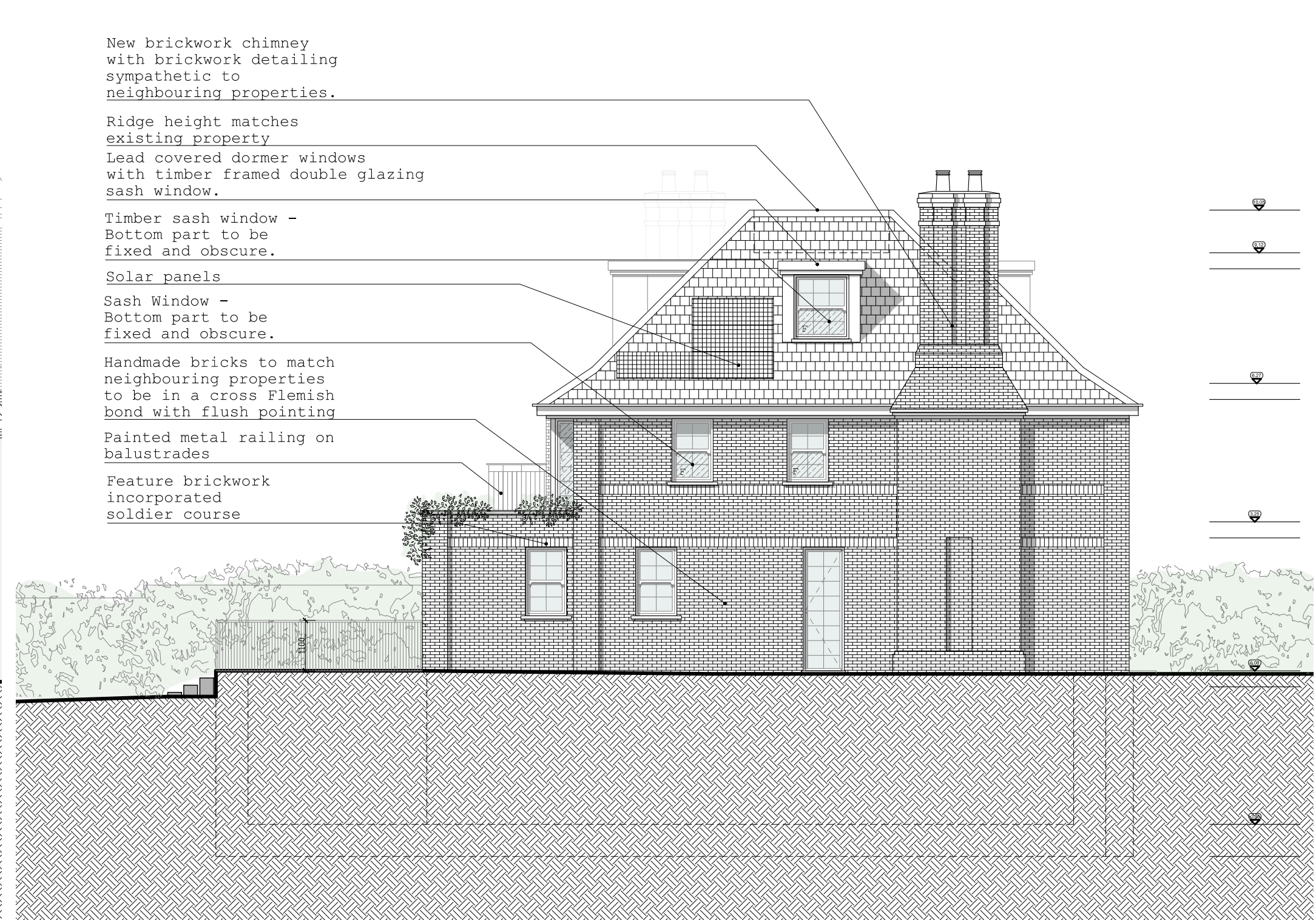


no.24

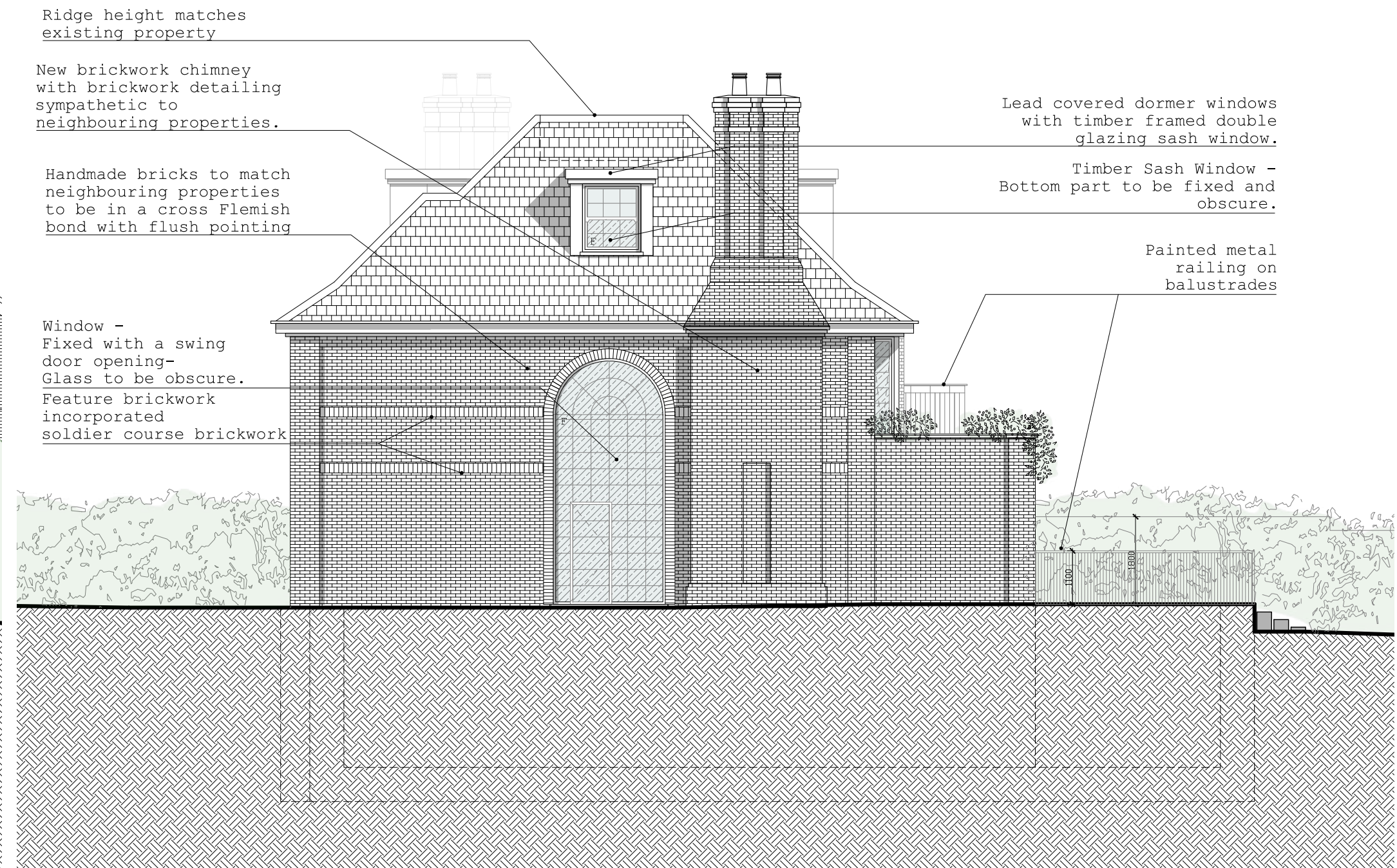
Proposed Rear Elevation
Scale 1:100

no.26

no.28



Proposed West Side Elevation
Scale 1:100



Proposed East Side Elevation
Scale 1:100

Metres
