

ENERGIST

BEYOND BUILDING

Energy Statement

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Contents

EXECUTIVE SUMMARY	4
1. INTRODUCTION	7
1.1 SITE DESCRIPTION.....	7
1.2 PURPOSE OF THE ENERGY STRATEGY.....	8
1.3 METHODOLOGY	8
1.4 ASSESSMENT METHODS.....	10
2. BASELINE: BUILDING REGULATIONS	11
2.1 INTRODUCTION	11
2.2 DEVELOPMENT'S BASELINE	11
3. REDUCED ENERGY DEMAND.....	12
3.1 INTRODUCTION	12
3.2 FABRIC ENERGY EFFICIENCY STANDARD	14
4. RENEWABLE AND LOW-CARBON ENERGY TECHNOLOGIES.....	15
4.1 INTRODUCTION	15
4.2 DEVELOPMENT'S LZC PERFORMANCE	17
5. MAINS WATER CONSUMPTION	18
5.1 INTRODUCTION	18
5.2 DEVELOPMENT'S WATER CONSUMPTION	18
6. SUSTAINABLE TRANSPORT	20
7. EMBODIED CARBON	21
7.1 SUSTAINABLE MATERIAL SELECTION	21
7.2 MATERIAL EFFICIENCY & WASTE REDUCTION	24
7.3 LOCAL SOURCING & TRANSPORTATION EFFICIENCY	25
7.4 CIRCULAR ECONOMY APPROACH.....	26
8. CLIMATE CHANGE ADAPTATION	27
CONCLUSIONS AND RECOMMENDATIONS	28
APPENDICES	29
APPENDIX 1: LIST OF ABBREVIATIONS	29
APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE.....	30
APPENDIX 3: SAP RESULTS	32
APPENDIX 4: LZCT ASSESSMENT	33
APPENDIX 5: PART G CALCULATIONS	41



EXECUTIVE SUMMARY

This Energy Strategy has been produced by Energist UK on behalf of Redcliffe Homes Limited ('the Applicant'). It supports a planning application for the residential development at Hilperton, Wiltshire ('the Development'). This application falls under the jurisdiction of Wiltshire Council.

The development proposals comprise the construction of up to 80 new homes. Whilst this is an outline application, as the site is controlled by a housebuilder we have been able to model a range of potential dwelling types in order to best estimate the site's energy performance.

The Applicant has adopted a sustainable design approach, incorporating efficient Low and Zero-Carbon (LZC) technologies to ensure compliance with [The Climate Change Act \(2008\)](#) and the [National Planning Policy Framework \(2024\)](#).

The Applicant will successfully deliver [Wiltshire Core Strategy \(2015\)](#) planning policy, with reference to [Policy CP 41 - Sustainable Construction and Low Carbon Energy](#).

The Applicant has committed to a design approach that aligns with the principles of the [Energy Hierarchy](#). The development has been optimised to minimise on-site emissions by incorporating high-performance building fabric, innovative design, and advanced heating systems, resulting in a significant reduction in CO₂ emissions.

The development is expected to achieve a 68.4% reduction in regulated carbon dioxide (CO₂) emissions beyond the Target Emission Rate (TER) set by [Approved Document Part L \(AD L\) 2021](#), through the proposed measures.

Table 1 below summarises the measures implemented to meet the prescribed energy performance.



Table 1 — Measures incorporated to deliver the energy standard

Fabric	Energy-efficient building fabric and insulation to all heat loss floors, walls and roofs: ▪ External Wall U-Value: 0.18 W/m².K ▪ Ground Floor: 0.12 W/m².K ▪ Party Wall: 0 W/m².K (<i>fully filled and sealed</i>) ▪ Roof: 0.08 W/m².K ▪ External Door: 1.20 W/m².K ▪ Glazing — double-glazed units: — Glazing U-Value: 1.10 W/m².K — Glazing G-Value: 0.64 ▪ Design Air Permeability: 4.00 m³/m²hr @50 Pa ▪ Thermal Bridging: Bespoke psi-values
Building services	▪ Lighting: Low-energy lighting throughout the building — 80 lm/W ▪ Ventilation: Intermittent Extract Fans ▪ Space heating and hot water: — Individual ASHPs will be installed to all plots — Space Heating Controls: Time and temperature zone controls



In line with the strategy outlined above, the effectiveness of the design measures, along with the low-carbon and renewable energy solutions, in fulfilling the Applicant's commitment to the [Energy Hierarchy](#), is demonstrated Figure 1 below.

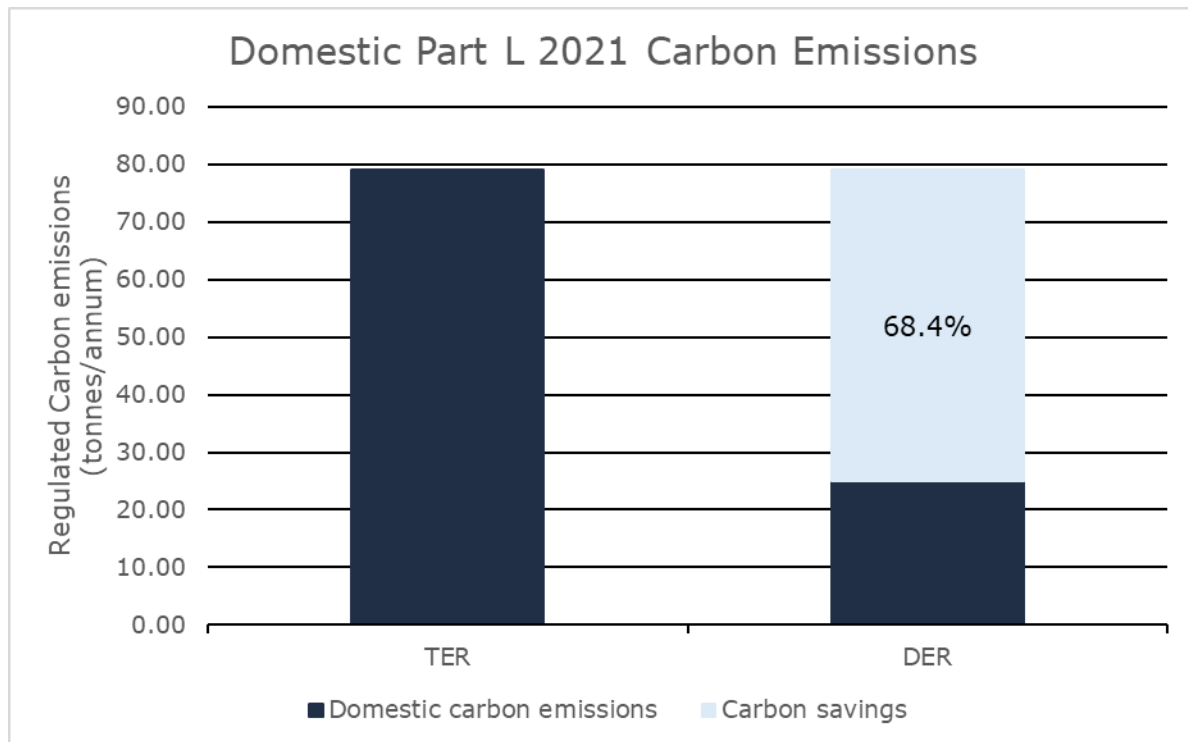


Figure 1 — How the Development delivers the energy hierarchy – Energist's Graph

As this is an outline application all measures are to be reviewed again at detailed design.



1. INTRODUCTION

1.1 Site Description

The proposed development is residential and is situated within the jurisdiction of the Wiltshire Council. The current proposal is up to 80 dwellings, with site access from the South from Devizes Road.



Figure 2 — The proposed site plan for Hilperton, Wiltshire
[Source: Thrive Architects]



1.2 Purpose of the Energy Strategy

This Energy Strategy has been produced by Energist UK on behalf of Redcliffe Homes ('the Applicant'). It outlines climate change mitigation measures for the development at Land at Hilperton, Wiltshire.

This Energy Strategy demonstrates the approach adopted by the Applicant to comply with:

- i) [The Climate Change Act \(2008\)](#).
- ii) [National Planning Policy Framework \(2023\)](#).
- iii) [Wiltshire Core Strategy \(2015\)](#):
 - [Policy CP 41 - Sustainable Construction and Low Carbon Energy](#).

The way in which the Applicant meets the energy standard and achieves CO₂ reductions at Hilperton, Wiltshire will be explained in further sections of this report.

1.3 Methodology

Energy Hierarchy

The [Wiltshire Core Strategy \(2015\)](#) encourages design in line with the principles of the energy hierarchy. The principles and priorities of the energy hierarchy are outlined below.

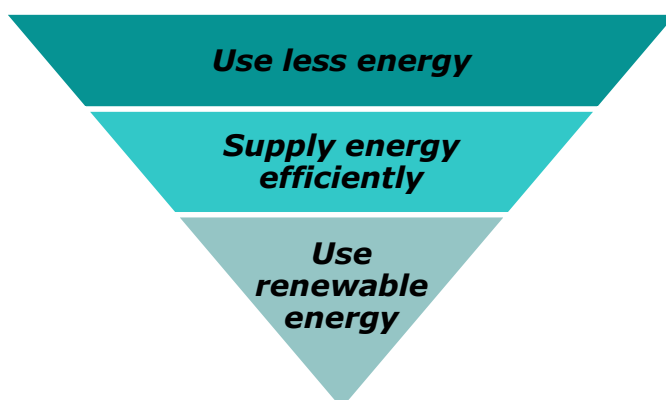


Figure 3 — Three-tier Energy Hierarchy



This Energy Strategy is assessed against, and presented, to align with the following steps:

1. The Baseline

The Baseline represents the minimum energy performance that a building must achieve to comply with the relevant building regulations, specifically AD L 2021. It sets TER, which is the benchmark for CO₂ emissions based on a standard building of similar type, size, and use. The Baseline is not an active step in the energy hierarchy, but rather it serves as a reference point. All subsequent measures in the hierarchy are assessed against this Baseline to demonstrate how much the proposed development improves upon the regulatory minimum standards.

2. Reduced Energy Demand

The first step involves reducing energy demand through energy efficient design and operational measures. This includes improving building insulation, reducing air leakage, and optimizing the efficiency of energy systems. The aim is to minimize the amount of energy required in the first place.

3. Renewable and Low Carbon Technologies

The next step in the hierarchy focuses on using renewable energy sources to meet the remaining energy needs. The goal is to further reduce carbon emissions by replacing fossil fuels with LZC energy sources.



1.4 Assessment Methods

The estimated energy performance of the development has been calculated using SAP 10.2 methodology. This assessment includes representative residential dwellings from each domestic home type configuration.

SAP Assessment (Domestic Dwellings)

The SAP methodology has been used to calculate the regulated energy demands associated with hot water, space heating, and fixed electrical items. Part L1 has been applied for the new-build energy assessment, ensuring compliance with relevant regulations. A total of 10 sample SAP assessments have been conducted and extrapolated across 78 dwellings to estimate TER and DER. A mix of property types has been assessed to ensure an accurate representation of the proposed development.

The sample size selected is considered appropriate for extrapolation across the development.



2. BASELINE: BUILDING REGULATIONS

2.1 Introduction

To assess the effectiveness of demand-reduction measures, it is first necessary to establish the baseline energy demand (referred to as TER).

The AD L 2021 TER for the development has been calculated using Part L model designs, applied to the Applicant's development details. The TER represents the maximum allowable regulated CO₂ emissions for the development to achieve compliance with AD L 2021.

2.2 Development's Baseline

The resulting TER for the development has been calculated as 79.05 tCO₂/year for the development. To ensure compliance with AD L 2021, CO₂ emissions should not exceed this figure.

Table 2 — Development's Target Emission Rate for **Residential Element**

	<i>CO₂ emissions</i>	
	<i>tCO₂/year</i>	<i>% reduction</i>
Target Emission Rate: Compliant with AD L 2021	79.05	-



3. REDUCED ENERGY DEMAND

3.1 Introduction

The development incorporates a high-quality, sustainable design by integrating both passive and active measures to minimise energy demand. These include:

- Energy-efficient building fabric and insulation for all heat loss floors, walls, and roofs, reducing heat demand.
- High-performance glazing throughout the development.
- Enhanced build quality, ensuring good air-tightness results to minimise heat loss.
- Efficient building services.
- Minimised cold bridging, achieved through bespoke psi-value calculations.
- Low-energy lighting installed throughout the development.

By optimising the thermal envelope, the need for space heating is significantly reduced, as heat transmittance through thermal elements is minimised. Additionally, low air permeability rates help to lower heating demand by reducing air infiltration, thereby limiting heat losses in winter and excessive heat gains in summer.

Adopting a 'fabric first' approach, the building fabric has been carefully designed and specified to meet or exceed current Building Regulations requirements. This, combined with an energy-efficient plant specification, forms the basis of the design strategy.



Table 3 — Design specification for the Development

Element	Proposed Design Specification
External Wall U-Value (W/m ² .K):	0.18
Ground Floor (W/m ² .K)	0.12
Party Wall U-Value (W/m ² .K)	0 (fully filled and sealed)
Roof (Flat) U-Value (W/m ² .K)	0.08
External Door U-Value (W/m ² .K)	1.20
Glazing U-Value (W/m ² .K)	1.10 (double-glazed units)
Glazing G-Value	0.64
Design Air Permeability (m ³ /m ² hr @50 Pa)	4.0
Thermal Bridging	Bespoke psi-values
Lighting (lm/W)	80
Ventilation	Intermittent extract fans
Space Heating ¹	92.3% efficient gas boiler
Hot Water Heating	From the main heating system
Space Heating Controls	Time and temperature zone controls

¹ By using a standard system like gas boilers in the initial stage, a consistent baseline is established to measure the energy savings achieved solely through improvements in the building's fabric. This approach ensures that any reductions in energy demand are due to the efficiency of the building design itself, rather than the heating system. This standardisation allows for a like-for-like comparison of energy performance across different buildings or design options. Additionally, ventilation and lighting are assessed in this stage as they significantly impact the building's overall energy efficiency. The actual heating system, along with renewable technologies, is introduced in later stages to enhance these foundational efficiencies.

Notional PV is then manually adjusted into the calculations in line with the standard practice. This allows the effectiveness of fabric measures to be assessed as a percentage reduction in CO₂ emissions over the baseline for both domestic and commercial elements of the Development separately.



3.2 Fabric Energy Efficiency Standard

The total Part L Fabric Energy Efficiency Standard (FEES) is provided for the development as a whole and set out in the table below. The FEES target is the maximum energy demand for the dwellings.

DFEE (Dwelling Fabric Energy Efficiency) is the actual fabric energy efficiency achieved by a dwelling, measured in kWh/m²/year. It reflects how well the building fabric (walls, floors, roof, windows, doors, and airtightness) minimises energy demand for space heating.

The 4.7% improvement indicates that the building fabric performs well and helps to minimise the initial energy demand, in line with the energy hierarchy.

Table 4 — Site-wide total energy demand from dwellings.

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Residential element's total energy demand	37.78	36.00	4.7%



4. RENEWABLE AND LOW-CARBON ENERGY TECHNOLOGIES

4.1 Introduction

In line with planning policy CP 41 of [Wiltshire Core Strategy \(2015\)](#), the applicant should commit to the integration of LZC technologies within their energy strategy for the development.

Viability of the following low-carbon and renewable energy technologies have been considered:

- wind,
- solar,
- aerothermal,
- geothermal,
- water source heat pumps,
- biomass.

A detailed review of these technologies is provided in Appendix 2. Table 5 summarises the LZC technologies considered viable for the development:

Table 5 — Summary of Feasibility for the Development

✓	<i>Solar Thermal</i> <i>Solar PV</i> <i>Air Source Heat Pumps</i>
X	<i>Wind Turbines</i> <i>Biomass Boilers</i> <i>Ground or Water Source Heat Pumps</i>

The Applicant has adopted a strategy for LZC technologies that is compatible with previously detailed specification elements.



AIR SOURCE HEAT PUMPS

Following the implementation of design measures to minimise energy demand, the development will utilise heat pump technology to provide low carbon heating and hot water to all plots on site. Individual ASHPs will be installed per dwelling.

SOLAR THERMAL / SOLAR PV

Whilst technically feasible, the applicant has opted not to pursue the incorporation of solar thermal or PV. The decision was made to incorporate ASHP technology as the low zero carbon energy source in combination with significant improvements to the fabric specification above Part L notional design. Significant investment was made to a fabric first approach to make the dwellings more comfortable for occupants, as well as ensuring that the risk of fuel poverty is reduced, rather than the reliance on bolt-on technologies such as solar PV. The incorporation of ASHP technology is aligned with the upcoming changes in the building regulations, which seeks to move away from the reliance on fossil fuels as well as removing the need for on-site combustion.



4.2 Development's LZC Performance

At the final stage, the estimated CO₂ emissions for the development are 24.94 tCO₂ per annum for the residential dwellings.

This equates to a reduction of 54.11 tCO₂ per annum for the residential element, representing a 68.4% improvement over the baseline.

For detailed SAP results, please refer to Appendix 3.

Table 6 — Development's carbon emissions for **Residential Element**

	<i>CO₂ emissions</i>	
	<i>tCO₂/year</i>	<i>% reduction</i>
Target Emission Rate: Compliant with AD L 2021	79.05	-
<i>After demand-reduction measures and renewable and low carbon technologies</i>	24.94	68.4%



5. MAINS WATER CONSUMPTION

5.1 Introduction

Water consumption in residential properties significantly impacts both operational running costs (e.g., water charges) and energy usage, particularly for domestic hot water heating. This is recognised in the SAP 10.2 methodology, which assumes reduced energy consumption for dwellings that comply with [Approved Document Part G](#).

5.2 Development's Water Consumption

The Applicant will implement water-efficient fixtures and fittings across the development to minimise water demand. Each dwelling will be designed to achieve a water consumption rate of 110 litres per person per day, excluding an additional allowance of up to 5 litres per person per day for external water use.

The 110 litres per person per day standard will be achieved through the specifications outlined in Table 7. For further details, please refer to Appendix 5.



Table 7 — Sample water-efficiency specification for a typical dwelling.

Water fittings	Performance
Kitchen taps flow rate	8.0 Litres per minute
Other basin taps flow rate	6.1 Litres per minute
WCs flush volume (full/part)	4.0/2.6 Litres
Shower flow rate	8 Litres per minute
Bath volume	155 Litres
Dishwasher water consumption	1.3 litres per place setting
Washing-machine water consumption	8.2 litres per kg



6. SUSTAINABLE TRANSPORT

The Development will ensure connectivity within the site and to the surrounding area, including integrating with existing transport networks. This helps to ensure ease of movement for residents and supports the use of sustainable transport modes.

There will also be a provision for EV charging in line with relevant policy and building regulations.

A separately submitted Transport Statement will accompany the application.



7. EMBODIED CARBON

7.1 Sustainable Material Selection

The impact of materials selection is an important consideration when designing a new development. The energy and natural resources consumed over the course of extraction or procurement, processing and manufacturing can be significant.

The Applicant will implement an environmentally responsible approach to the procurement of construction materials and supply chain management for the development where possible.

Good-practice principles for the responsible sourcing of sustainable materials will be applied across the Development. The life cycle impact of materials will be considered.

The applicant constantly reviews and responds to material suppliers based on sustainability and carbon credentials. Their key providers for this site have been summarised below.

The key facing material for this site is Bekstone and they promote high levels of sustainability through the manufacturing process.

"Bekstone recognises it has a responsibility to minimise the impact caused by its operations and supply chain on the climate. As such we continue to review, measure and monitor our operational procedures so that we continue to make improvements to reduce emissions that contribute towards Climate Change. This policy is implemented in accordance and conjunction with our Environmental Policy.

Bekstone ensures that it meets the legal responsibilities covered by the Environmental Protection Act 1990 (EPA). The Integrated Pollution Control and Air Pollution Control by Local Authorities measuring the impact of our operations on the local air, water and land and ensuring we operate within the approved guidelines.

Actions undertaken and being undertaken to improve upon our basic local and legal requirements include:

A change to 100% 'green' electricity at our production plants and offices in January 2008. Electricity that is used to power our production machinery, light, heat and general power is supplied from renewable resources via generation which is Climate Change Levy exempt.



Sources which contribute include wind turbines and hydro electric schemes. Audited by Lloyds Register Quality Assurance within ISO 9001 : 2000.

We have spent many years working with the Carbon Trust in order to minimise our carbon output and our reductions have been certified. Measuring carbon output helps us to create changes to our manufacturing and supply chain activities in order to continue to reduce the amount of carbon we produce. In doing this we are able to demonstrate our progress and positive contribution towards the slowing of climate change."

All timber including the frame is responsibly sourced to lower emissions. The timber frames are provided by Taylor Lane and they strive to reduce carbon from the overall manufacturing process. They set out that:

"As such, we are working towards net zero.

To achieve this, we have formed a Corporate Social Responsibility Taskforce. Representatives from all departments meet regularly to discuss our journey to net zero, address immediate concerns, long-term targets, and agree and implement actions. It is an open forum and anyone from within the business is welcome.

For greater accountability, we have also joined Greener Footprints 30 for 2030 campaign. Launched by the Herefordshire Climate and Nature Action Partnership, we are tracking our progress alongside 29 other Herefordshire-based businesses, and in turn, we are playing our part in helping the county realise its ambition to be net zero by 2030.

Positive actions include installing solar photovoltaic panels on the roof of our office, electric cars for directors and sales staff, installation of energy efficient lighting in the factories, replacing company vehicles with bicycles for staff to make short journeys between company premises on Rotherwas Industrial Estate, and employing an ambitious recycling programme. The latter is supported by third-party supplier, Hereford's Pedicargo Recycling Service which collects trade waste by bike that is then compacted, shredded and recycled."

All windows are provided by Munster joinery and they set out that:

"We are conscious of the importance of sustainability and strive to continually improve our operations with this in mind. Munster Joinery use green energy. Wind turbines and biomass CHP power our manufacturing plant and we have robust recycling and water treatment practices in place.



At Munster Joinery we recognise the increasing importance of waste management and recycling in the joinery industry. We have a dedicated 'waste management and recycling' division. As a company we are fully self reliant in dealing with all waste and packaging products and all recyclable materials on site. We have also developed an integrated approach to resource efficiency to ensure the most effective use of natural resources.

We consider sustainability in the selection of the materials that go into our products. The Life Cycle analysis of our products examines environmental impacts due to extraction, production, embodied energy, durability and service life, maintenance and repair, end of life disposal. We are in the process of developing and publishing EPDs for all our products.

We are conscious of the need to reduce our carbon footprint and manage our natural resources effectively. Our production facility in Ballydesmond gets much of it's day to day power needs from 2 wind turbines with an electrical output of 4.2 megawatts and a Biomass steam turbine with an electrical output of 2.8 megawatts. The wind turbines are capable of powering 2,260 homes annually. The installation will easily achieve annual savings of over 9,000 tonnes of carbon emissions showing Munster Joinery's commitment to protecting our environment."



7.2 Material Efficiency & Waste Reduction

The Applicant will implement guidance on sustainable waste management. As a primary objective, and in accordance with the waste hierarchy, the Applicant will seek to prevent waste in the first instance. This will be achieved through a site waste management plan.

This is key with around a third of the UK's waste coming from the construction and demolition sector. The Applicant will work with a principal contractor in order to deliver the objective of reducing the proportion of waste diverted to landfill. The Applicant will monitor and review this commitment by defining the following:

- Waste minimisation actions to be undertaken.
- Procedures for minimising hazardous waste.
- Procedures for sorting, reusing, and recycling construction waste into defined waste groups, either on-site or through a licensed external contractor. The delivery of this target will be managed through the effective implementation of an on-site plan that will focus on steps in the waste hierarchy.

Redcliffe Homes implement precision construction techniques and modular design to reduce waste.

All sites including this Development will utilise timber frames and standard house typologies. This modular style construction significantly reduces waste given much of the construction is undertaken off-site under a controlled environment.

The use of timber frame panels creates an efficient design, accurate production and process as well as a quicker watertight dwelling on site. The efficiency in timber frame design and reduces building errors, waste in production and on site. The optimised structural designs reduce the materials used and also create a lighter construction and reduced substructure design.

The use of reusing the same house design and type of construction ensures efficiency through repetition, familiarisation and designing out complex issues.

The external facing materials are still undertaken onsite, although the standard house types together with using the same labourers means that material wastage is limited.

Further details will be provided within the waste management plan.



7.3 Local Sourcing & Transportation Efficiency

Redcliffe Homes prioritize local suppliers to cut down on transportation emissions.

The key materials largely all come from less than 100 miles away from the development as summarised below:

- Bricks – Ibstock, various quarries nationally including Bristol (approx. 31 miles via road)
- Stonework – Bekstone, Brize Norton, Oxfordshire (approx. 58 miles via road)
- Tiles – Marley, Staffordshire, Midlands (approx. 133 miles via road)
- Timber frame, Taylor Lane, Hereford, Midlands (approx. 85 miles via road)
- Windows – Munster joinery manufactured in Warwick, Midlands (approx. 81 miles via road)
- Doors – IG Doors, Caerphilly, South Wales (approx. 68 miles via road)

Given the geographical constraints and limited population within the Wiltshire area, there is a limited manufacturing base within Wiltshire and the South West. This means that materials need to be sought from further away than just the South West, although as is set out above, Redcliffe Homes has kept this as local as possible.

In terms of trades and workers, Redcliffe Homes have a company policy to only develop sites within 1 hour from the company head office in Chipping Sodbury to avoid unnecessary travel times. When meetings are required on-site, the company strongly encourages car sharing amongst staff.

At this stage, the specific trades are not known. However, all trades for the site will come from the local area and will only expand as far as Swindon, Bristol and Gloucester.

Whilst Redcliffe Home will strongly encourage to use of trades from Wiltshire, there is a limited supply meaning that they may need to be brought in from cities listed above.



7.4 Circular Economy Approach

Redcliffe Homes will seek to incorporate reclaimed and recyclable materials to extend material life cycles and reduce landfill waste.

The key focus of this will relate to soil and hardcore, where this will be reused as much as possible to avoid unnecessary and costly disposal.

Given Redcliffe Homes are developing several sites in this area, there will be the opportunity to share soil and hardcore to avoid additional resources being imported to site.



8. CLIMATE CHANGE ADAPTATION

The Applicant has taken a high standard of energy efficiency including optimal levels of thermal insulation and passive ventilation. The Applicant has designed a Development which enhances the existing qualities of the surrounding area whilst also making positive steps towards mitigating and adapting to climate change.

The Applicant addresses their potential impact on climate change by designing a development that reduces energy demand and, in doing so, takes positive action towards meeting their CO₂ reduction target. The development has been designed to take positive steps towards zero carbon, through the use of ASHPs for the heating and hot water, meeting the requirements for low carbon heating solutions and the use of renewable technology.

The Development has been designed to encourage walking, cycling and the use of public transport. Full details can be found in the separate Transport Statement which will accompany the application.

Outdoor space will be provided for all properties, along with public open space improving quality of life for all occupants.

Policies and procedures will be put in place by the Applicant to in order to minimise the possible negative effects of construction, such as air pollution, noise and vibration, traffic congestion, dust and contamination of land and water.

The Development will be designed to achieve airborne sound insulation beyond Part E of the Building Regulations for party walls.

All dwellings will be designed in line with Part O of the Building Regulations, to ensure that overheating risk is minimised.

Any artificial lighting proposed for the Development will be designed to meet the local plan policy, measures will be taken where possible to reduce light pollution on site.



CONCLUSIONS AND RECOMMENDATIONS

The development delivers a highly efficient and sustainable energy strategy, meeting the requirements of national and local planning policy, including [CP 41](#) of the [Wiltshire Core Strategy \(2015\)](#).

By integrating passive design measures, efficient energy supply, and renewable technologies, the development achieves a total site-wide reduction of 68.4% in regulated CO₂ emissions, representing a significant carbon reduction over minimum requirements.

The strategy follows the principles of the [Energy Hierarchy](#).

- 'Optimised building fabric, energy-efficient glazing, low-energy lighting, and minimum thermal bridging result in a low energy demand design.
- Individual ASHP systems will provide space heating and hot water and will contribute to further carbon reductions compared against regulatory requirements.
- Overall reductions of 68.4% over Part AD L 2021.

An aspirational target of 110 litres per person per day has been targeted and achieved with the proposed fittings specification.

A number of sustainability measures have also been identified and incorporated within the design, in particular with regards to sustainable transport, embodied carbon and climate change adaption. As this is an outline application all measures are to be reviewed again at detailed design

This strategy highlights that the development will meet local and regional energy policies, delivering a sustainable and future-proofed energy solution.



APPENDICES

APPENDIX 1: LIST OF ABBREVIATIONS

AD L 2021	<i>Approved Document Part L of Buildings Regulations 2021</i>
AD O 2021	<i>Approved Document Part P of Buildings Regulations 2021</i>
ASHP	<i>Air Source Heat Pump</i>
BER	<i>Building Emission Rate</i>
BRE	<i>Building Research Establishment</i>
CIBSE	<i>Chartered Institution of Building Services Engineers</i>
COP	<i>Coefficient of Performance</i>
DER	<i>Dwelling Emission Rate</i>
DHN	<i>District Heat Network</i>
DHW	<i>Domestic Hot Water</i>
EAHP	<i>Exhaust Air Heat Pump</i>
EVC	<i>Electric Vehicle Charging</i>
FEES	<i>Fabric Energy Efficiency Standard</i>
LZC	<i>Low and Zero-Carbon technologies</i>
NCM	<i>National Calculation Methodology</i>
PV	<i>Photovoltaics</i>
SAP	<i>Standard Assessment Procedure</i>
SBEM	<i>Simplified Building Energy Model</i>
TER	<i>Target Emission Rate</i>
TFEE	<i>Target Fabric Energy Efficiency</i>
VRF	<i>Variable Refrigerant Flow</i>



APPENDIX 2: PLANNING POLICY AND DESIGN GUIDANCE

The Climate Change Act (2008)

Passed in November 2008, the Climate Change Act mandated that the UK would reduce emissions of six key greenhouse gases, including Carbon Dioxide, by 80% by 2050.

As a consequence, the reduction of carbon dioxide emissions is at the forefront of National, Regional and Local Planning Policy, along with continuing step changes in performance introduced by the Building Regulations Approved Document L (2021).

Approved Document L (2021)

This development is subject to the requirements of Approved Document L (2021). ADL 2013 represented an approximate reduction of 6% in the Target Emission Rate (kgCO₂/sqm per annum) over the requirements of Approved Document L (2010) for residential development and an aggregate 9% reduction for non-residential development. ADL (2021) has seen a further 31% improvement over these targets. It also sees the introduction of a Primary Energy Target, a measure of heating demand (kW hrs/sqm per annum) to ensure new-build dwellings with low-carbon heating systems still meet satisfactory energy-efficiency standards.

National Planning Policy Framework (2024)

The National Planning Policy Framework (NPPF) encourages Local Planning Authorities to 'support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. I ' (NPPF paragraph 161), 'Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating and drought from rising temperatures '. (NPPF Paragraph 162).

Paragraph 165, upholds the requirement for Local Plans to: 'To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for locating potential heat customers and suppliers.

In paragraph 166, NPPF stipulates that local planning authorities should take account of the benefits of decentralised energy and passive design measures as a means of energy efficiency in new development: 'In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.'



Wiltshire Core Strategy (2015)

CP 41 Sustainable construction and low-carbon energy

Climate change adaptation

New development, building conversions, refurbishments and extensions will be encouraged to incorporate design measures to reduce energy demand.

Development will be well insulated and designed to take advantage of natural light and heat from the sun and use natural air movement for ventilation, whilst maximising cooling in the summer.

Sustainable construction

New homes (excluding extensions and conversions) will be required to achieve at least Level 4 (in full) of the Code for Sustainable Homes.

Conversions of property to residential use will not be permitted unless BREEAM's Homes "Very Good" standards are achieved.

All non-residential development will be required to achieve the relevant BREEAM "Very Good" standards, rising to the relevant BREEAM "Excellent" standards from 2019.

Existing buildings

Retrofitting measures to improve the energy performance of existing buildings will be encouraged in accordance with the following hierarchy:

- i. Reduce energy consumption through energy efficiency measures
- ii. Use renewable or low-carbon energy from a local/district source
- iii. Use building-integrated renewable or low-carbon technologies.

Opportunities should be sought to facilitate carbon reduction through retrofitting at whole street or neighbourhood scales to reduce individual costs, improve viability and support coordinated programmes for improvement.

Renewable and low-carbon energy

All proposals for major development will be required to submit a Sustainable Energy Strategy alongside the planning application outlining the low-carbon strategy for the proposal.

In all cases, including those listed above, proposals relating to historic buildings, listed buildings and buildings within conservation areas and world heritage sites should ensure that appropriate sensitive approaches and materials are used.

Safeguarding of the significance of heritage assets should be in accordance with appropriate national policy and established best practice.

