



Energy Statement

BO.SE.RG40-0

**Land East of Easthampstead Road / Pearce's Farm,
Wokingham**

Revision 03

Date: 27 August 2024

Revision History

Revision	Issue Date	Description	Issued by	Checked by
03	27.08.2024	Draft document	Bobby D	

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Calculations contained within this report have been produced based on information supplied to Energist by the Client and the Design Team. Any alterations to the technical specification on which this report is based will invalidate its findings.

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This Energy Statement summarises how a development specification can be improved over the minimum standards of Building Regulations to enhance energy performance and reduce regulated carbon emissions from the site.

The Local Planning Authority has requested this document be produced to satisfy a planning condition.

This report should be provided to the Local Planning Authority, along with evidence of SAP / SBEM calculations. The specification summary listed in Sections 6 (for fabric) and 7 (for services) should be used by the Design Team to ensure the final construction project meets the reduction targets as listed in this document.

1. EXECUTIVE SUMMARY

1.1 Purpose of this document

Energist UK has been appointed by the Applicant Nicholas King Homes to create this [Energy Statement](#) for the proposed development at land at Pearces Farm in support of the outline planning application.

This document outlines a specification of measures which demonstrates how the Applicant will meet compliance at the proposed development for reducing annual, regulated (in-use) carbon emissions from the buildings in line with:

- i) The [National Planning Policy Framework](#) (2023)

Standardised national guidance to ensure consistency of local planning conditions regarding sustainable design and energy use.

- ii) Building Regulations [Approved Document Part L](#) (2021)

Use SAP10 to show full building compliance with the Target Emission Rate, Target Primary Energy Rate, Target Fabric Energy Efficiency, maximum U-Value thresholds, and minimum efficiencies for building services.

- iii) Local planning policy of [Wokingham Borough Council](#),

Go beyond the minimum standards of the Building Regulations targets (above) and ensure the development shows a 19% reduction over the Target Emission Rate, while also showing how the design will utilise renewable technology to offset at least 10% of the annual regulated energy use.

See Section 7 of this document for weblinks to view, in full, the latest versions of these policy documents.

1.2 Summary of results

The Applicant demonstrates commitment to meeting the required energy standard targets at the land at Pearces Farm by implementing the following improvements over the Baseline specification.

1. Improved fabric performance
2. Heat Pump installation
3. Waste Water Heat Recovery

In doing so, the site will:

- Exceed the minimum standards of Building Regulations Approved Document Part L (2021), with an improvement of 83.21% overall.
- The design will go beyond the requirements of the Wokingham LOCAL PLANNING AUTHORITY SPD, Policy CP1 of the Core Strategy, Policy NRM11 which set a minimum improvement target of 10%.

This chart visualises the LPA target against the Baseline specification, and shows the improvements made through fabric and LZC improvements.