1:100

0 1 2 3 4 5 10

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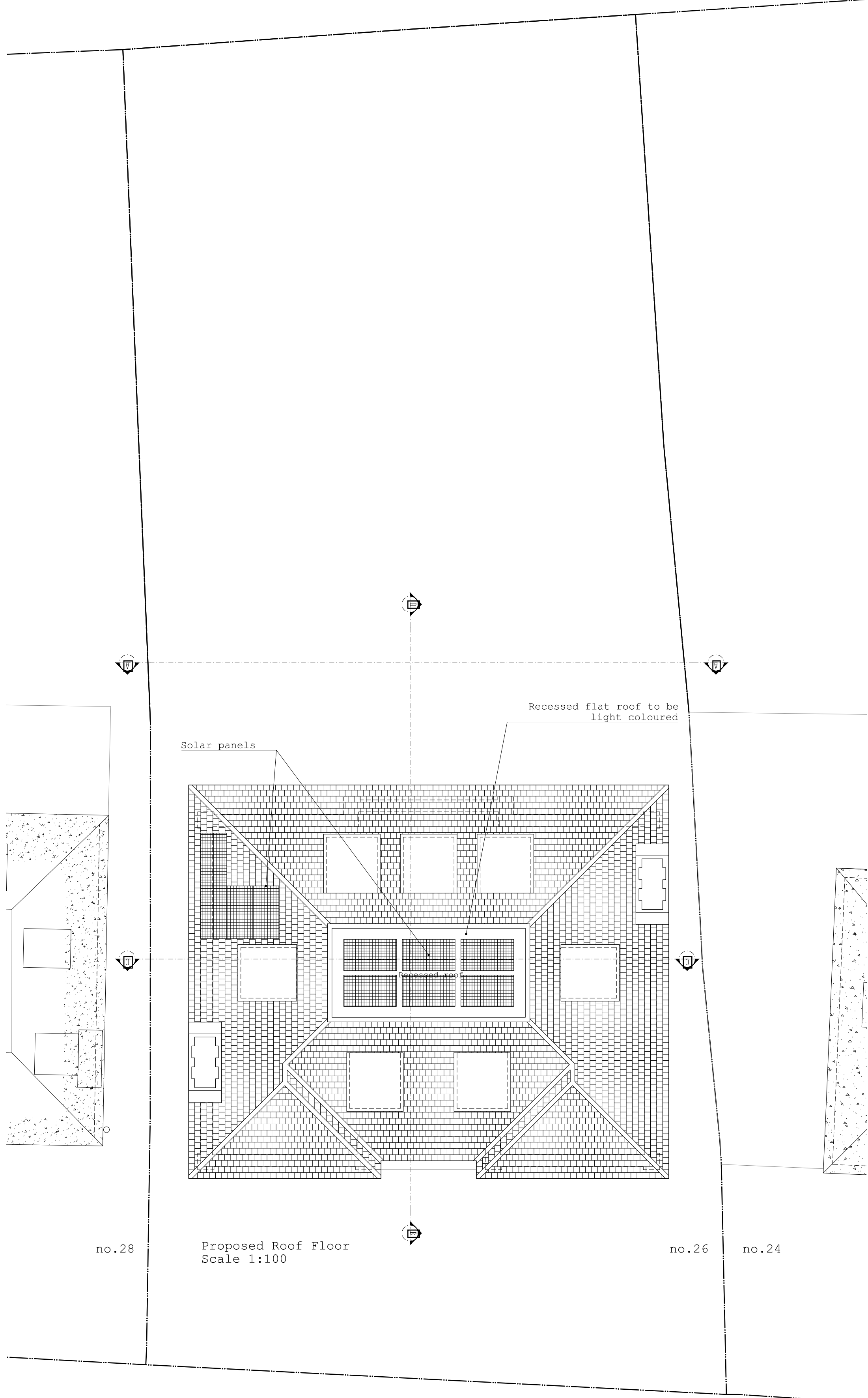
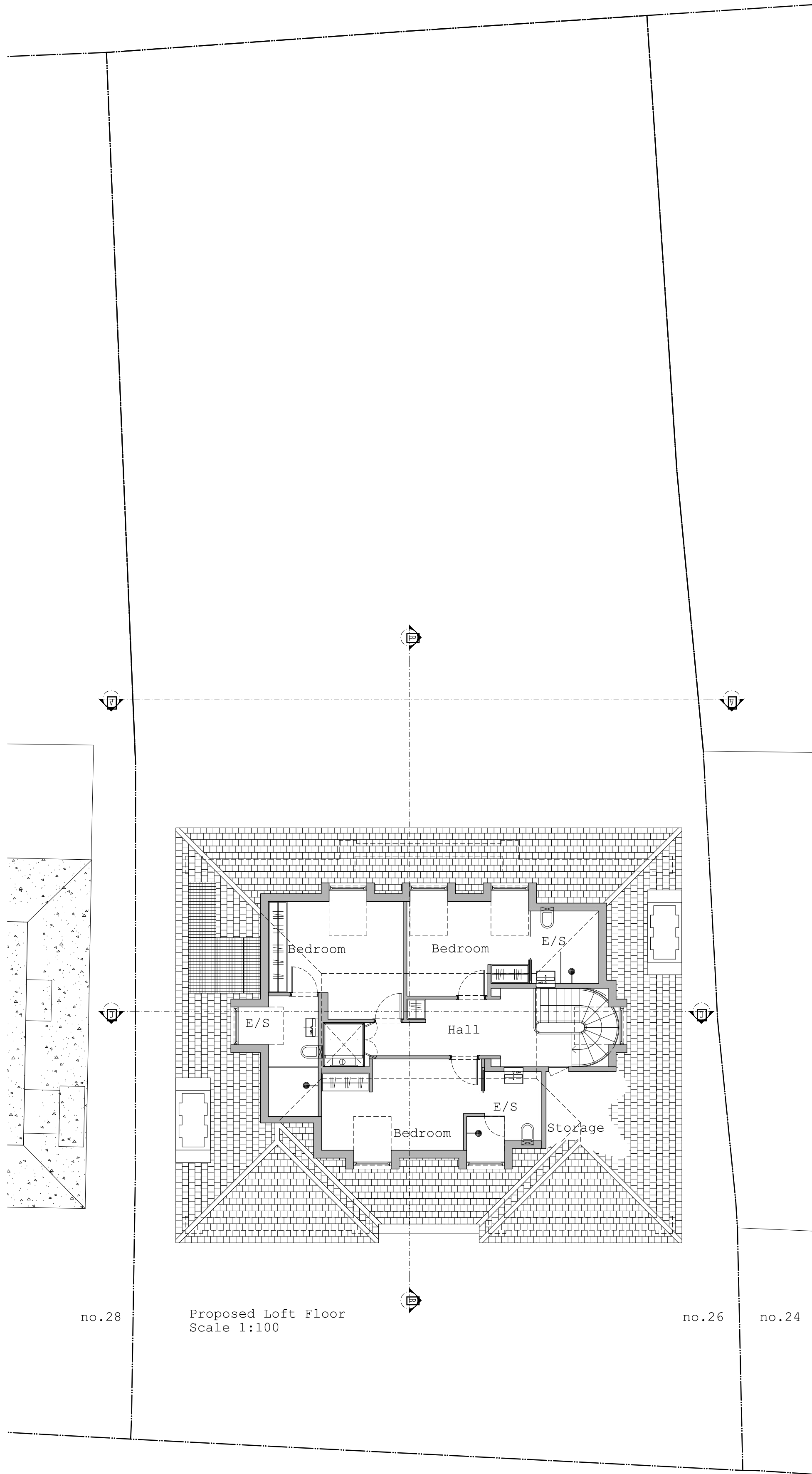
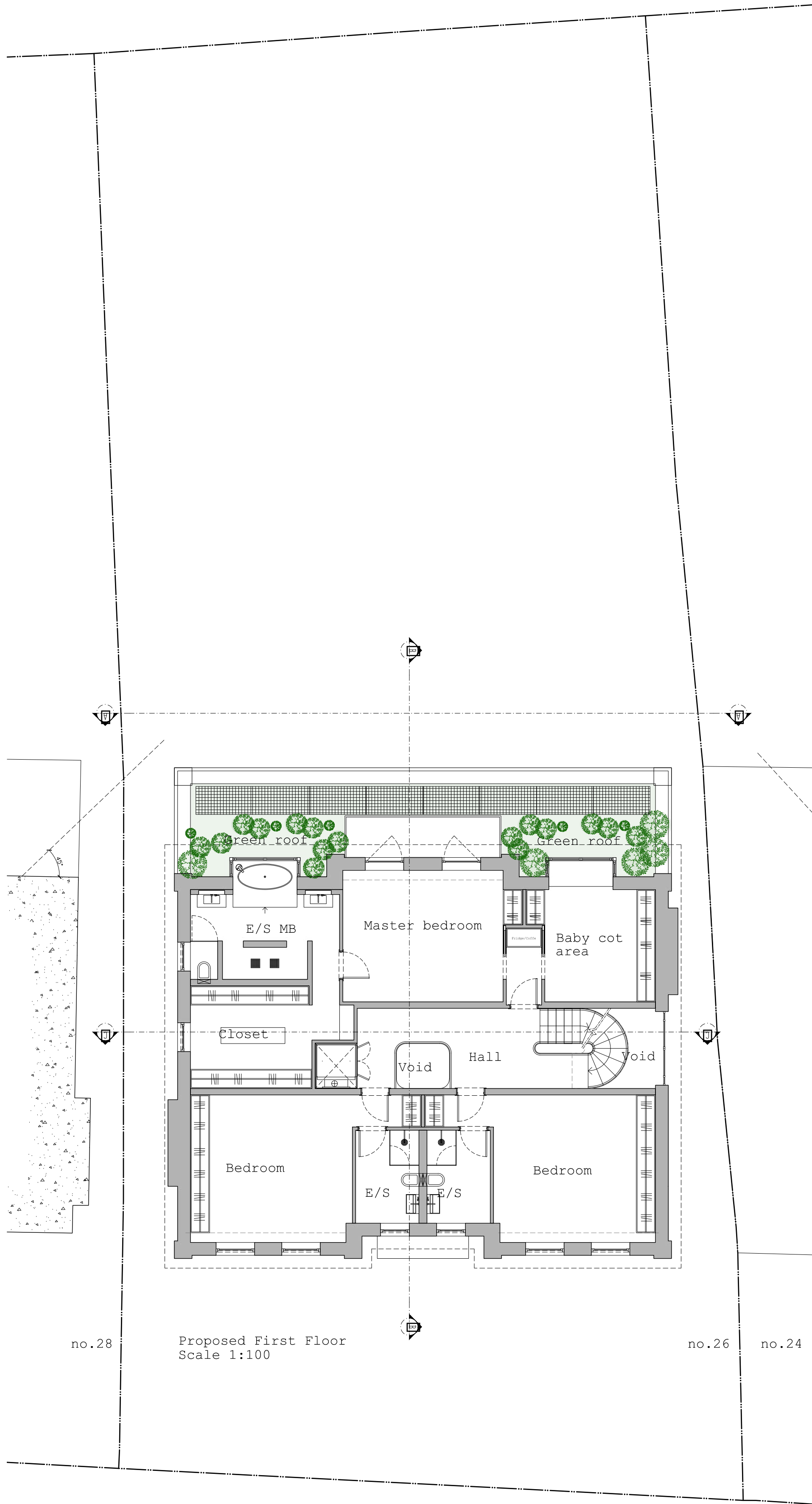
Project
26 Sheldon Avenue
London N6 4JT