In all cases the impact of these requirements on the viability of development will be taken into consideration



APPENDIX 3: SAP RESULTS

(see following pages)

Full SAP Calculation Printout



Plot Reference	2B A22			Issued on Date	26/01/2026
Assessment Reference	AH A22	Plot Type Ref	2B A22		
Plot Address	2B A22, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	86 B	DER	3.51	TER	11.67
Environmental	97 A	% DER < TER			69.92
CO ₂ Emissions (t/year)	0.26	DFEE	35.35	TFEE	36.29
Compliance Check	See BREL	% DFEE < TFEE			2.60
% DPER < TPER	39.73	DPER	36.87	TPER	61.17
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	39.6600 (1b)	x 2.3800 (2b)	= 94.3908 (1b) - (3b)
First floor	39.6600 (1c)	x 2.7000 (2c)	= 107.0820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.4728 (5)

2. Ventilation rate

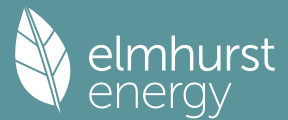
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1489 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3489 (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) = 0.2966 (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	0.3781	0.3707	0.3633	0.3262	0.3188	0.2817	0.2817	0.2743	0.2966	0.3188	0.3336	0.3485 (22b)
Effective ac	0.5715	0.5687	0.5660	0.5532	0.5508	0.5397	0.5397	0.5376	0.5440	0.5508	0.5557	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Window			7.2400	1.0536	7.6284		(27)
Door			5.0400	1.1000	5.5440		(26)
Ground Floor			39.6600	0.1200	4.7592	75.0000	2974.5000 (28a)
External Wall	91.0600	12.2800	78.7800	0.1800	14.1804	9.0000	709.0200 (29a)
Plane Ceiling	39.6600		39.6600	0.0800	3.1728	9.0000	356.9400 (30)
Total net area of external elements Aum(A, m ²)			170.3800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.2848		(33)
Main dwelling							
Party Wall			46.4700	0.0000	0.0000	20.0000	929.4000 (32)
Internal Wall GF			68.0600			9.0000	612.5400 (32c)
Internal Wall FF			70.4600			9.0000	634.1400 (32c)
Internal Floor			39.6600			18.0000	713.8800 (32d)
Internal Ceiling			39.6600			9.0000	356.9400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7287.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							91.8729 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				7.7100	0.0500	0.3855	

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E3 Sill	4.3100	0.0330	0.1422
E4 Jamb	15.5600	0.0330	0.5135
E5 Ground floor (normal)	17.8900	0.0900	1.6101
E10 Eaves (insulation at ceiling level)	8.7400	0.0350	0.3059
E12 Gable (insulation at ceiling level)	9.1300	0.1080	0.9860
E16 Corner (normal)	10.1800	0.0460	0.4683
E6 Intermediate floor within a dwelling	17.8900	0.0670	1.1986
P1 Party wall - Ground floor	9.1300	0.1600	1.4608
P2 Party wall - Intermediate floor within a dwelling	9.1300	0.0000	0.0000
E18 Party wall between dwellings	10.1800	0.0840	0.8551
P4 Party wall - Roof (insulation at ceiling level)	9.1300	0.2400	2.1912
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.1173 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	45.4020 (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	37.9960	37.8115	37.6306	36.7808	36.6218	35.8817	35.8817	35.7447	36.1668	36.6218	36.9435	37.2797	(38)
Heat transfer coeff	83.3981	83.2135	83.0326	82.1829	82.0239	81.2838	81.2838	81.1467	81.5689	82.0239	82.3455	82.6817	(39)
Average = Sum(39)m / 12 =												82.1821	
HLP	1.0514	1.0491	1.0468	1.0361	1.0341	1.0248	1.0248	1.0230	1.0284	1.0341	1.0381	1.0424	(40)
HLP (average)												1.0361	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4498 (42)
Hot water usage for mixer showers	65.2953	64.3141	62.8842	60.1483	58.1294	55.8778	54.5980	56.0171	57.5727	59.9901	62.7847	65.0452	(42a)
Hot water usage for baths	28.2024	27.7835	27.1937	26.1062	25.2918	24.3889	23.9012	24.4868	25.1246	26.0908	27.2007	28.1070	(42b)
Hot water usage for other uses	39.7187	38.2744	36.8301	35.3858	33.9415	32.4971	32.4971	33.9415	35.3858	36.8301	38.2744	39.7187	(42c)
Average daily hot water use (litres/day)												122.4561	(43)
Daily hot water use	133.2164	130.3720	126.9080	121.6403	117.3627	112.7638	110.9963	114.4454	118.0830	122.9110	128.2598	132.8709	(44)
Energy conte	210.9822	185.6480	195.0528	166.5195	157.9927	138.6563	134.2404	141.7073	145.6082	166.7891	182.7297	208.0437	(45)
Energy content (annual)										Total = Sum(45)m =		2033.9699	
Distribution loss (46)m = 0.15 x (45)m	31.6473	27.8472	29.2579	24.9779	23.6989	20.7984	20.1361	21.2561	21.8412	25.0184	27.4094	31.2066	(46)
Water storage loss (or HIU loss):													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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	256.3414	226.6176	240.4120	210.4155	203.3519	182.5523	179.5996	187.0665	189.5042	212.1483	226.6257	253.4029	(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	256.3414	226.6176	240.4120	210.4155	203.3519	182.5523	179.5996	187.0665	189.5042	212.1483	226.6257	253.4029	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2568.0379	(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	106.4390	94.5036	101.1424	90.4845	88.8199	81.2200	80.9223	83.4050	83.5315	91.7447	95.8744	105.4619	(65)

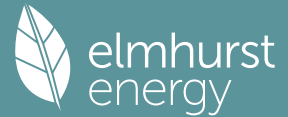
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	129.3859	143.2487	129.3859	133.6988	129.3859	133.6988	129.3859	129.3859	133.6988	129.3859	133.6988	129.3859	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.0135	220.2758	214.5749	202.4383	187.1180	172.7192	163.0998	160.8375	166.5384	178.6750	193.9953	208.3941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	(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)	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	(71)
Water heating gains (Table 5)	143.0631	140.6304	135.9441	125.6730	119.3816	112.8056	108.7665	112.1036	116.0160	123.3128	133.1589	141.7499	(72)
Total internal gains	550.2100	563.9023	539.6524	521.5575	495.6330	478.9710	460.9997	462.0745	476.0007	491.1212	520.6004	539.2774	(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	5.0700	11.2829	0.6400	0.7000	0.7700	17.7599 (75)
Southwest	2.1700	36.7938	0.6400	0.7000	0.7700	24.7883 (79)

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Solar gains	42.5482	78.3745	122.9045	178.5486	223.9617	232.8868	220.1396	184.6472	141.9198	90.8453	52.0372	35.7172 (83)
Total gains	592.7582	642.2768	662.5569	700.1060	719.5948	711.8578	681.1393	646.7217	617.9205	581.9665	572.6376	574.9946 (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	24.2723	24.3262	24.3792	24.6313	24.6790	24.9037	24.9037	24.9458	24.8167	24.6790	24.5826	24.4826	
alpha	2.6182	2.6217	2.6253	2.6421	2.6453	2.6602	2.6602	2.6631	2.6544	2.6453	2.6388	2.6322	
util living area	0.9357	0.9186	0.8941	0.8377	0.7465	0.6057	0.4754	0.5120	0.6916	0.8463	0.9126	0.9401 (86)	
Living	18.6502	18.8960	19.2823	19.8496	20.3632	20.7478	20.9043	20.8805	20.6169	19.9825	19.2473	18.6128	
Non living	17.2958	17.6058	18.0925	18.8002	19.4175	19.8524	20.0032	19.9859	19.7188	18.9748	18.0585	17.2532	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7979	18.8960	19.2823	19.8496	20.3632	20.7478	20.9043	20.8805	20.6169	19.9825	19.2473	18.9468 (87)	
Th 2	20.0407	20.0426	20.0445	20.0534	20.0550	20.0628	20.0628	20.0642	20.0598	20.0550	20.0517	20.0482 (88)	
util rest of house	0.9275	0.9082	0.8799	0.8146	0.7077	0.5425	0.3892	0.4265	0.6347	0.8200	0.8999	0.9324 (89)	
MIT 2	18.9464	17.6058	18.0925	18.8002	19.4175	19.8524	20.0032	19.9859	19.7188	18.9748	18.0585	17.7569 (90)	
Living area fraction									fLA = Living area / (4) =				0.2005 (91)
MIT	19.1171	17.8644	18.3310	19.0106	19.6071	20.0319	20.1838	20.1652	19.8988	19.1768	18.2968	17.9954 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1171	17.8644	18.3310	19.0106	19.6071	20.0319	20.1838	20.1652	19.8988	19.1768	18.2968	17.9954 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9182	0.8774	0.8477	0.7843	0.6870	0.5402	0.4009	0.4363	0.6238	0.7904	0.8690	0.9109 (94)
Useful gains	544.2964	563.5069	561.6597	549.0814	494.3514	384.5488	273.0897	282.1528	385.4732	459.9932	497.6436	523.7433 (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	1235.7186	1078.8153	982.3583	830.9157	648.5707	441.5226	291.3081	305.5348	473.0042	703.4996	922.0086	1140.6260 (97)
Space heating kWh	514.4181	346.2872	312.9997	202.9207	114.7391	0.0000	0.0000	0.0000	0.0000	181.1688	305.5428	458.9607 (98a)
Space heating requirement - total per year (kWh/year)												2437.0372
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	514.4181	346.2872	312.9997	202.9207	114.7391	0.0000	0.0000	0.0000	0.0000	181.1688	305.5428	458.9607 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2437.0372
Space heating per m2										(98c) / (4) =		30.7241 (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 %)												308.8995 (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	514.4181	346.2872	312.9997	202.9207	114.7391	0.0000	0.0000	0.0000	0.0000	181.1688	305.5428	458.9607 (98)
Space heating efficiency (main heating system 1)	308.8995	308.8995	308.8995	308.8995	308.8995	0.0000	0.0000	0.0000	0.0000	308.8995	308.8995	308.8995 (210)
Space heating fuel (main heating system)	166.5325	112.1035	101.3274	65.6915	37.1445	0.0000	0.0000	0.0000	0.0000	58.6498	98.9133	148.5793 (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	256.3414	226.6176	240.4120	210.4155	203.3519	182.5523	179.5996	187.0665	189.5042	212.1483	226.6257	253.4029 (64)
Efficiency of water heater (217)m	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164	307.0164 (216)
Fuel for water heating, kWh/month	83.4944	73.8129	78.3059	68.5356	66.2349	59.4601	58.4984	60.9305	61.7244	69.1000	73.8155	82.5373 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	33.2173	26.6482	23.9937	17.5788	13.5784	11.0937	12.3867	16.1007	20.9132	27.4392	30.9925	34.1406 (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												788.9418 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												307.0164
Water heating fuel used												836.4496 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	268.0830 (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	1893.4744 (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	788.9418	0.1547	122.0121	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	836.4496	0.1410	117.9245	(264)
Space and water heating			239.9366	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	268.0830	0.1443	38.6927	(268)
Total CO2, kg/year			278.6292	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5100	(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	788.9418	1.5725	1240.6265	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	836.4496	1.5213	1272.4950	(278)
Space and water heating			2513.1215	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	268.0830	1.5338	411.1946	(282)
Total Primary energy kWh/year			2924.3161	(286)
Dwelling Primary energy Rate (DPER)			36.8700	(287)

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

1. Overall dwelling characteristics

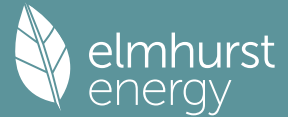
		Area	Storey height	Volume
		(m2)	(m)	(m3)
Main dwelling				
Ground floor		39.6600 (1b)	x 2.3800 (2b)	= 94.3908 (1b) - (3b)
First floor		39.6600 (1c)	x 2.7000 (2c)	= 107.0820 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3200			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	201.4728 (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	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1489 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3989	(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) =	0.3391 (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	0.4323	0.4238	0.4154	0.3730	0.3645	0.3221	0.3221	0.3136	0.3391	0.3645	0.3815	0.3984	(22b)
Effective ac	0.5934	0.5898	0.5863	0.5696	0.5664	0.5519	0.5519	0.5492	0.5575	0.5664	0.5728	0.5794	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Main dwelling													
TER Opaque door			5.0400	1.0000	5.0400			(26)					
TER Opening Type			7.2400	1.1450	8.2901			(27)					
Ground Floor			39.6600	0.1300	5.1558			(28a)					
External Wall	91.0600	12.2800	78.7800	0.1800	14.1804			(29a)					
Plane Ceiling	39.6600		39.6600	0.1100	4.3626			(30)					
Total net area of external elements Aum(A, m2)			170.3800					(31)					
Fabric heat loss, W/K = Sum (A x U)					37.0289			(33)					
Main dwelling													
Party Wall			46.4700	0.0000	0.0000			(32)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							91.8729	(35)					
List of Thermal Bridges													
K1 Element				Length	Psi-value		Total						
E2 Other lintels (including other steel lintels)				7.7100	0.0500		0.3855						
E3 Sill				4.3100	0.0500		0.2155						
E4 Jamb				15.5600	0.0500		0.7780						
E5 Ground floor (normal)				17.8900	0.1600		2.8624						
E10 Eaves (insulation at ceiling level)				8.7400	0.0600		0.5244						
E12 Gable (insulation at ceiling level)				9.1300	0.0600		0.5478						
E16 Corner (normal)				10.1800	0.0900		0.9162						
E6 Intermediate floor within a dwelling				17.8900	0.0000		0.0000						
P1 Party wall - Ground floor				9.1300	0.0800		0.7304						
P2 Party wall - Intermediate floor within a dwelling				9.1300	0.0000		0.0000						
E18 Party wall between dwellings				10.1800	0.0600		0.6108						
P4 Party wall - Roof (insulation at ceiling level)				9.1300	0.1200		1.0956						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6666	(36)					
Point Thermal bridges							0.0000						
Total fabric heat loss						(33) + (36) + (36a) =	45.6955	(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	39.4559	39.2147	38.9782	37.8675	37.6596	36.6922	36.6922	36.5131	37.0649	37.6596	38.0800	38.5196	(38)
Average = Sum(39)m / 12 =	85.1514	84.9101	84.6737	83.5629	83.3551	82.3877	82.3877	82.2086	82.7603	83.3551	83.7755	84.2150	(39)
												83.5619	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0735	1.0705	1.0675	1.0535	1.0509	1.0387	1.0387	1.0364	1.0434	1.0509	1.0562	1.0617	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.0535	
												31	

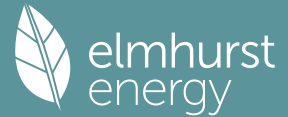
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4498	(42)
Hot water usage for mixer showers	65.2953	64.3141	62.8842	60.1483	58.1294	55.8778	54.5980	56.0171	57.5727	59.9901	62.7847	65.0452	(42a)	
Hot water usage for baths	28.2024	27.7835	27.1937	26.1062	25.2918	24.3889	23.9012	24.4868	25.1246	26.0908	27.2007	28.1070	(42b)	
Hot water usage for other uses	39.7187	38.2744	36.8301	35.3858	33.9415	32.4971	32.4971	33.9415	35.3858	36.8301	38.2744	39.7187	(42c)	
Average daily hot water use (litres/day)												122.4561	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	133.2164	130.3720	126.9080	121.6403	117.3627	112.7638	110.9963	114.4454	118.0830	122.9110	128.2598	132.8709	(44)	
Energy content (annual)	210.9822	185.6480	195.0528	166.5195	157.9927	138.6563	134.2404	141.7073	145.6082	166.7891	182.7297	208.0437	(45)	
Distribution loss (46)m = 0.15 x (45)m	31.6473	27.8472	29.2579	24.9779	23.6989	20.7984	20.1361	21.2561	21.8412	25.0184	27.4094	31.2066	(46)	
Water storage loss (or HIU loss):														
Store volume													210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7016	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.9188	(55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)	
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month	262.7288	232.3868	246.7994	216.5968	209.7393	188.7336	185.9870	193.4539	195.6855	218.5357	232.8070	259.7903	(62)	
WWHRS	-29.8503	-26.3999	-27.6444	-22.8907	-21.3333	-18.2550	-17.1112	-18.1960	-18.8874	-22.2661	-25.2248	-29.2975	(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	232.8785	205.9870	219.1550	193.7062	188.4060	170.4786	168.8758	175.2579	176.7981	196.2695	207.5822	230.4928	(64)	
12Total per year (kWh/year)													2365.8877	(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)	
													0.0000	(64a)
Heat gains from water heating, kWh/month	111.5489	99.1190	106.2523	95.4296	93.9298	86.1651	86.0322	88.5150	88.4766	96.8546	100.8195	110.5718	(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	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	122.4916	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	129.3859	143.2487	129.3859	133.6988	129.3859	133.6988	129.3859	129.3859	133.6988	129.3859	133.6988	129.3859	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	218.0135	220.2758	214.5749	202.4383	187.1180	172.7192	163.0998	160.8375	166.5384	178.6750	193.9953	208.3941	(68)
Pumps, fans	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	35.2492	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	-97.9933	(71)

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Water heating gains (Table 5)	149.9313	147.4986	142.8123	132.5411	126.2498	119.6737	115.6347	118.9717	122.8841	130.1810	140.0271	148.6180 (72)
Total internal gains	560.0781	573.7705	549.5205	531.4256	505.5012	485.8391	467.8679	468.9426	482.8688	500.9894	530.4686	549.1456 (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				5.0700	11.2829	0.6300		0.7000		0.7700		17.4824 (75)
Southwest				2.1700	36.7938	0.6300		0.7000		0.7700		24.4009 (79)
Solar gains	41.8834	77.1498	120.9841	175.7587	220.4623	229.2480	216.6999	181.7621	139.7023	89.4258	51.2241	35.1592 (83)
Total gains	601.9615	650.9204	670.5046	707.1844	725.9635	715.0871	684.5678	650.7047	622.5712	590.4152	581.6927	584.3047 (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	23.7726	23.8401	23.9067	24.2245	24.2849	24.5700	24.5700	24.6236	24.4594	24.2849	24.1630	24.0369
alpha	2.5848	2.5893	2.5938	2.6150	2.6190	2.6380	2.6380	2.6416	2.6306	2.6190	2.6109	2.6025
util living area	0.9345	0.9176	0.8934	0.8373	0.7470	0.6080	0.4779	0.5138	0.6926	0.8447	0.9110	0.9387 (86)
MIT	18.6102	18.8571	19.2478	19.8262	20.3468	20.7393	20.9003	20.8764	20.6067	19.9675	19.2241	18.5805 (87)
Th 2	20.0225	20.0250	20.0275	20.0390	20.0412	20.0512	20.0512	20.0531	20.0473	20.0412	20.0368	20.0322 (88)
util rest of house	0.9261	0.9070	0.8790	0.8140	0.7079	0.5441	0.3904	0.4272	0.6351	0.8180	0.8980	0.9308 (89)
MIT 2	17.2348	17.5465	18.0390	18.7622	19.3885	19.8342	19.9895	19.9724	19.6980	18.9472	18.0205	17.2031 (90)
Living area fraction												0.2005 (91)
MIT	17.5105	17.8092	18.2813	18.9755	19.5806	20.0157	20.1721	20.1536	19.8802	19.1517	18.2618	17.4792 (92)
Temperature adjustment												0.0000
adjusted MIT	17.5105	17.8092	18.2813	18.9755	19.5806	20.0157	20.1721	20.1536	19.8802	19.1517	18.2618	17.4792 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8967	0.8755	0.8461	0.7831	0.6866	0.5415	0.4022	0.4370	0.6239	0.7879	0.8665	0.9024 (94)
Useful gains	539.7571	569.8572	567.3095	553.8038	498.4504	387.2387	275.3215	284.3704	388.3996	465.1941	504.0485	527.2900 (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	1124.8923	1096.1250	997.5625	841.9384	656.8853	446.1835	294.2964	308.5770	478.3699	712.8295	935.0818	1118.3102 (97)
Space heating kWh	435.3406	353.6519	320.1083	207.4569	117.8756	0.0000	0.0000	0.0000	0.0000	184.2407	310.3440	439.7190 (98a)
Space heating requirement - total per year (kWh/year)												2368.7370
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	435.3406	353.6519	320.1083	207.4569	117.8756	0.0000	0.0000	0.0000	0.0000	184.2407	310.3440	439.7190 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2368.7370
Space heating per m ²										(98c) / (4) =		29.8630 (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)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	435.3406	353.6519	320.1083	207.4569	117.8756	0.0000	0.0000	0.0000	0.0000	184.2407	310.3440	439.7190 (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)	471.6583	383.1549	346.8128	224.7637	127.7092	0.0000	0.0000	0.0000	0.0000	199.6108	336.2340	476.4020 (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	232.8785	205.9870	219.1550	193.7062	188.4060	170.4786	168.8758	175.2579	176.7981	196.2695	207.5822	230.4928 (64)
Efficiency of water heater	85.4417	85.2607	84.9083	84.2139	83.0390	79.8000	79.8000	79.8000	79.8000	83.9182	84.9596	85.4843 (217)
Fuel for water heating, kWh/month	272.5584	241.5967	258.1079	230.0169	226.8885	213.6323	211.6239	219.6214	221.5516	233.8820	244.3304	269.6316 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	26.8838	21.5672	19.4189	14.2271	10.9894	8.9785	10.0249	13.0308	16.9257	22.2074	25.0832	27.6310 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-37.0800	-52.2412	-75.0195	-84.2443	-90.7356	-84.6482	-83.6287	-79.0418	-70.8705	-59.7415	-40.7661	-32.0640 (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)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.9901	-44.1740	-87.8400	-131.9832	-174.5638	-175.4156	-173.3240	-146.6943	-107.4641	-63.1520	-28.0185	-16.5941	(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												2566.3456	(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												2843.4418	(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)												216.9679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1960.2949	(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												3752.4605	(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	2566.3456	0.2100	538.9326 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2843.4418	0.2100	597.1228 (264)
Space and water heating			1136.0554 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	216.9679	0.1443	31.3152 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-790.0812	0.1346	-106.3510
PV Unit electricity exported	-1170.2136	0.1259	-147.3139
Total			-253.6649 (269)
Total CO2, kg/year			925.6349 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6700 (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	2566.3456	1.1300	2899.9706 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2843.4418	1.1300	3213.0892 (278)
Space and water heating			6113.0598 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	216.9679	1.5338	332.7927 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-790.0812	1.4975	-1183.1377
PV Unit electricity exported	-1170.2136	0.4621	-540.7428
Total			-1723.8806 (283)
Total Primary energy kWh/year			4852.0727 (286)
Target Primary Energy Rate (TPER)			61.1700 (287)

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Plot Reference	Alderton			Issued on Date	26/01/2026
Assessment Reference	Alderton	Plot Type Ref	Alderton		
Plot Address	Alderton, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	82 B	DER	3.77	TER	9.55
Environmental	96 A	% DER < TER			60.52
CO ₂ Emissions (t/year)	0.5	DFEE	38.57	TFEE	39.83
Compliance Check	See BREL	% DFEE < TFEE			3.15
% DPER < TPER	21.21	DPER	39.43	TPER	50.05
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	71.5600 (1b)	x 2.4000 (2b)	= 171.7440 (1b) - (3b)
First floor	70.4900 (1c)	x 2.6500 (2c)	= 186.7985 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 358.5425 (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	5 * 10 = 50.0000 (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) =	50.0000 / (5) = 0.1395 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3395 (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) = 0.2885 (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	0.3679	0.3607	0.3535	0.3174	0.3102	0.2741	0.2741	0.2669	0.2885	0.3102	0.3246	0.3390 (22b)
Effective ac	0.5677	0.5650	0.5625	0.5504	0.5481	0.5376	0.5376	0.5356	0.5416	0.5481	0.5527	0.5575 (25)

3. Heat losses and heat loss parameter

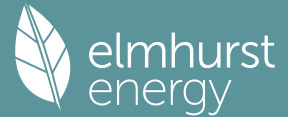
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Door			1.9100	1.2000	2.2920		(26)
Glazed Door			2.1200	1.1000	2.3320		(26a)
Window			18.0700	1.0536	19.0393		(27)
Glazed Door			4.9200	1.1000	5.4120		(26a)
Ground Floor			71.5600	0.1200	8.5872	75.0000	5366.9998 (28a)
External Walls	179.1030	27.0200	152.0830	0.1800	27.3749	9.0000	1368.7470 (29a)
Plane Ceiling	70.4900		70.4900	0.0800	5.6392	9.0000	634.4100 (30)
Bay Roof	1.0800		1.0800	0.0800	0.0864	9.0000	9.7200 (30)
Total net area of external elements Aum (A, m ²)			322.2330				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.7630		(33)
Main dwelling							
IW Stud			174.9540			9.0000	1574.5860 (32c)
IW Block			98.2560			75.0000	7369.1998 (32c)
Internal Floor			70.4900			18.0000	1268.8200 (32d)
Internal Ceiling			70.4900			9.0000	634.4100 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 18226.8924 (34)
128.3132 (35)

6. Solar gains						
[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	5.6200	11.2829	0.6400	0.7000	0.7700	19.6866 (75)
Southeast	1.0600	36.7938	0.6400	0.7000	0.7700	12.1086 (77)
Southwest	10.3300	36.7938	0.6400	0.7000	0.7700	118.0012 (79)
Northwest	1.0600	11.2829	0.6400	0.7000	0.7700	3.7131 (81)

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Solar gains	153.5095	269.2559	389.0526	516.6591	610.2863	619.7663	591.7391	519.7650	432.9092	303.1515	185.2844	130.4562 (83)
Total gains	860.2449	994.9572	1082.8904	1187.3720	1246.2980	1233.5603	1181.5085	1110.0405	1041.4649	931.4980	852.3170	821.9652 (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	32.9332	33.0000	33.0657	33.3777	33.4367	33.7143	33.7143	33.7662	33.6068	33.4367	33.3175	33.1938	
alpha	3.1955	3.2000	3.2044	3.2252	3.2291	3.2476	3.2476	3.2511	3.2405	3.2291	3.2212	3.2129	
util living area	0.9796	0.9667	0.9460	0.8970	0.8079	0.6621	0.5185	0.5636	0.7635	0.9159	0.9672	0.9823 (86)	
Living	18.8411	19.1108	19.5012	20.0315	20.4951	20.8178	20.9392	20.9191	20.6921	20.0923	19.3818	18.7974	
Non living	17.4832	17.8258	18.3198	18.9836	19.5381	19.8945	20.0031	19.9904	19.7714	19.0703	18.1784	17.4319	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8956	19.1108	19.5012	20.0315	20.4951	20.8178	20.9392	20.9191	20.6921	20.0923	19.3818	19.1055 (87)	
Th 2	20.0153	20.0171	20.0189	20.0272	20.0287	20.0359	20.0359	20.0373	20.0332	20.0287	20.0256	20.0223 (88)	
util rest of house	0.9759	0.9608	0.9360	0.8767	0.7680	0.5909	0.4195	0.4653	0.7028	0.8953	0.9604	0.9791 (89)	
MIT 2	19.0059	17.8258	18.3198	18.9836	19.5381	19.8945	20.0031	19.9904	19.7714	19.0703	18.1784	17.8987 (90)	
Living area fraction									FLA = Living area / (4) =				0.1250 (91)
MIT	19.1170	17.9864	18.4674	19.1146	19.6577	20.0099	20.1200	20.1065	19.8865	19.1980	18.3288	18.0495 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1170	17.9864	18.4674	19.1146	19.6577	20.0099	20.1200	20.1065	19.8865	19.1980	18.3288	18.0495 (93)	

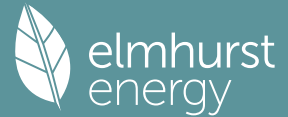
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9718	0.9437	0.9149	0.8533	0.7505	0.5888	0.4287	0.4728	0.6923	0.8726	0.9435	0.9700 (94)
Useful gains	836.0024	938.9449	990.6965	1013.1988	935.3597	726.3790	506.4539	524.8551	721.0470	812.7813	804.1494	797.3071 (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	2277.9114	2007.7769	1832.4561	1549.4379	1204.9651	812.4293	528.6191	555.7621	871.7610	1301.9142	1706.3602	2112.4499 (97)
Space heating kWh	1072.7803	718.2551	626.2691	386.0921	200.5864	0.0000	0.0000	0.0000	0.0000	363.9149	649.5918	978.4662 (98a)
Space heating requirement - total per year (kWh/year)												4995.9560
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	1072.7803	718.2551	626.2691	386.0921	200.5864	0.0000	0.0000	0.0000	0.0000	363.9149	649.5918	978.4662 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4995.9560
Space heating per m2										(98c) / (4) =		35.1704 (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 %)												288.6678 (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	1072.7803	718.2551	626.2691	386.0921	200.5864	0.0000	0.0000	0.0000	0.0000	363.9149	649.5918	978.4662 (98)
Space heating efficiency (main heating system 1)	288.6678	288.6678	288.6678	288.6678	288.6678	0.0000	0.0000	0.0000	0.0000	288.6678	288.6678	288.6678 (210)
Space heating fuel (main heating system)	371.6314	248.8172	216.9515	133.7496	69.4869	0.0000	0.0000	0.0000	0.0000	126.0670	225.0309	338.9592 (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	283.2088	250.2894	265.3510	231.8589	223.8067	200.6243	197.1809	205.5516	208.4183	233.6685	250.0314	279.9149 (64)
Efficiency of water heater (217)m	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023	187.9023 (216)
Fuel for water heating, kWh/month	150.7213	133.2019	141.2175	123.3933	119.1080	106.7705	104.9380	109.3928	110.9184	124.3564	133.0645	148.9683 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	47.3819	38.0116	34.2252	25.0748	19.3685	15.8243	17.6686	22.9663	29.8310	39.1399	44.2084	48.6988 (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												1730.6938 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												187.9023

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Water heating fuel used	1506.0508 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	382.3994 (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	3619.1440 (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	1730.6938	0.1550	268.2539 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1506.0508	0.1410	212.3853 (264)
Space and water heating			480.6392 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	382.3994	0.1443	55.1920 (268)
Total CO2, kg/year			535.8312 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.7700 (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	1730.6938	1.5738	2723.7568 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1506.0508	1.5215	2291.3838 (278)
Space and water heating			5015.1405 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	382.3994	1.5338	586.5369 (282)
Total Primary energy kWh/year			5601.6775 (286)
Dwelling Primary energy Rate (DPER)			39.4300 (287)

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

1. Overall dwelling characteristics

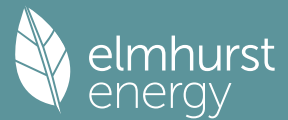
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	71.5600 (1b)	x 2.4000 (2b)	= 171.7440 (1b) - (3b)
First floor	70.4900 (1c)	x 2.6500 (2c)	= 186.7985 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.0500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	358.5425 (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) = 0.1116 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3616 (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) = 0.3073 (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	0.3918	0.3842	0.3765	0.3381	0.3304	0.2920	0.2920	0.2843	0.3073	0.3304	0.3457	0.3611 (22b)
Effective ac	0.5768	0.5738	0.5709	0.5571	0.5546	0.5426	0.5426	0.5404	0.5472	0.5546	0.5598	0.5652 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			1.9100	1.0000	1.9100			(26)
TER Semi-glazed door			7.0400	1.0000	7.0400			(26a)
TER Opening Type			18.0700	1.1450	20.6908			(27)
Ground Floor			71.5600	0.1300	9.3028			(28a)
External Walls	179.1030	27.0200	152.0830	0.1800	27.3749			(29a)
Plane Ceiling	70.4900		70.4900	0.1100	7.7539			(30)
Bay Roof	1.0800		1.0800	0.1100	0.1188			(30)
Total net area of external elements Aum(A, m2)			322.2330					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.1913			(33)

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

128.3132 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.0240	0.0500	0.9512
E3 Sill	17.1040	0.0500	0.8552
E4 Jamb	44.6000	0.0500	2.2300
E5 Ground floor (normal)	36.1900	0.1600	5.7904
E6 Intermediate floor within a dwelling	69.6200	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	12.8500	0.0600	0.7710
E12 Gable (insulation at ceiling level)	21.9600	0.0600	1.3176
E16 Corner (normal)	35.1000	0.0900	3.1590
E17 Corner (inverted - internal area greater than external area)	14.9000	-0.0900	-1.3410

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

13.7334 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 87.9247 (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	68.2430	67.8902	67.5445	65.9206	65.6168	64.2024	64.2024	63.9405	64.7472	65.6168	66.2314	66.8740	(38)
Heat transfer coeff	156.1676	155.8149	155.4692	153.8453	153.5414	152.1271	152.1271	151.8651	152.6718	153.5414	154.1561	154.7987	(39)
Average = Sum(39)m / 12 =													153.8438