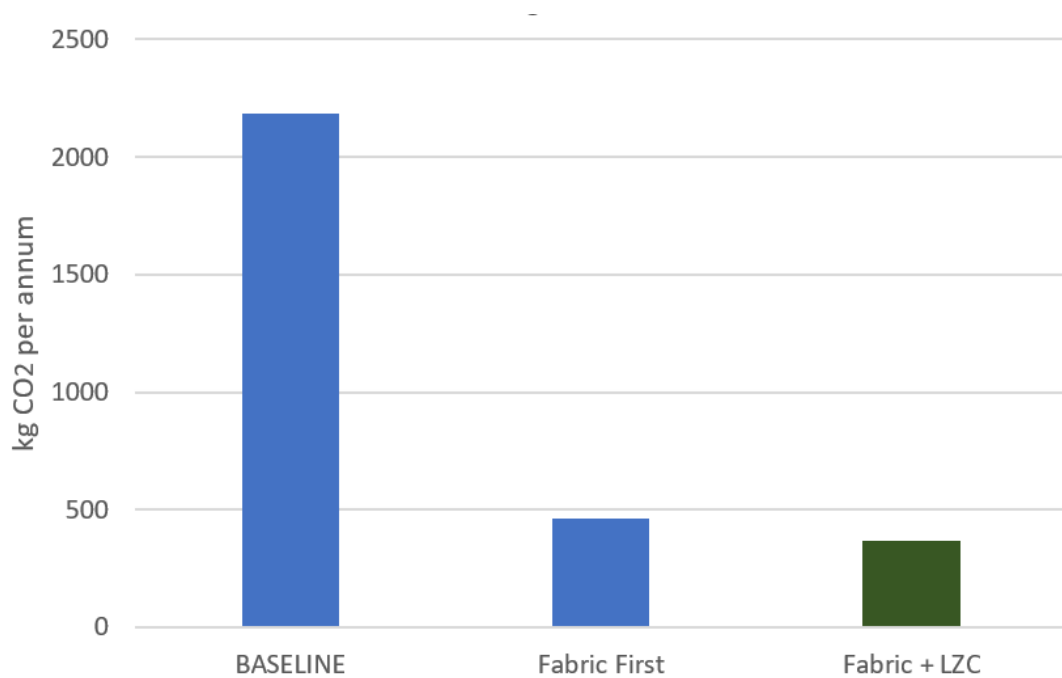


Fig1: Summary of residential kgCO₂ at various stages of improvement

Baseline Emissions	2,182.32 kgCO ₂ per annum
Proposed Emissions	366.51 kgCO ₂ per annum
Reduction of 1272.37 kgCO ₂ 83.21%	

2. METHODOLOGY

2.1 Energy Hierarchy

This Energy Statement lists a number of design improvements which will be incorporated into the development to ensure the previously mentioned requirements are met.

To do this, a process called **The Energy Hierarchy** will be followed.

The Energy Hierarchy is a list of enhancement techniques which are prioritised to assist construction projects in creating buildings which require less energy, without compromising comfortable living conditions for the occupants.

In this case, a **three-tier** Energy Hierarchy will be used:

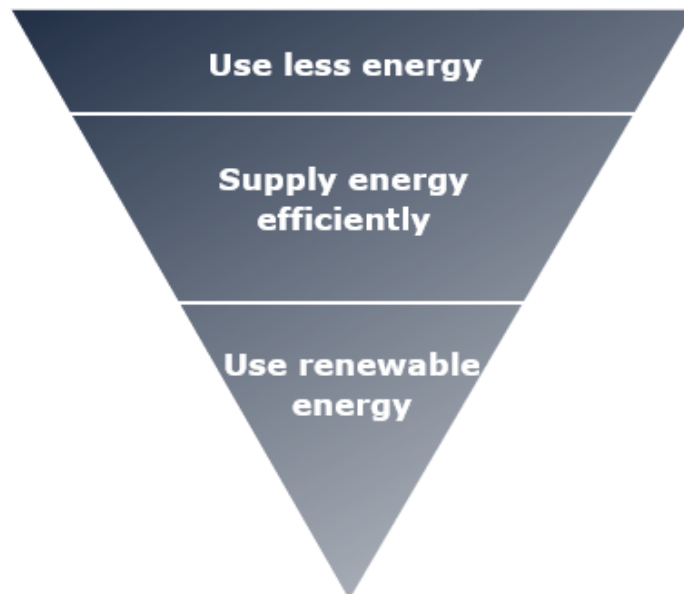


Fig2: Energy Hierarchy (three-tier)

Use less energy: Create a construction specification with low levels of heat loss and install building services which operate at a consistently high efficiency.

Supply energy efficiently: Minimise the amount of fossil fuels used in the overall energy mix for the development. Encourage the use of electricity tariffs which fund renewable and low carbon power supplies.

Use renewable energy: Encourage the use of on-site renewable technology and low carbon heating systems.

2.2 Stages of compliance

To meet the requirements outlined in this Energy Statement, the Applicant needs to consider how the proposed energy performance of the Development can be improved compared to a notional baseline:



Fig3: Stages of compliance (three-tier)

Baseline energy demand: Also known as the sitewide Target Emission Rate. This is the minimum standard required to show compliance with Building Regulations Approved Document Part L in England.

Fabric First approach: When considering ways of improving the energy performance of a new building, it is important to begin with the fabric. A building with lower U-values, lower thermal bridging losses and a more airtight design will naturally have a lower heating demand.

Low carbon and renewables: Following a review of the fabric elements, building services can then be reviewed to look for further improvements. This may include the use of low energy heating systems and onsite electricity generation.

2.3 Methods of compliance

Energist has used [SAP10.2](#) methodology and the [Elmhurst DesignSAP](#) to calculate the energy demand for 15 sample dwellings on the development.

This creates a sample dataset which is extrapolated to reflect the true number of dwellings that make up the whole planning application.