Client
Mr. & Mrs. Patel

Zone	Discipline	Status
A	ARCHITECTURE	PLANNING
Level	Drawing Number	Revision
	26SA-PA-05-B	B
Paper Size	A1 SHEET	
Drawing Title	Proposed elevations	
Scale	Date	Drawn
1:100	20/09/23	BMG
Project Title	Checked	
26 Sheldon Avenue	BMG	

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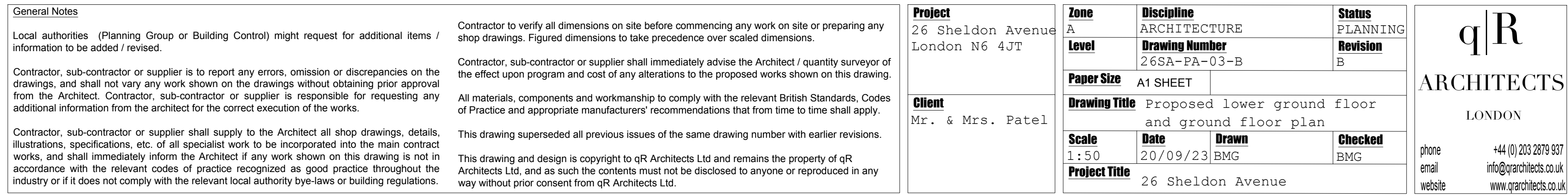
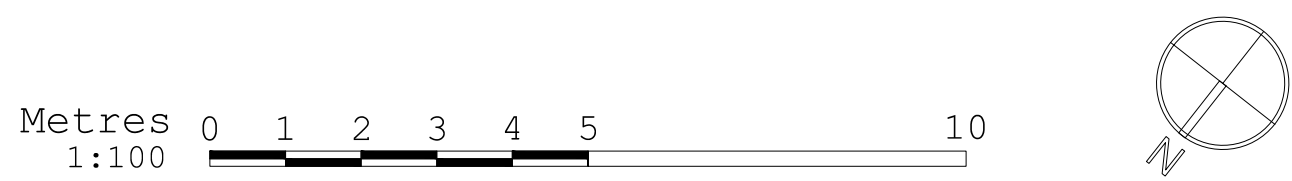
Project
26 Sheldon Avenue
London N6 4JT

Client
Mr. & Mrs. Patel

Zone A	Discipline ARCHITECTURE	Status PLANNING
Level	Drawing Number 26SA-PA-04-B	Revision B
Paper Size	A1 SHEET	
Drawing Title	Proposed first, loft and roof plan	
Scale 1:100	Date 20/09/23	Drawn BMG
Project Title	26 Sheldon Avenue	

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Specifications



Model			AM040BXMMDGR/EU	AM050BXMMDGR/EU	AM060BXMMDGR/EU	AM080BXMWGH/EU	AM100BXMWGH/EU	AM120BXMWGH/EU
Electrical								
Power Supply		Φ, #, V, Hz	3Φ, 4, 380~415 V, 50 Hz	3Φ, 4, 380~415 V, 50 Hz	3Φ, 4, 380~415 V, 50 Hz	3Φ, 4, 380~415 V, 50 Hz	3Φ, 4, 380~415 V, 50 Hz	3Φ, 4, 380~415 V, 50 Hz
Minimum SSC value		MVA	3.9	3.9	3.9	3.4	4.6	5.1
MCA		A	16.1	16.1	16.1	18	21.5	23.5
MFA		A	20	20	20	25	30	30
Interconnecting Communication Cable		mm²	Screened 0.75-1.5mm², 2 Core, F1 F2 Connection					
Performance¹								
Horsepower		HP	4	5	6	8	10	12
Capacity (Rated)	Nominal Cooling Capacity	kW	12.1	14	15.5	22.4	28	33.6
	Nominal Heating Capacity	kW	12.1	14	15.5	22.4	28	33.6
	Max Heating Capacity	kW	13.5	16	18	25	31.5	37.5
Operating Temperature Range	Cooling	°C	-5.0 ~ 48.0 °C	-5.0 ~ 48.0 °C	-5.0 ~ 48.0 °C	-5.0 ~ 48.0 °C	-5.0 ~ 52.0 °C	-5.0 ~ 52.0 °C
	Heating	°C	-25.0 ~ 26.0 °C	-25.0 ~ 26.0 °C	-25.0 ~ 26.0 °C	-20.0 ~ 24.0 °C	-25.0 ~ 24.0 °C	-25.0 ~ 24.0 °C
Maximum quantity of connectable indoor units		ea	8	9	10	13	18	21
Energy Efficiency²								
Rated Efficiency	EER (Nominal Cooling)	W/W	3.13	2.8	2.7	2.25	2.2	2.35
	COP (Nominal Heating)	W/W	3.98	3.66	3.5	3.8	3.6	3.65
Seasonal Efficiency (Ducted)	SEER	W/W	7.3	7.05	7.2	6.05	6.3	6.3
	SCOP	W/W	4.6	4.7	4.9	4.2	4.2	4.6
	ηs,c	%	289	279	285	239	249	249
	ηs,h	%	181	185	193	165	165	181
Seasonal Efficiency (Cassettes)	SEER	W/W	7.9	7.4	7.75	6.3	6.4	6.5
	SCOP	W/W	4.65	4.65	4.9	4.25	4.15	4.5
	ηs,c	%	313	293	307	249	253	257
	ηs,h	%	183	183	193	167	163	177
Fan								
Type		-	Propeller	Propeller	Propeller	Propeller	Propeller	Propeller
Discharge Direction			Horizontal	Horizontal	Horizontal	Horizontal	Horizontal	Horizontal
Number of Fans		ea	2	2	2	2	2	2
Fan Motor	Model	-	BLDC	BLDC	BLDC	BLDC	BLDC	BLDC
	Output x n	W	125 x 2	125 x 2	125 x 2	139x 2	244 x 2	244 x 2
Airflow Rate		m³/min	100	100	100	135	165	166
		l/s	1667	1667	1667	2250	2750	2766.7
Static Pressure	Max	Pa	29.4	29.4	29.4	29.4	29.4	29.4
Compressor								
Type		-	Twin BLDC Rotary	Twin BLDC Rotary	Twin BLDC Rotary	Scroll Inverter	Scroll Inverter	Scroll Inverter
Output x n		kW	4.04 x 1	4.04 x 1	4.04 x 1	5.18 x 1	6.39 x 1	6.39 x 1
Piping Connections								
Liquid Pipe		ø, mm (inch)	9.52 (3/8)	9.52 (3/8)	9.52 (3/8)	9.52 (3/8)	9.52 (3/8)	12.70 (1/2)
Gas Pipe		ø, mm (inch)	15.88 (5/8)	15.88 (5/8)	19.05 (3/4)	19.05 (3/4)	22.22 (7/8)	28.58 (1-1/8)
Refrigerant								
Type			R410A (Fluorinated greenhouse gas, GWP=2088)					
Factory Charging		kg	3.2	3.2	3.3	3.7	4.3	4.8
		tCO₂e	6.68	6.68	6.89	7.73	8.98	10.02
Sound								
Sound Pressure Level	Cooling	dB(A)	51	52	53	58	58	60
	Heating	dB(A)	55	55	55	59	64	64
Sound Power Level		dB(A)	68	69	70	73	74	76
Dimensions								
Net Weight		kg	95.0	95.0	98.0	135	155.0	162.0
Net Dimensions	(W x H x D)	mm	940 x 1210 x 330	940 x 1210 x 330	940 x 1210 x 330	940 x 1420 x 330	940 x 1630 x 460	940 x 1630 x 460