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0994	1.0969	1.0945	1.0830	1.0809	1.0709	1.0709	1.0691	1.0748	1.0809	1.0852	1.0897	(40)
HLP (average)												1.0830	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

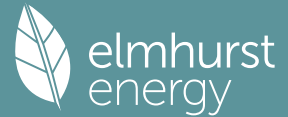
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9209 (42)
Hot water usage for mixer showers	73.1935	72.0936	70.4907	67.4240	65.1608	62.6369	61.2023	62.7930	64.5367	67.2466	70.3793	72.9131	(42a)
Hot water usage for baths	31.5988	31.1295	30.4687	29.2502	28.3378	27.3261	26.7796	27.4359	28.1504	29.2329	30.4765	31.4920	(42b)
Hot water usage for other uses	44.5428	42.9231	41.3033	39.6836	38.0639	36.4441	36.4441	38.0639	39.6836	41.3033	42.9231	44.5428	(42c)
Average daily hot water use (litres/day)													137.2726 (43)
Daily hot water use	149.3352	146.1462	142.2628	136.3578	131.5624	126.4071	124.4260	128.2927	132.3707	137.7829	143.7789	148.9479	(44)
Energy conte	236.5104	208.1102	218.6526	186.6669	177.1083	155.4323	150.4825	158.8532	163.2263	186.9701	204.8394	233.2165	(45)
Energy content (annual)										Total = Sum(45)m =		2280.0686	
Distribution loss (46)m = 0.15 x (45)m	35.4766	31.2165	32.7979	28.0000	26.5662	23.3148	22.5724	23.8280	24.4839	28.0455	30.7259	34.9825	(46)
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(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	291.4172	257.7035	273.5593	239.8026	232.0151	208.5679	205.3893	213.7600	216.3619	241.8769	257.9750	288.1232	(62)
WVHRS	-33.4610	-29.5932	-30.9883	-25.6595	-23.9138	-20.4632	-19.1810	-20.3970	-21.1720	-24.9594	-28.2760	-32.8414	(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	257.9562	228.1103	242.5710	214.1430	208.1013	188.1047	186.2083	193.3629	195.1899	216.9174	229.6989	255.2819	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2615.6459	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	122.5652	108.8712	116.6274	104.5752	102.8139	94.1897	93.9609	96.7441	96.7812	106.0930	110.6176	121.4699	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	146.0444	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	172.2792	190.7377	172.2792	178.0218	172.2792	178.0218	172.2792	172.2792	178.0218	172.2792	178.0218	172.2792	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	311.7310	314.9658	306.8142	289.4605	267.5545	246.9660	233.2116	229.9768	238.1284	255.4821	277.3881	297.9766	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	37.6044	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	-116.8355	(71)
Water heating gains (Table 5)	164.7381	162.0108	156.7573	145.2434	138.1908	130.8190	126.2915	130.0324	134.4184	142.5981	153.6355	163.2660	(72)

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Total internal gains
718.5616 737.5276 705.6640 682.5391 647.8378 622.6202 598.5956 599.1018 617.3819 640.1728 678.8588 703.3351 (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					5.6200	11.2829	0.6300	0.7000			0.7700	19.3790 (75)
Southeast					1.0600	36.7938	0.6300	0.7000			0.7700	11.9194 (77)
Southwest					10.3300	36.7938	0.6300	0.7000			0.7700	116.1575 (79)
Northwest					1.0600	11.2829	0.6300	0.7000			0.7700	3.6551 (81)

Solar gains	151.1109	265.0487	382.9736	508.5863	600.7506	610.0824	582.4932	511.6437	426.1450	298.4148	182.3893	128.4179 (83)
Total gains	869.6725	1002.5763	1088.6377	1191.1254	1248.5885	1232.7026	1181.0888	1110.7454	1043.5269	938.5875	861.2481	831.7530 (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	32.4205	32.4938	32.5661	32.9099	32.9750	33.2816	33.2816	33.3390	33.1628	32.9750	32.8435	32.7072
alpha	3.1614	3.1663	3.1711	3.1940	3.1983	3.2188	3.2188	3.2226	3.2109	3.1983	3.1896	3.1805
util living area	0.9791	0.9664	0.9460	0.8978	0.8102	0.6666	0.5233	0.5680	0.7661	0.9156	0.9666	0.9817 (86)
MIT	18.8126	19.0811	19.4729	20.0086	20.4786	20.8092	20.9356	20.9149	20.6814	20.0765	19.3613	18.7718 (87)
Th 2	20.0013	20.0034	20.0054	20.0147	20.0165	20.0246	20.0246	20.0262	20.0215	20.0165	20.0129	20.0092 (88)
util rest of house	0.9753	0.9604	0.9359	0.8775	0.7703	0.5949	0.4228	0.4683	0.7052	0.8947	0.9596	0.9784 (89)
MIT 2	17.4385	17.7797	18.2757	18.9473	19.5100	19.8766	19.9899	19.9769	19.7509	19.0427	18.1447	17.3915 (90)
Living area fraction	17.6102	17.9423	18.4253	19.0799	19.6311	19.9931	20.1080	20.0941	19.8671	19.1718	18.2967	0.1250 (91)
MIT	17.6102	17.9423	18.4253	19.0799	19.6311	19.9931	20.1080	20.0941	19.8671	19.1718	18.2967	17.5640 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6102	17.9423	18.4253	19.0799	19.6311	19.9931	20.1080	20.0941	19.8671	19.1718	18.2967	17.5640 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9620	0.9429	0.9144	0.8537	0.7522	0.5924	0.4319	0.4758	0.6942	0.8717	0.9423	0.9663 (94)
Useful gains	836.6061	945.3269	995.4646	1016.8393	939.1861	730.2471	510.1624	528.4620	724.4548	818.1380	811.5604	803.7085 (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	2078.6172	2032.1921	1854.0114	1566.1257	1217.7494	820.4392	533.6667	561.0102	880.4797	1316.1324	1726.0404	2068.7223 (97)
Space heating kWh	924.0563	730.3734	638.7588	395.4862	207.2511	0.0000	0.0000	0.0000	0.0000	370.5078	658.4256	941.1702 (98a)
Space heating requirement - total per year (kWh/year)												4866.0295
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	924.0563	730.3734	638.7588	395.4862	207.2511	0.0000	0.0000	0.0000	0.0000	370.5078	658.4256	941.1702 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4866.0295
Space heating per m2										(98c) / (4) =		34.2558 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	924.0563	730.3734	638.7588	395.4862	207.2511	0.0000	0.0000	0.0000	0.0000	370.5078	658.4256	941.1702 (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)	1001.1444	791.3038	692.0464	428.4791	224.5407	0.0000	0.0000	0.0000	0.0000	401.4169	713.3539	1019.6860 (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	257.9562	228.1103	242.5710	214.1430	208.1013	188.1047	186.2083	193.3629	195.1899	216.9174	229.6989	255.2819 (64)
Efficiency of water heater	86.6669	86.4788	86.1265	85.4161	84.0506	79.8000	79.8000	79.8000	79.8000	85.2496	86.2832	86.7133 (217)
Fuel for water heating, kWh/month	297.6411	263.7759	281.6450	250.7057	247.5905	235.7201	233.3438	242.3094	244.5989	254.4497	266.2152	294.3974 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	35.7962	28.7171	25.8565	18.9436	14.6326	11.9549	13.3483	17.3507	22.5368	29.5695	33.3987	36.7911 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-62.7390	-86.3567	-121.1658	-132.7924	-140.2480	-129.7432	-128.0283	-122.2400	-111.6800	-97.0210	-68.1833	-54.4811 (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)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-42.0389	-87.6089	-172.6875	-257.3548	-338.4415	-339.4995	-335.6009	-285.0639	-210.0956	-124.7203	-55.9272	-33.3145	(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												5271.9713	(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												3112.3927	(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)												288.8960	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3537.0322	(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												5222.2278	(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	5271.9713	0.2100	1107.1140 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3112.3927	0.2100	653.6025 (264)
Space and water heating			1760.7164 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	288.8960	0.1443	41.6966 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1254.6786	0.1351	-169.5510
PV Unit electricity exported	-2282.3536	0.1261	-287.8496
Total			-457.4007 (269)
Total CO2, kg/year			1356.9417 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5500 (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	5271.9713	1.1300	5957.3275 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3112.3927	1.1300	3517.0038 (278)
Space and water heating			9474.3313 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	288.8960	1.5338	443.1183 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1254.6786	1.4995	-1881.3491
PV Unit electricity exported	-2282.3536	0.4630	-1056.6277
Total			-2937.9767 (283)
Total Primary energy kWh/year			7109.5736 (286)
Target Primary Energy Rate (TPER)			50.0500 (287)

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Plot Reference	Axminster			Issued on Date	26/01/2026
Assessment Reference	Axminster	Plot Type Ref	Axminster		
Plot Address	Axminster, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	86 B	DER	3.52	TER	11.89
Environmental	97 A	% DER < TER			70.40
CO ₂ Emissions (t/year)	0.25	DFEE	36.06	TFEE	37.68
Compliance Check	See BREL	% DFEE < TFEE			4.29
% DPER < TPER	40.71	DPER	36.89	TPER	62.22
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	39.2700 (1b)	x 2.3900 (2b)	= 93.8553 (1b) - (3b)
First floor	39.2700 (1c)	x 2.6500 (2c)	= 104.0655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 197.9208 (5)

2. Ventilation rate

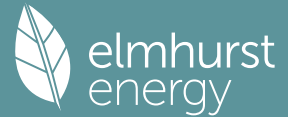
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.2021 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.4021 (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) = 0.3418 (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	0.4358	0.4272	0.4187	0.3760	0.3674	0.3247	0.3247	0.3162	0.3418	0.3674	0.3845	0.4016 (22b)
Effective ac	0.5950	0.5913	0.5876	0.5707	0.5675	0.5527	0.5527	0.5500	0.5584	0.5675	0.5739	0.5806 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Patio Doors			5.0400	1.0536	5.3103		(27)
Windows			5.8500	1.0536	6.1638		(27)
Front Door			2.2300	1.2000	2.6760		(26)
Ground Floor			39.3600	0.1200	4.7232	75.0000	2952.0000 (28a)
External Wall Render	90.9800	13.1200	77.8600	0.1800	14.0148	9.0000	700.7400 (29a)
Plane Ceiling	39.3600		39.3600	0.0800	3.1488	9.0000	354.2400 (30)
Total net area of external elements Aum(A, m ²)			169.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.0369		(33)
Main dwelling							
Party Wall			40.3900	0.0000	0.0000	20.0000	807.8000 (32)
IW Block			160.8400			75.0000	12062.9997 (32c)
Internal Floor			39.3600			18.0000	708.4800 (32d)
Internal Ceiling			39.3600			9.0000	354.2400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17940.4997 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							228.4250 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				8.5400	0.0500	0.4270	

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E3 Sill	5.0800	0.0330	0.1676
E4 Jamb	19.9000	0.0330	0.6567
E5 Ground floor (normal)	17.8300	0.0900	1.6047
E6 Intermediate floor within a dwelling	17.8300	0.0670	1.1946
E10 Baves (insulation at ceiling level)	7.7200	0.0350	0.2702
E18 Party wall between dwellings	10.2000	0.0840	0.8568
E16 Corner (normal)	10.2000	0.0460	0.4692
E12 Gable (insulation at ceiling level)	10.1200	0.1080	1.0930
P1 Party wall - Ground floor	7.9200	0.1600	1.2672
P4 Party wall - Roof (insulation at ceiling level)	7.9200	0.2400	1.9008
P2 Party wall - Intermediate floor within a dwelling	7.9200	0.0000	0.0000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.9078 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	45.9447 (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	38.8585	38.6177	38.3817	37.2730	37.0655	36.0999	36.0999	35.9211	36.4718	37.0655	37.4852	37.9239	(38)
Heat transfer coeff	84.8033	84.5625	84.3264	83.2177	83.0103	82.0446	82.0446	81.8658	82.4166	83.0103	83.4299	83.8686	(39)
Average = Sum(39)m / 12 =												83.2167	
HLP	1.0797	1.0767	1.0737	1.0596	1.0569	1.0446	1.0446	1.0423	1.0494	1.0569	1.0623	1.0678	(40)
HLP (average)												1.0595	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4346 (42)
Hot water usage for mixer showers	65.0395	64.0621	62.6378	59.9127	57.9016	55.6589	54.3841	55.7976	57.3471	59.7551	62.5388	64.7903	(42a)
Hot water usage for baths	28.0923	27.6751	27.0876	26.0043	25.1932	24.2937	23.8079	24.3913	25.0266	25.9890	27.0946	27.9974	(42b)
Hot water usage for other uses	39.5625	38.1238	36.6852	35.2466	33.8079	32.3693	32.3693	33.8079	35.2466	36.6852	38.1238	39.5625	(42c)
Average daily hot water use (litres/day)												121.9762	(43)
Daily hot water use	132.6943	129.8611	126.4106	121.1636	116.9027	112.3219	110.5614	113.9969	117.6202	122.4293	127.7572	132.3502	(44)
Energy conte	210.1554	184.9204	194.2884	165.8669	157.3736	138.1129	133.7144	141.1520	145.0375	166.1354	182.0135	207.2284	(45)
Energy content (annual)										Total = Sum(45)m =		2025.9989	
Distribution loss (46)m = 0.15 x (45)m	31.5233	27.7381	29.1433	24.8800	23.6060	20.7169	20.0572	21.1728	21.7556	24.9203	27.3020	31.0843	(46)
Water storage loss (or HIU loss):													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7128	(55)
Total storage loss	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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	255.5146	225.8900	239.6476	209.7629	202.7328	182.0089	179.0736	186.5112	188.9335	211.4946	225.9095	252.5876	(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	255.5146	225.8900	239.6476	209.7629	202.7328	182.0089	179.0736	186.5112	188.9335	211.4946	225.9095	252.5876	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2560.0669	(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	106.1640	94.2617	100.8883	90.2675	88.6141	81.0394	80.7474	83.2204	83.3418	91.5274	95.6363	105.1908	(65)

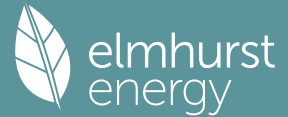
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.3227	129.8930	117.3227	121.2335	117.3227	121.2335	117.3227	117.3227	121.2335	117.3227	121.2335	117.3227	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.3621	218.6073	212.9495	200.9049	185.7007	171.4109	161.8644	159.6192	165.2770	177.3216	192.5258	206.8156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	(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)	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	(71)
Water heating gains (Table 5)	142.6936	140.2704	135.6025	125.3716	119.1049	112.5547	108.5314	111.8554	115.7525	123.0207	132.8282	141.3855	(72)
Total internal gains	535.8970	548.2893	525.3934	507.0286	481.6470	464.7176	447.2372	448.3160	461.7815	477.1836	506.1061	525.0425	(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
North	5.0400	10.6334	0.6400	0.7000	0.7700	16.6385 (74)
North	3.7300	10.6334	0.6400	0.7000		12.3138 (74)
South	2.1200	46.7521	0.6400	0.7000	0.7700	30.7714 (78)

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Solar gains	59.7237	105.7250	158.2131	223.5715	279.0399	290.5425	274.4188	230.3540	180.0995	120.2188	72.1910	50.7254 (83)
Total gains	595.6208	654.0143	683.6065	730.6000	760.6869	755.2601	721.6560	678.6699	641.8810	597.4024	578.2971	575.7679 (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	58.7651	58.9324	59.0974	59.8848	60.0344	60.7410	60.7410	60.8737	60.4669	60.0344	59.7324	59.4200
alpha	4.9177	4.9288	4.9398	4.9923	5.0023	5.0494	5.0494	5.0582	5.0311	5.0023	4.9822	4.9613
util living area	0.9918	0.9858	0.9742	0.9352	0.8395	0.6572	0.4925	0.5420	0.7799	0.9452	0.9841	0.9930 (86)
Living	19.7740	19.9349	20.1721	20.5173	20.8010	20.9571	20.9917	20.9869	20.8983	20.5544	20.1198	19.7536
Non living	18.6003	18.8061	19.1072	19.5401	19.8642	20.0205	20.0434	20.0431	19.9715	19.5931	19.0509	18.5814
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.3728	19.9349	20.1721	20.5173	20.8010	20.9571	20.9917	20.9869	20.8983	20.5544	20.1198	19.9279 (87)
Th 2	20.0174	20.0199	20.0224	20.0340	20.0362	20.0463	20.0463	20.0482	20.0424	20.0362	20.0318	20.0272 (88)
util rest of house	0.9894	0.9817	0.9664	0.9149	0.7916	0.5738	0.3897	0.4362	0.7053	0.9238	0.9787	0.9910 (89)
MIT 2	19.4524	18.8061	19.1072	19.5401	19.8642	20.0205	20.0434	20.0431	19.9715	19.5931	19.0509	18.8419 (90)
Living area fraction												FLA = Living area / (4) = 0.2228 (91)
MIT	19.6575	19.0576	19.3445	19.7579	20.0730	20.2292	20.2547	20.2534	20.1780	19.8073	19.2891	19.0839 (92)
Temperature adjustment												0.0000
adjusted MIT	19.6575	19.0576	19.3445	19.7579	20.0730	20.2292	20.2547	20.2534	20.1780	19.8073	19.2891	19.0839 (93)

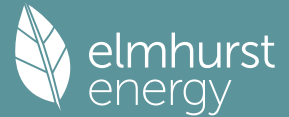
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9883	0.9763	0.9594	0.9080	0.7937	0.5906	0.4126	0.4596	0.7170	0.9175	0.9732	0.9883 (94)
Useful gains	588.6559	638.5127	655.8410	663.3639	603.7332	446.0652	297.7595	311.9237	460.2000	548.1358	562.7831	569.0285 (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	1302.3679	1197.2029	1083.1278	903.5678	695.0417	461.8439	299.8480	315.4614	500.9261	764.3029	1016.9332	1248.2919 (97)
Space heating kWh	531.0018	375.4398	317.9014	172.9468	67.9335	0.0000	0.0000	0.0000	0.0000	160.8284	326.9880	505.3720 (98a)
Space heating requirement - total per year (kWh/year)												2458.4117
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	531.0018	375.4398	317.9014	172.9468	67.9335	0.0000	0.0000	0.0000	0.0000	160.8284	326.9880	505.3720 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2458.4117
Space heating per m2										(98c) / (4) =		31.3014 (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 %)												308.5377 (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	531.0018	375.4398	317.9014	172.9468	67.9335	0.0000	0.0000	0.0000	0.0000	160.8284	326.9880	505.3720 (98)
Space heating efficiency (main heating system 1)	308.5377	308.5377	308.5377	308.5377	308.5377	0.0000	0.0000	0.0000	0.0000	308.5377	308.5377	308.5377 (210)
Space heating fuel (main heating system)	172.1027	121.6836	103.0349	56.0537	22.0179	0.0000	0.0000	0.0000	0.0000	52.1260	105.9799	163.7959 (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	255.5146	225.8900	239.6476	209.7629	202.7328	182.0089	179.0736	186.5112	188.9335	211.4946	225.9095	252.5876 (64)
Efficiency of water heater (217)m	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446	306.8446 (216)
Fuel for water heating, kWh/month	83.2717	73.6171	78.1007	68.3613	66.0702	59.3163	58.3597	60.7836	61.5730	68.9256	73.6234	82.3178 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	30.0721	24.1249	21.7218	15.9143	12.2927	10.0432	11.2138	14.5761	18.9330	24.8411	28.0579	30.9079 (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												796.7947 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												306.8446

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Water heating fuel used	834.3203 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	242.6988 (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	1873.8139 (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	796.7947	0.1556	123.9993 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	834.3203	0.1410	117.6227 (264)
Space and water heating			241.6221 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	242.6988	0.1443	35.0289 (268)
Total CO2, kg/year			276.6510 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5200 (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	796.7947	1.5761	1255.8550 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	834.3203	1.5213	1269.2498 (278)
Space and water heating			2525.1048 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	242.6988	1.5338	372.2596 (282)
Total Primary energy kWh/year			2897.3644 (286)
Dwelling Primary energy Rate (DPER)			36.8900 (287)

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

1. Overall dwelling characteristics

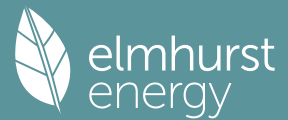
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	39.2700 (1b)	x 2.3900 (2b)	= 93.8553 (1b) - (3b)
First floor	39.2700 (1c)	x 2.6500 (2c)	= 104.0655 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	197.9208 (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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1516 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4016 (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) = 0.3413 (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	0.4352	0.4267	0.4181	0.3755	0.3669	0.3243	0.3243	0.3157	0.3413	0.3669	0.3840	0.4011 (22b)
Effective ac	0.5947	0.5910	0.5874	0.5705	0.5673	0.5526	0.5526	0.5498	0.5583	0.5673	0.5737	0.5804 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.2300	1.0000	2.2300			(26)
TER Opening Type			10.8900	1.1450	12.4695			(27)
Ground Floor			39.3600	0.1300	5.1168			(28a)
External Wall Render	90.9800	13.1200	77.8600	0.1800	14.0148			(29a)
Plane Ceiling	39.3600		39.3600	0.1100	4.3296			(30)
Total net area of external elements Aum(A, m2)			169.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.1607			(33)
Main dwelling								
Party Wall			40.3900	0.0000	0.0000			(32)

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

228.4250 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	8.5400	0.0500	0.4270	
E2 Other lintels (including other steel lintels)	5.0800	0.0500	0.2540	
E3 Sill	19.9000	0.0500	0.9950	
E4 Jamb	17.8300	0.1600	2.8528	
E5 Ground floor (normal)	17.8300	0.0000	0.0000	
E6 Intermediate floor within a dwelling	7.7200	0.0600	0.4632	
E10 Baves (insulation at ceiling level)	10.2000	0.0600	0.6120	
E18 Party wall between dwellings	10.2000	0.0900	0.9180	
E16 Corner (normal)	10.1200	0.0600	0.6072	
E12 Gable (insulation at ceiling level)	7.9200	0.0800	0.6336	
P1 Party wall - Ground floor	7.9200	0.1200	0.9504	
P4 Party wall - Roof (insulation at ceiling level)	7.9200	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.7132 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	46.8739 (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	38.8423	38.6022	38.3667	37.2609	37.0540	36.0909	36.0909	35.9125	36.4619	37.0540	37.4726	37.9101	(38)
Heat transfer coeff	85.7162	85.4760	85.2406	84.1348	83.9279	82.9648	82.9648	82.7864	83.3357	83.9279	84.3464	84.7840	(39)
Average = Sum(39)m / 12 =												84.1338	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0914	1.0883	1.0853	1.0712	1.0686	1.0563	1.0563	1.0541	1.0611	1.0686	1.0739	1.0795	(40)
HLP (average)												1.0712	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

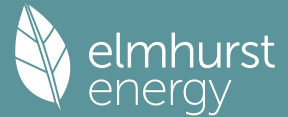
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4346 (42)
Hot water usage for mixer showers													
65.0395	64.0621	62.6378	59.9127	57.9016	55.6589	54.3841	55.7976	57.3471	59.7551	62.5388	64.7903	64.7903	(42a)
Hot water usage for baths													
28.0923	27.6751	27.0876	26.0043	25.1932	24.2937	23.8079	24.3913	25.0266	25.9890	27.0946	27.9974	27.9974	(42b)
Hot water usage for other uses													
39.5625	38.1238	36.6852	35.2466	33.8079	32.3693	32.3693	33.8079	35.2466	36.6852	38.1238	39.5625	39.5625	(42c)
Average daily hot water use (litres/day)												121.9762	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.6943	129.8611	126.4106	121.1636	116.9027	112.3219	110.5614	113.9969	117.6202	122.4293	127.7572	132.3502	(44)
Energy conte	210.1554	184.9204	194.2884	165.8669	157.3736	138.1129	133.7144	141.1520	145.0375	166.1354	182.0135	207.2284	(45)
Energy content (annual)										Total = Sum(45)m =		2025.9989	
Distribution loss (46)m = 0.15 x (45)m	31.5233	27.7381	29.1433	24.8800	23.6060	20.7169	20.0572	21.1728	21.7556	24.9203	27.3020	31.0843	(46)
Water storage loss (or HIU loss):													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	261.9020	231.6593	246.0350	215.9443	209.1202	188.1903	185.4610	192.8986	195.1149	217.8820	232.0909	258.9750	(62)
WWHRS	-29.7334	-26.2964	-27.5361	-22.8010	-21.2497	-18.1835	-17.0441	-18.1247	-18.8134	-22.1789	-25.1260	-29.1827	(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	232.1686	205.3629	218.4989	193.1433	187.8705	170.0068	168.4168	174.7738	176.3015	195.7031	206.9649	229.7923	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2359.0034	(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)
												0.0000	(64a)
Heat gains from water heating, kWh/month	111.2739	98.8771	105.9982	95.2126	93.7240	85.9844	85.8573	88.3303	88.2869	96.6373	100.5814	110.3007	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	121.7287	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.3227	129.8930	117.3227	121.2335	117.3227	121.2335	117.3227	117.3227	121.2335	117.3227	121.2335	117.3227	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.3621	218.6073	212.9495	200.9049	185.7007	171.4109	161.8644	159.6192	165.2770	177.3216	192.5258	206.8156	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	35.1729	(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)													

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	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830	-97.3830 (71)
Water heating gains (Table 5)	149.5618	147.1386	142.4707	132.2398	125.9731	119.4228	115.3996	118.7235	122.6206	129.8888	139.6964	148.2536 (72)
Total internal gains	545.7652	558.1575	535.2615	516.8967	491.5151	471.5858	454.1053	455.1841	468.6497	487.0518	515.9743	534.9106 (73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		or Table 6b		or Table 6c		factor		W	
			W/m2						Table 6d			
North	8.7700		10.6334		0.6300		0.7000		0.7700		28.4999 (74)	
South	2.1200		46.7521		0.6300		0.7000		0.7700		30.2906 (78)	
Solar gains	58.7905	104.0730	155.7411	220.0781	274.6799	286.0028	270.1310	226.7547	177.2855	118.3403	71.0630	49.9328 (83)
Total gains	604.5557	662.2305	691.0026	736.9749	766.1951	757.5886	724.2363	681.9388	645.9352	605.3922	587.0373	584.8434 (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	58.1392	58.3026	58.4636	59.2320	59.3780	60.0673	60.0673	60.1967	59.7999	59.3780	59.0834	58.7785
alpha	4.8759	4.8868	4.8976	4.9488	4.9585	5.0045	5.0045	5.0131	4.9867	4.9585	4.9389	4.9186
util living area	0.9913	0.9853	0.9736	0.9346	0.8398	0.6607	0.4958	0.5447	0.7811	0.9437	0.9833	0.9926 (86)
MIT	19.7669	19.9270	20.1644	20.5102	20.7959	20.9546	20.9911	20.9861	20.8949	20.5512	20.1150	19.7466 (87)
Th 2	20.0079	20.0104	20.0128	20.0244	20.0266	20.0366	20.0366	20.0385	20.0328	20.0266	20.0222	20.0176 (88)
util rest of house	0.9888	0.9810	0.9655	0.9141	0.7917	0.5766	0.3914	0.4376	0.7061	0.9218	0.9777	0.9904 (89)
MIT 2	18.5844	18.7891	19.0902	19.5238	19.8504	20.0094	20.0335	20.0331	19.9595	19.5814	19.0377	18.5656 (90)
Living area fraction	18.8479	19.0426	19.3296	19.7436	20.0611	20.2200	20.2469	20.2455	20.1679	19.7975	19.2777	18.8288 (92)
Temperature adjustment	18.8479	19.0426	19.3296	19.7436	20.0611	20.2200	20.2469	20.2455	20.1679	19.7975	19.2777	18.8288 (93)
adjusted MIT	18.8479	19.0426	19.3296	19.7436	20.0611	20.2200	20.2469	20.2455	20.1679	19.7975	19.2777	18.8288 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9847	0.9754	0.9584	0.9071	0.7936	0.5934	0.4147	0.4613	0.7176	0.9155	0.9720	0.9867 (94)
Useful gains	595.2984	645.9441	662.2286	668.4744	608.0619	449.5560	300.3180	314.5865	463.5540	554.2228	570.5726	577.0928 (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	1246.9904	1208.8559	1093.6003	912.3200	701.7281	466.2599	302.5628	318.3511	505.6739	771.9243	1027.1491	1240.2854 (97)
Space heating kWh	484.8589	378.2767	320.9405	175.5688	69.6876	0.0000	0.0000	0.0000	0.0000	161.9700	328.7351	493.4153 (98a)
Space heating requirement - total per year (kWh/year)												2413.4529
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	484.8589	378.2767	320.9405	175.5688	69.6876	0.0000	0.0000	0.0000	0.0000	161.9700	328.7351	493.4153 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2413.4529
Space heating per m2										(98c) / (4) =		30.7290 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	484.8589	378.2767	320.9405	175.5688	69.6876	0.0000	0.0000	0.0000	0.0000	161.9700	328.7351	493.4153 (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)	525.3076	409.8339	347.7145	190.2154	75.5012	0.0000	0.0000	0.0000	0.0000	175.4821	356.1593	534.5778 (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	232.1686	205.3629	218.4989	193.1433	187.8705	170.0068	168.4168	174.7738	176.3015	195.7031	206.9649	229.7923 (64)
Efficiency of water heater (217)m	85.6714	85.4106	84.9206	83.8465	82.0500	79.8000	79.8000	79.8000	79.8000	83.6387	85.0923	79.8000 (216)
Fuel for water heating, kWh/month	270.9989	240.4420	257.2978	230.3536	228.9706	213.0411	211.0486	219.0148	220.9292	233.9863	243.2240	268.0484 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	24.3773	19.5564	17.6084	12.9007	9.9648	8.1414	9.0903	11.8159	15.3476	20.1369	22.7446	25.0549 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-36.6722	-51.6587	-74.1897	-83.3375	-89.7945	-83.7874	-82.7577	-78.1713	-70.0509	-59.0464	-40.3049	-31.7107 (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)												

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(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.8268	-43.8084	-87.0682	-130.7637	-172.8961	-173.7191	-171.6683	-145.3449	-106.5300	-62.6386	-27.8032	-16.4689	(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												2614.7919	(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												2837.3553	(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)												196.7391	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1941.0182	(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												3793.8681	(238)

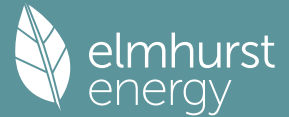
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2614.7919	0.2100	549.1063	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2837.3553	0.2100	595.8446	(264)
Space and water heating			1144.9509	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	196.7391	0.1443	28.3955	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-781.4819	0.1346	-105.1913	
PV Unit electricity exported	-1159.5363	0.1259	-145.9834	
Total			-251.1747	(269)
Total CO2, kg/year			934.1010	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.8900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2614.7919	1.1300	2954.7148	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2837.3553	1.1300	3206.2115	(278)
Space and water heating			6160.9263	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	196.7391	1.5338	301.7650	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-781.4819	1.4975	-1170.2520	
PV Unit electricity exported	-1159.5363	0.4621	-535.8595	
Total			-1706.1115	(283)
Total Primary energy kWh/year			4886.6806	(286)
Target Primary Energy Rate (TPER)			62.2200	(287)

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Plot Reference	Banbury			Issued on Date	26/01/2026
Assessment Reference	Banbury	Plot Type Ref	Banbury		
Plot Address	Banbury, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	86 B	DER	2.91	TER	9.50
Environmental	97 A	% DER < TER			69.37
CO ₂ Emissions (t/year)	0.37	DFEE	37.70	TFEE	40.28
Compliance Check	See BREL	% DFEE < TFEE			6.41
% DPER < TPER	38.93	DPER	30.32	TPER	49.64
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	69.5000 (1b)	x 2.4000 (2b)	= 166.8000 (1b) - (3b)
First floor	69.5000 (1c)	x 2.7000 (2c)	= 187.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 354.4500 (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	5 * 10 = 50.0000 (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) =	50.0000 / (5) = 0.1411 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3411 (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) = 0.2899 (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	0.3696	0.3624	0.3551	0.3189	0.3116	0.2754	0.2754	0.2682	0.2899	0.3116	0.3261	0.3406 (22b)
Effective ac	0.5683	0.5657	0.5631	0.5508	0.5486	0.5379	0.5379	0.5360	0.5420	0.5486	0.5532	0.5580 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.2300	1.2000	2.6760		(26)
Window			17.6700	1.0536	18.6178		(27)
Patio Doors			10.0800	1.0536	10.6207		(27)
Ground Floor			69.5000	0.1200	8.3400	75.0000	5212.5000 (28a)
External Wall Stone	190.9400	29.9800	160.9600	0.1800	28.9728	9.0000	1448.6400 (29a)
Plane Ceiling	69.5000		69.5000	0.0800	5.5600	9.0000	625.5000 (30)
Total net area of external elements Aum(A, m ²)			329.9400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.7873		(33)
Main dwelling							
IW Stud			289.6500			9.0000	2606.8499 (32c)
Internal Floor			69.5000			18.0000	1251.0000 (32d)
Internal Ceiling			69.5000			9.0000	625.5000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11769.9900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							84.6762 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				19.9100	0.0500	0.9955	
E3 Sill				14.0500	0.0330	0.4637	

elmhurst
energy

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	66.4746	66.1644	65.8602	64.4317	64.1645	62.9203	62.9203	62.6899	63.3995	64.1645	64.7051	65.2704 (38)
Heat transfer coeff	154.0795	153.7692	153.4651	152.0366	151.7693	150.5251	150.5251	150.2947	151.0044	151.7693	152.3100	152.8752 (39)
Average = Sum(39)m / 12 =												152.0353
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1085	1.1063	1.1041	1.0938	1.0919	1.0829	1.0829	1.0813	1.0864	1.0919	1.0958	1.0998 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