¹ Performances are based on the following test conditions.

- Cooling: Indoor temperature 27°CDB, 19°CWB, Outdoor temperature 35°CDB, 24°CWB
- Heating: Indoor temperature 20°CDB, 15°CWB, Outdoor temperature 7°CDB, 6°CWB
- Equivalent refrigerant pipe length 7.5m, Level differences 0m

² Efficiencies shown are according to EU No 2016/2281 (LOT 21) Ecodesign requirements for heat pumps/air conditioners

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STORAGE

13.8kWh SolarEdge Home Battery (48V)

Self-consumption

56%

25% from batteries

Total Storage Capacity

13.8 kWh



Backup Time from Batteries Only

35 hr

46% Backed Up

Backup Time from Batteries & PV

45 hr

46% Backed Up

WHAT YOU CAN POWER

 or  or  or  or  or 

3hr3+ Days9hr6hr3+ Days27hr

SYSTEM OVERVIEW

 18 PV modules

 1 Inverter

 18 Optimizers

 1 Battery

SIMULATION RESULTS

 Installed DC Power
7.02 kWp

 Max Achieved AC Power
5.00 kW

 Annual Energy Production
3.81 MWh

 CO2 Emission Saved (Annually)
735.9 kg

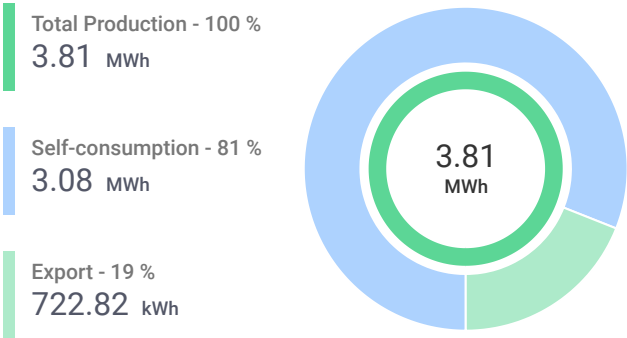
 Equivalent Trees Planted (Annually)
34

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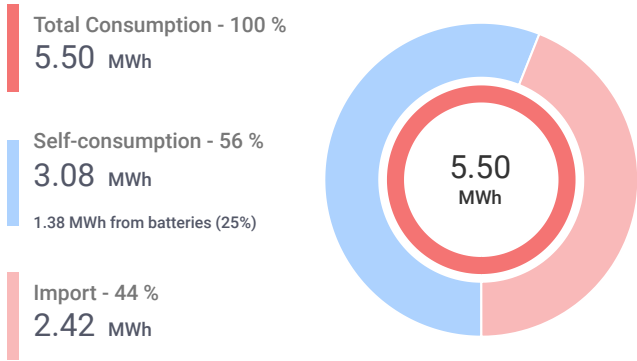
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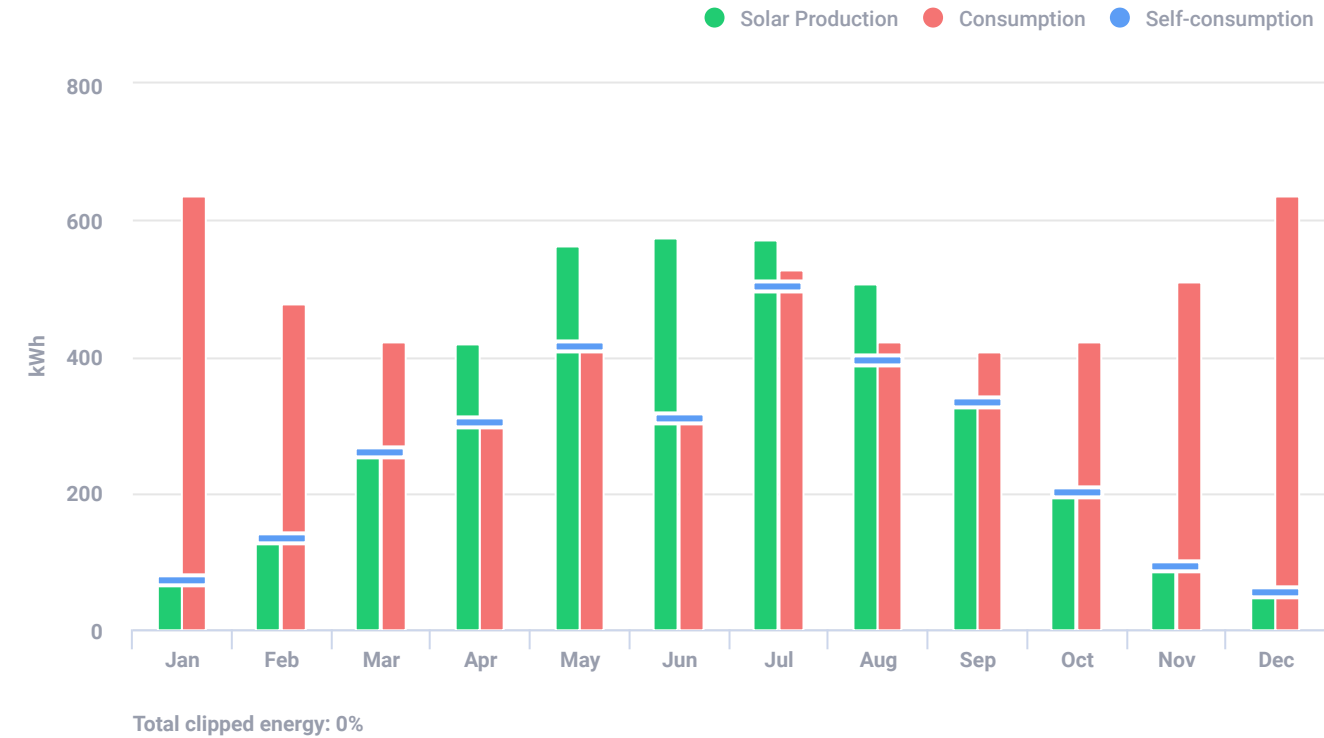
SYSTEM PRODUCTION



CONSUMPTION



ESTIMATED MONTHLY ENERGY



PV MODULES

# Module	Model	Peak power	Racking type	Orientation	Azimuth	Tilt
4	JA Solar, JAM60S20-390/MR (1000V)	1.6 kWp			180°	0°
6	JA Solar, JAM60S20-390/MR (1000V)	2.3 kWp			180°	0°

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PV MODULES (CONTINUED)

# Module	Model	Peak power	Racking type	Orientation	Azimuth	Tilt
8	JA Solar, JAM60S20-390/MR (1000V)	3.1 kWp			316°	2°
Total:	18	7 kWp				

ESTIMATED BILL SAVINGS YEAR 1

Avg. Monthly			
Current Monthly Bill	Monthly Bill with SolarEdge	Net Bill Monthly Savings	Bill Offset
£ 165.50	£ 70.61	£ 94.89	57.33 %
Estimated Net Lifetime Bill Savings			
£ 20,922			
Utility Provider: UK provider Utility Rate: 36p with 4p export rate (0.36 £/kWh)			

BILL OF MATERIALS (BOM)

Items	Part Number	Quantity	Price (£)
Total (£)			
SE5K-RWB48		1	
S500B		18	
13.8kWh SolarEdge Home Battery (48V)		1	
JAM60S20-390/MR (1000V)		18	

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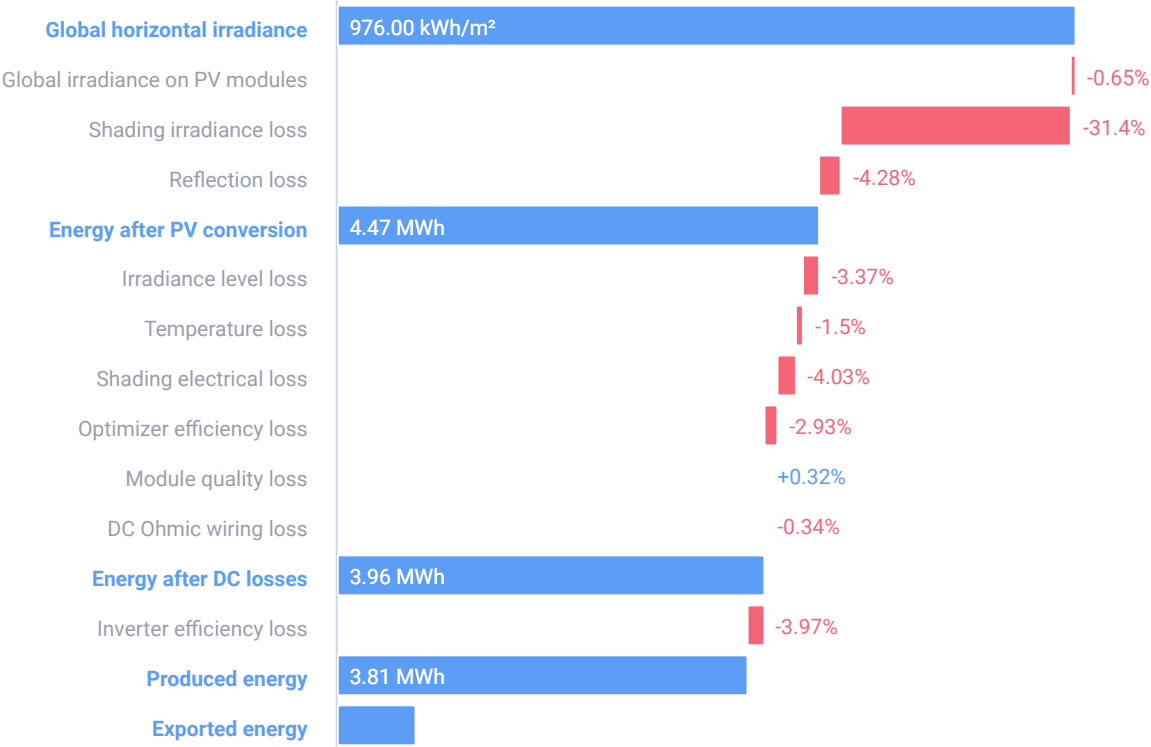
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ELECTRICAL DESIGN

Inverters & Storage	Strings per inverter	Optimizers per string	PV modules per string
 1 x SE5K-RWB48 6.2kW 124% Oversizing 1 x 13.8kWh SolarEdge Home Battery (48V)	 1 x string	 18 x S500B	 18

SYSTEM LOSS DIAGRAM



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SIMULATION PARAMETERS



LOCATION & GRID

Time zone	BST (London)
Weather station	Southwark (9.41 km away)
Station altitude	11 m
Station data source	Meteonorm 7.1
Grid	400V L-L, 230V L-N



LOSS FACTORS

Near shading	Enabled
Albedo	0.20
Soiling/Snow	0%
Incidence angle modifier (IAM), ASHRAE b0 param.	0.05
Thermal loss factor U _c (const) Flush mount	20
Thermal loss factor U _c (const) Tilted	29
LID loss factor	0%
System unavailability	0%

Mono

390W MBB Half-Cell Module

JAM60S20 365-390/MR Series

Introduction

Assembled with multi-busbar PERC cells, the half-cell configuration of the modules offers the advantages of higher power output, better temperature-dependent performance, reduced shading effect on the energy generation, lower risk of hot spot, as well as enhanced tolerance for mechanical loading.



Higher output power



Lower LCOE



Less shading and lower resistive loss

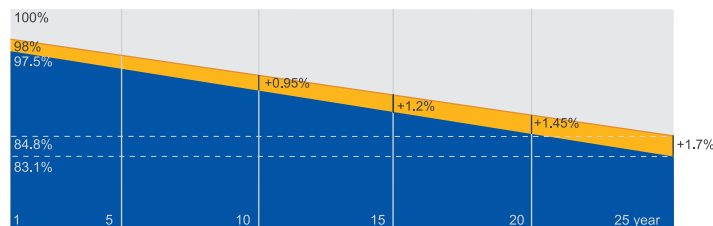


Better mechanical loading tolerance

Superior Warranty

- 12-year product warranty
- 25-year linear power output warranty

0.55% Annual Degradation
Over 25 years



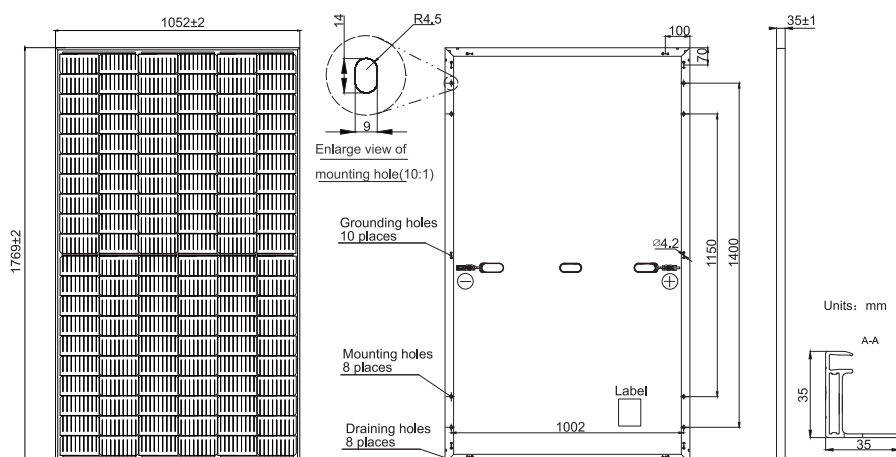
■ New linear power warranty ■ Standard module linear power warranty

Comprehensive Certificates

- IEC 61215, IEC 61730, UL 61215, UL 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- ISO 45001: 2018 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval



MECHANICAL DIAGRAMS



Remark: customized frame color and cable length available upon request

SPECIFICATIONS

Cell	Mono
Weight	20.5kg±3%
Dimensions	1769±2mm×1052±2mm×35±1mm
Cable Cross Section Size	4mm ² (IEC) ,12 AWG(UL)
No. of cells	120(6×20)
Junction Box	IP68, 3 diodes
Connector	QC 4.10(1000V) QC 4.10-35(1500V)
Cable Length (Including Connector)	Portrait:300mm(+)/400mm(-); Landscape:1000mm(+)/1000mm(-)
Packaging Configuration	31pcs/Pallet 806pcs/40ft Container