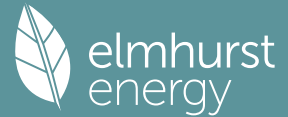
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5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.6128	173.3927	156.6128	161.8332	156.6128	161.8332	156.6128	156.6128	161.8332	156.6128	161.8332	156.6128	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.2722	311.4711	303.4100	286.2488	264.5859	244.2258	230.6240	227.4251	235.4862	252.6474	274.3103	294.6704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	(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)	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	(71)
Water heating gains (Table 5)	168.1931	165.4693	160.2227	148.7240	141.6806	134.3186	129.7969	133.5330	137.9132	146.0822	157.1051	166.7229	(72)
Total internal gains	699.8054	717.0605	686.9728	663.5333	629.6066	607.1049	583.7611	584.2982	601.9599	622.0697	659.9759	684.7334	(73)

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.5400	10.6334	0.6400	0.7000	0.7700	5.0840 (74)
East	2.0500	19.6403	0.6400	0.7000	0.7700	12.5001 (76)
South	5.5900	46.7521	0.6400	0.7000	0.7700	81.1379 (78)
West	8.4900	19.6403	0.6400	0.7000	0.7700	51.7686 (80)
North	5.0400	10.6334	0.6400	0.7000	0.7700	16.6385 (74)
East	5.0400	19.6403	0.6400	0.7000	0.7700	30.7319 (76)

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Solar gains	197.8609	360.2369	545.8636	750.9784	899.0240	915.2387	873.1362	761.0252	617.5875	413.2585	241.4280	166.3434 (83)
Total gains	897.6663	1077.2974	1232.8364	1414.5117	1528.6306	1522.3436	1456.8972	1345.3234	1219.5475	1035.3282	901.4040	851.0768 (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	21.2192	21.2620	21.3041	21.5043	21.5422	21.7202	21.7202	21.7535	21.6513	21.5422	21.4657	21.3863	
alpha	2.4146	2.4175	2.4203	2.4336	2.4361	2.4480	2.4480	2.4502	2.4434	2.4361	2.4310	2.4258	
util living area	0.9473	0.9198	0.8769	0.7949	0.6802	0.5373	0.4161	0.4595	0.6519	0.8390	0.9239	0.9531 (86)	
Living	18.1712	18.5597	19.1179	19.8188	20.3857	20.7588	20.9069	20.8787	20.5911	19.8271	18.8806	18.1049	
Non living	16.6778	17.1671	17.8663	18.7313	19.4022	19.8173	19.9580	19.9379	19.6516	18.7627	17.5844	16.5979	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.5529	18.5597	19.1179	19.8188	20.3857	20.7588	20.9069	20.8787	20.5911	19.8271	18.8806	18.5099 (87)	
Th 2	19.9939	19.9957	19.9975	20.0059	20.0075	20.0148	20.0148	20.0162	20.0120	20.0075	20.0043	20.0010 (88)	
util rest of house	0.9405	0.9097	0.8612	0.7685	0.6381	0.4744	0.3345	0.3767	0.5930	0.8121	0.9126	0.9469 (89)	
MIT 2	18.6719	17.1671	17.8663	18.7313	19.4022	19.8173	19.9580	19.9379	19.6516	18.7627	17.5844	17.2112 (90)	
Living area fraction									fLA = Living area / (4) =				0.1378 (91)
MIT	18.7933	17.3590	18.0387	18.8811	19.5377	19.9470	20.0887	20.0675	19.7811	18.9093	17.7629	17.3901 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.7933	17.3590	18.0387	18.8811	19.5377	19.9470	20.0887	20.0675	19.7811	18.9093	17.7629	17.3901 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9307	0.8735	0.8219	0.7332	0.6159	0.4698	0.3409	0.3812	0.5777	0.7751	0.8774	0.9248 (94)
Useful gains	835.4487	940.9971	1013.3064	1037.1550	941.5555	715.2059	496.6707	512.8924	704.4829	802.4789	790.8746	787.0524 (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	2233.1133	1915.8106	1770.7947	1517.4964	1189.5242	804.8577	525.1396	551.2042	857.8669	1261.0975	1624.0721	2016.4359 (97)
Space heating kWh	1039.8625	655.0747	563.5713	345.8457	184.4887	0.0000	0.0000	0.0000	0.0000	341.2123	599.9022	914.6613 (98a)
Space heating requirement - total per year (kWh/year)												4644.6187
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	1039.8625	655.0747	563.5713	345.8457	184.4887	0.0000	0.0000	0.0000	0.0000	341.2123	599.9022	914.6613 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4644.6187
Space heating per m2										(98c) / (4) =		33.4145 (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 %)												337.4414 (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	1039.8625	655.0747	563.5713	345.8457	184.4887	0.0000	0.0000	0.0000	0.0000	341.2123	599.9022	914.6613 (98)
Space heating efficiency (main heating system 1)	337.4414	337.4414	337.4414	337.4414	337.4414	0.0000	0.0000	0.0000	0.0000	337.4414	337.4414	337.4414 (210)
Space heating fuel (main heating system)	308.1609	194.1299	167.0131	102.4906	54.6728	0.0000	0.0000	0.0000	0.0000	101.1175	177.7797	271.0578 (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	294.4489	260.4490	276.6145	242.7918	235.1248	211.5982	208.5339	216.8936	219.3820	244.9736	260.9404	291.1592 (64)
Efficiency of water heater (217)m	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856	297.4856 (216)
Fuel for water heating, kWh/month	98.9792	87.5501	92.9842	81.6147	79.0374	71.1289	70.0988	72.9089	73.7454	82.3481	87.7153	97.8734 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	42.9937	34.4911	31.0554	22.7525	17.5747	14.3587	16.0322	20.8393	27.0682	35.5150	40.1141	44.1886 (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												1376.4224 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												297.4856
Water heating fuel used												995.9844 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	346.9836 (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	2719.3904 (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	1376.4224	0.1551	213.4961 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	995.9844	0.1409	140.3489 (264)
Space and water heating			353.8451 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	346.9836	0.1443	50.0805 (268)
Total CO2, kg/year			403.9255 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9100 (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	1376.4224	1.5742	2166.7466 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	995.9844	1.5211	1514.9446 (278)
Space and water heating			3681.6912 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	346.9836	1.5338	532.2151 (282)
Total Primary energy kWh/year			4213.9063 (286)
Dwelling Primary energy Rate (DPER)			30.3200 (287)

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

1. Overall dwelling characteristics

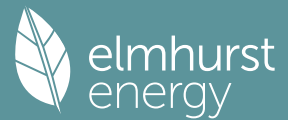
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	69.5000 (1b)	x 2.4000 (2b)	= 166.8000 (1b) - (3b)
First floor	69.5000 (1c)	x 2.7000 (2c)	= 187.6500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	139.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	354.4500 (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) = 0.1129 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3629 (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) = 0.3084 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infiltr rate	0.3932	0.3855	0.3778	0.3393	0.3316	0.2930	0.2930	0.2853	0.3084	0.3316	0.3470	0.3624 (22b)
Effective ac	0.5773	0.5743	0.5714	0.5576	0.5550	0.5429	0.5429	0.5407	0.5476	0.5550	0.5602	0.5657 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.2300	1.0000	2.2300			(26)
TER Opening Type			27.7500	1.1450	31.7748			(27)
Ground Floor			69.5000	0.1300	9.0350			(28a)
External Wall Stone	190.9400	29.9800	160.9600	0.1800	28.9728			(29a)
Plane Ceiling	69.5000		69.5000	0.1100	7.6450			(30)
Total net area of external elements Aum(A, m2)			329.9400					(31)
Fabric heat loss, W/K = Sum (A x U)					79.6576			(33)

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

84.6762 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	19.9100	0.0500	0.9955
E3 Sill	14.0500	0.0500	0.7025
E4 Jamb	45.4400	0.0500	2.2720
E5 Ground floor (normal)	37.4400	0.1600	5.9904
E6 Intermediate floor within a dwelling	37.4400	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	18.6500	0.0600	1.1190
E12 Gable (insulation at ceiling level)	18.4900	0.0600	1.1094
E16 Corner (normal)	25.5000	0.0900	2.2950
E17 Corner (inverted - internal area greater than external area)	5.1000	-0.0900	-0.4590

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

14.0248 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 93.6824 (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	67.5281	67.1769	66.8327	65.2159	64.9134	63.5051	63.5051	63.2444	64.0476	64.9134	65.5253	66.1651 (38)
Average = Sum(39)m / 12 =	161.2105	160.8593	160.5151	158.8983	158.5958	157.1875	157.1875	156.9268	157.7300	158.5958	159.2077	159.8475 (39)

Average = Sum(39)m / 12 =

158.8968

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1598	1.1573	1.1548	1.1432	1.1410	1.1308	1.1308	1.1290	1.1347	1.1410	1.1454	1.1500 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

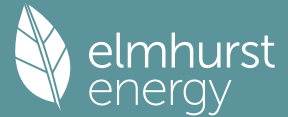
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9152 (42)
Hot water usage for mixer showers													
73.0974	71.9989	70.3982	67.3354	65.0752	62.5546	61.1219	62.7106	64.4520	67.1583	70.2869	72.8174	(42a)	
Hot water usage for baths													
31.5575	31.0888	30.4289	29.2119	28.3007	27.2904	26.7446	27.4000	28.1136	29.1947	30.4367	31.4508	(42b)	
Hot water usage for other uses													
44.4841	42.8665	41.2489	39.6313	38.0137	36.3961	36.3961	38.0137	39.6313	41.2489	42.8665	44.4841	(42c)	
Average daily hot water use (litres/day)													137.0923 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
149.1391	145.9543	142.0760	136.1787	131.3897	126.2411	124.2626	128.1243	132.1969	137.6020	143.5901	148.7523	(44)	
Energy content (annual)	236.1999	207.8370	218.3655	186.4218	176.8758	155.2282	150.2849	158.6446	163.0120	186.7246	204.5704	232.9102	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.4300	31.1755	32.7548	27.9633	26.5314	23.2842	22.5427	23.7967	24.4518	28.0087	30.6856	34.9365	(46)	
Water storage loss (or HIU loss):													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)	
If cylinder contains dedicated solar storage													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)	
Total heat required for water heating calculated for each month													
291.1067	257.4302	273.2722	239.5574	231.7825	208.3638	205.1917	213.5514	216.1476	241.6314	257.7060	287.8170	(62)	
WWHRS	-33.4171	-29.5544	-30.9476	-25.6259	-23.8824	-20.4363	-19.1558	-20.3703	-21.1442	-24.9267	-28.2389	-32.7983	(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													
257.6896	227.8759	242.3246	213.9316	207.9002	187.9275	186.0359	193.1811	195.0034	216.7047	229.4671	255.0187	(64)	
12Total per year (kWh/year)													2613.0601 (64)
Electric shower(s)													2613 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
122.4619	108.7804	116.5319	104.4937	102.7366	94.1218	93.8952	96.6748	96.7100	106.0114	110.5281	121.3681	(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	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579	145.7579 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	156.6128	173.3927	156.6128	161.8332	156.6128	161.8332	156.6128	156.6128	161.8332	156.6128	161.8332	156.6128 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	308.2722	311.4711	303.4100	286.2488	264.5859	244.2258	230.6240	227.4251	235.4862	252.6474	274.3103	294.6704 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758	37.5758 (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)	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063	-116.6063 (71)
Water heating gains (Table 5)	164.5993	161.8756	156.6290	145.1302	138.0869	130.7248	126.2032	129.9392	134.3194	142.4884	153.5113	163.1291 (72)
Total internal gains	699.2116	716.4667	686.3790	662.9395	629.0128	603.5111	580.1673	580.7044	598.3662	621.4759	659.3822	684.1397 (73)

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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
North					6.5800	10.6334	0.6300	0.7000			0.7700	21.3830 (74)
East					7.0900	19.6403	0.6300	0.7000			0.7700	42.5564 (76)
South					5.5900	46.7521	0.6300	0.7000			0.7700	79.8701 (78)
West					8.4900	19.6403	0.6300	0.7000			0.7700	50.9597 (80)
Solar gains	194.7693	354.6082	537.3345	739.2443	884.9767	900.9381	859.4934	749.1342	607.9377	406.8013	237.6557	163.7442 (83)
Total gains	893.9809	1071.0749	1223.7135	1402.1838	1513.9896	1504.4492	1439.6607	1329.8386	1206.3039	1028.2772	897.0379	847.8839 (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	20.2806	20.3248	20.3684	20.5757	20.6149	20.7996	20.7996	20.8342	20.7281	20.6149	20.5357	20.4535
alpha	2.3520	2.3550	2.3579	2.3717	2.3743	2.3866	2.3866	2.3889	2.3819	2.3743	2.3690	2.3636
util living area	0.9488	0.9227	0.8823	0.8045	0.6944	0.5547	0.4331	0.4768	0.6673	0.8461	0.9265	0.9542 (86)
MIT	18.0311	18.4190	18.9871	19.7126	20.3130	20.7209	20.8890	20.8571	20.5394	19.7362	18.7629	17.9677 (87)
Th 2	19.9523	19.9543	19.9563	19.9657	19.9675	19.9757	19.9757	19.9772	19.9726	19.9675	19.9639	19.9602 (88)
util rest of house	0.9420	0.9127	0.8667	0.7782	0.6516	0.4893	0.3463	0.3893	0.6070	0.8193	0.9152	0.9481 (89)
MIT 2	16.4790	16.9681	17.6808	18.5786	19.2919	19.7482	19.9088	19.8859	19.5678	18.6291	17.4150	16.4031 (90)
Living area fraction	16.6928	17.1680	17.8608	18.7348	19.4326	19.8822	20.0439	20.0197	19.7017	18.7816	17.6007	16.6187 (92)
Temperature adjustment	16.6928	17.1680	17.8608	18.7348	19.4326	19.8822	20.0439	20.0197	19.7017	18.7816	17.6007	16.6187 (93)
adjusted MIT	16.6928	17.1680	17.8608	18.7348	19.4326	19.8822	20.0439	20.0197	19.7017	18.7816	17.6007	16.6187 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9106	0.8756	0.8260	0.7405	0.6266	0.4828	0.3524	0.3932	0.5891	0.7803	0.8791	0.9186 (94)
Useful gains	814.0669	937.7858	1010.7784	1038.3348	948.7106	726.3535	507.3752	522.8566	710.6101	802.3962	788.6057	778.8969 (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	1997.8530	1973.4150	1823.5737	1562.7357	1226.3557	830.2946	541.3309	568.0315	883.5530	1297.5748	1671.7926	1985.0911 (97)
Space heating kWh	880.7369	695.9428	604.7197	377.5687	206.5680	0.0000	0.0000	0.0000	0.0000	368.4129	635.8945	897.4085 (98a)
Space heating requirement - total per year (kWh/year)												4667.2520
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	880.7369	695.9428	604.7197	377.5687	206.5680	0.0000	0.0000	0.0000	0.0000	368.4129	635.8945	897.4085 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4667.2520
Space heating per m2										(98c) / (4) =		33.5774 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	880.7369	695.9428	604.7197	377.5687	206.5680	0.0000	0.0000	0.0000	0.0000	368.4129	635.8945	897.4085 (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)	954.2111	754.0009	655.1676	409.0668	223.8006	0.0000	0.0000	0.0000	0.0000	399.1472	688.9432	972.2736 (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	257.6896	227.8759	242.3246	213.9316	207.9002	187.9275	186.0359	193.1811	195.0034	216.7047	229.4671	255.0187 (64)
Efficiency of water heater	86.5895	86.3965	86.0244	85.3198	84.0454	79.8000	79.8000	79.8000	79.8000	85.2395	86.2214	79.8000 (216)
Fuel for water heating, kWh/month	297.5992	263.7559	281.6928	250.7410	247.3666	235.4981	233.1277	242.0816	244.3651	254.2302	266.1369	294.3506 (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	32.5410	26.1056	23.5052	17.2209	13.3019	10.8678	12.1345	15.7729	20.4874	26.8806	30.3615	33.4455 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-61.1184	-84.2431	-118.3930	-129.9995	-137.5254	-127.3132	-125.6005	-119.7648	-109.2236	-94.6980	-66.4477	-53.0568 (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)	-40.6433	-84.7145	-167.0012	-248.9165	-327.3841	-328.4214	-324.6822	-275.8140	-203.2890	-120.6600	-54.0901	-32.2113 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												

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(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												5056.6111	(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												3110.9457	(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)												262.6248	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3435.2116	(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												5080.9700	(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	5056.6111	0.2100	1061.8883	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3110.9457	0.2100	653.2986	(264)
Space and water heating			1715.1869	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	262.6248	0.1443	37.9049	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1227.3839	0.1351	-165.8176	
PV Unit electricity exported	-2207.8277	0.1261	-278.4377	
Total			-444.2553	(269)
Total CO2, kg/year			1320.7658	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.5000	(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	5056.6111	1.1300	5713.9705	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3110.9457	1.1300	3515.3687	(278)
Space and water heating			9229.3392	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	262.6248	1.5338	402.8227	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1227.3839	1.4993	-1840.2526	
PV Unit electricity exported	-2207.8277	0.4629	-1022.0781	
Total			-2862.3307	(283)
Total Primary energy kWh/year			6899.9320	(286)
Target Primary Energy Rate (TPER)			49.6400	(287)

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Plot Reference	Elmhurst				Issued on Date	26/01/2026	
Assessment Reference	Elmhurst			Plot Type Ref	Elmhurst		
Plot Address	Elmhurst, Hilperton, Trowbridge, BA14 6JB				SAP Version	10.2	
SAP Rating	86 B		DER	3.45		TER	11.66
Environmental	97 A		% DER < TER				70.41
CO ₂ Emissions (t/year)	0.25		DFEE	34.91		TFEE	36.75
Compliance Check	See BREL		% DFEE < TFEE				5.00
% DPER < TPER	40.52		DPER	36.21		TPER	60.89
Assessor Details	Mr. Aymon Winter				Assessor ID	AU06-0001	
Client	Redcliffe Homes Ltd, Gerrian Baker						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	39.6900 (1b)	x 2.3800 (2b)	= 94.4622 (1b) - (3b)
First floor	39.6900 (1c)	x 2.7000 (2c)	= 107.1630 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.6252 (5)

2. Ventilation rate

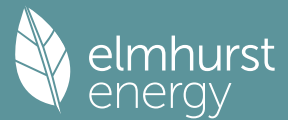
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1984 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3984 (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) = 0.3386 (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	0.4318	0.4233	0.4148	0.3725	0.3640	0.3217	0.3217	0.3132	0.3386	0.3640	0.3810	0.3979 (22b)
Effective ac	0.5932	0.5896	0.5860	0.5694	0.5663	0.5517	0.5517	0.5491	0.5573	0.5663	0.5726	0.5792 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			9.9000	1.0536	10.4310		(27)
Patio Door			5.0400	1.0536	5.3103		(27)
Ground Floor			39.6900	0.1200	4.7628	75.0000	2976.7500 (28a)
External Wall Render	90.8800	14.9400	75.9400	0.1800	13.6692	9.0000	683.4600 (29a)
Plane Ceiling	39.6900		39.6900	0.0800	3.1752	9.0000	357.2100 (30)
Total net area of external elements Aum(A, m ²)			170.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.3486		(33)
Main dwelling							
Party Wall			44.7800	0.0000	0.0000	20.0000	895.6000 (32)
IW Stud			159.8800			9.0000	1438.9200 (32c)
Internal Floor			39.6900			18.0000	714.4200 (32d)
Internal Ceiling			39.6900			9.0000	357.2100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	7423.5700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							93.5194 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				9.8000	0.0500	0.4900	
E3 Sill				6.3400	0.0330	0.2092	

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E4 Jamb	23.9600	0.0330	0.7907
E5 Ground floor (normal)	17.8200	0.0900	1.6038
E10 Eaves (insulation at ceiling level)	9.0400	0.0350	0.3164
E12 Gable (insulation at ceiling level)	8.7800	0.1080	0.9482
E16 Corner (normal)	10.2000	0.0460	0.4692
E6 Intermediate floor within a dwelling	17.8200	0.0670	1.1939
P1 Party wall - Ground floor	8.7800	0.1600	1.4048
P2 Party wall - Intermediate floor within a dwelling	8.7800	0.0000	0.0000
E18 Party wall between dwellings	10.2000	0.0840	0.8568
P4 Party wall - Roof (insulation at ceiling level)	8.7800	0.2400	2.1072

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.3903 (36)

Point Thermal bridges 0.0000

Total fabric heat loss (33) + (36) + (36a) = 47.7389 (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	39.4697	39.2289	38.9928	37.8841	37.6767	36.7111	36.7111	36.5322	37.0830	37.6767	38.0963	38.5351	(38)
Average = Sum(39)m / 12 =	87.2086	86.9677	86.7317	85.6230	85.4156	84.4499	84.4499	84.2711	84.8219	85.4156	85.8352	86.2739	(39)
												85.6220	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0986	1.0956	1.0926	1.0786	1.0760	1.0639	1.0639	1.0616	1.0686	1.0760	1.0813	1.0868	(40)
HLP (average)												1.0786	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4510 (42)
Hot water usage for mixer showers	65.3148	64.3332	62.9029	60.1663	58.1467	55.8945	54.6143	56.0338	57.5898	60.0080	62.8034	65.0645	(42a)
Hot water usage for baths	28.2107	27.7917	27.2018	26.1139	25.2993	24.3961	23.9082	24.4941	25.1320	26.0985	27.2087	28.1153	(42b)
Hot water usage for other uses	39.7306	38.2859	36.8411	35.3964	33.9516	32.5069	32.5069	33.9516	35.3964	36.8411	38.2859	39.7306	(42c)
Average daily hot water use (litres/day)												122.4926	(43)
Daily hot water use	133.2561	130.4108	126.9458	121.6765	117.3976	112.7974	111.0294	114.4795	118.1182	122.9476	128.2980	132.9105	(44)
Energy content (annual)	211.0451	185.7033	195.1109	166.5691	158.0398	138.6976	134.2804	141.7495	145.6515	166.8388	182.7841	208.1057	(45)
Distribution loss (46)m = 0.15 x (45)m	31.6568	27.8555	29.2666	24.9854	23.7060	20.8046	20.1421	21.2624	21.8477	25.0258	27.4176	31.2159	(46)
Water storage loss (or HIU loss):												210.0000	(47)
Store volume												1.3200	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400	(49)
Temperature factor from Table 2b												0.7128	(55)
Enter (49) or (54) in (55)													
Total storage loss	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(56)
If cylinder contains dedicated solar storage	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968	(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	256.4043	226.6729	240.4701	210.4651	203.3990	182.5936	179.6396	187.1087	189.5475	212.1980	226.6801	253.4649	(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	256.4043	226.6729	240.4701	210.4651	203.3990	182.5936	179.6396	187.1087	189.5475	212.1980	226.6801	253.4649	(64)
12Total per year (kWh/year)												2568.6438	(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	106.4599	94.5220	101.1617	90.5010	88.8356	81.2338	80.9356	83.4191	83.5459	91.7612	95.8925	105.4825	(65)

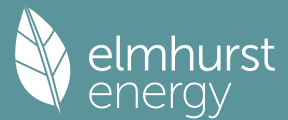
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.6286	123.5888	111.6286	115.3496	111.6286	115.3496	111.6286	111.6286	115.3496	111.6286	115.3496	111.6286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.1399	220.4035	214.6992	202.5556	187.2265	172.8193	163.1944	160.9308	166.6350	178.7786	194.1077	208.5150	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	(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)	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	(71)
Water heating gains (Table 5)	143.0912	140.6578	135.9701	125.6959	119.4027	112.8247	108.7844	112.1224	116.0360	123.3350	133.1840	141.7776	(72)
Total internal gains	532.6245	544.4149	522.0628	503.3659	478.0226	460.7584	443.3723	444.4467	457.7854	473.5071	502.4062	521.6860	(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
North	2.7900	10.6334	0.6400	0.7000	0.7700	9.2106 (74)
South	5.7900	46.7521	0.6400	0.7000	0.7700	84.0409 (78)
West	1.3200	19.6403	0.6400	0.7000	0.7700	8.0488 (80)
North	5.0400	10.6334	0.6400	0.7000	0.7700	16.6385 (74)

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Solar gains	117.9388	202.7814	285.1964	370.8038	434.4664	440.6026	420.8634	371.3802	314.2300	225.9407	141.5412	100.7871 (83)
Total gains	650.5633	747.1963	807.2592	874.1698	912.4891	901.3609	864.2356	815.8269	772.0155	699.4478	643.9474	622.4731 (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	23.6456	23.7111	23.7757	24.0835	24.1420	24.4181	24.4181	24.4699	24.3110	24.1420	24.0240	23.9018
alpha	2.5764	2.5807	2.5850	2.6056	2.6095	2.6279	2.6279	2.6313	2.6207	2.6095	2.6016	2.5935
util living area	0.9265	0.8969	0.8570	0.7809	0.6712	0.5254	0.4020	0.4374	0.6179	0.8029	0.8962	0.9331 (86)
Living	18.6750	19.0095	19.4556	20.0303	20.5004	20.8154	20.9333	20.9150	20.7020	20.1026	19.3116	18.6240
Non living	17.3013	17.7197	18.2755	18.9833	19.5350	19.8827	19.9911	19.9794	19.7712	19.0864	18.1126	17.2432
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.8106	19.0095	19.4556	20.0303	20.5004	20.8154	20.9333	20.9150	20.7020	20.1026	19.3116	18.9564 (87)
Th 2	20.0020	20.0044	20.0069	20.0183	20.0205	20.0304	20.0304	20.0323	20.0266	20.0205	20.0161	20.0116 (88)
util rest of house	0.9171	0.8841	0.8389	0.7527	0.6279	0.4625	0.3224	0.3569	0.5576	0.7715	0.8812	0.9244 (89)
MIT 2	18.9253	17.7197	18.2755	18.9833	19.5350	19.8827	19.9911	19.9794	19.7712	19.0864	18.1126	17.7421 (90)
Living area fraction									FLA = Living area / (4) =			0.3861 (91)
MIT	19.2672	18.2177	18.7312	19.3876	19.9077	20.2428	20.3549	20.3407	20.1306	19.4788	18.5755	18.2109 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2672	18.2177	18.7312	19.3876	19.9077	20.2428	20.3549	20.3407	20.1306	19.4788	18.5755	18.2109 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9091	0.8554	0.8111	0.7323	0.6225	0.4769	0.3498	0.3835	0.5645	0.7515	0.8538	0.9044 (94)
Useful gains	591.3947	639.1491	654.7433	640.1446	568.0331	429.8380	302.3120	312.8511	435.7701	525.6495	549.7798	562.9946 (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	1305.2635	1158.2125	1060.8298	897.9770	701.0693	476.5358	317.1026	332.0848	511.5275	758.3879	985.0061	1208.7784 (97)
Space heating kWh	531.1184	348.8106	302.1283	185.6393	98.9790	0.0000	0.0000	0.0000	0.0000	173.1574	313.3629	480.4631 (98a)
Space heating requirement - total per year (kWh/year)												2433.6590
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	531.1184	348.8106	302.1283	185.6393	98.9790	0.0000	0.0000	0.0000	0.0000	173.1574	313.3629	480.4631 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2433.6590
Space heating per m2										(98c) / (4) =		30.6583 (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 %)												307.7333 (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	531.1184	348.8106	302.1283	185.6393	98.9790	0.0000	0.0000	0.0000	0.0000	173.1574	313.3629	480.4631 (98)
Space heating efficiency (main heating system 1)	307.7333	307.7333	307.7333	307.7333	307.7333	0.0000	0.0000	0.0000	0.0000	307.7333	307.7333	307.7333 (210)
Space heating fuel (main heating system)	172.5905	113.3483	98.1786	60.3248	32.1639	0.0000	0.0000	0.0000	0.0000	56.2687	101.8294	156.1297 (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	256.4043	226.6729	240.4701	210.4651	203.3990	182.5936	179.6396	187.1087	189.5475	212.1980	226.6801	253.4649 (64)
Efficiency of water heater (217)m	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619	306.4619 (216)
Fuel for water heating, kWh/month	83.6660	73.9645	78.4666	68.6758	66.3701	59.5812	58.6173	61.0545	61.8503	69.2412	73.9668	82.7068 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	28.6620	22.9937	20.7033	15.1681	11.7163	9.5723	10.6880	13.8927	18.0452	23.6763	26.7423	29.4586 (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												790.8339 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												306.4619

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Water heating fuel used	838.1609 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	231.3187 (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	1860.3135 (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	790.8339	0.1551	122.6393 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	838.1609	0.1410	118.1658 (264)
Space and water heating			240.8051 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	231.3187	0.1443	33.3864 (268)
Total CO2, kg/year			274.1916 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.4500 (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	790.8339	1.5741	1244.8329 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	838.1609	1.5213	1275.0988 (278)
Space and water heating			2519.9317 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	231.3187	1.5338	354.8043 (282)
Total Primary energy kWh/year			2874.7360 (286)
Dwelling Primary energy Rate (DPER)			36.2100 (287)

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

1. Overall dwelling characteristics

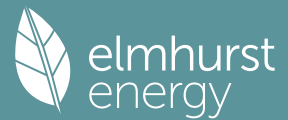
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	39.6900 (1b)	x 2.3800 (2b)	= 94.4622 (1b) - (3b)
First floor	39.6900 (1c)	x 2.7000 (2c)	= 107.1630 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	201.6252 (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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1488 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3988 (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) = 0.3390 (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	0.4322	0.4237	0.4152	0.3729	0.3644	0.3220	0.3220	0.3135	0.3390	0.3644	0.3813	0.3983 (22b)
Effective ac	0.5934	0.5898	0.5862	0.5695	0.5664	0.5518	0.5518	0.5492	0.5575	0.5664	0.5727	0.5793 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opening Type			14.9400	1.1450	17.1069			(27)
Ground Floor			39.6900	0.1300	5.1597			(28a)
External Wall Render	90.8800	14.9400	75.9400	0.1800	13.6692			(29a)
Plane Ceiling	39.6900		39.6900	0.1100	4.3659			(30)
Total net area of external elements Aum(A, m2)			170.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.3017			(33)
Main dwelling								
Party Wall			44.7800	0.0000	0.0000			(32)

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

93.5194 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.8000	0.0500	0.4900
E3 Sill	6.3400	0.0500	0.3170
E4 Jamb	23.9600	0.0500	1.1980
E5 Ground floor (normal)	17.8200	0.1600	2.8512
E10 Eaves (insulation at ceiling level)	9.0400	0.0600	0.5424
E12 Gable (insulation at ceiling level)	8.7800	0.0600	0.5268
E16 Corner (normal)	10.2000	0.0900	0.9180
E6 Intermediate floor within a dwelling	17.8200	0.0000	0.0000
P1 Party wall - Ground floor	8.7800	0.0800	0.7024
P2 Party wall - Intermediate floor within a dwelling	8.7800	0.0000	0.0000
E18 Party wall between dwellings	10.2000	0.0600	0.6120
P4 Party wall - Roof (insulation at ceiling level)	8.7800	0.1200	1.0536

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

9.2114 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 49.5131 (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	39.4822	39.2409	39.0044	37.8935	37.6856	36.7180	36.7180	36.5389	37.0907	37.6856	38.1061	38.5457
Heat transfer coeff	88.9953	88.7540	88.5175	87.4066	87.1987	86.2311	86.2311	86.0519	86.6038	87.1987	87.6192	88.0588
Average = Sum(39)m / 12 =												87.4056

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1211	1.1181	1.1151	1.1011	1.0985	1.0863	1.0863	1.0841	1.0910	1.0985	1.1038	1.1093
HLP (average)												1.1011
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

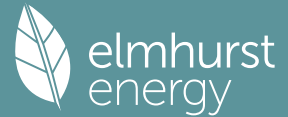
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.4510 (42)
Hot water usage for mixer showers	65.3148	64.3332	62.9029	60.1663	58.1467	55.8945	54.6143	56.0338	57.5898	60.0080	62.8034	65.0645	(42a)
Hot water usage for baths	28.2107	27.7917	27.2018	26.1139	25.2993	24.3961	23.9082	24.4941	25.1320	26.0985	27.2087	28.1153	(42b)
Hot water usage for other uses	39.7306	38.2859	36.8411	35.3964	33.9516	32.5069	32.5069	33.9516	35.3964	36.8411	38.2859	39.7306	(42c)
Average daily hot water use (litres/day)													122.4926 (43)
Daily hot water use	133.2561	130.4108	126.9458	121.6765	117.3976	112.7974	111.0294	114.4795	118.1182	122.9476	128.2980	132.9105	(44)
Energy conte	211.0451	185.7033	195.1109	166.5691	158.0398	138.6976	134.2804	141.7495	145.6515	166.8388	182.7841	208.1057	(45)
Energy content (annual)										Total = Sum(45)m =		2034.5758	
Distribution loss (46)m = 0.15 x (45)m	31.6568	27.8555	29.2666	24.9854	23.7060	20.8046	20.1421	21.2624	21.8477	25.0258	27.4176	31.2159	(46)
Water storage loss (or HIU loss):													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7016 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.7917	232.4421	246.8575	216.6464	209.7864	188.7749	186.0270	193.4961	195.7289	218.5853	232.8614	259.8523	(62)
WWHRS	-29.8592	-26.4077	-27.6526	-22.8975	-21.3396	-18.2605	-17.1163	-18.2014	-18.8930	-22.2727	-25.2323	-29.3062	(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	232.9325	206.0344	219.2049	193.7489	188.4467	170.5145	168.9107	175.2947	176.8359	196.3126	207.6291	230.5460	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2366.4111	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	111.5698	99.1374	106.2717	95.4461	93.9455	86.1788	86.0455	88.5290	88.4910	96.8712	100.8376	110.5924	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	122.5496	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.6286	123.5888	111.6286	115.3496	111.6286	115.3496	111.6286	111.6286	115.3496	111.6286	115.3496	111.6286	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	218.1399	220.4035	214.6992	202.5556	187.2265	172.8193	163.1944	160.9308	166.6350	178.7786	194.1077	208.5150	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	35.2550	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	-98.0397	(71)

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Water heating gains (Table 5)	149.9594	147.5259	142.8382	132.5640	126.2708	119.6928	115.6526	118.9906	122.9042	130.2032	140.0522	148.6457 (72)
Total internal gains	542.4927	554.2831	531.9310	513.2341	487.8908	467.6265	450.2404	451.3148	464.6536	483.3752	512.2744	531.5542 (73)

6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific FF data or Table 6c		Access factor Table 6d		Gains W	
North	7.8300		10.6334		0.6300		0.7000		0.7700		25.4452 (74)	
South	5.7900		46.7521		0.6300		0.7000		0.7700		82.7277 (78)	
West	1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (80)	
Solar gains	116.0960	199.6129	280.7402	365.0100	427.6779	433.7181	414.2874	365.5774	309.3202	222.4104	139.3296	99.2123 (83)
Total gains	658.5887	753.8960	812.6712	878.2441	915.5687	901.3447	864.5278	816.8922	773.9738	705.7856	651.6040	630.7664 (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	23.1709	23.2339	23.2960	23.5921	23.6483	23.9137	23.9137	23.9635	23.8108	23.6483	23.5348	23.4173
alpha	2.5447	2.5489	2.5531	2.5728	2.5766	2.5942	2.5942	2.5976	2.5874	2.5766	2.5690	2.5612
util living area	0.9257	0.8968	0.8577	0.7833	0.6754	0.5320	0.4082	0.4435	0.6230	0.8037	0.8955	0.9321 (86)
MIT	18.6321	18.9640	19.4124	19.9941	20.4756	20.8021	20.9275	20.9081	20.6850	20.0749	19.2755	18.5816 (87)
Th 2	19.9836	19.9861	19.9885	19.9999	20.0021	20.0120	20.0120	20.0139	20.0082	20.0021	19.9977	19.9932 (88)
util rest of house	0.9160	0.8838	0.8395	0.7550	0.6317	0.4678	0.3263	0.3609	0.5618	0.7720	0.8803	0.9233 (89)
MIT 2	17.2367	17.6519	18.2108	18.9274	19.4932	19.8539	19.9696	19.9571	19.7389	19.0410	18.0566	17.1792 (90)
Living area fraction	17.7755	18.1586	18.6748	19.3392	19.8725	20.2200	20.3394	20.3243	20.1042	19.4402	18.5273	17.7207 (92)
MIT	17.7755	18.1586	18.6748	19.3392	19.8725	20.2200	20.3394	20.3243	20.1042	19.4402	18.5273	17.7207 (92)
Temperature adjustment	17.7755	18.1586	18.6748	19.3392	19.8725	20.2200	20.3394	20.3243	20.1042	19.4402	18.5273	17.7207 (93)
adjusted MIT	17.7755	18.1586	18.6748	19.3392	19.8725	20.2200	20.3394	20.3243	20.1042	19.4402	18.5273	17.7207 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8886	0.8545	0.8111	0.7337	0.6255	0.4820	0.3543	0.3879	0.5682	0.7514	0.8523	0.8969 (94)
Useful gains	585.2202	644.2307	659.1268	644.3908	572.7063	434.4305	306.3357	316.8558	439.7483	530.3128	555.3519	565.7113 (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	1199.2561	1176.7500	1077.6795	912.4583	712.6338	484.6223	322.4544	337.6920	519.9842	770.8540	1001.2486	1190.6133 (97)
Space heating kWh	456.8427	357.8530	311.4032	193.0086	104.1060	0.0000	0.0000	0.0000	0.0000	178.9626	321.0456	464.9270 (98a)
Space heating requirement - total per year (kWh/year)												2388.1488
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	456.8427	357.8530	311.4032	193.0086	104.1060	0.0000	0.0000	0.0000	0.0000	178.9626	321.0456	464.9270 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2388.1488
Space heating per m2										(98c) / (4) =		30.0850 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	456.8427	357.8530	311.4032	193.0086	104.1060	0.0000	0.0000	0.0000	0.0000	178.9626	321.0456	464.9270 (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)	494.9542	387.7064	337.3816	209.1101	112.7909	0.0000	0.0000	0.0000	0.0000	193.8923	347.8284	503.7129 (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	232.9325	206.0344	219.2049	193.7489	188.4467	170.5145	168.9107	175.2947	176.8359	196.3126	207.6291	230.5460 (64)
Efficiency of water heater (217)m	85.5421	85.2855	84.8468	84.0512	82.7858	79.8000	79.8000	79.8000	79.8000	83.8528	85.0336	79.8000 (216)
Fuel for water heating, kWh/month	272.3017	241.5820	258.3538	230.5130	227.6318	213.6773	211.6676	219.6675	221.5989	234.1156	244.1731	269.3304 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	23.1942	18.6073	16.7538	12.2745	9.4812	7.7462	8.6491	11.2424	14.6028	19.1596	21.6407	23.8389 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-36.9981	-52.0924	-74.7867	-83.9868	-90.4828	-84.4256	-83.3730	-78.7386	-70.5600	-59.5051	-40.6470	-31.9943 (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)												

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(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	-21.1159	-44.3958	-88.1959	-132.4043	-175.0173	-175.8349	-173.7740	-147.1681	-107.9095	-63.4813	-28.1896	-16.7006	(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												2587.3769	(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												2844.6127	(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)												187.1906	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1961.7776	(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												3743.4026	(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	2587.3769	0.2100	543.3491 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2844.6127	0.2100	597.3687 (264)
Space and water heating			1140.7178 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	187.1906	0.1443	27.0174 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-787.5903	0.1346	-106.0196
PV Unit electricity exported	-1174.1873	0.1259	-147.8402
Total			-253.8598 (269)
Total CO2, kg/year			925.8046 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6600 (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	2587.3769	1.1300	2923.7359 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2844.6127	1.1300	3214.4123 (278)
Space and water heating			6138.1482 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	187.1906	1.5338	287.1192 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-787.5903	1.4975	-1179.4221
PV Unit electricity exported	-1174.1873	0.4622	-542.6757
Total			-1722.0979 (283)
Total Primary energy kWh/year			4833.2704 (286)
Target Primary Energy Rate (TPER)			60.8900 (287)

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Plot Reference	Foxham			Issued on Date	26/01/2026
Assessment Reference	Foxham	Plot Type Ref	Foxham		
Plot Address	Foxham, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	85 B	DER	3.29	TER	11.01
Environmental	97 A	% DER < TER			70.12
CO ₂ Emissions (t/year)	0.33	DFEE	38.52	TFEE	41.13
Compliance Check	See BREL	% DFEE < TFEE			6.36
% DPER < TPER	40.10	DPER	34.44	TPER	57.49
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	53.5000 (1c)	x 2.7000 (2c)	= 144.4500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 272.8500 (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	5 * 10 = 50.0000 (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) =	Air changes per hour 50.0000 / (5) = 0.1833 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3833 (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) = 0.3258 (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	0.4153	0.4072	0.3991	0.3583	0.3502	0.3095	0.3095	0.3013	0.3258	0.3502	0.3665	0.3828 (22b)
Effective ac	0.5863	0.5829	0.5796	0.5642	0.5613	0.5479	0.5479	0.5454	0.5531	0.5613	0.5672	0.5733 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			4.4600	1.2000	5.3520		(26)
Window			13.9800	1.0536	14.7299		(27)
Patio Door			5.0400	1.0536	5.3103		(27)
Ground Floor			53.5000	0.1200	6.4200	75.0000	4012.5000 (28a)
External Wall Stone	151.9800	23.4800	128.5000	0.1800	23.1300	9.0000	1156.5000 (29a)
Plane Ceiling	53.5000		53.5000	0.0800	4.2800	9.0000	481.5000 (30)
Total net area of external elements Aum(A, m ²)			258.9800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.2222		(33)
Main dwelling							
IW Stud			210.0000			9.0000	1890.0000 (32c)
Internal Floor			53.5000			18.0000	963.0000 (32d)
Internal Ceiling			53.5000			9.0000	481.5000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8985.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							83.9720 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				16.7200	0.0500	0.8360	
E3 Sill				11.8300	0.0330	0.3904	

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E4 Jamb						34.6000		0.0330		1.1418		
E5 Ground floor (normal)						29.8000		0.0900		2.6820		
E6 Intermediate floor within a dwelling						29.8000		0.0670		1.9966		
E10 Eaves (insulation at ceiling level)						17.7000		0.0350		0.6195		
E12 Gable (insulation at ceiling level)						12.1200		0.1080		1.3090		
E16 Corner (normal)						20.4000		0.0460		0.9384		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											9.9137	(36)
Point Thermal bridges											0.0000	
Total fabric heat loss									(33) + (36) + (36a) =		69.1359	(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	52.7869	52.4853	52.1897	50.8012	50.5414	49.3321	49.3321	49.1081	49.7979	50.5414	51.0669	51.6164 (38)
Average = Sum(39)m / 12 =	121.9228	121.6212	121.3256	119.9371	119.6773	118.4679	118.4679	118.2440	118.9338	119.6773	120.2028	120.7522 (39)
												119.9358
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1395	1.1366	1.1339	1.1209	1.1185	1.1072	1.1072	1.1051	1.1115	1.1185	1.1234	1.1285 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.7956 (42)
Hot water usage for mixer showers												
	71.0923	70.0239	68.4671	65.4883	63.2901	60.8387	59.4453	60.9903	62.6840	65.3161	68.3588	70.8199 (42a)
Hot water usage for baths												
	30.6952	30.2394	29.5974	28.4138	27.5274	26.5447	26.0138	26.6513	27.3454	28.3970	29.6050	30.5915 (42b)
Hot water usage for other uses												
	43.2594	41.6863	40.1133	38.5402	36.9671	35.3941	35.3941	36.9671	38.5402	40.1133	41.6863	43.2594 (42c)
Average daily hot water use (litres/day)												133.3308 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	145.0469	141.9496	138.1777	132.4423	127.7847	122.7774	120.8532	124.6088	128.5696	133.8264	139.6502	144.6708 (44)
Energy conte	229.7189	202.1344	212.3741	181.3069	172.0228	150.9692	146.1614	154.2917	158.5392	181.6011	198.9573	226.5195 (45)
Energy content (annual)										Total = Sum(45)m =		2214.5962
Distribution loss	(46)m = 0.15 x (45)m											
	34.4578	30.3202	31.8561	27.1960	25.8034	22.6454	21.9242	23.1438	23.7809	27.2402	29.8436	33.9779 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss												
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage												
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	287.9679	254.7464	270.6231	237.6769	230.2718	207.3392	204.4104	212.5407	214.9092	239.8501	255.3273	284.7685 (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	287.9679	254.7464	270.6231	237.6769	230.2718	207.3392	204.4104	212.5407	214.9092	239.8501	255.3273	284.7685 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2900.4312 (64)
Electric shower(s)												2900 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	122.9807	109.2993	117.2136	105.3805	103.7968	95.2932	95.1979	97.9012	97.8103	106.9816	111.2493	121.9169 (65)

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

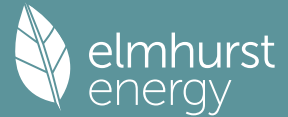
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	137.9164	152.6931	137.9164	142.5136	137.9164	137.9164	137.9164	137.9164	142.5136	137.9164	142.5136	137.9164 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	267.1732	269.9457	262.9593	248.0860	229.3112	211.6655	199.8771	197.1047	204.0911	218.9644	237.7392	255.3849 (68)
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)	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227 (71)
Water heating gains (Table 5)	165.2967	162.6477	157.5451	146.3619	139.5118	132.3517	127.9541	131.5876	135.8476	143.7924	154.5129	163.8668 (72)
Total internal gains	635.3198	650.2200	623.3543	601.8950	571.6729	551.4644	530.6812	531.5422	547.3858	565.6067	599.6992	622.1016 (73)

6. Solar gains												

[Jan]												
			Area		Solar flux		g		FF		Access	Gains
			m2		Table 6a		W/m2		Specific data		factor	W
									or Table 6c		Table 6d	
North			2.7900		10.6334		0.6400		0.7000		0.7700	9.2106 (74)
East			7.6400		19.6403		0.6400		0.7000		0.7700	46.5856 (76)
South			2.7900		46.7521		0.6400		0.7000		0.7700	40.4964 (78)
West			0.7600		19.6403		0.6400		0.7000		0.7700	4.6342 (80)
North			5.0400		10.6334		0.6400		0.7000		0.7700	16.6385 (74)

Solar gains	117.5652	215.9183	333.4339	470.9719	576.0638	592.1127	562.5310	481.7879	381.0901	249.2300	143.7552	98.6623 (83)
Total gains	752.8851	866.1384	956.7882	1072.8668	1147.7367	1143.5770	1093.2122	1013.3301	928.4759	814.8367	743.4544	720.7639 (84)

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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	20.4706	20.5214	20.5714	20.8095	20.8547	21.0676	21.0676	21.1075	20.9851	20.8547	20.7635	20.6690
alpha	2.3647	2.3681	2.3714	2.3873	2.3903	2.4045	2.4045	2.4072	2.3990	2.3903	2.3842	2.3779
util living area	0.9379	0.9137	0.8766	0.8021	0.6941	0.5526	0.4311	0.4736	0.6611	0.8354	0.9139	0.9432 (86)
Living	18.1834	18.5265	19.0463	19.7401	20.3247	20.7292	20.8929	20.8626	20.5573	19.7960	18.8875	18.1316
Non living	16.6800	17.1120	17.7642	18.6239	19.3192	19.7728	19.9296	19.9080	19.6011	18.7117	17.5802	16.6195
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.5591	18.5265	19.0463	19.7401	20.3247	20.7292	20.8929	20.8626	20.5573	19.7960	18.8875	18.5328 (87)
Th 2	19.9687	19.9710	19.9733	19.9838	19.9858	19.9950	19.9950	19.9967	19.9914	19.9858	19.9818	19.9776 (88)
util rest of house	0.9299	0.9028	0.8607	0.7759	0.6520	0.4883	0.3462	0.3879	0.6016	0.8078	0.9014	0.9360 (89)
MIT 2	18.6576	17.1120	17.7642	18.6239	19.3192	19.7728	19.9296	19.9080	19.6011	18.7117	17.5802	17.2246 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.8207	17.3678	17.9960	18.8257	19.5010	19.9458	20.1038	20.0806	19.7740	18.9078	17.8166	17.4612 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8207	17.3678	17.9960	18.8257	19.5010	19.9458	20.1038	20.0806	19.7740	18.9078	17.8166	17.4612 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9194	0.8658	0.8214	0.7405	0.6294	0.4849	0.3559	0.3955	0.5873	0.7715	0.8649	0.9116 (94)
Useful gains	692.1765	749.9078	785.9236	794.4298	722.4116	554.5318	389.0354	400.8164	545.2998	628.6086	643.0474	657.0842 (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	1770.3985	1516.3456	1394.7642	1190.4623	933.6059	633.3035	415.0894	435.2133	674.8352	994.2577	1288.1653	1601.3189 (97)
Space heating kWh	802.1972	515.0462	452.9774	285.1434	157.1286	0.0000	0.0000	0.0000	0.0000	272.0430	464.4848	702.5106 (98a)
Space heating requirement - total per year (kWh/year)												3651.5310
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	802.1972	515.0462	452.9774	285.1434	157.1286	0.0000	0.0000	0.0000	0.0000	272.0430	464.4848	702.5106 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3651.5310
Space heating per m2										(98c) / (4) =		34.1265 (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 %)												329.8526 (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	802.1972	515.0462	452.9774	285.1434	157.1286	0.0000	0.0000	0.0000	0.0000	272.0430	464.4848	702.5106 (98)
Space heating efficiency (main heating system 1)	329.8526	329.8526	329.8526	329.8526	329.8526	0.0000	0.0000	0.0000	0.0000	329.8526	329.8526	329.8526 (210)
Space heating fuel (main heating system)	243.1987	156.1443	137.3272	86.4457	47.6360	0.0000	0.0000	0.0000	0.0000	82.4741	140.8159	212.9771 (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	287.9679	254.7464	270.6231	237.6769	230.2718	207.3392	204.4104	212.5407	214.9092	239.8501	255.3273	284.7685 (64)
Efficiency of water heater (217)m	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329	296.8329 (216)
Fuel for water heating, kWh/month	97.0135	85.8215	91.1702	80.0709	77.5762	69.8505	68.8638	71.6028	72.4007	80.8031	86.0172	95.9356 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	36.8858	29.5911	26.6435	19.5202	15.0780	12.3188	13.7546	17.8788	23.2228	30.4695	34.4153	37.9110 (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												1107.0189 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												296.8329
Water heating fuel used												977.1259 (219)
Space cooling fuel												0.0000 (221)

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Electricity for pumps and fans:
 Total electricity for the above, kWh/year 0.0000 (231)
 Electricity for lighting (calculated in Appendix L) 297.6894 (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 2381.8342 (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	1107.0189	0.1549	171.4802 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	977.1259	0.1409	137.6775 (264)
Space and water heating			309.1577 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	297.6894	0.1443	42.9658 (268)
Total CO2, kg/year			352.1235 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2900 (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	1107.0189	1.5734	1741.8153 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	977.1259	1.5210	1486.2075 (278)
Space and water heating			3228.0228 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	297.6894	1.5338	456.6060 (282)
Total Primary energy kWh/year			3684.6288 (286)
Dwelling Primary energy Rate (DPER)			34.4400 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	53.5000 (1b)	x 2.4000 (2b)	= 128.4000 (1b) - (3b)
First floor	53.5000 (1c)	x 2.7000 (2c)	= 144.4500 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	107.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 272.8500 (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) = 0.1466 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3966 (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) = 0.3371 (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	0.4298	0.4214	0.4130	0.3708	0.3624	0.3203	0.3203	0.3118	0.3371	0.3624	0.3792	0.3961 (22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5568	0.5657	0.5719	0.5784 (25)

3. Heat losses and heat loss parameter

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Element													
Main dwelling													
TER Opaque door													(26)
TER Opening Type													(27)
Ground Floor													(28a)
External Wall Stone	151.9800		23.4800			128.5000		0.1800	23.1300				(29a)
Plane Ceiling	53.5000					53.5000		0.1100	5.8850				(30)
Total net area of external elements Aum(A, m2)						258.9800							(31)
Fabric heat loss, W/K = Sum (A x U)						(26)...(30) + (32) =		62.2086					(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												83.9720	(35)
List of Thermal Bridges													
K1 Element									Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)									16.7200	0.0500	0.8360		
E3 Sill									11.8300	0.0500	0.5915		
E4 Jamb									34.6000	0.0500	1.7300		
E5 Ground floor (normal)									29.8000	0.1600	4.7680		
E6 Intermediate floor within a dwelling									29.8000	0.0000	0.0000		
E10 Eaves (insulation at ceiling level)									17.7000	0.0600	1.0620		
E12 Gable (insulation at ceiling level)									12.1200	0.0600	0.7272		
E16 Corner (normal)									20.4000	0.0900	1.8360		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												11.5507	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss									(33) + (36) + (36a) =			73.7593	(37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	53.3374	53.0144	52.6978	51.2109	50.9327	49.6377	49.6377	49.3979	50.1365	50.9327	51.4955	52.0839	(38)
Heat transfer coeff	127.0967	126.7737	126.4572	124.9703	124.6921	123.3970	123.3970	123.1572	123.8958	124.6921	125.2548	125.8432	(39)
Average = Sum(39)m / 12 =												124.9689	
HLP	1.1878	1.1848	1.1818	1.1679	1.1653	1.1532	1.1532	1.1510	1.1579	1.1653	1.1706	1.1761	(40)
HLP (average)												1.1679	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

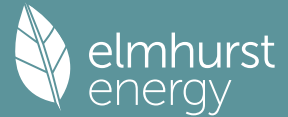
4. Water heating energy requirements (kWh/year)													

Assumed occupancy													2.7956 (42)
Hot water usage for mixer showers	71.0923	70.0239	68.4671	65.4883	63.2901	60.8387	59.4453	60.9903	62.6840	65.3161	68.3588	70.8199	(42a)
Hot water usage for baths	30.6952	30.2394	29.5974	28.4138	27.5274	26.5447	26.0138	26.6513	27.3454	28.3970	29.6050	30.5915	(42b)
Hot water usage for other uses	43.2594	41.6863	40.1133	38.5402	36.9671	35.3941	35.3941	36.9671	38.5402	40.1133	41.6863	43.2594	(42c)
Average daily hot water use (litres/day)												133.3308	(43)
Daily hot water use	145.0469	141.9496	138.1777	132.4423	127.7847	122.7774	120.8532	124.6088	128.5696	133.8264	139.6502	144.6708	(44)
Energy conte	229.7189	202.1344	212.3741	181.3069	172.0228	150.9692	146.1614	154.2917	158.5392	181.6011	198.9573	226.5195	(45)
Energy content (annual)										Total = Sum(45)m =		2214.5962	
Distribution loss (46)m = 0.15 x (45)m	34.4578	30.3202	31.8561	27.1960	25.8034	22.6454	21.9242	23.1438	23.7809	27.2402	29.8436	33.9779	(46)
Water storage loss (or HIU loss):													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(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	284.6257	251.7276	267.2808	234.4425	226.9296	204.1048	201.0682	209.1985	211.6748	236.5079	252.0929	281.4263	(62)
WWHRS	-32.5004	-28.7436	-30.0987	-24.9229	-23.2272	-19.8757	-18.6303	-19.8115	-20.5642	-24.2429	-27.4643	-31.8986	(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	252.1252	222.9839	237.1822	209.5196	203.7023	184.2290	182.4379	189.3870	191.1106	212.2650	224.6286	249.5277	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2559.0990	(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)
												0.0000	(64a)
Heat gains from water heating, kWh/month	120.3070	106.8843	114.5398	102.7930	101.1230	92.7057	92.5241	95.2274	95.2228	104.3078	108.6618	119.2432	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	139.7784	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	137.9164	152.6931	137.9164	142.5136	137.9164	137.9164	142.5136	137.9164	137.9164	142.5136	137.9164	137.9164	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1732	269.9457	262.9593	248.0860	229.3112	211.6655	199.8771	197.1047	204.0911	218.9644	237.7392	255.3849	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	36.9778	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	-111.8227	(71)
Water heating gains (Table 5)	161.7029	159.0540	153.9514	142.7681	135.9180	128.7580	124.3604	127.9938	132.2538	140.1987	150.9191	160.2731	(72)
Total internal gains	634.7260	649.6263	622.7605	601.3012	571.0791	547.8706	527.0874	527.9484	543.7921	565.0129	599.1054	621.5078	(73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North					7.8300	10.6334	0.6300	0.7000		0.7700	25.4452 (74)
East					7.6400	19.6403	0.6300	0.7000		0.7700	45.8577 (76)
South					2.7900	46.7521	0.6300	0.7000		0.7700	39.8636 (78)
West					0.7600	19.6403	0.6300	0.7000		0.7700	4.5618 (80)
Solar gains	115.7283	212.5446	328.2240	463.6129	567.0628	582.8609	553.7415	474.2599	375.1355	245.3358	97.1207 (83)
Total gains	750.4543	862.1709	950.9845	1064.9141	1138.1419	1130.7315	1080.8289	1002.2084	918.9276	810.3487	718.6285 (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	19.6373	19.6873	19.7366	19.9714	20.0160	20.2260	20.2260	20.2654	20.1446	20.0160	19.9260	19.8329
alpha	2.3092	2.3125	2.3158	2.3314	2.3344	2.3484	2.3484	2.3510	2.3430	2.3344	2.3284	2.3222
util living area	0.9395	0.9165	0.8813	0.8105	0.7066	0.5688	0.4472	0.4899	0.6752	0.8419	0.9166	0.9446 (86)
MIT	18.0530	18.3964	18.9256	19.6404	20.2548	20.6912	20.8745	20.8406	20.5070	19.7113	18.7773	18.0026 (87)
Th 2	19.9298	19.9322	19.9346	19.9457	19.9478	19.9576	19.9576	19.9594	19.9538	19.9478	19.9436	19.9392 (88)
util rest of house	0.9315	0.9057	0.8655	0.7843	0.6639	0.5021	0.3574	0.3998	0.6145	0.8143	0.9041	0.9373 (89)
MIT 2	16.4954	16.9281	17.5929	18.4804	19.2137	19.7053	19.8819	19.8575	19.5205	18.5871	17.4218	16.4367 (90)
Living area fraction										fLA = Living area /	(4) =	0.1808 (91)
MIT	16.7771	17.1937	17.8339	18.6902	19.4020	19.8836	20.0614	20.0353	19.6989	18.7904	17.6669	16.7199 (92)
Temperature adjustment												0.0000
adjusted MIT	16.7771	17.1937	17.8339	18.6902	19.4020	19.8836	20.0614	20.0353	19.6989	18.7904	17.6669	16.7199 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8978	0.8678	0.8249	0.7467	0.6388	0.4970	0.3669	0.4069	0.5978	0.7761	0.8667	0.9051 (94)
Useful gains	673.7548	748.1505	784.4986	795.2037	726.9920	561.9825	396.5646	407.7769	549.2982	628.9483	641.9195	650.4643 (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	1585.8003	1558.5131	1433.2524	1223.4813	960.3765	651.9810	427.1234	447.7151	693.6832	1021.2753	1323.5573	1575.5459 (97)
Space heating kWh	678.5618	544.5636	482.6728	308.3599	173.6381	0.0000	0.0000	0.0000	0.0000	291.8913	490.7792	688.2607 (98a)
Space heating requirement - total per year (kWh/year)												3658.7275
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	678.5618	544.5636	482.6728	308.3599	173.6381	0.0000	0.0000	0.0000	0.0000	291.8913	490.7792	688.2607 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3658.7275
Space heating per m2										(98c) / (4) =		34.1937 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	678.5618	544.5636	482.6728	308.3599	173.6381	0.0000	0.0000	0.0000	0.0000	291.8913	490.7792	688.2607	(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)	735.1699	589.9931	522.9392	334.0844	188.1236	0.0000	0.0000	0.0000	0.0000	316.2419	531.7218	745.6779	(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	252.1252	222.9839	237.1822	209.5196	203.7023	184.2290	182.4379	189.3870	191.1106	212.2650	224.6286	249.5277	(64)
Efficiency of water heater	86.1673	85.9828	85.6184	84.9250	83.7038	79.8000	79.8000	79.8000	79.8000	84.7745	85.7630	79.8000	(216)
Fuel for water heating, kWh/month	292.5995	259.3356	277.0224	246.7113	243.3609	230.8635	228.6189	237.3271	239.4869	250.3877	261.9180	289.4322	(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	28.6563	22.9891	20.6992	15.1651	11.7140	9.5704	10.6859	13.8899	18.0416	23.6716	26.7370	29.4527	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-48.6027	-67.7887	-96.3975	-107.1628	-114.4947	-106.4365	-105.0561	-99.6534	-90.0214	-76.8732	-53.1464	-42.1009	(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)	-29.7318	-62.2722	-123.2944	-184.5208	-243.3852	-244.3808	-241.5644	-204.8569	-150.5458	-88.9060	-39.6417	-23.5372	(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)

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Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1											3963.9518	(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											3057.0640	(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)											231.2727	(232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation											-2644.3715	(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											4693.9170	(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	3963.9518	0.2100	832.4299 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3057.0640	0.2100	641.9834 (264)
Space and water heating			1474.4133 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	231.2727	0.1443	33.3798 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1007.7343	0.1348	-135.8745
PV Unit electricity exported	-1636.6373	0.1260	-206.2094
Total			-342.0839 (269)
Total CO2, kg/year			1177.6385 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0100 (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	3963.9518	1.1300	4479.2655 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3057.0640	1.1300	3454.4823 (278)
Space and water heating			7933.7478 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	231.2727	1.5338	354.7339 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1007.7343	1.4983	-1509.9175
PV Unit electricity exported	-1636.6373	0.4625	-756.9369
Total			-2266.8544 (283)
Total Primary energy kWh/year			6151.7281 (286)
Target Primary Energy Rate (TPER)			57.4900 (287)

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Plot Reference	Mais First			Issued on Date	26/01/2026
Assessment Reference	Mais First	Plot Type Ref	Mais First		
Plot Address	Mais First, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	82 B	DER	4.71	TER	13.03
Environmental	96 A	% DER < TER			63.85
CO ₂ Emissions (t/year)	0.27	DFEE	37.22	TFEE	38.41
Compliance Check	See BREL	% DFEE < TFEE			3.09
% DPER < TPER	27.48	DPER	49.50	TPER	68.25
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	4.0500 (1b)	x 2.3800 (2b)	= 9.6390 (1b) - (3b)
First floor	57.7100 (1c)	x 2.7000 (2c)	= 155.8170 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.4560 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 20.0000 / (5) = 0.1209 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3209 (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) = 0.2727 (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	0.3478	0.3409	0.3341	0.3000	0.2932	0.2591	0.2591	0.2523	0.2727	0.2932	0.3068	0.3205 (22b)
Effective ac	0.5605	0.5581	0.5558	0.5450	0.5430	0.5336	0.5336	0.5318	0.5372	0.5430	0.5471	0.5514 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Window			12.6500	1.0536	13.3285		(27)
Door			2.7200	1.1000	2.9920		(26)
Ground Floor			4.0500	0.1200	0.4860	75.0000	303.7500 (28a)
External Wall	67.8000	15.3700	52.4300	0.1800	9.4374	9.0000	471.8700 (29a)
Plane Ceiling	57.7100		57.7100	0.0800	4.6168	9.0000	519.3900 (30)
Total net area of external elements Aum(A, m ²)			129.5600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		30.8607		(33)
Main dwelling							
Party Wall			31.0200	0.0000	0.0000	20.0000	620.4000 (32)
Party Floor			53.6600			30.0000	1609.8000 (32d)
IW Stud			90.2000			9.0000	811.8000 (32c)
Internal Floor			4.0500			18.0000	72.9000 (32d)
Internal Ceiling			4.0500			9.0000	36.4500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	4446.3600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							71.9942 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				11.0200	0.0500	0.5510	

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E3 Sill	10.0200	0.0330	0.3307
E4 Jamb	21.8000	0.0330	0.7194
E5 Ground floor (normal)	3.2600	0.0900	0.2934
E10 Eaves (insulation at ceiling level)	12.1400	0.0350	0.4249
E12 Gable (insulation at ceiling level)	3.2600	0.1080	0.3521
E16 Corner (normal)	12.0100	0.0460	0.5525
E17 Corner (inverted - internal area greater than external area)	2.3850	0.0310	0.0739
E6 Intermediate floor within a dwelling	23.7700	0.0670	1.5926
P1 Party wall - Ground floor	6.6500	0.1600	1.0640
P2 Party wall - Intermediate floor within a dwelling	6.3100	0.0000	0.0000
E18 Party wall between dwellings	9.5400	0.0840	0.8014
P4 Party wall - Roof (insulation at ceiling level)	6.3100	0.2400	1.5144
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			8.2702 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	39.1309 (37)