ELECTRICAL PARAMETERS AT STC

TYPE	JAM60S20 -365/MR	JAM60S20 -370/MR	JAM60S20 -375/MR	JAM60S20 -380/MR	JAM60S20 -385/MR	JAM60S20 -390/MR
Rated Maximum Power(P _{max}) [W]	365	370	375	380	385	390
Open Circuit Voltage(V _{oc}) [V]	41.13	41.30	41.45	41.62	41.78	41.94
Maximum Power Voltage(V _{mp}) [V]	33.96	34.23	34.50	34.77	35.04	35.33
Short Circuit Current(I _{sc}) [A]	11.30	11.35	11.41	11.47	11.53	11.58
Maximum Power Current(I _{mp}) [A]	10.75	10.81	10.87	10.93	10.99	11.04
Module Efficiency [%]	19.6	19.9	20.2	20.4	20.7	21.0
Power Tolerance	0~+5W					
Temperature Coefficient of I _{sc} (α _{Isc})	+0.044%/°C					
Temperature Coefficient of V _{oc} (β _{Voc})	-0.272%/°C					
Temperature Coefficient of P _{max} (γ _{Pmp})	-0.350%/°C					
STC	Irradiance 1000W/m ² , cell temperature 25°C, AM1.5G					

Remark: Electrical data in this catalog do not refer to a single module and they are not part of the offer.They only serve for comparison among different module types.

ELECTRICAL PARAMETERS AT NOCT

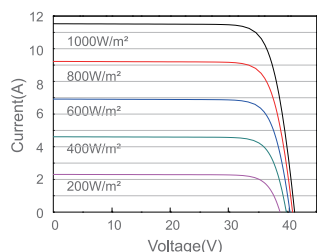
TYPE	JAM60S20 -365/MR	JAM60S20 -370/MR	JAM60S20 -375/MR	JAM60S20 -380/MR	JAM60S20 -385/MR	JAM60S20 -390/MR
Rated Max Power(P _{max}) [W]	276	280	284	287	291	295
Open Circuit Voltage(V _{oc}) [V]	38.41	38.65	38.89	39.14	39.38	39.63
Max Power Voltage(V _{mp}) [V]	32.05	32.30	32.55	32.72	32.96	33.20
Short Circuit Current(I _{sc}) [A]	9.15	9.20	9.25	9.30	9.35	9.40
Max Power Current(I _{mp}) [A]	8.61	8.66	8.71	8.78	8.83	8.88
NOCT	Irradiance 800W/m ² , ambient temperature 20°C, wind speed 1m/s, AM1.5G					

OPERATING CONDITIONS

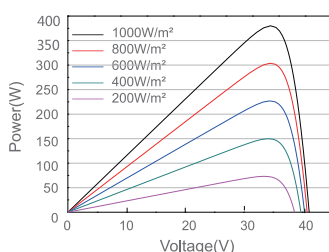
Maximum System Voltage	1000V/1500V DC
Operating Temperature	-40°C~+85°C
Maximum Series Fuse Rating	20A
Maximum Static Load,Front	5400Pa (112 lb/ft ²)
Maximum Static Load,Back	2400Pa (50 lb/ft ²)
NOCT	45±2°C
Safety Class	Class II
Fire Performance	UL Type 1

CHARACTERISTICS

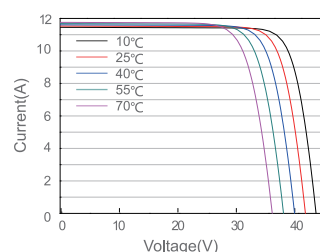
Current-Voltage Curve JAM60S20-380/MR



Power-Voltage Curve JAM60S20-380/MR



Current-Voltage Curve JAM60S20-380/MR



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ALL DIMENSIONS are in mm unless otherwise stated

For standard symbols refer to the relevant Specification where applicable

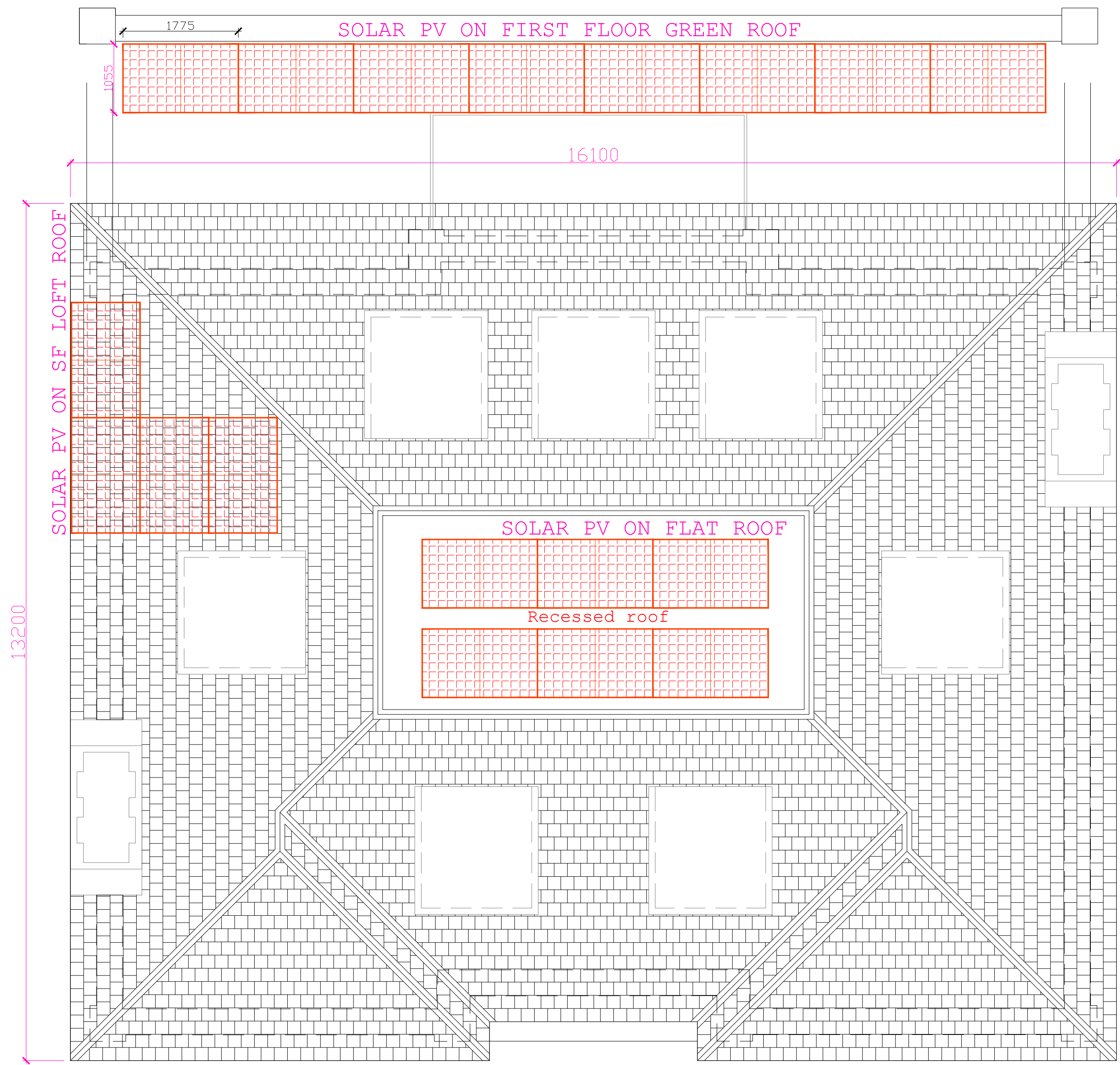
For information only, **DO NOT SCALE** drawing

All works shall be carried out in accordance with the Specification

Contractor must verify all dimensions on site before commencing

~~any work or shop drawings~~

PRELIMINARY



Proposed Roof Floor
Scale 1:50 [A1]

	PRELIMINARY ISSUE	BLUE	HS	SEPT'23
REV	DESCRIPTION	DESN	CHKD	DATE
DESIGNED BY BLUEBELL RENEWABLE ENERGY M&E CONSULTANTS +447830181118				
WORKING WITH qR ARCHITECTS				
PROJECT 26 SHELDON AVENUE LONDON				
TITLE MECHANICAL SERVICES ROOF SOLAR PV LAYOUT				
SCALE	1:50	ORIGINAL SIZE	A1	DATE
DRAWN	BLUE	DESIGNED	BLUE	CHECKED
DRAWING NUMBER	117/SP03	REVISION		

Fast Charging Solo 3 - Home Datasheet

This datasheet details the technical specifications for the Solo 3 (Home) a variant of the Solo product family. If you're unsure which model you have, please contact Pod Point directly.