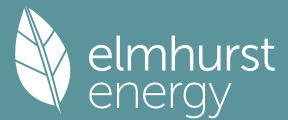
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	30.6017	30.4735	30.3478	29.7576	29.6472	29.1331	29.1331	29.0379	29.3311	29.6472	29.8706	30.1041 (38)
Average = Sum(39)m / 12 =	69.7326	69.6044	69.4788	68.8885	68.7781	68.2640	68.2640	68.1688	68.4621	68.7781	69.0015	69.2351 (39)
												68.8880
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1291	1.1270	1.1250	1.1154	1.1136	1.1053	1.1053	1.1038	1.1085	1.1136	1.1173	1.1210 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.0309 (42)
Hot water usage for mixer showers	58.2717	57.3960	56.1199	53.6783	51.8765	49.8672	48.7251	49.9915	51.3797	53.5371	56.0311	58.0484 (42a)
Hot water usage for baths	25.1820	24.8080	24.2813	23.3103	22.5831	21.7769	21.3414	21.8644	22.4338	23.2965	24.2876	25.0968 (42b)
Hot water usage for other uses	35.4288	34.1405	32.8522	31.5638	30.2755	28.9872	28.9872	30.2755	31.5638	32.8522	34.1405	35.4288 (42c)
Average daily hot water use (litres/day)												109.2802 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.8824	116.3444	113.2533	108.5524	104.7352	100.6313	99.0536	102.1314	105.3773	109.6858	114.4592	118.5740 (44)
Energy content (annual)	188.2807	165.6729	174.0662	148.6028	140.9937	123.7379	119.7968	126.4600	129.9408	148.8426	163.0681	185.6583 (45)
Distribution loss (46)m = 0.15 x (45)m	28.2421	24.8509	26.1099	22.2904	21.1491	18.5607	17.9695	18.9690	19.4911	22.3264	24.4602	27.8487 (46)
Water storage loss (or HIU 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	188.2807	165.6729	174.0662	148.6028	140.9937	123.7379	119.7968	126.4600	129.9408	148.8426	163.0681	185.6583 (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	188.2807	165.6729	174.0662	148.6028	140.9937	123.7379	119.7968	126.4600	129.9408	148.8426	163.0681	185.6583 (64)
12Total per year (kWh/year)												1815.1207 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	62.6033	55.0862	57.8770	49.4104	46.8804	41.1428	39.8324	42.0479	43.2053	49.4902	54.2201	61.7314 (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	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.8824	99.5127	89.8824	92.8785	89.8824	92.8785	89.8824	89.8824	92.8785	89.8824	92.8785	89.8824 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.3629	179.2033	174.5654	164.6918	152.2282	140.5141	132.6884	130.8479	135.4858	145.3594	157.8231	169.5371 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547 (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)	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374 (71)
Water heating gains (Table 5)	84.1443	81.9736	77.7917	68.6256	63.0113	57.1428	53.5382	56.5160	60.0074	66.5190	75.3057	82.9723 (72)
Total internal gains	407.8536	417.1536	398.7035	382.6600	361.5859	343.9995	329.5730	330.7104	341.8357	358.2249	382.4713	398.8559 (73)

6. Solar gains												
[Jan]												
		Area		Solar flux		g		FF		Access		Gains
		m2		Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast		5.6300		11.2829		0.6400		0.7000		0.7700		19.7216 (75)
Southeast		3.5100		36.7938		0.6400		0.7000		0.7700		40.0953 (77)
Northwest		3.5100		11.2829		0.6400		0.7000		0.7700		12.2953 (81)
Solar gains	72.1122	133.4685	210.8652	308.6198	388.8965	405.0938	382.6427	319.8465	244.2593	155.1275	88.3105	60.4599 (83)
Total gains	479.9658	550.6221	609.5688	691.2797	750.4824	749.0932	712.2158	650.5568	586.0950	513.3524	470.7819	459.3157 (84)

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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	17.7119	17.7446	17.7767	17.9290	17.9577	18.0930	18.0930	18.1182	18.0407	17.9577	17.8996	17.8392
alpha	2.1808	2.1830	2.1851	2.1953	2.1972	2.2062	2.2062	2.2079	2.2027	2.1972	2.1933	2.1893
util living area	0.9095	0.8796	0.8349	0.7485	0.6308	0.4933	0.3830	0.4269	0.6111	0.7917	0.8808	0.9165 (86)
MIT	18.0839	18.4490	18.9997	19.7265	20.3299	20.7274	20.8884	20.8547	20.5384	19.7546	18.8082	18.0170 (87)
Th 2	19.9771	19.9788	19.9805	19.9883	19.9897	19.9965	19.9965	19.9978	19.9939	19.9897	19.9868	19.9837 (88)
util rest of house	0.8995	0.8666	0.8167	0.7206	0.5890	0.4336	0.3066	0.3485	0.5533	0.7618	0.8657	0.9072 (89)
MIT 2	16.5848	17.0407	17.7262	18.6171	19.3281	19.7705	19.9264	19.9016	19.5839	18.6741	17.5035	16.5038 (90)
Living area fraction	fLA = Living area / (4) = 0.3849 (91)											
MIT	17.1617	17.5827	18.2164	19.0441	19.7136	20.1388	20.2967	20.2684	19.9513	19.0900	18.0056	17.0862 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.1617	17.5827	18.2164	19.0441	19.7136	20.1388	20.2967	20.2684	19.9513	19.0900	18.0056	17.0862 (93)
8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8622	0.8273	0.7782	0.6908	0.5766	0.4425	0.3303	0.3706	0.5507	0.7302	0.8276	0.8711 (94)
Useful gains	413.8493	455.5198	474.3898	477.5016	432.7302	331.4574	235.2182	241.1021	322.7449	374.8595	389.6266	400.1003 (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	896.8833	882.7726	814.0391	698.8093	551.1637	378.1001	252.3487	263.7061	400.5886	583.9241	752.5059	892.1787 (97)
Space heating kWh	359.3773	287.1139	252.6990	159.3415	88.1145	0.0000	0.0000	0.0000	0.0000	155.5441	261.2731	366.1064 (98a)
Space heating requirement - total per year (kWh/year)	1929.5699											
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	359.3773	287.1139	252.6990	159.3415	88.1145	0.0000	0.0000	0.0000	0.0000	155.5441	261.2731	366.1064 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1929.5699											
Space heating per m2	(98c) / (4) =											31.2430 (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 %)												249.9000 (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	359.3773	287.1139	252.6990	159.3415	88.1145	0.0000	0.0000	0.0000	0.0000	155.5441	261.2731	366.1064 (98)
Space heating efficiency (main heating system 1)	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000 (210)
Space heating fuel (main heating system)	143.8085	114.8915	101.1201	63.7621	35.2599	0.0000	0.0000	0.0000	0.0000	62.2425	104.5511	146.5012 (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	188.2807	165.6729	174.0662	148.6028	140.9937	123.7379	119.7968	126.4600	129.9408	148.8426	163.0681	185.6583 (64)
Efficiency of water heater	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000 (216)
Fuel for water heating, kWh/month	107.5275	94.6162	99.4096	84.8674	80.5218	70.6670	68.4162	72.2216	74.2095	85.0043	93.1285	106.0299 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	21.3359	17.1165	15.4115	11.2911	8.7216	7.1256	7.9561	10.3417	13.4328	17.6245	19.9069	21.9289 (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	772.1368 (211)											
Space heating fuel - main system 2	0.0000 (213)											
Space heating fuel - secondary	0.0000 (215)											
Efficiency of water heater	175.1000											
Water heating fuel used	1036.6195 (219)											
Space cooling fuel	0.0000 (221)											
Electricity for pumps and fans:												
Total electricity for the above, kWh/year	0.0000 (231)											
Electricity for lighting (calculated in Appendix L)	172.1930 (232)											
Energy saving/generation technologies (Appendices M ,N and O)												

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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	1980.9493 (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	772.1368	0.1544	119.1990 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1036.6195	0.1416	146.7626 (264)
Space and water heating			265.9616 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	172.1930	0.1443	24.8528 (268)
Total CO2, kg/year			290.8144 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.7100 (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	772.1368	1.5715	1213.4383 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1036.6195	1.5235	1579.3292 (278)
Space and water heating			2792.7675 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	172.1930	1.5338	264.1154 (282)
Total Primary energy kWh/year			3056.8829 (286)
Dwelling Primary energy Rate (DPER)			49.5000 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	4.0500 (1b)	x 2.3800 (2b)	= 9.6390 (1b) - (3b)
First floor	57.7100 (1c)	x 2.7000 (2c)	= 155.8170 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	165.4560 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1209 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3709 (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) = 0.3152 (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	0.4019	0.3941	0.3862	0.3468	0.3389	0.2995	0.2995	0.2916	0.3152	0.3389	0.3547	0.3704 (22b)
Effective ac	0.5808	0.5776	0.5746	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (25)

3. Heat losses and heat loss parameter

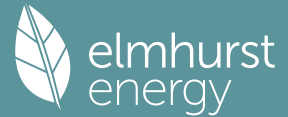
Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			2.7200	1.0000	2.7200		(26)
TER Opening Type			12.6500	1.1450	14.4847		(27)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)m \times (5)$												
(38)m	Jan 31.7107	Feb 31.5395	Mar 31.3716	Apr 30.5831	May 30.4356	Jun 29.7488	Jul 29.7488	Aug 29.6216	Sep 30.0133	Oct 30.4356	Nov 30.7340	Dec 31.0460 (38)
Heat transfer coeff	71.5429	71.3717	71.2038	70.4153	70.2678	69.5810	69.5810	69.4538	69.8455	70.2678	70.5662	70.8782 (39)
Average = Sum(39)m / 12 =												70.4146
HLP	Jan 1.1584	Feb 1.1556	Mar 1.1529	Apr 1.1401	May 1.1378	Jun 1.1266	Jul 1.1266	Aug 1.1246	Sep 1.1309	Oct 1.1378	Nov 1.1426	Dec 1.1476 (40)
HLP (average)												1.1401
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												2.0309 (42)
Hot water usage for mixer showers	58.2717	57.3960	56.1199	53.6783	51.8765	49.8672	48.7251	49.9915	51.3797	53.5371	56.0311	58.0484 (42a)
Hot water usage for baths	25.1820	24.8080	24.2813	23.3103	22.5831	21.7769	21.3414	21.8644	22.4338	23.2965	24.2876	25.0968 (42b)
Hot water usage for other uses	35.4288	34.1405	32.8522	31.5638	30.2755	28.9872	28.9872	30.2755	31.5638	32.8522	34.1405	35.4288 (42c)
Average daily hot water use (litres/day)												109.2802 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.8824	116.3444	113.2533	108.5524	104.7352	100.6313	99.0536	102.1314	105.3773	109.6858	114.4592	118.5740 (44)
Energy content (annual)	188.2807	165.6729	174.0662	148.6028	140.9937	123.7379	119.7968	126.4600	129.9408	148.8426	163.0681	185.6583 (45)
Distribution loss (46)m = 0.15 x (45)m	28.2421	24.8509	26.1099	22.2904	21.1491	18.5607	17.9695	18.9690	19.4911	22.3264	24.4602	27.8487 (46)
Water storage loss (or HIU 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	234.8756	207.7586	220.6611	193.6947	187.5886	168.8297	166.3917	173.0549	175.0326	195.4375	208.1599	232.2532 (62)
VVHRS	-26.6394	-23.5601	-24.6708	-20.4284	-19.0385	-16.2914	-15.2706	-16.2387	-16.8557	-19.8710	-22.5114	-26.1461 (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	208.2362	184.1985	195.9903	173.2663	168.5501	152.5383	151.1211	156.8161	158.1769	175.5665	185.6485	206.1071 (64)
12Total per year (kWh/year)												2116.2161 (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	99.8793	88.7548	95.1529	85.4839	84.1563	77.2163	77.1084	79.3239	79.2788	86.7661	90.2936	99.0073 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	101.5467	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	89.8824	99.5127	89.8824	92.8785	89.8824	92.8785	89.8824	89.8824	92.8785	89.8824	92.8785	89.8824 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	177.3629	179.2033	174.5654	164.6918	152.2282	140.5141	132.6884	130.8479	135.4858	145.3594	157.8231	169.5371 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547	33.1547 (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)	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374	-81.2374 (71)
Water heating gains (Table 5)	134.2463	132.0756	127.8937	118.7277	113.1133	107.2449	103.6403	106.6181	110.1094	116.6211	125.4078	133.0743 (72)
Total internal gains	457.9556	467.2557	448.8056	432.7620	411.6879	394.1015	379.6751	380.8124	391.9378	408.3270	432.5734	448.9579 (73)

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6. Solar gains

[Jan]	Area m2		Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	5.6300		11.2829		0.6300		0.7000		0.7700		19.4134 (75)	
Southeast	3.5100		36.7938		0.6300		0.7000		0.7700		39.4688 (77)	
Northwest	3.5100		11.2829		0.6300		0.7000		0.7700		12.1032 (81)	
Solar gains	70.9855	131.3831	207.5705	303.7976	382.8200	398.7642	376.6639	314.8489	240.4427	152.7036	86.9307	59.5152 (83)
Total gains	528.9411	598.6387	656.3760	736.5596	794.5080	792.8657	756.3390	695.6613	632.3805	561.0306	519.5040	508.4731 (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	17.2638	17.3052	17.3460	17.5402	17.5771	17.7505	17.7505	17.7830	17.6833	17.5771	17.5027	17.4257
alpha	2.1509	2.1537	2.1564	2.1693	2.1718	2.1834	2.1834	2.1855	2.1789	2.1718	2.1668	2.1617
util living area	0.8954	0.8651	0.8197	0.7327	0.6158	0.4785	0.3694	0.4098	0.5887	0.7695	0.8630	0.9023 (86)
MIT	18.1464	18.4996	19.0391	19.7547	20.3444	20.7357	20.8925	20.8618	20.5610	19.8064	18.8789	18.0907 (87)
Th 2	19.9534	19.9557	19.9579	19.9682	19.9701	19.9791	19.9791	19.9808	19.9757	19.9701	19.9662	19.9621 (88)
util rest of house	0.8840	0.8508	0.8001	0.7036	0.5731	0.4188	0.2937	0.3323	0.5301	0.7376	0.8461	0.8916 (89)
MIT 2	16.6519	17.0913	17.7607	18.6356	19.3276	19.7623	19.9126	19.8907	19.5905	18.7205	17.5789	16.5861 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.2271	17.6333	18.2527	19.0663	19.7190	20.1369	20.2898	20.2645	19.9640	19.1384	18.0792	17.1652 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.2271	17.6333	18.2527	19.0663	19.7190	20.1369	20.2898	20.2645	19.9640	19.1384	18.0792	17.1652 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8446	0.8103	0.7615	0.6747	0.5619	0.4285	0.3176	0.3548	0.5294	0.7074	0.8070	0.8531 (94)
Useful gains	446.7310	485.0494	499.8074	496.9358	446.4235	339.7198	240.1780	246.7977	334.7618	396.8618	419.2330	433.7845 (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	924.8443	908.7994	836.8384	715.8648	563.4748	385.2649	256.7383	268.4019	409.5752	599.9765	774.7624	918.9503 (97)
Space heating kWh	355.7163	284.7600	250.7511	157.6288	87.0862	0.0000	0.0000	0.0000	0.0000	151.1173	255.9811	360.9634 (98a)
Space heating requirement - total per year (kWh/year)	1904.0042											
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	355.7163	284.7600	250.7511	157.6288	87.0862	0.0000	0.0000	0.0000	0.0000	151.1173	255.9811	360.9634 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1904.0042											
Space heating per m2	(98c) / (4) =											
	30.8291 (99)											

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	355.7163	284.7600	250.7511	157.6288	87.0862	0.0000	0.0000	0.0000	0.0000	151.1173	255.9811	360.9634 (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)	385.3914	308.5157	271.6696	170.7788	94.3512	0.0000	0.0000	0.0000	0.0000	163.7241	277.3360	391.0763 (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	208.2362	184.1985	195.9903	173.2663	168.5501	152.5383	151.1211	156.8161	158.1769	175.5665	185.6485	206.1071 (64)
Efficiency of water heater (217)m	85.2498	85.0331	84.6134	83.8483	82.6538	79.8000	79.8000	79.8000	79.8000	83.7253	84.7805	79.8000 (216)
Fuel for water heating, kWh/month	244.2658	216.6197	231.6303	206.6427	203.9231	191.1508	189.3749	196.5115	198.2167	209.6935	218.9754	241.6169 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	18.6758	14.9824	13.4900	9.8834	7.6342	6.2372	6.9642	9.0523	11.7580	15.4272	17.4249	19.1949 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-29.1718	-41.2746	-59.5567	-67.2554	-72.8027	-68.0886	-67.2734	-63.3814	-56.5396	-47.3505	-32.1330	-25.2056 (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	-16.0426	-33.7961	-67.2486	-101.1033	-133.7643	-134.4018	-132.7947	-112.3808	-82.3149	-48.3366	-21.4239	-12.6805 (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)												

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(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												2062.8431	(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												2548.6211	(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)												150.7244	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1526.3213	(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												3321.8672	(238)

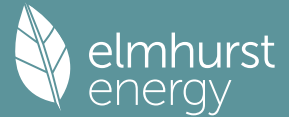
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2062.8431	0.2100	433.1970	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2548.6211	0.2100	535.2104	(264)
Space and water heating			968.4075	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	150.7244	0.1443	21.7542	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-630.0333	0.1345	-84.7334	
PV Unit electricity exported	-896.2880	0.1259	-112.8174	
Total			-197.5508	(269)
Total CO2, kg/year			804.5401	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.0300	(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	2062.8431	1.1300	2331.0127	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2548.6211	1.1300	2879.9418	(278)
Space and water heating			5210.9545	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	150.7244	1.5338	231.1861	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-630.0333	1.4970	-943.1901	
PV Unit electricity exported	-896.2880	0.4620	-414.1170	
Total			-1357.3070	(283)
Total Primary energy kWh/year			4214.9343	(286)
Target Primary Energy Rate (TPER)			68.2500	(287)

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Plot Reference	Mais Ground				Issued on Date	26/01/2026	
Assessment Reference	Mais Ground			Plot Type Ref	Mais Ground		
Plot Address	Mais Ground, Hilperton, Trowbridge, BA14 6JB				SAP Version	10.2	
SAP Rating	81 B	DER	5.49	TER	13.14		
Environmental	96 A	% DER < TER				58.22	
CO ₂ Emissions (t/year)	0.26	DFEE	33.02	TFEE	34.59		
Compliance Check	See BREL	% DFEE < TFEE				4.54	
% DPER < TPER	16.67	DPER	57.46	TPER	68.96		
Assessor Details	Mr. Aymon Winter				Assessor ID	AU06-0001	
Client	Redcliffe Homes Ltd, Gerrian Baker						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling	51.7900	2.3800	123.2602
Ground floor			
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.7900		
Dwelling volume			123.2602

2. Ventilation rate

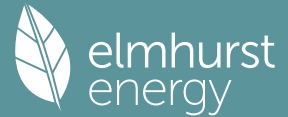
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	2 * 10 = 20.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) = 0.1623 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3623 (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) = 0.3079 (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	0.3926	0.3849	0.3772	0.3387	0.3310	0.2925	0.2925	0.2848	0.3079	0.3310	0.3464	0.3618 (22b)
Effective ac	0.5771	0.5741	0.5711	0.5574	0.5548	0.5428	0.5428	0.5406	0.5474	0.5548	0.5600	0.5655 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Window			13.5400	1.0536	14.2663		(27)
Door			2.7200	1.1000	2.9920		(26)
Ground Floor			51.7900	0.1200	6.2148	75.0000	3884.2500 (28a)
External Wall	50.9900	16.2600	34.7300	0.1800	6.2514	9.0000	312.5700 (29a)
Total net area of external elements Aum(A, m ²)			102.7800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	29.7245		(33)
Main dwelling							
Party Wall			37.6800	0.0000	0.0000	20.0000	753.6000 (32)
Party Floor			53.6600			30.0000	1609.8000 (32d)
Party Ceiling			51.7900			20.0000	1035.8000 (32b)
IW Stud			75.6900			9.0000	681.2100 (32c)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 8277.2300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							159.8229 (35)
List of Thermal Bridges							
K1 Element					Length	Psi-value	Total
E2 Other lintels (including other steel lintels)					8.9200	0.0500	0.4460
E3 Sill					6.3200	0.0330	0.2086
E4 Jamb					23.4400	0.0330	0.7735
E5 Ground floor (normal)					21.3800	0.0900	1.9242

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E16 Corner (normal)	7.1500	0.0460	0.3289
E17 Corner (inverted - internal area greater than external area)	4.7700	0.0310	0.1479
P1 Party wall - Ground floor	14.0800	0.1600	2.2528
P2 Party wall - Intermediate floor within a dwelling	14.0800	0.0000	0.0000
E18 Party wall between dwellings	7.1500	0.0840	0.6006
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.6825 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	36.4069 (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	23.4727	23.3510	23.2316	22.6712	22.5664	22.0783	22.0783	21.9879	22.2663	22.5664	22.7785	23.0002 (38)
Average = Sum(39)m / 12 =	59.8796	59.7579	59.6386	59.0781	58.9733	58.4852	58.4852	58.3948	58.6732	58.9733	59.1854	59.4072 (39)
												59.0776
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1562	1.1538	1.1515	1.1407	1.1387	1.1293	1.1293	1.1275	1.1329	1.1387	1.1428	1.1471 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7429 (42)
Hot water usage for mixer showers												
Hot water usage for baths	53.4418	52.6387	51.4684	49.2292	47.5767	45.7339	44.6865	45.8479	47.1211	49.0997	51.3870	53.2370 (42a)
Hot water usage for other uses	23.1049	22.7618	22.2786	21.3876	20.7205	19.9807	19.5812	20.0610	20.5834	21.3750	22.2843	23.0268 (42b)
Average daily hot water use (litres/day)	32.4788	31.2977	30.1167	28.9356	27.7546	26.5736	26.5736	27.7546	28.9356	30.1167	31.2977	32.4788 (42c)
												100.2196 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	109.0255	106.6982	103.8636	99.5525	96.0518	92.2882	90.8412	93.6635	96.6402	100.5914	104.9690	108.7427 (44)
Energy content (annual)	172.6698	151.9368	159.6345	136.2823	129.3042	113.4791	109.8645	115.9750	119.1670	136.5016	149.5476	170.2647 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1664.6272
Water storage loss (or HIU loss):	25.9005	22.7905	23.9452	20.4423	19.3956	17.0219	16.4797	17.3962	17.8750	20.4752	22.4321	25.5397 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month												
WWHRS	172.6698	151.9368	159.6345	136.2823	129.3042	113.4791	109.8645	115.9750	119.1670	136.5016	149.5476	170.2647 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	172.6698	151.9368	159.6345	136.2823	129.3042	113.4791	109.8645	115.9750	119.1670	136.5016	149.5476	170.2647 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 1664.6272 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	57.4127	50.5190	53.0785	45.3139	42.9936	37.7318	36.5300	38.5617	39.6230	45.3868	49.7246	56.6130 (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	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	76.6066	84.8145	76.6066	79.1602	76.6066	79.1602	76.6066	76.6066	79.1602	76.6066	79.1602	76.6066 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	151.8812	153.4572	149.4856	141.0306	130.3576	120.3265	113.6251	112.0490	116.0206	124.4757	135.1487	145.1798 (68)
Pumps, fans	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150 (71)
Total internal gains	77.1676	75.1771	71.3421	62.9359	57.7872	52.4053	49.0994	51.8302	55.0320	61.0037	69.0619	76.0928 (72)
	357.7985	365.5919	349.5774	335.2698	316.8945	301.0350	288.4742	289.6290	299.3559	314.2291	335.5139	350.0223 (73)

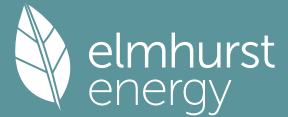
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	6.6800	36.7938	0.6400	0.7000	0.7700	76.3067 (77)
Southwest	5.1000	36.7938	0.6400	0.7000	0.7700	58.2581 (79)
Northwest	1.7600	11.2829	0.6400	0.7000	0.7700	6.1652 (81)
Solar gains	140.7300	241.7631	336.2302	425.7228	485.1668	485.3188
Total gains	498.5286	607.3550	685.8076	760.9926	802.0613	786.3539
						466.3758
						421.4683
						367.1350
						268.6663
						168.9351
						120.1943 (83)
						470.2165 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	38.3976	38.4758	38.5527	38.9185	38.9877	39.3130	39.3130	39.3739	39.1871	38.9877	38.8479	38.7029
alpha	3.5598	3.5651	3.5702	3.5946	3.5992	3.6209	3.6209	3.6249	3.6125	3.5992	3.5899	3.5802
util living area	0.9561	0.9185	0.8616	0.7572	0.6171	0.4585	0.3363	0.3708	0.5637	0.8020	0.9252	0.9631 (86)
MIT	19.4870	19.8306	20.2073	20.5978	20.8447	20.9599	20.9899	20.9856	20.9152	20.5765	19.9675	19.4202 (87)
Th 2	19.9552	19.9571	19.9590	19.9677	19.9694	19.9770	19.9770	19.9784	19.9741	19.9694	19.9660	19.9626 (88)
util rest of house	0.9476	0.9040	0.8381	0.7196	0.5638	0.3911	0.2601	0.2914	0.4929	0.7612	0.9093	0.9558 (89)
MIT 2	18.2302	18.6552	19.1126	19.5719	19.8371	19.9511	19.9727	19.9719	19.9138	19.5637	18.8390	18.1520 (90)
Living area fraction									FLA = Living area / (4) =			
MIT	18.8092	19.1967	19.6169	20.0445	20.3013	20.4158	20.4414	20.4389	20.3752	20.0303	19.3589	18.7363 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8092	19.1967	19.6169	20.0445	20.3013	20.4158	20.4414	20.4389	20.3752	20.0303	19.3589	18.7363 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9359	0.8915	0.8295	0.7225	0.5816	0.4205	0.2950	0.3276	0.5214	0.7638	0.8981	0.9449 (94)
Useful gains	466.5770	541.4531	568.8511	549.8534	466.4485	330.6595	222.6948	232.9470	347.5311	445.2281	453.0642	444.3152 (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	868.8055	854.3430	782.2749	658.3976	507.2489	340.1408	224.6624	235.8502	368.1831	556.1385	725.5496	863.5585 (97)
Space heating kWh	299.2580	210.2620	158.7873	78.1518	30.3555	0.0000	0.0000	0.0000	0.0000	82.5174	196.1895	311.9171 (98a)
Space heating requirement - total per year (kWh/year)												1367.4386
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	299.2580	210.2620	158.7873	78.1518	30.3555	0.0000	0.0000	0.0000	0.0000	82.5174	196.1895	311.9171 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1367.4386
Space heating per m2										(98c) / (4) =		26.4035 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	299.2580	210.2620	158.7873	78.1518	30.3555	0.0000	0.0000	0.0000	0.0000	82.5174	196.1895	311.9171 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	176.0341	123.6836	93.4043	45.9717	17.8562	0.0000	0.0000	0.0000	0.0000	48.5396	115.4056	183.4806 (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	172.6698	151.9368	159.6345	136.2823	129.3042	113.4791	109.8645	115.9750	119.1670	136.5016	149.5476	170.2647 (64)
Efficiency of water heater (217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (216)
Fuel for water heating, kWh/month	101.5705	89.3746	93.9027	80.1661	76.0613	66.7524	64.6262	68.2206	70.0982	80.2950	87.9692	100.1557 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	17.3506	13.9193	12.5328	9.1821	7.0925	5.7946	6.4700	8.4100	10.9237	14.3325	16.1885	17.8329 (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												804.3757 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												170.0000
Water heating fuel used												979.1925 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												140.0296 (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)

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Total delivered energy for all uses

1923.5978 (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	804.3757	0.1562	125.6397	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)			138.6322	(264)
Space and water heating	979.1925	0.1416	264.2719	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	140.0296	0.1443	20.2106	(268)
Total CO2, kg/year			284.4825	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.4900	(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	804.3757	1.5782	1269.4897	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)			1491.8370	(278)
Space and water heating	979.1925	1.5235	2761.3267	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	140.0296	1.5338	214.7822	(282)
Total Primary energy kWh/year			2976.1088	(286)
Dwelling Primary energy Rate (DPER)			57.4600	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling	51.7900	2.3800	123.2602	(1b) - (3b)
Ground floor				(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	51.7900			(5)
Dwelling volume			123.2602	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1623 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4123	(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) =	0.3504 (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	0.4468	0.4380	0.4293	0.3855	0.3767	0.3329	0.3329	0.3241	0.3504	0.3767	0.3942	0.4117	(22b)
Effective ac	0.5998	0.5959	0.5921	0.5743	0.5710	0.5554	0.5554	0.5525	0.5614	0.5710	0.5777	0.5848	(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	
Main dwelling								
TER Opaque door			2.7200	1.0000	2.7200			(26)
TER Opening Type			10.2300	1.1450	11.7137			(27)
Ground Floor			51.7900	0.1300	6.7327			(28a)
External Wall	50.9900	12.9500	38.0400	0.1800	6.8472			(29a)
Total net area of external elements Aum(A, m2)			102.7800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	28.0136		(33)
Main dwelling								
Party Wall			37.6800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.8229	(35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	8.9200	0.0500	0.4460
E2 Other lintels (including other steel lintels)	6.3200	0.0500	0.3160
E3 Sill	23.4400	0.0500	1.1720
E4 Jamb	21.3800	0.1600	3.4208
E5 Ground floor (normal)	7.1500	0.0900	0.6435
E16 Corner (normal)	4.7700	-0.0900	-0.4293
E17 Corner (inverted - internal area greater than external area)	14.0800	0.0800	1.1264
P1 Party wall - Ground floor	14.0800	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	7.1500	0.0600	0.4290
E18 Party wall between dwellings			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			7.1244 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	35.1380 (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	24.3977	24.2401	24.0856	23.3598	23.2240	22.5918	22.5918	22.4748	22.8353	23.2240	23.4987	23.7859	(38)
Heat transfer coeff	59.5358	59.3781	59.2236	58.4978	58.3620	57.7299	57.7299	57.6128	57.9733	58.3620	58.6367	58.9239	(39)
Average = Sum(39)m / 12 =												58.4971	
HLP	1.1496	1.1465	1.1435	1.1295	1.1269	1.1147	1.1147	1.1124	1.1194	1.1269	1.1322	1.1377	(40)
HLP (average)												1.1295	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													1.7429 (42)
Hot water usage for mixer showers	53.4418	52.6387	51.4684	49.2292	47.5767	45.7339	44.6865	45.8479	47.1211	49.0997	51.3870	53.2370	(42a)
Hot water usage for baths	23.1049	22.7618	22.2786	21.3876	20.7205	19.9807	19.5812	20.0610	20.5834	21.3750	22.2843	23.0268	(42b)
Hot water usage for other uses	32.4788	31.2977	30.1167	28.9356	27.7546	26.5736	26.5736	27.7546	28.9356	30.1167	31.2977	32.4788	(42c)
Average daily hot water use (litres/day)												100.2196	(43)
Daily hot water use	109.0255	106.6982	103.8636	99.5525	96.0518	92.2882	90.8412	93.6635	96.6402	100.5914	104.9690	108.7427	(44)
Energy conte	172.6698	151.9368	159.6345	136.2823	129.3042	113.4791	109.8645	115.9750	119.1670	136.5016	149.5476	170.2647	(45)
Energy content (annual)										Total = Sum(45)m =		1664.6272	
Distribution loss (46)m = 0.15 x (45)m	25.9005	22.7905	23.9452	20.4423	19.3956	17.0219	16.4797	17.3962	17.8750	20.4752	22.4321	25.5397	(46)
Water storage loss (or HIU 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	219.2647	194.0226	206.2294	181.3742	175.8991	158.5709	156.4594	162.5699	164.2588	183.0965	194.6395	216.8596	(62)
WWHRS	-24.4314	-21.6073	-22.6259	-18.7351	-17.4605	-14.9411	-14.0049	-14.8928	-15.4586	-18.2240	-20.6456	-23.9789	(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	194.8333	172.4153	183.6035	162.6390	158.4386	143.6299	142.4546	147.6771	148.8002	164.8725	173.9939	192.8807	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		1986.2387	(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	94.6886	84.1876	90.3544	81.3873	80.2696	73.8053	73.8059	75.8376	75.6965	82.6627	85.7981	93.8889	(65)

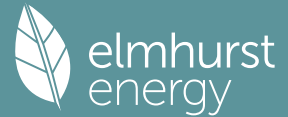
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	87.1438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	77.2501	85.5269	77.2501	79.8252	77.2501	79.8252	77.2501	77.2501	79.8252	77.2501	79.8252	77.2501	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	151.8812	153.4572	149.4856	141.0306	130.3576	120.3265	113.6251	112.0490	116.0206	124.4757	135.1487	145.1798	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	31.7144	(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)	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	-69.7150	(71)
Water heating gains (Table 5)	127.2697	125.2791	121.4441	113.0380	107.8892	102.5073	99.2014	101.9323	105.1340	111.1058	119.1640	126.1948	(72)
Total internal gains	408.5441	416.4064	400.3230	386.0368	367.6400	351.8021	339.2198	340.3745	350.1229	364.9747	386.2809	400.7679	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	5.0500	36.7938	0.6300	0.7000	0.7700	56.7856 (77)
Southwest	3.8500	36.7938	0.6300	0.7000	0.7700	43.2920 (79)
Northwest	1.3300	11.2829	0.6300	0.7000	0.7700	4.5861 (81)

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Solar gains	104.6637	179.8044	250.0624	316.6215	360.8329	360.9464	346.8577	313.4578	273.0475	199.8131	125.6404	89.3908 (83)
Total gains	513.2078	596.2108	650.3854	702.6583	728.4729	712.7485	686.0775	653.8323	623.1704	564.7878	511.9213	490.1587 (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	38.6193	38.7218	38.8229	39.3046	39.3960	39.8274	39.8274	39.9083	39.6601	39.3960	39.2114	39.0203
alpha	3.5746	3.5815	3.5882	3.6203	3.6264	3.6552	3.6552	3.6606	3.6440	3.6264	3.6141	3.6014
util living area	0.9522	0.9216	0.8758	0.7864	0.6572	0.4946	0.3640	0.3964	0.5895	0.8111	0.9216	0.9582 (86)
MIT	19.5359	19.8219	20.1614	20.5482	20.8136	20.9506	20.9875	20.9828	20.9047	20.5665	20.0015	19.4889 (87)
Th 2	19.9606	19.9630	19.9654	19.9768	19.9789	19.9889	19.9889	19.9907	19.9850	19.9789	19.9746	19.9701 (88)
util rest of house	0.9431	0.9076	0.8539	0.7508	0.6040	0.4243	0.2831	0.3132	0.5181	0.7714	0.9051	0.9502 (89)
MIT 2	18.2945	18.6492	19.0645	19.5270	19.8176	19.9564	19.9835	19.9828	19.9165	19.5615	18.8864	18.2426 (90)
Living area fraction	18.8664	19.1894	19.5698	19.9974	20.2765	20.4144	20.4460	20.4435	20.3718	20.0245	19.4001	18.8168 (92)
MIT	18.8664	19.1894	19.5698	19.9974	20.2765	20.4144	20.4460	20.4435	20.3718	20.0245	19.4001	18.8168 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8664	19.1894	19.5698	19.9974	20.2765	20.4144	20.4460	20.4435	20.3718	20.0245	19.4001	18.8168 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9312	0.8952	0.8445	0.7515	0.6202	0.4546	0.3201	0.3510	0.5463	0.7734	0.8942	0.9388 (94)
Useful gains	477.8850	533.7034	549.2338	528.0739	451.7864	323.9904	219.5884	229.5003	340.4362	436.7820	457.7397	460.1803 (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	867.2236	848.4806	774.0434	649.1754	500.5390	335.6669	222.0319	232.9590	363.5961	550.0324	721.2384	861.2771 (97)
Space heating kWh	289.6679	211.5302	167.2583	87.1931	36.2720	0.0000	0.0000	0.0000	0.0000	84.2583	189.7190	298.4160 (98a)
Space heating requirement - total per year (kWh/year)												1364.3149
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	289.6679	211.5302	167.2583	87.1931	36.2720	0.0000	0.0000	0.0000	0.0000	84.2583	189.7190	298.4160 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1364.3149
Space heating per m2										(98c) / (4) =		26.3432 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	289.6679	211.5302	167.2583	87.1931	36.2720	0.0000	0.0000	0.0000	0.0000	84.2583	189.7190	298.4160 (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)	313.8331	229.1769	181.2116	94.4670	39.2979	0.0000	0.0000	0.0000	0.0000	91.2874	205.5461	323.3110 (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	194.8333	172.4153	183.6035	162.6390	158.4386	143.6299	142.4546	147.6771	148.8002	164.8725	173.9939	192.8807 (64)
Efficiency of water heater	84.9474	84.5194	83.8513	82.7262	81.3356	79.8000	79.8000	79.8000	79.8000	82.6325	84.2542	79.8000 (216)
Fuel for water heating, kWh/month	229.3577	203.9948	218.9633	196.5991	194.7960	179.9873	178.5145	185.0590	186.4665	199.5251	206.5106	85.0349 (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	226.8255 (219)
(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	16.0511	12.8768	11.5941	8.4943	6.5613	5.3606	5.9854	7.7801	10.1055	13.2590	14.9760	16.4972 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-24.6507	-34.9752	-50.6145	-57.3437	-62.2522	-58.3102	-57.6370	-54.2288	-48.2435	-40.2342	-27.1971	-21.2899 (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)	-13.2647	-27.9767	-55.7205	-83.8366	-110.9683	-111.4919	-110.1338	-93.1598	-68.1956	-40.0060	-17.7140	-10.4802 (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												1478.1310 (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												2406.5995 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												86.0000 (231)

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Electricity for lighting (calculated in Appendix L)	129.5412 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1279.9253 (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	2820.3464 (238)

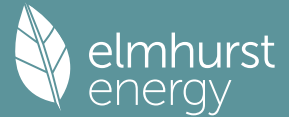
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1478.1310	0.2100	310.4075 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2406.5995	0.2100	505.3859 (264)
Space and water heating			815.7934 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	129.5412	0.1443	18.6968 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-536.9772	0.1344	-72.1787
PV Unit electricity exported	-742.9481	0.1259	-93.5034
Total			-165.6821 (269)
Total CO2, kg/year			680.7374 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1400 (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	1478.1310	1.1300	1670.2881 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2406.5995	1.1300	2719.4574 (278)
Space and water heating			4389.7455 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	129.5412	1.5338	198.6946 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-536.9772	1.4968	-803.7322
PV Unit electricity exported	-742.9481	0.4620	-343.2210
Total			-1146.9532 (283)
Total Primary energy kWh/year			3571.5877 (286)
Target Primary Energy Rate (TPER)			68.9600 (287)

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Plot Reference	Sherston				Issued on Date	26/01/2026	
Assessment Reference	Sherston			Plot Type Ref	Sherston		
Plot Address	Sherston, Hilperton, Trowbridge, BA14 6JB				SAP Version	10.2	
SAP Rating	86 B	DER	3.23	TER	10.33		
Environmental	97 A	% DER < TER				68.73	
CO ₂ Emissions (t/year)	0.29	DFEE	33.52	TFEE	35.13		
Compliance Check	See BREL	% DFEE < TFEE				4.57	
% DPER < TPER	37.12	DPER	33.84	TPER	53.82		
Assessor Details	Mr. Aymon Winter				Assessor ID	AU06-0001	
Client	Redcliffe Homes Ltd, Gerrian Baker						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	47.8500 (1b)	x 2.3800 (2b)	= 113.8830 (1b) - (3b)
First floor	47.8500 (1c)	x 2.7000 (2c)	= 129.1950 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.0780 (5)

2. Ventilation rate

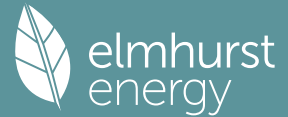
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1646 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3646 (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) = 0.3099 (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	0.3951	0.3873	0.3796	0.3409	0.3331	0.2944	0.2944	0.2866	0.3099	0.3331	0.3486	0.3641 (22b)
Effective ac	0.5780	0.5750	0.5720	0.5581	0.5555	0.5433	0.5433	0.5411	0.5480	0.5555	0.5608	0.5663 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Windows			10.5700	1.0536	11.1370		(27)
Patio Door			5.0400	1.0536	5.3103		(27)
Ground Floor			47.8500	0.1200	5.7420	75.0000	3588.7500 (28a)
External Wall	108.4000	15.6100	92.7900	0.1800	16.7022	9.0000	835.1100 (29a)
Plane Ceiling	47.8500		47.8500	0.0800	3.8280	9.0000	430.6500 (30)
Total net area of external elements Aum(A, m ²)			204.1000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.7195		(33)
Main dwelling							
Party Wall			41.9000	0.0000	0.0000	20.0000	838.0000 (32)
Internal Wall GF			62.6700			9.0000	564.0300 (32c)
Internal Wall GF			109.9200			9.0000	989.2800 (32c)
Internal Floor			47.8500			18.0000	861.3000 (32d)
Internal Ceiling			47.8500			9.0000	430.6500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8537.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							89.2139 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				10.9600	0.0500	0.5480	

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E3 Sill	6.8600	0.0330	0.2264
E4 Jamb	26.4800	0.0330	0.8738
E5 Ground floor (normal)	21.2900	0.0900	1.9161
E10 Eaves (insulation at ceiling level)	9.9000	0.0350	0.3465
E12 Gable (insulation at ceiling level)	11.3000	0.1080	1.2204
E16 Corner (normal)	15.3000	0.0460	0.7038
E17 Corner (inverted - internal area greater than external area)	5.0900	0.0310	0.1578
E6 Intermediate floor within a dwelling	21.2900	0.0670	1.4264
P1 Party wall - Ground floor	8.2300	0.1600	1.3168
P2 Party wall - Intermediate floor within a dwelling	8.2300	0.0000	0.0000
E18 Party wall between dwellings	10.2000	0.0840	0.8568
P4 Party wall - Roof (insulation at ceiling level)	8.2300	0.2400	1.9752
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.5680 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	54.2876 (37)

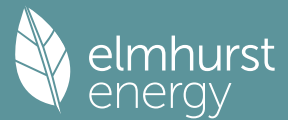
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	46.3685	46.1254	45.8871	44.7678	44.5584	43.5836	43.5836	43.4031	43.9591	44.5584	44.9820	45.4249 (38)
Average = Sum(39)m / 12 =	100.6560	100.4129	100.1746	99.0554	98.8460	97.8711	97.8711	97.6906	98.2466	98.8460	99.2696	99.7125 (39)
												99.0544
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0518	1.0492	1.0468	1.0351	1.0329	1.0227	1.0227	1.0208	1.0266	1.0329	1.0373	1.0419 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.6960 (42)
Hot water usage for mixer showers												
	69.4227	68.3795	66.8592	63.9504	61.8038	59.4099	58.0493	59.5580	61.2119	63.7822	66.7535	69.1568 (42a)
Hot water usage for baths												
	29.9773	29.5321	28.9051	27.7492	26.8836	25.9238	25.4054	26.0279	26.7058	27.7328	28.9126	29.8759 (42b)
Hot water usage for other uses												
	42.2397	40.7037	39.1677	37.6317	36.0957	34.5597	34.5597	36.0957	37.6317	39.1677	40.7037	42.2397 (42c)
Average daily hot water use (litres/day)												130.1988 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	141.6397	138.6152	134.9320	129.3313	124.7831	119.8935	118.0144	121.6817	125.5494	130.6827	136.3697	141.2724 (44)
Energy conte	224.3227	197.3862	207.3855	177.0481	167.9821	147.4230	142.7282	150.6673	154.8150	177.3352	194.2837	221.1984 (45)
Energy content (annual)										Total = Sum(45)m =		2162.5752
Distribution loss (46)m = 0.15 x (45)m												
	33.6484	29.6079	31.1078	26.5572	25.1973	22.1135	21.4092	22.6001	23.2222	26.6003	29.1425	33.1798 (46)
Water storage loss (or HIU loss):												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7128 (55)
Total storage loss												
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968 (56)
If cylinder contains dedicated solar storage												
	22.0968	19.9584	22.0968	21.3840	22.0968	21.3840	22.0968	22.0968	21.3840	22.0968	21.3840	22.0968 (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												
	269.6819	238.3558	252.7447	220.9441	213.3413	191.3190	188.0874	196.0265	198.7110	222.6944	238.1797	266.5576 (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	269.6819	238.3558	252.7447	220.9441	213.3413	191.3190	188.0874	196.0265	198.7110	222.6944	238.1797	266.5576 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2696.6432 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	110.8746	98.4066	105.2430	93.9853	92.1414	84.1350	83.7445	86.3843	86.5928	95.2513	99.7161	109.8358 (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	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	130.6319	144.6281	130.6319	134.9863	130.6319	134.9863	130.6319	130.6319	134.9863	130.6319	134.9863	130.6319 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	249.1829	251.7687	245.2527	231.3810	213.8704	197.4129	186.4183	183.8325	190.3485	204.2203	221.7308	238.1883 (68)
Pumps, fans	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800 (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)	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398 (71)
Total internal gains	149.0251	146.4384	141.4557	130.5351	123.8460	116.8541	112.5598	116.1079	120.2678	128.0260	138.4946	147.6288 (72)
	592.2798	606.2752	580.7802	560.3423	531.7881	512.6932	493.0498	494.0122	509.0425	526.3180	558.6516	579.8889 (73)

6. Solar gains												
[Jan]		Area	Solar flux	g	FF	Access	Gains					
		m2	Table 6a	Specific data	Specific data	factor	W					
			W/m2	or Table 6b	or Table 6c	Table 6d						
North		3.4500	10.6334	0.6400	0.7000	0.7700	11.3894 (74)					
South		6.4600	46.7521	0.6400	0.7000	0.7700	93.7658 (78)					
West		0.6600	19.6403	0.6400	0.7000	0.7700	4.0244 (80)					

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North	5.0400		10.6334		0.6400		0.7000		0.7700		16.6385 (74)	
Solar gains	125.8181	214.9996	299.5949	386.1901	450.4972	456.2651	436.0483	385.9397	328.8514	238.7345	150.7385	107.6972 (83)
Total gains	718.0980	821.2748	880.3751	946.5323	982.2853	968.9583	929.0981	879.9519	837.8939	765.0525	709.3901	687.5862 (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	23.5615	23.6185	23.6747	23.9422	23.9929	24.2319	24.2319	24.2767	24.1393	23.9929	23.8905	23.7844
alpha	2.5708	2.5746	2.5783	2.5961	2.5995	2.6155	2.6155	2.6184	2.6093	2.5995	2.5927	2.5856
util living area												
	0.9324	0.9056	0.8700	0.8009	0.6978	0.5544	0.4280	0.4635	0.6428	0.8187	0.9047	0.9385 (86)
Living	18.6083	18.9337	19.3732	19.9516	20.4431	20.7868	20.9212	20.9007	20.6674	20.0433	19.2449	18.5554
Non living	17.2462	17.6545	18.2046	18.9207	19.5044	19.8886	20.0159	20.0016	19.7687	19.0466	18.0582	17.1845
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.7765	18.9337	19.3732	19.9516	20.4431	20.7868	20.9212	20.9007	20.6674	20.0433	19.2449	18.8973 (87)
Th 2	20.0404	20.0425	20.0446	20.0542	20.0560	20.0645	20.0645	20.0660	20.0612	20.0560	20.0524	20.0485 (88)
util rest of house												
	0.9240	0.8941	0.8538	0.7752	0.6571	0.4928	0.3479	0.3831	0.5851	0.7901	0.8912	0.9308 (89)
MIT 2	18.9264	17.6545	18.2046	18.9207	19.5044	19.8886	20.0159	20.0016	19.7687	19.0466	18.0582	17.7006 (90)
Living area fraction												
MIT	19.0766	17.8804	18.4110	19.1028	19.6702	20.0472	20.1757	20.1604	19.9274	19.2226	18.2677	17.9119 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0766	17.8804	18.4110	19.1028	19.6702	20.0472	20.1757	20.1604	19.9274	19.2226	18.2677	17.9119 (93)

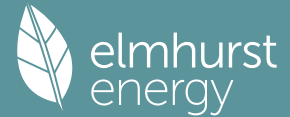
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9141	0.8606	0.8195	0.7451	0.6387	0.4916	0.3579	0.3917	0.5760	0.7600	0.8583	0.9081 (94)
Useful gains	656.3810	706.8156	721.4353	705.3049	627.4295	476.3148	332.4799	344.6618	482.6687	581.4164	608.9030	624.4166 (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	1487.3498	1303.4033	1193.1808	1010.6403	787.8203	533.1210	349.9621	367.3519	572.5246	852.3102	1108.6153	1367.2490 (97)
Space heating kWh	618.2407	400.9070	350.9787	219.8415	119.3308	0.0000	0.0000	0.0000	0.0000	201.5450	359.7929	552.6673 (98a)
Space heating requirement - total per year (kWh/year)												2823.3038
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	618.2407	400.9070	350.9787	219.8415	119.3308	0.0000	0.0000	0.0000	0.0000	201.5450	359.7929	552.6673 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2823.3038
Space heating per m2										(98c) / (4) =		29.5016 (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 %)												301.9982 (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	618.2407	400.9070	350.9787	219.8415	119.3308	0.0000	0.0000	0.0000	0.0000	201.5450	359.7929	552.6673 (98)
Space heating efficiency (main heating system 1)	301.9982	301.9982	301.9982	301.9982	301.9982	0.0000	0.0000	0.0000	0.0000	301.9982	301.9982	301.9982 (210)
Space heating fuel (main heating system)	204.7167	132.7514	116.2188	72.7956	39.5137	0.0000	0.0000	0.0000	0.0000	66.7371	119.1374	183.0035 (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	269.6819	238.3558	252.7447	220.9441	213.3413	191.3190	188.0874	196.0265	198.7110	222.6944	238.1797	266.5576 (64)
Efficiency of water heater (217)m	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950	305.9950 (216)
Fuel for water heating, kWh/month	88.1328	77.8953	82.5977	72.2051	69.7205	62.5236	61.4675	64.0620	64.9393	72.7771	77.8378	87.1117 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	34.4637	27.6481	24.8940	18.2384	14.0879	11.5099	12.8514	16.7048	21.6979	28.4688	32.1554	35.4216 (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												934.8743 (211)
Space heating fuel - main system 2												0.0000 (213)

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Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	305.9950	
Water heating fuel used	881.2704	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	278.1420	(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	2094.2867	(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	934.8743	0.1550	144.9117	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	881.2704	0.1410	124.2684	(264)
Space and water heating			269.1801	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	278.1420	0.1443	40.1445	(268)
Total CO2, kg/year			309.3246	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.2300	(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	934.8743	1.5738	1471.3207	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	881.2704	1.5214	1340.7748	(278)
Space and water heating			2812.0956	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	278.1420	1.5338	426.6235	(282)
Total Primary energy kWh/year			3238.7191	(286)
Dwelling Primary energy Rate (DPER)			33.8400	(287)

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

1. Overall dwelling characteristics

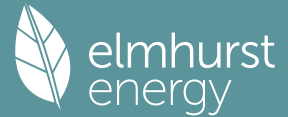
	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	47.8500 (1b)	x 2.3800 (2b)	= 113.8830	(1b) - (3b)
First floor	47.8500 (1c)	x 2.7000 (2c)	= 129.1950	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	95.7000			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 243.0780	(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	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1234 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3734 (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) =	0.3174 (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	0.4047	0.3968	0.3888	0.3491	0.3412	0.3015	0.3015	0.2936	0.3174	0.3412	0.3571	0.3730 (22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5695 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opening Type			15.6100	1.1450	17.8740			(27)
Ground Floor			47.8500	0.1300	6.2205			(28a)
External Wall	108.4000	15.6100	92.7900	0.1800	16.7022			(29a)
Plane Ceiling	47.8500		47.8500	0.1100	5.2635			(30)
Total net area of external elements Aum(A, m2)			204.1000					(31)
Fabric heat loss, W/K = Sum (A x U)					46.0602			(33)
Main dwelling								
Party Wall			41.9000	0.0000	0.0000			(32)

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

89.2139 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	10.9600	0.0500	0.5480	
E3 Sill	6.8600	0.0500	0.3430	
E4 Jamb	26.4800	0.0500	1.3240	
E5 Ground floor (normal)	21.2900	0.1600	3.4064	
E10 Eaves (insulation at ceiling level)	9.9000	0.0600	0.5940	
E12 Gable (insulation at ceiling level)	11.3000	0.0600	0.6780	
E16 Corner (normal)	15.3000	0.0900	1.3770	
E17 Corner (inverted - internal area greater than external area)	5.0900	-0.0900	-0.4581	
E6 Intermediate floor within a dwelling	21.2900	0.0000	0.0000	
P1 Party wall - Ground floor	8.2300	0.0800	0.6584	
P2 Party wall - Intermediate floor within a dwelling	8.2300	0.0000	0.0000	
E18 Party wall between dwellings	10.2000	0.0600	0.6120	
P4 Party wall - Roof (insulation at ceiling level)	8.2300	0.1200	0.9876	

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

10.0703 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 56.1305 (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	46.6765	46.4215	46.1714	44.9971	44.7774	43.7546	43.7546	43.5652	44.1486	44.7774	45.2219	45.6866	(38)
Average = Sum(39)m / 12 =	102.8071	102.5520	102.3020	101.1277	100.9079	99.8851	99.8851	99.6957	100.2791	100.9079	101.3524	101.8171	(39)
												101.1266	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0743	1.0716	1.0690	1.0567	1.0544	1.0437	1.0437	1.0418	1.0478	1.0544	1.0591	1.0639	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6960 (42)
Hot water usage for mixer showers	69.4227	68.3795	66.8592	63.9504	61.8038	59.4099	58.0493	59.5580	61.2119	63.7822	66.7535	69.1568	(42a)
Hot water usage for baths	29.9773	29.5321	28.9051	27.7492	26.8836	25.9238	25.4054	26.0279	26.7058	27.7328	28.9126	29.8759	(42b)
Hot water usage for other uses	42.2397	40.7037	39.1677	37.6317	36.0957	34.5597	34.5597	36.0957	37.6317	39.1677	40.7037	42.2397	(42c)
Average daily hot water use (litres/day)												130.1988	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	141.6397	138.6152	134.9320	129.3313	124.7831	119.8935	118.0144	121.6817	125.5494	130.6827	136.3697	141.2724	(44)
Energy content (annual)	224.3227	197.3862	207.3855	177.0481	167.9821	147.4230	142.7282	150.6673	154.8150	177.3352	194.2837	221.1984	(45)
Distribution loss (46)m = 0.15 x (45)m	33.6484	29.6079	31.1078	26.5572	25.1973	22.1135	21.4092	22.6001	23.2222	26.6003	29.1425	33.1798	(46)

Water storage loss (or HIU loss):

Store volume 210.0000 (47)

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

Temperature factor from Table 2b 1.7016 (48)

Enter (49) or (54) in (55) 0.5400 (49)

Total storage loss 0.9188 (55)

If cylinder contains dedicated solar storage 28.4842 (56)

Primary loss 28.4842 (57)

Combi loss 23.2624 (59)

Total heat required for water heating calculated for each month 0.0000 (61)

WWHRS 276.0693 (62)

PV diverter -31.7372 (63a)

Solar input -0.0000 (63b)

FGHRS 0.0000 (63c)

Output from w/h 0.0000 (63d)

244.3321 216.0565 229.7402 202.7878 197.0469 178.0914 176.2819 183.0677 184.8111 205.4082 217.5417 241.7955 (64)

Total per year (kWh/year) = Sum(64)m = 2476.9610 (64)

12Total per year (kWh/year) 2477 (64)

Electric shower(s) 0.0000 (64a)

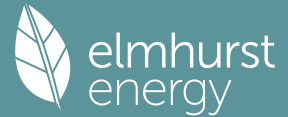
Heat gains from water heating, kWh/month 0.0000 (64a)

115.9846 103.0220 110.3529 98.9304 97.2513 89.0800 88.8544 91.4942 91.5379 100.3612 104.6612 114.9457 (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	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	134.7997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.6319	144.6281	130.6319	134.9863	130.6319	134.9863	130.6319	130.6319	134.9863	130.6319	134.9863	130.6319	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	249.1829	251.7687	245.2527	231.3810	213.8704	197.4129	186.4183	183.8325	190.3485	204.2203	221.7308	238.1883	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	36.4800	(69)

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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)	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398	-107.8398 (71)
Water heating gains (Table 5)	155.8932	153.3066	148.3239	137.4033	130.7141	123.7223	119.4279	122.9760	127.1359	134.8941	145.3628	154.4970 (72)
Total internal gains	602.1480	616.1433	590.6484	570.2104	541.6563	519.5613	499.9180	500.8804	515.9106	536.1862	568.5198	589.7571 (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			
North				8.4900	10.6334	0.6300	0.7000	0.7700	27.5900 (74)			
South				6.4600	46.7521	0.6300	0.7000	0.7700	92.3007 (78)			
West				0.6600	19.6403	0.6300	0.7000	0.7700	3.9615 (80)			
Solar gains	123.8522	211.6403	294.9138	380.1558	443.4582	449.1360	429.2350	379.9094	323.7131	235.0042	148.3832	106.0145 (83)
Total gains	726.0002	827.7836	885.5621	950.3663	985.1144	968.6973	929.1531	880.7898	839.6238	771.1904	716.9030	695.7716 (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	23.0685	23.1259	23.1824	23.4516	23.5026	23.7433	23.7433	23.7884	23.6500	23.5026	23.3996	23.2928
alpha	2.5379	2.5417	2.5455	2.5634	2.5668	2.5829	2.5829	2.5859	2.5767	2.5668	2.5600	2.5529
util living area	0.9318	0.9056	0.8709	0.8032	0.7020	0.5609	0.4343	0.4696	0.6478	0.8197	0.9042	0.9378 (86)
MIT	18.5608	18.8844	19.3269	19.9135	20.4167	20.7724	20.9147	20.8932	20.6494	20.0141	19.2065	18.5096 (87)
Th 2	20.0219	20.0241	20.0262	20.0363	20.0382	20.0470	20.0470	20.0487	20.0437	20.0382	20.0344	20.0304 (88)
util rest of house	0.9232	0.8940	0.8545	0.7774	0.6609	0.4981	0.3521	0.3873	0.5893	0.7907	0.8906	0.9299 (89)
MIT 2	17.1758	17.5819	18.1361	18.8630	19.4612	19.8597	19.9948	19.9797	19.7360	18.9997	17.9995	17.1164 (90)
Living area fraction	17.4203	17.8119	18.3464	19.0486	19.6299	20.0209	20.1572	20.1410	19.8973	19.1789	18.2127	17.3624 (91)
MIT	17.4203	17.8119	18.3464	19.0486	19.6299	20.0209	20.1572	20.1410	19.8973	19.1789	18.2127	17.3624 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4203	17.8119	18.3464	19.0486	19.6299	20.0209	20.1572	20.1410	19.8973	19.1789	18.2127	17.3624 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8921	0.8599	0.8195	0.7464	0.6415	0.4963	0.3620	0.3957	0.5795	0.7599	0.8570	0.9001 (94)
Useful gains	647.6491	711.7926	725.6992	709.3847	631.9630	480.7552	336.3856	348.5389	486.5331	585.9960	614.3983	626.2386 (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	1348.8646	1324.1436	1211.9072	1026.2999	800.1936	541.4671	355.3142	372.9644	581.3479	865.6774	1126.2980	1340.1575 (97)
Space heating kWh	521.7043	411.4998	361.7387	228.1790	125.1636	0.0000	0.0000	0.0000	0.0000	208.0830	368.5678	531.1556 (98a)
Space heating requirement - total per year (kWh/year)												2756.0917
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	521.7043	411.4998	361.7387	228.1790	125.1636	0.0000	0.0000	0.0000	0.0000	208.0830	368.5678	531.1556 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2756.0917
Space heating per m2										(98c) / (4) =		28.7993 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	521.7043	411.4998	361.7387	228.1790	125.1636	0.0000	0.0000	0.0000	0.0000	208.0830	368.5678	531.1556 (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)	565.2268	445.8286	391.9163	247.2145	135.6052	0.0000	0.0000	0.0000	0.0000	225.4420	399.3150	575.4665 (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	244.3321	216.0565	229.7402	202.7878	197.0469	178.0914	176.2819	183.0677	184.8111	205.4082	217.5417	241.7955 (64)
Efficiency of water heater (217)m	85.7166	85.4809	85.0732	84.3250	83.0705	79.8000	79.8000	79.8000	79.8000	84.0888	85.2321	79.8000 (216)
Fuel for water heating, kWh/month	285.0465	252.7541	270.0499	240.4836	237.2044	223.1722	220.9047	229.4082	231.5928	244.2753	255.2343	281.8989 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	27.1427	21.7749	19.6059	14.3641	11.0953	9.0649	10.1215	13.1563	17.0887	22.4213	25.3248	27.8971 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-43.9725	-61.5860	-87.9395	-98.1848	-105.2694	-98.0082	-96.7599	-91.6205	-82.4895	-70.0634	-48.1836	-38.0617 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-26.0893	-54.7395	-108.5512	-162.6948	-214.8157	-215.7602	-213.2549	-180.7312	-132.6721	-78.2083	-34.8053	-20.6445 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year												
Space heating fuel - main system 1												2986.0149 (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												2972.0249 (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)												219.0573 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2365.1061 (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												3897.9911 (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	2986.0149	0.2100	627.0631 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2972.0249	0.2100	624.1252 (264)
Space and water heating			1251.1884 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	219.0573	0.1443	31.6167 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-922.1389	0.1347	-124.2470
PV Unit electricity exported	-1442.9671	0.1260	-181.7478
Total			-305.9947 (269)
Total CO2, kg/year			988.7396 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3300 (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	2986.0149	1.1300	3374.1968 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2972.0249	1.1300	3358.3882 (278)
Space and water heating			6732.5850 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	219.0573	1.5338	335.9974 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-922.1389	1.4980	-1381.3425
PV Unit electricity exported	-1442.9671	0.4623	-667.1428
Total			-2048.4853 (283)
Total Primary energy kWh/year			5150.1979 (286)
Target Primary Energy Rate (TPER)			53.8200 (287)

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Plot Reference	York			Issued on Date	26/01/2026
Assessment Reference	York	Plot Type Ref	York		
Plot Address	York, Hilperton, Trowbridge, BA14 6JB			SAP Version	10.2
SAP Rating	86 B	DER	3.12	TER	10.24
Environmental	97 A	% DER < TER			69.53
CO ₂ Emissions (t/year)	0.35	DFEE	37.57	TFEE	39.97
Compliance Check	See BREL	% DFEE < TFEE			6.02
% DPER < TPER	39.07	DPER	32.58	TPER	53.47
Assessor Details	Mr. Aymon Winter			Assessor ID	AU06-0001
Client	Redcliffe Homes Ltd, Gerrian Baker				

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	59.8000 (1b)	x 2.4000 (2b)	= 143.5200 (1b) - (3b)
First floor	59.8000 (1c)	x 2.7000 (2c)	= 161.4600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 304.9800 (5)

2. Ventilation rate

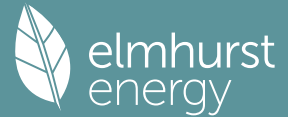
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	5 * 10 = 50.0000 (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) =	50.0000 / (5) = 0.1639 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3639 (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) = 0.3094 (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	0.3944	0.3867	0.3790	0.3403	0.3326	0.2939	0.2939	0.2862	0.3094	0.3326	0.3480	0.3635 (22b)
Effective ac	0.5778	0.5748	0.5718	0.5579	0.5553	0.5432	0.5432	0.5409	0.5478	0.5553	0.5606	0.5661 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Front Door			2.2300	1.2000	2.6760		(26)
Window			15.0900	1.0536	15.8994		(27)
Patio Doors			5.0400	1.0536	5.3103		(27)
Ground Floor			59.8000	0.1200	7.1760	75.0000	4485.0000 (28a)
External Wall Stone	136.6300	17.8600	118.7700	0.1800	21.3786	9.0000	1068.9300 (29a)
External Wall Cladding	25.6500	4.5000	21.1500	0.1800	3.8070	9.0000	190.3500 (29a)
Plane Ceiling	59.8000		59.8000	0.0800	4.7840	9.0000	538.2000 (30)
Total net area of external elements Aum(A, m ²)			281.8800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	61.0314		(33)
Main dwelling							
IW Stud			242.9100			9.0000	2186.1900 (32c)
Internal Floor			59.8000			18.0000	1076.4000 (32d)
Internal Ceiling			59.8000			9.0000	538.2000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10083.2701 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							84.3083 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				14.2700	0.0500	0.7135	

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E3 Sill	9.3800	0.0330	0.3095
E4 Jamb	35.0800	0.0330	1.1576
E5 Ground floor (normal)	31.8000	0.0900	2.8620
E6 Intermediate floor within a dwelling	31.8000	0.0670	2.1306
E10 Baves (insulation at ceiling level)	13.1500	0.0350	0.4603
E12 Gable (insulation at ceiling level)	18.6500	0.1080	2.0142
E16 Corner (normal)	25.5000	0.0460	1.1730
E17 Corner (inverted - internal area greater than external area)	5.1000	0.0310	0.1581
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.9788 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	72.0102 (37)