The Solo 3 includes and exceeds all required and “optional” safety features noted in the BS EN 61851-1 standard for electric vehicle charging. The Solo 3 is available in universal socketed or tethered models with either Type 1 or 2 cables. The Solo 3 is available with models offering charging rates of either 3.6kW, 7kW and 22kW - with the 22kW not compatible with Auto Power Balancing feature as standard.

Speed category	Fast charging
Charging rate	3.6, 7 or 22kW
Product family	Solo

- Single vehicle charging
- Wi-Fi enabled
- 3 Year warranty
- Smart Reporting & Pod Point Network enabled



Universal
Socket



Tethered
Type 1 - 4.8m cable or
Type 2 - 7.5m cable

Power and Environmental

Power rating	2.5-22kW - AC
Input voltage range	240-400 VAC (50Hz)
Output current	0-30A - AC RMS
IP rating	IP54 enclosure (IP44/54 for plugs and socket)
Operating temperature	-25°C to 50°C
Standby consumption	<2.5W
Materials	Polycarbonate
Protections	6mA DC Leakage, Over current, PME and failed earth protection.

Physical properties

Height Width Depth	330mm 290mm 112 (167mm Socketed)
Weight	Socket - 3.5kg Tethered - 6kg
Charging connectors	1 Type 1 (SAE J1772) 2 Type 2 (IEC 62196-2)
Colour	Black/Grey

Connectivity & Communication

Connectivity	IEEE 802.11bgn Wi-Fi
Feature updates	Yes - Via Wi-Fi
Software updates	Yes - Via Wi-Fi

Socket

Socket type	Mennekes Type 2 (IEC 62196-2) socket with statutory locking mechanism.
-------------	--

Standards & Compliance

Standards compliance	LVD 2014/35/EU EMCD 2014/30/EU BS EN 61851-1:2019 EN61000-3 and -2 CE Certified BS7671: 2018
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Security

Wi-Fi	WEP, WPA, WPA2 or Open Wi-Fi
Connection security	Secure data encryption HTTPS with SHA-256 hash algorithm

Solo 3 Home - Model Matrix						
Model	S7-1C-03 (single-phase)	S7-2C-03 (single-phase)	S7-UC-03 (single-phase)	S7-UCB-03 (single-phase)	S22-2C-03 (three-phase)	S22-UC-03 (three-phase)
Connection type	Tethered	Tethered	Universal Socket	Universal Socket	Tethered	Universal Socket
Vehicle connector	SAE J1772 (Type 1)	IEC62196-2 (Type 2)	Any ⁽¹⁾	Any ⁽¹⁾	IEC62196-2 (Type 2)	Any ⁽¹⁾
Cable length	4.8 m	7.5 m	NA ⁽¹⁾	NA ⁽¹⁾	7.5 m	NA ⁽¹⁾
Cable holster supplied	Yes	Yes	No	No	Yes	No
Maximum power rating	30A (~7kW) ⁽²⁾	30A (~7kW) ⁽²⁾	30A (~7kW) ⁽²⁾	30A (~7kW) ⁽²⁾	30A x 3 (~22kW) ⁽²⁾	30A x 3 (~22kW) ⁽²⁾
Auto Power Balancing (Load management)	Yes	Yes	Yes	Yes	No	No
Variant	ABG ⁽³⁾	ABG ⁽³⁾	ABG ⁽³⁾	ABG ⁽³⁾	AAA ⁽⁴⁾	AAA ⁽⁴⁾
⁽¹⁾ User provides the suitable charging cable, supplied with the vehicle or purchased separately. ⁽²⁾ Power rating will vary due to vehicles maximum rate of charge and local supply voltage. ⁽³⁾ All the ABX variants ⁽⁴⁾ All the AAX variants						

Pod Point’s hardware and software are engineered in house to meet the requirements of BS EN 61851-1 edition 3 and are tested using accredited independent test facilities. BS EN61851-1 includes various mandatory test standards that must also be adhered to.

UK and European based manufacturing facilities are used for production, In house customer support teams are locally based providing best in class support.

Universal socket models include a locking mechanism as standard (BS7671:2018 regulation 722.55.101.4)

Installation & Safety

- For full installation details, please see our Solo 3 Home - Install guide [here](#)
- To start training to become a Pod Point Domestic Certified Installer please visit our website [here](#) for more information.
- Our on-board 6mA DC Leakage protection is fully compliant with BS 7671:2018 - regulation 722.531.2.101. This can be used safely in conjunction with a Type A RCD/RCBO, instead of requiring a more costly Type B RCD.
- Certified Pod Point installations include double or four pole RCD protection (Regulation 722.531.2.1.1) fitted at source providing protection for the entire installation, This RCD/RCBO may also fulfill requirements of regulation 722.537
- An Energy Clamp (single-phase only) that protects your home's main fuse from over currents that may result from the additional supply load when charging an EV.
- All Pod Point charging units include the Pod Point PEN Isolation system, which provides complete earthing protection without the need of additional earth rod installation. This is in compliance with BS7671:2018 regulation 722.411.4.1 (v)
- Standard installation costs include the supply cable (up to 15 metres), a mini consumer unit with RCBO, domestic load sensor cable and general sundries (cable cleats, screws etc..)

After sales service

- We will not undertake any repairs for any out-of-warranty failures without first receiving acceptance of our quotation for related costs. Refer to the Solo 3 installation guide for further details of supply requirements. Our Solo 3 is provided with a 3 year product warranty as standard, the terms of which can be found [here](#).

Smart Charging

- Charging may be interrupted or rate-limited for brief periods to facilitate grid management in periods of peak local, regional or national demand. If utilised, Pod Point will manage these limits to mitigate any significant effect on vehicle charging times overall.

Limitations of use

- Pod Point do not authorise the use of charging cable adaptors and "smart" cables due to their impact on safety.*
- Pod Point equipment must only be used with European certified vehicles and cables, (damaged or non approved cables should not be used with any EVSE or vehicles).

** BS EN 61851-1 forbids the use of in cable adaptors, extensions leads and cables that change the operational state of the EVSE (smart cables).*

Warranty and support

To maintain our 3 year limited warranty, The installation shall be in accordance with Pod Point's guidance, comply with relevant legislation and be installed by a certified electrician.

Any hardware failure should be promptly reported to us [here](#). You must quote the serial number and location of the product with a brief description of the failure.

Our support team will then investigate and attempt to remotely resolve the issue. They may ask you to provide additional information to assist in this.

If the issue cannot be resolved remotely, and the product is within warranty, we will arrange for one of our team to visit. If the issue is a result of any shortcoming in design or manufacture it will be made good free of charge or at our option, exchanged for a replacement product. If we attend site and the fault is not a result of a design or manufacture issue of our product, we will make reasonable attempts to diagnose the issue and propose a resolution which may have an associated fee. A call out fee will be applicable where our product is not at fault.

Limitation of liability

In no event will we accept any liability for any loss, costs or damages consequential of the use and/or misuse of our hardware products, except and only to the extent that this is caused by our negligence.

Easee One

Built to comply with UK regulations, the Easee One comes with both integrated type B RCD protection and open PEN conductor protection.



Why choose Easee One?

Forward-looking home charging



Benefits

- Integrated open PEN conductor protection, i.e., no need for earth rod
- Reduced cost and time to install
- Fully dynamic charging power 1.4–7.4 kW
- Load balancing of up to 3 units per fuse by integrated wireless communication
- Automatic queuing system
- Offline proof load balancing
- Integrated eSIM in each box, lifetime free subscription
- Possibility of WiFi connection
- Permanent locking of the Type 2 cable
- Integrated earth fault protection (RCD)
- Integrated RFID reader (NFC / ISO 14443 and MIFARE Classic®)
- Energy measurement (+/- 2 %), for reading charge consumption
- The box is 69 % smaller than other solutions and weighs only 1.5 kg
- 3 year warranty
- Universal, fits all types of electric cars and mains
- Full control with the Easee app or local WiFi interface, and open API
- Tethered or untethered, at the click of a button

Why choose Easee One?