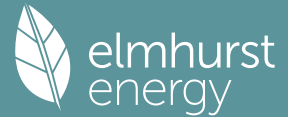
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	58.1503	57.8463	57.5484	56.1488	55.8869	54.6679	54.6679	54.4422	55.1375	55.8869	56.4167	56.9705 (38)
Average = Sum(39)m / 12 =	130.1605	129.8565	129.5586	128.1590	127.8971	126.6781	126.6781	126.4524	127.1477	127.8971	128.4269	128.9807 (39)
												128.1577
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0883	1.0858	1.0833	1.0716	1.0694	1.0592	1.0592	1.0573	1.0631	1.0694	1.0738	1.0784 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												2.8618 (42)
Hot water usage for mixer showers												
	72.2021	71.1170	69.5359	66.5106	64.2781	61.7884	60.3732	61.9424	63.6625	66.3357	69.4259	71.9254 (42a)
Hot water usage for baths												
	31.1725	30.7095	30.0576	28.8555	27.9554	26.9574	26.4183	27.0657	27.7705	28.8385	30.0653	31.0671 (42b)
Hot water usage for other uses												
	43.9372	42.3395	40.7418	39.1441	37.5464	35.9487	35.9487	37.5464	39.1441	40.7418	42.3395	43.9372 (42c)
Average daily hot water use (litres/day)												135.4126 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	147.3118	144.1660	140.3352	134.5102	129.7799	124.6944	122.7402	126.5544	130.5771	135.9160	141.8307	146.9297 (44)
Energy content (annual)	233.3058	205.2905	215.6900	184.1378	174.7087	153.3263	148.4436	156.7008	161.0147	184.4367	202.0639	230.0565 (45)
Distribution loss (46)m = 0.15 x (45)m												
	34.9959	30.7936	32.3535	27.6207	26.2063	22.9990	22.2665	23.5051	24.1522	27.6655	30.3096	34.5085 (46)
Water storage loss (or HIU loss):												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss												
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage												
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	291.5548	257.9025	273.9390	240.5078	232.9577	209.6963	206.6926	214.9498	217.3847	242.6857	258.4339	288.3055 (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	291.5548	257.9025	273.9390	240.5078	232.9577	209.6963	206.6926	214.9498	217.3847	242.6857	258.4339	288.3055 (64)
12Total per year (kWh/year)												2935.0104 (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												
	124.1734	110.3487	118.3161	106.3218	104.6898	96.0770	95.9567	98.7022	98.6334	107.9244	112.2822	123.0930 (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	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	148.3680	164.2645	148.3680	153.3136	148.3680	153.3136	148.3680	148.3680	153.3136	148.3680	153.3136	148.3680 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	284.6915	287.6457	280.2012	264.3527	244.3469	225.5442	212.9829	210.0287	217.4732	233.3216	253.3275	272.1302 (68)
Pumps, fans	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088 (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)	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702 (71)
Total internal gains	166.8997	164.2094	159.0271	147.6692	140.7121	133.4403	128.9741	132.6643	136.9908	145.0597	155.9476	165.4476 (72)
	665.8855	682.0460	653.5226	631.2618	599.3533	578.2244	556.2512	556.9872	573.7039	592.6756	628.5149	651.8720 (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
North	8.6900	10.6334	0.6400	0.7000	0.7700	28.6882 (74)
East	0.6600	19.6403	0.6400	0.7000	0.7700	4.0244 (76)
South	2.8500	46.7521	0.6400	0.7000	0.7700	41.3673 (78)
West	2.8900	19.6403	0.6400	0.7000	0.7700	17.6220 (80)
North	5.0400	10.6334	0.6400	0.7000	0.7700	16.6385 (74)

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Solar gains	108.3404	196.7156	303.2276	435.6709	544.7738	566.3627	535.3698	449.7074	348.2284	226.4312	131.9412	91.3327 (83)
Total gains	774.2259	878.7615	956.7502	1066.9327	1144.1272	1144.5871	1091.6210	1006.6946	921.9322	819.1069	760.4561	743.2047 (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	21.5189	21.5693	21.6189	21.8550	21.8997	22.1104	22.1104	22.1499	22.0288	21.8997	21.8094	21.7157
alpha	2.4346	2.4380	2.4413	2.4570	2.4600	2.4740	2.4740	2.4767	2.4686	2.4600	2.4540	2.4477
util living area	0.9463	0.9262	0.8952	0.8284	0.7247	0.5823	0.4582	0.5042	0.6938	0.8566	0.9254	0.9509 (86)
Living	18.2213	18.5355	19.0252	19.7056	20.3000	20.7185	20.8883	20.8553	20.5372	19.7791	18.9028	18.1735
Non living	16.7504	17.1475	17.7644	18.6123	19.3252	19.7988	19.9642	19.9397	19.6148	18.7196	17.6229	16.6944
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.5785	18.5355	19.0252	19.7056	20.3000	20.7185	20.8883	20.8553	20.5372	19.7791	18.9028	18.5689 (87)
Th 2	20.0104	20.0125	20.0145	20.0241	20.0259	20.0343	20.0343	20.0359	20.0311	20.0259	20.0223	20.0185 (88)
util rest of house	0.9394	0.9169	0.8815	0.8049	0.6850	0.5193	0.3729	0.4186	0.6373	0.8320	0.9144	0.9446 (89)
MIT 2	18.7107	17.1475	17.7644	18.6123	19.3252	19.7988	19.9642	19.9397	19.6148	18.7196	17.6229	17.2934 (90)
Living area fraction									fLA = Living area / (4) =			0.1321 (91)
MIT	18.8254	17.3308	17.9310	18.7568	19.4540	19.9203	20.0863	20.0607	19.7367	18.8595	17.7920	17.4619 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8254	17.3308	17.9310	18.7568	19.4540	19.9203	20.0863	20.0607	19.7367	18.8595	17.7920	17.4619 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9295	0.8820	0.8433	0.7680	0.6586	0.5112	0.3777	0.4210	0.6178	0.7948	0.8797	0.9221 (94)
Useful gains	719.6733	775.0263	806.8676	819.3628	753.5383	585.1053	412.3435	423.7683	569.5908	650.9852	668.9947	685.3059 (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	1890.6318	1614.2248	1480.9812	1263.2318	991.7129	673.9705	441.6336	462.9029	716.6926	1056.3723	1373.1364	1710.5297 (97)
Space heating kWh	871.1931	563.9414	501.5405	319.5857	177.2019	0.0000	0.0000	0.0000	0.0000	301.6080	506.9820	762.7665 (98a)
Space heating requirement - total per year (kWh/year)												4004.8191
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	871.1931	563.9414	501.5405	319.5857	177.2019	0.0000	0.0000	0.0000	0.0000	301.6080	506.9820	762.7665 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4004.8191
Space heating per m2										(98c) / (4) =		33.4851 (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 %)												332.2038 (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	871.1931	563.9414	501.5405	319.5857	177.2019	0.0000	0.0000	0.0000	0.0000	301.6080	506.9820	762.7665 (98)
Space heating efficiency (main heating system 1)	332.2038	332.2038	332.2038	332.2038	332.2038	0.0000	0.0000	0.0000	0.0000	332.2038	332.2038	332.2038 (210)
Space heating fuel (main heating system)	262.2466	169.7577	150.9737	96.2017	53.3413	0.0000	0.0000	0.0000	0.0000	90.7901	152.6118	229.6080 (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	291.5548	257.9025	273.9390	240.5078	232.9577	209.6963	206.6926	214.9498	217.3847	242.6857	258.4339	288.3055 (64)
Efficiency of water heater (217)m	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798	296.9798 (216)
Fuel for water heating, kWh/month	98.1733	86.8418	92.2416	80.9846	78.4423	70.6096	69.5982	72.3786	73.1985	81.7179	87.0207	97.0792 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	40.1612	32.2188	29.0095	21.2536	16.4169	13.4127	14.9760	19.4664	25.2849	33.1752	37.4713	41.2774 (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												1205.5309 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												296.9798
Water heating fuel used												988.2862 (219)

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Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	324.1240 (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	2517.9411 (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	1205.5309	0.1548	186.6222 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	988.2862	0.1409	139.2579 (264)
Space and water heating			325.8801 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	324.1240	0.1443	46.7811 (268)
Total CO2, kg/year			372.6613 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.1200 (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	1205.5309	1.5731	1896.3857 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	988.2862	1.5210	1503.2119 (278)
Space and water heating			3399.5976 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	324.1240	1.5338	497.1523 (282)
Total Primary energy kWh/year			3896.7498 (286)
Dwelling Primary energy Rate (DPER)			32.5800 (287)

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

1. Overall dwelling characteristics

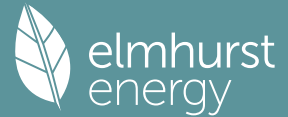
	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	59.8000 (1b)	x 2.4000 (2b)	= 143.5200 (1b) - (3b)
First floor	59.8000 (1c)	x 2.7000 (2c)	= 161.4600 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	304.9800 (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) = 0.1312 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3812 (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) = 0.3240 (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	0.4131	0.4050	0.3969	0.3564	0.3483	0.3078	0.3078	0.2997	0.3240	0.3483	0.3645	0.3807 (22b)
Effective ac	0.5853	0.5820	0.5788	0.5635	0.5606	0.5474	0.5474	0.5449	0.5525	0.5606	0.5664	0.5725 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Opaque door			2.2300	1.0000	2.2300			(26)
TER Opening Type			20.1300	1.1450	23.0496			(27)
Ground Floor			59.8000	0.1300	7.7740			(28a)
External Wall Stone	136.6300	17.8600	118.7700	0.1800	21.3786			(29a)
External Wall Cladding	25.6500	4.5000	21.1500	0.1800	3.8070			(29a)
Plane Ceiling	59.8000		59.8000	0.1100	6.5780			(30)
Total net area of external elements Aum(A, m2)			281.8800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	64.8172		(33)

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

84.3083 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	14.2700	0.0500	0.7135	
E2 Other lintels (including other steel lintels)	9.3800	0.0500	0.4690	
E3 Sill	35.0800	0.0500	1.7540	
E4 Jamb	31.8000	0.1600	5.0880	
E5 Ground floor (normal)	31.8000	0.0000	0.0000	
E6 Intermediate floor within a dwelling	13.1500	0.0600	0.7890	
E10 Baves (insulation at ceiling level)	18.6500	0.0600	1.1190	
E12 Gable (insulation at ceiling level)	25.5000	0.0900	2.2950	
E16 Corner (normal)	5.1000	-0.0900	-0.4590	
E17 Corner (inverted - internal area greater than external area)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			11.7685	(36)
Point Thermal Bridges			0.0000	(36a) =
Total fabric heat loss			76.5857	(33) + (36) + (36a) = (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	58.9083	58.5748	58.2480	56.7129	56.4257	55.0887	55.0887	54.8411	55.6037	56.4257	57.0067	57.6142	(38)
Heat transfer coeff	135.4940	135.1606	134.8337	133.2986	133.0114	131.6744	131.6744	131.4268	132.1894	133.0114	133.5925	134.1999	(39)
Average = Sum(39)m / 12 =												133.2973	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1329	1.1301	1.1274	1.1145	1.1121	1.1010	1.1010	1.0989	1.1053	1.1121	1.1170	1.1221	(40)
HLP (average)												1.1145	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

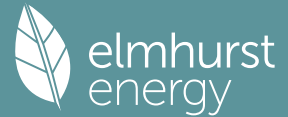
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8618 (42)
Hot water usage for mixer showers	72.2021	71.1170	69.5359	66.5106	64.2781	61.7884	60.3732	61.9424	63.6625	66.3357	69.4259	71.9254	(42a)
Hot water usage for baths	31.1725	30.7095	30.0576	28.8555	27.9554	26.9574	26.4183	27.0657	27.7705	28.8385	30.0653	31.0671	(42b)
Hot water usage for other uses	43.9372	42.3395	40.7418	39.1441	37.5464	35.9487	35.9487	37.5464	39.1441	40.7418	42.3395	43.9372	(42c)
Average daily hot water use (litres/day)												135.4126	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	147.3118	144.1660	140.3352	134.5102	129.7799	124.6944	122.7402	126.5544	130.5771	135.9160	141.8307	146.9297	(44)
Energy conte	233.3058	205.2905	215.6900	184.1378	174.7087	153.3263	148.4436	156.7008	161.0147	184.4367	202.0639	230.0565	(45)
Energy content (annual)										Total = Sum(45)m =		2249.1754	
Distribution loss (46)m = 0.15 x (45)m	34.9959	30.7936	32.3535	27.6207	26.2063	22.9990	22.2665	23.5051	24.1522	27.6655	30.3096	34.5085	(46)
Water storage loss (or HIU loss):													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0208	(55)
Total storage loss	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(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	288.2126	254.8837	270.5968	237.2734	229.6155	206.4619	203.3504	211.6076	214.1503	239.3435	255.1995	284.9633	(62)
WWHRS	-33.0078	-29.1923	-30.5685	-25.3120	-23.5898	-20.1860	-18.9211	-20.1207	-20.8852	-24.6213	-27.8930	-32.3965	(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	255.2049	225.6914	240.0283	211.9614	206.0256	186.2760	184.4292	191.4869	193.2651	214.7222	227.3065	252.5668	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2588.9642	(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	121.4996	107.9337	115.6424	103.7343	102.0161	93.4895	93.2829	96.0285	96.0459	105.2506	109.6947	120.4192	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	143.0878	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.3680	164.2645	148.3680	153.3136	148.3680	153.3136	148.3680	148.3680	153.3136	148.3680	153.3136	148.3680	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.6915	287.6457	280.2012	264.3527	244.3469	225.5442	212.9829	210.0287	217.4732	233.3216	253.3275	272.1302	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	37.3088	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	-114.4702	(71)
Water heating gains (Table 5)	163.3059	160.6156	155.4333	144.0754	137.1184	129.8465	125.3803	129.0705	133.3970	141.4659	152.3538	161.8538	(72)
Total internal gains	665.2918	681.4522	652.9288	630.6681	598.7596	574.6306	552.6575	553.3935	570.1101	592.0819	627.9212	651.2783	(73)

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6. Solar gains

[Jan]	Area m ²		Solar flux Table 6a W/m ²		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W	
North	13.7300		10.6334		0.6300		0.7000		0.7700		44.6184 (74)	
East	0.6600		19.6403		0.6300		0.7000		0.7700		3.9615 (76)	
South	2.8500		46.7521		0.6300		0.7000		0.7700		40.7209 (78)	
West	2.8900		19.6403		0.6300		0.7000		0.7700		17.3467 (80)	
Solar gains	106.6476	193.6419	298.4897	428.8635	536.2617	557.5133	527.0046	442.6807	342.7873	222.8932	129.8796	89.9056 (83)
Total gains	771.9393	875.0941	951.4185	1059.5316	1135.0213	1132.1439	1079.6621	996.0742	912.8974	814.9751	757.8008	741.1838 (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	20.6718	20.7228	20.7731	21.0123	21.0577	21.2715	21.2715	21.3115	21.1886	21.0577	20.9661	20.8712
alpha	2.3781	2.3815	2.3849	2.4008	2.4038	2.4181	2.4181	2.4208	2.4126	2.4038	2.3977	2.3914
util living area	0.9476	0.9284	0.8990	0.8355	0.7359	0.5977	0.4740	0.5200	0.7067	0.8620	0.9275	0.9520 (86)
MIT	18.0980	18.4129	18.9114	19.6111	20.2326	20.6814	20.8702	20.8336	20.4886	19.6994	18.7994	18.0522 (87)
Th 2	19.9741	19.9763	19.9785	19.9890	19.9909	20.0001	20.0001	20.0017	19.9965	19.9909	19.9870	19.9828 (88)
util rest of house	0.9407	0.9191	0.8854	0.8121	0.6960	0.5328	0.3843	0.4305	0.6493	0.8375	0.9166	0.9457 (89)
MIT 2	16.5754	16.9737	17.6025	18.4762	19.2240	19.7344	19.9193	19.8920	19.5376	18.6021	17.4741	16.5222 (90)
Living area fraction	fLA = Living area / (4) =											0.1321 (91)
MIT	16.7765	17.1638	17.7754	18.6261	19.3573	19.8595	20.0449	20.0164	19.6633	18.7470	17.6492	16.7243 (92)
Temperature adjustment												0.0000
adjusted MIT	16.7765	17.1638	17.7754	18.6261	19.3573	19.8595	20.0449	20.0164	19.6633	18.7470	17.6492	16.7243 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9093	0.8834	0.8462	0.7733	0.6671	0.5228	0.3886	0.4320	0.6274	0.7987	0.8811	0.9159 (94)
Useful gains	701.9589	773.0974	805.0531	819.3400	757.1621	591.8451	419.5387	430.2687	572.7682	650.9076	667.7165	678.8213 (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	1690.4944	1657.5865	1520.3032	1296.4791	1018.5032	692.5448	453.6061	475.2965	735.4053	1083.6480	1409.2917	1680.7610 (97)
Space heating kWh	735.4704	594.3767	532.1461	343.5401	194.4378	0.0000	0.0000	0.0000	0.0000	321.9589	533.9341	745.4431 (98a)
Space heating requirement - total per year (kWh/year)												4001.3072
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	735.4704	594.3767	532.1461	343.5401	194.4378	0.0000	0.0000	0.0000	0.0000	321.9589	533.9341	745.4431 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4001.3072
Space heating per m ²												(98c) / (4) = 33.4557 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	735.4704	594.3767	532.1461	343.5401	194.4378	0.0000	0.0000	0.0000	0.0000	321.9589	533.9341	745.4431 (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)	796.8260	643.9617	576.5397	372.1995	210.6585	0.0000	0.0000	0.0000	0.0000	348.8179	578.4768	807.6307 (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	255.2049	225.6914	240.0283	211.9614	206.0256	186.2760	184.4292	191.4869	193.2651	214.7222	227.3065	252.5668 (64)
Efficiency of water heater	86.2929	86.1267	85.7923	85.1363	83.9301	79.8000	79.8000	79.8000	79.8000	84.9661	85.9069	79.8000 (216)
Fuel for water heating, kWh/month	295.7426	262.0457	279.7784	248.9673	245.4728	233.4285	231.1143	239.9585	242.1868	252.7152	264.5962	292.5399 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	30.8279	24.7313	22.2678	16.3143	12.6017	10.2957	11.4957	14.9425	19.4088	25.4654	28.7632	31.6847 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-53.6441	-74.4736	-105.4095	-116.6033	-124.0838	-115.1543	-113.6430	-108.0337	-97.9708	-84.1676	-58.5285	-46.5077 (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	-33.9149	-70.9029	-140.1527	-209.4280	-275.9390	-276.9742	-273.7945	-232.3348	-170.9249	-101.1333	-45.1860	-26.8598 (233b)

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Electricity generated by wind turbines (Appendix M) (negative quantity)														
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)														
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)														
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year														
Space heating fuel - main system 1													4335.1107	(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													3088.5463	(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)													248.7991	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2955.7648	(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													4802.6912	(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	4335.1107	0.2100	910.3732 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3088.5463	0.2100	648.5947 (264)
Space and water heating			1558.9680 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	248.7991	0.1443	35.9094 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1098.2198	0.1349	-148.1912
PV Unit electricity exported	-1857.5450	0.1260	-234.1257
Total			-382.3168 (269)
Total CO2, kg/year			1224.4898 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.2400 (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	4335.1107	1.1300	4898.6751 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3088.5463	1.1300	3490.0573 (278)
Space and water heating			8388.7324 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	248.7991	1.5338	381.6163 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1098.2198	1.4987	-1645.9310
PV Unit electricity exported	-1857.5450	0.4627	-859.4133
Total			-2505.3443 (283)
Total Primary energy kWh/year			6395.1052 (286)
Target Primary Energy Rate (TPER)			53.4700 (287)



APPENDIX 4: LZCT ASSESSMENT

Please refer to the following page for Viability of the following low-carbon and renewable energy technologies:

- i) wind,*
- ii) solar,*
- iii) aerothermal,*
- iv) geothermal,*
- v) water source heat pumps,*
- vi) biomass.*



i) Wind

Wind	<i>The ability to generate electricity via a turbine or similar device which harnesses natural wind energy. This could be considered as an onsite solution to reducing carbon emissions (turbines included within the development), or offsite (investing financially into a nearby wind farm).</i>
Installation considerations	– Wind turbines come in a variety of sizes and shapes. Turbines of 1 Kw can be installed to single house and large-scale turbines of 1-2 MW can be installed on a development to generate electricity to multiple dwellings and other buildings. In both instances the electricity generated can be used on site or exported to the grid. Vertical- or horizontal-axis turbines are available. – A roof-mounted 1 kW micro wind system costs up to £3,000. A 2.5 kW pole-mounted system costs between £9,900 and £19,000. A 6 kW pole-mounted system costs between £21,000 and £30,000 (taken from the Energy Saving Trust, TBC by supplier) – Local average wind speed is a determining factor. A minimum average wind speed of 6 m/s is required. – Noise considerations can be an issue dependent on density and build-up of the surrounding area. – Buildings in the immediate area can disrupt wind speed and reduce performance of the system. – Planning permission will be required along with suitable space to site the turbine, whether ground installed, or roof mounted.
Advantages	– Generation of clean electricity which can be exported to the grid or used onsite. – Can benefit from the Feed in Tariff, reducing payback costs.
Disadvantages	– Planning restrictions and local climate often limit installation opportunities. – Annual maintenance required. – High initial capital cost. It is usual for an investor to consider a series of turbines to make the investment financially sound.
Development feasibility ✗	– Installing a large turbine in an area such as this is not considered to be appropriate due to its appearance and physical impact on the built-up environment. Residents' and neighbours' concerns may include the look of the turbine, the hum of the generator and the possibility of stroboscopic shadowing from the blades on homes. – Wind speed has been checked for the development scheme using the NOABL wind map: – http://www.rensmart.com/Weather/BERR. The wind speed at ten metres for the development scheme is 4.6 metres per second (m/s) which is below the minimum of 5 m/s and threshold for technical viability. – Typical payback times for a single turbine are expected to be greater than 15 years which means that the cost of installing and maintaining a single wind turbine is not considered a commercially viable option.



ii) Solar PV and/or Solar Thermal

Solar PV Solar Thermal	<i>The ability to generate energy (either electricity, hot water or a combination of the two) through harnessing natural solar energy. This could include the use of solar thermal panels, photovoltaic (PV) panels, or a combined solution. PV panels, similarly, to turbines, can be considered both on and offsite.</i> <i>Solar Photovoltaics convert solar radiation into electricity which can be used on site or exported to the national grid.</i> <i>Solar Thermal generates domestic hot water from the sun's radiation. Glycol circulates within either flat plate or evacuated tube panels, absorbing heat from the sun, and transferring this energy to a water cylinder. A well-designed solar thermal system will account for 50-60% of a dwelling's annual hot water demand. Sizing the system to meet a higher demand will lead to excess heat generation in the summer months and overheating of the system.</i>
Installation considerations	– <i>Operate most efficiently on a south-facing sloping roof (between 30- and 45-degree pitch.)</i> – <i>Shading must be minimal (one shaded panel can impact the output of the rest of the array.)</i> – <i>Panels must not be laid horizontally on a flat roof as they will not self-clean. Panels will therefore need to be installed at an angle and with appropriate space between them, to avoid over-shading.</i> – <i>Large arrays may require upgrades to substations if exporting electricity to the grid.</i> – <i>Local planning requirements may restrict installation of panels on certain elevations.</i> – <i>Installation must take into account pitch and fall of the roof, along with any additional plant on the roof to ensure there is sufficient room.</i> – <i>The average domestic solar PV system is 4kWp and costs £5,000 - £8,000 (including VAT at 5 per cent) - (taken from the Energy Saving Trust).</i>
Advantages	– <i>Relatively straightforward installation, connection to landlord's supply and metering.</i> – <i>Linear improvement in performance as more panels are installed.</i> – <i>Installation costs are continually reducing.</i> – <i>Can benefit from the Feed in Tariff to improve financial payback.</i>
Disadvantages	– <i>Less appropriate for high-rise developments, due to lack of roof space in relation to total floor area.</i> – <i>With Solar Thermal, performance is limited by the hot water demand of the building – system oversizing will lead to overheating.</i>



Development feasibility ✓	– The suitability of Solar panels has been considered for this Development and are concluded as a technically-viable option. – There are potential areas of roof space suitable for the positioning of unshaded Solar PV arrays.
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iii) Aerothermal

Aerothermal	The transfer of latent heat in the atmosphere to a compressed refrigerant gas to warm the water in a heating system. This includes air to water heat pumps and air conditioning systems. Air Source Heat Pumps (ASHPs) extract heat from the external air and condense this energy to heat a smaller space within a dwelling or non-domestic building. A pump circulates a refrigerant through a coil to absorb energy from the air. This refrigerant is then compressed to raise its temperature which can then be used for space heating and domestic hot water. They can feed either low-temperature radiators or underfloor heating and often have electric immersion heater back-up for the winter months.
Installation considerations	– ASHPs operate effectively in buildings with a low energy demand, as they emit low levels of energy suitable for maintaining rather than dramatically increasing internal temperatures. It is therefore vital that the dwelling has a low heating demand to ensure the system can provide appropriate space-heating capability. – Underfloor heating will give the best performance, but oversized radiators can also be used. – Immersion heater back-up required to ensure appropriate Domestic Hot Water (DHW) temperature in winter months. – Noise from the external unit can limit areas for installation. – £7,000-£11,000 per dwelling (taken from the Energy Saving Trust).
Advantages	– Air source systems are a good alternative solution to providing heating and hot water to well-insulated, low heat loss dwellings. – Running costs between heat pumps and modern gas boilers are comparable especially when Gas boilers require PV to achieve building regulation compliance.



Disadvantages	– Heat pumps are generally quiet to run, however if a collection of pumps were used, this could generate a noticeable hum while in operation. – Residents need to be made aware of the most efficient way of using a heat pump as the low flow rates used by such a system means that room temperature cannot be changed as reactively as a conventional gas or oil boiler system. – Will not perform well in homes that are left unoccupied and unheated for a long period of time. – Back-up immersion heating can drastically increase running costs. – Noise and aesthetic considerations limit installation opportunities.
Development feasibility ✓	– ASHPs are considered a viable option for this development scheme and shall be utilised as part of an individual heat pump strategy for dwellings. This works well with the reduced energy demand, as achieved through passive design principles. – This presents a zero carbon ready energy strategy for the development, as the national grid continues to decarbonise.

iv) Geothermal

Geothermal	The transfer of latent heat from the ground to a compressed refrigerant gas to warm the water in a heating system. This includes ground source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils. Ground Source Heat Pumps (GSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the ground) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the ground, either through coils or in bore holes and piles, circulating a mix of water and antifreeze to extract energy from the ground, where the year-round temperature is relatively consistent (approx. 10 °C at 4 metres depth). This leads to a reliable source of heat for the building. Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for GSHPs tend to be higher than those of ASHPs.
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Installation considerations	– Require appropriate ground conditions to sink piles/bore holes or excavate for coils (which also require a large area of land.) – Decision between coils or piles can lead to significant extra cost. – Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators. – Similar to ASHPs, perform best in well-insulated buildings with a low heating demand. – Electric immersion heater required for winter use. – £11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust).
Advantages	– Perform well in well-insulated buildings, with limited heating demand. – More efficient than ASHPs.
Disadvantages	– The coils can be damaged by natural earthworks and by intensive gardening practices – occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit. – Will not perform well in buildings that are left unoccupied and unheated for a long period of time. – Back up immersion heating can drastically increase running costs. – Large area of ground needed for coil installation.
Development feasibility 	– GSHPs are not considered a viable option for this development scheme as they conflict with the preferred option of ASHP electric heating which works well with the reduced energy demand, as achieved through passive design principles.

v) Water Source Heat Pumps

Water Source Heat Pumps	The transfer of latent heat from a local water source to a compressed refrigerant gas to warm the water in a heating system. This includes water source heat pumps. Heat can be collected through the use of either horizontally laid or vertically installed coils. Water Source Heat Pumps (WSHPs) operate on the same principle as an Air Source Heat Pump (ASHP) in that they extract heat from a source (in this instance the water) and compress this energy to increase temperature for space heating and hot water. Pipework is installed into the water source, circulating a mix of water and antifreeze to extract energy from the water, where the year-round temperature is relatively consistent (approx. 10 °C below surface). This leads to a reliable source of heat for the building. Again, an electrically powered pump circulates the liquid and powers the compressor, however annual efficiencies for WSHPs tend to be higher than those of ASHPs.
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Installation considerations	– Require a reliable water source near to the site. – Need to consider affect on the water course. – Need to consider whether low temperature output is fed through underfloor heating (most efficient) or oversized radiators. – Similar to ASHPs, perform best in well-insulated buildings with a low heating demand. – Electric immersion heater required for winter use. – £11,000-£15,000 per dwelling dependent on the size of the system (taken from the Energy Saving Trust).
Advantages	– Perform well in well-insulated buildings, with limited heating demand. – More efficient than ASHPs.
Disadvantages	– The coils can be damaged by high water flow or low water levels– occupants would need to be aware of the location of the coils for this system, and how to operate the system efficiently. Coils may also be damaged within the dwelling where the circuit is connected to the internal unit. – Will not perform well in buildings that are left unoccupied and unheated for a long period of time. – Back up immersion heating can drastically increase running costs. – Large area of water needed for coil installation.
Development feasibility ✗	– WSHPs are not considered a viable option for this development scheme as they conflict with the preferred option of ASHP electric heating which works well with the reduced energy demand, as achieved through passive design principles.

vi) Biomass

Biomass	Providing a heating system fuelled by plant based materials such as wood, crops, or food waste. Biomass boilers generate heat for space heating and domestic hot water through the combustion of biofuels, such as woodchip, wood pellets or potentially biofuel or bio diesel. Biomass is considered to be virtually zero carbon. They can be used on an individual scale or for multiple dwellings as part of a district-heating network. A back-up heat source should be provided as consistent delivery of fuel is necessary for continued operation.
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Installation considerations	– Biomass boilers are larger than conventional gas-fired boilers and also require what can be significant storage space for the fuel source. This needs to be considered at planning stage to ensure an appropriate plant room can be provided. – Flue required to expel exhaust gases – design needs to be in line with the requirements of the Building Regulations. – Need to consider whether fuel deliveries will be reliable and consistent to the location of the site (especially relevant in rural areas) and whether the plant room can be easily accessed by the delivery vehicle. – £9,000-£21,000 per dwelling dependent on size (taken from Energy Saving Trust).
Advantages	– Considerable reduction in CO₂ emissions.
Disadvantages	– Limited reduction in running costs compared to A-rated gas boilers, but at a substantially higher up-front cost. – Plant room space required for boiler and storage. – Dependent on consistent delivery of fuel. – Ongoing maintenance costs (need to be cleaned regularly to remove ash.)
Development feasibility 	– Biomass is not considered a technically viable option for the development scheme. The primary reason for this is down to the development's location within the context of Wiltshire and the negative environmental impact of high levels of NO_x gases that are emitted from biomass boilers and the subsequent impact on local air quality. This is contrary to planning policies for air quality in England. – There are also concerns regarding a sustainable supply of biomass to the site. – The capital installation cost would be high which leads us to the conclusion that biomass would not be a commercially viable option for this development scheme.



APPENDIX 5: PART G CALCULATIONS

Regulation: Part G (2015) Enhanced

Date issued: 26-6-2025. Revision: 0

This Compliance Checklist follows the methodology as listed in Appendix A of UK Building Regulations Approved Document AD G (2016). The targets comply with requirements of Part G (2015) Enhanced as used in England.

Table A1: The water efficiency calculator

Installation type	Unit of measure	Capacity / Flow rate	Use factor	Fixed use litres/person/day	Litres per person per day
WC (single flush)	Flush volume (litres)	0.0	4.42	0	0.00
WC (dual flush)	Full flush volume (litres)	4.0	1.46	0	5.84
	Part flush volume (litres)	2.6	2.96	0	7.70
WCs (multiple fittings)	Average effective flushing volume (litres)	0.0	4.42	0	0.00
Taps (excluding kitchen / utility room taps)	Flow rate (litres per minute)	6.1	1.58	1.58	11.29
Bath (where shower also present)	Capacity to overflow (litres)	155.0	0.11	0	17.05
Shower (where bath also present)	Flow rate (litres per minute)	8.0	4.37	0	34.96
Bath only	Capacity to overflow (litres)	0.0	0.50	0	0.00
Shower only	Flow rate (litres per minute)	0.0	5.60	0	0.00
Kitchen / utility room sink taps	Flow rate (litres per minute)	8.0	0.44	10.36	13.88
Washing machine	Litres/kg of dry load	8.2	2.10	0	17.16
Dishwasher	Litres/place setting	1.3	3.60	0	4.50
Waste disposal unit	Litres/use	0.0	3.08	0	0.00
Water softener	Litres/person/day	0.0	1.00	0	0.00
Total calculated use					112.37
Contribution from greywater (litres/person/day) from Table 4.6					0.00
Contribution from rainwater (litres/person/day) from Table 5.5					0.00
Normalisation factor					0.91
Total water consumption					102.26
External water use					5.00
Total water consumption (litres/person/day)					107.26