3_x

Optimized charging effect

You can have up to 3 Charging Robots on one fuse. All connected cars can be charged at the same time, and the available power is distributed automatically and dynamically between the vehicles. The total load will thus never exceed the set limit for the fuse.

eSIM

Internet access

All our Charging Robots are connected to the internet through mobile network*. If you buy now you get free mobile internet access throughout the lifetime of the product. In order to get software updates and increased redundancy, we recommend installing a local WiFi network, if there is no cellular coverage. The local WiFi network must be connected to the Internet.

*Assuming cellular coverage is available.

69%

Small

The Charging Robot is 69 % smaller and lighter than other electric chargers, with similar functionality. It weighs only 1.5 kg! This means that we save the environment at least 4 kg of copper and plastic per produced charger.

24_{/7}

Always updated

The Charging Robot is updated with new features continuously. This way, you know that you have purchased a safe and future-proof product.

5_x

A colourful choice

Available in Black as standard, we have 4 other front covers available to purchase: White, Anthracite, Red and Blue

3_{yr}

Warranty

We want you as a customer to have confidence that you have bought lasting quality. A product from Easee comes with a 3 year* warranty.

*Some countries may have extended warranty.

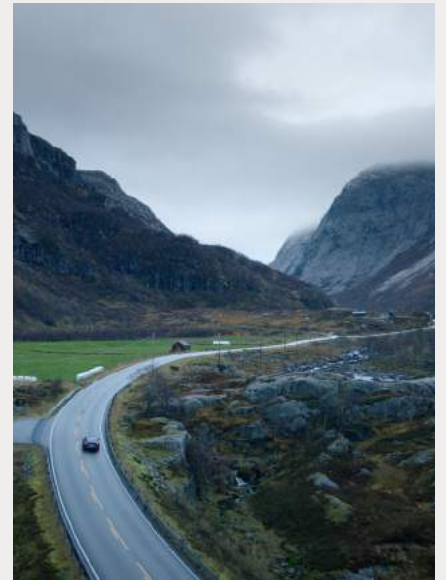
Why choose Easee One?

Made in Norway - for harsh weather conditions

We develop and manufacture our products in Norway. Our products are developed for being able to withstand harsh environments. Not only is it tough, it is also small! Our Charging Robot is 69 % smaller than other EV-chargers. It only weights 1.5 kg. We have strived to contribute to a sustainable future and are saving the enviroment for 4 kg of copper and plastics per produced charger.

The charger thrives just as well on the outside of a house as inside a garage. Its components are of high quality and is composed in a very special way. It is IP54 certified.

We want you as a customer to have confidence that you have bought lasting quality. One product from Easee comes with a 3 year warranty.



Feel safe

We've added 3 extra levels of security, so that we can sleep well at night, knowing that you can do it too. Safety is an important part of the design.

With an Easee Charging Robot you can be assured that charging is done safely. The Charging Robot is designed to the latest standards. In addition, there is built-in electronic earth fault protection that ensures detection of DC and ground faults.

The Charging Robot is also equipped with temperature sensors and protection to prevent overheating. You also don't have to worry about crooks, the charging cable can be permanently locked in the box via the app or the local WiFi interface.



Why choose Easee One?

Easy when you get two electric cars

We have made it easy and affordable to invest in modern and forward-looking charging infrastructure. With “Easee Ready” docking station you get a completely EV ready charge point at low cost. By pre-installing an Easee One charge point, it is possible upon demand to subsequently deploy our innovative “Plug & Play” technology at no additional installation cost.

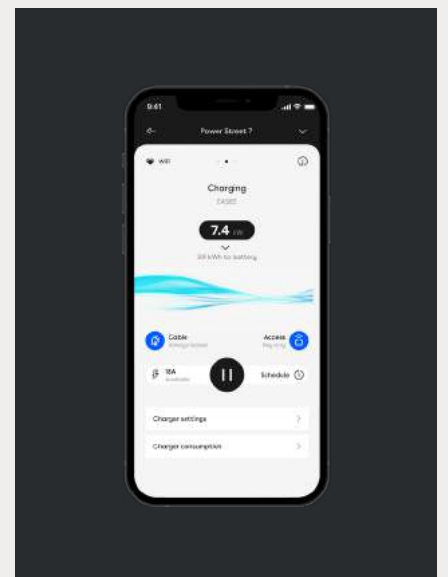
The Charging Robot acts as an intelligent junction box and it supports the expansion of multiple charging stations on the same cable.



Easee App

With the Easee app it is possible to control and plan when your car is charging. You can see live values for the current charge session and get an overview of your consumption. If you want to avoid finding the charging cable every time you charge the car, you can easily lock the cable permanently in the Charging Robot through the app.

You get full control over who can charge and when they can charge. We update the app periodically to make your Charging Robot even smarter. Additionally, with the Easee API further integrations and extended possibilities are available.



Specifications

Measurement
in mm



Technical

General

Dimension (mm): H: 256 x W: 193 x D: 106
Wall mounting (mm): c/c H: 160 x W: 125
Operating temperature: -30 °C to +50 °C
Weight: 1.5 kg

Charging

Charging power: 1.4-7.4 kW (6 - 32 A)
Number of phases: 1
Connection point: Type-2 socket (IEC 62196-2)
Voltage: 230 V AC - single phase (±10 %)
Mains frequency: 50/60 Hz
Advanced load distribution
Up to 3 Charging Robots on the same circuit
Accuracy of built-in energy meter (±2 %)

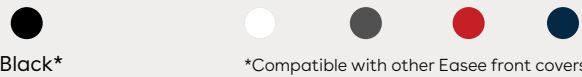
Connectivity

Built-in eSIM (LTE Cat M1/ 2G /GPRS)
WiFi 2.4 GHz b/g/n connection
Eease Link RF™
Control charging with the Eease app
RFID/NFC reader
OCPP 1.6 via our API
Open API

Sensors and indicators

Light strip showing the status of the charger
Touch button for manual adjustment
Temperature sensors in all main contacts

Colours



Safety

Protection

Integrated overload protection according to EN IEC 61851-1:2019
Built-in RCD for ground fault protection (30 mA AC/ 6 mA DC) according to EN 61008-1 and IEC 62955
Integrated broken PEN lead protection according to BS 7671:2018/A1:2020
Degree of protection: IP54 (the backplate is IP22 without cover)
Impact resistance: IK08
Fire class: UL94
Insulation class: II
Over voltage category III

Complies with the following regulations

2014/53/EU (RED)
2011/65/EU (RoHS)
2014/30/EU (EMC)
2014/35/EU (LVD)
See DoC for details at easee.support

Theft Protection

Electronics can be deactivated and tracked in case of theft (contact support if your device has been stolen).
The electronics can be permanently locked using a padlock (not included).
The charging cable can be locked permanently in the charging station.

Installation

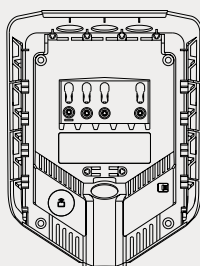
Power grids and fuses

Installation network: TT, TN-S, TN-C and TN-C-S
Installation circuit breaker: Max 40 A overload protection. The short-circuit current at the charging point (I_{kMax}) must not exceed 10 kA. If required by the installation method, type-A earth fault protection can be used for the circuit.

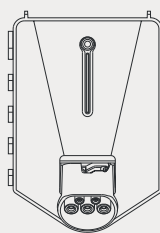
Integrated circuit in backplate

Wire cross-section: up to 16 mm² (single cable)/ up to 10 mm² (parallel connection)
Cable diameter: 8-22 mm
Terminal tightening: 5 Nm
Cable strip length: 12 mm

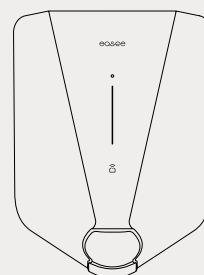
The product contains



Backplate



Chargeberry



Cover

Distribution UK

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Illustrations of the product and user interface are exemplary and may differ from the actual appearance.

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