This approach generates an acceptably accurate sitewide total to predict the regulated CO₂ emission rates and energy demand from the development without having to invest in completing SAP models for every dwelling at this early stage of the design process.

The Applicant commits to completing SAP analysis on all plots following planning approval and before work commences on site.

Evidence of these SAP calculations should accompany this Energy Strategy. This will include SAP BREL documents, SAP Worksheets and Predicted Energy Assessments.

For additional copies of these reports, or to query the inputs used, see Page 2 of this document for methods of contacting the Energist Technical Team.

3. SITE DETAILS

3.1 Description and location

The Proposed Development will come forward via the following planning applications:

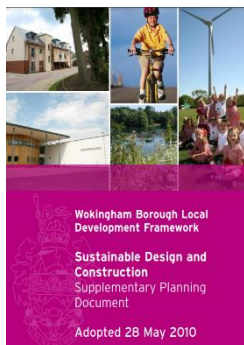
- An Outline Planning Application for Up to 180 market and affordable homes, and associated infrastructure, including open space, play space, landscaping SuDs and green infrastructure. All matters reserved except the main access into the site.



Image 1: Site location

4. PLANNING REQUIREMENTS

4.1 Local authority conditions



There is a requirement under the Wokingham Council Core Strategy SPD, Policy CP1 of the Core Strategy adopted May 2010 that all new build development will achieve a 19% reduction in CO₂, and 10% of all regulated energy use should come from renewable technologies on site.

An excerpt from the Policy is quoted below:

For further details, visit

[https://www.wokingham.gov.uk/planning-policy/adopted-](https://www.wokingham.gov.uk/planning-policy/adopted-planning-guidance)

[planning-guidance](https://www.wokingham.gov.uk/planning-policy/adopted-planning-guidance)

Policy NRM11

In line with the South East Plan policy NRM11, all developments involving 10 or more dwellings or 1,000m² or more gross non-residential floorspace (major developments) will be expected to secure at least 10% of their expected energy demand from decentralised, renewable or low carbon sources.

Non-residential development of 1000m² criteria applies to all proposals outside use class order C3. This means that nursing homes and residential institutions are included.

See the Council's 'Developers Guidance note for the 10% renewable energy requirement of the South East Plan policy NRM11'.

- An Energy Statement should be submitted with a planning application as part of a wider Sustainability Statement or the Design and Access Statement.*
- The Energy Statement should also include detailed information on the selected technology e.g layout plan, floor plans and elevations and visual impact etc.*

On-site renewable energy/ low carbon technologies are encouraged on all sizes and types of development. As stated in 'Sustainability Issue 1', renewable energy technology can be used as part of reaching Code for Sustainable Homes levels and BREEAM standards.

Policy NRM11 (of the South East Plan) requirements are not 'in addition' to any requirements of the Code for Sustainable Homes or BREEAM. Unless this is a requirement of the subsequent MDD DPD.

In some situations, decentralised/ renewable/ low carbon energy generation may not be appropriate. Development can deliver on carbon reduction targets without requiring the use of renewable energy.

5. BASELINE ENERGY DEMAND

5.1 The Notional

The following specification summary has been used to create the [Baseline target](#).

This is a notional specification and does not reflect the true proposals for this development.

The contents of this notional specification are used to calculate the [Target Emission Rate](#) under Approved Document Part L (2021).

Element	Specification (Residential)
Ground floor U-Value	0.13 W/m ² K
External walls U-Value	0.18 W/m ² K
Walls to corridors / core U-Value	0.18 W/m ² K
Party walls Between dwellings	0.0 W/m ² K
Roof U-Value	0.11 W/m ² K
Glazing U-Value g-value	1.20 W/m ² K 0.63 Maximum 25% glazing ratio
External Doors U-Value	1.00 W/m ² K
Thermal bridging Description	Notional psi-values SAP Appendix R
Air permeability 100% blower door testing	5.0 m ³ /(h·m ²) at 50 Pa
Ventilation system	System 1 Intermittent extraction fans to all wet rooms
Heating system	Gas boiler 89.5% boiler, feeding radiators

Hot water system	Gas boiler From main heating system
Showers	Unvented system From main heating system
Waste Water Heat Recovery	Applied to all showers 36% recovery efficiency
Lighting	LED 80 lumens per watt
Photovoltaic (PV) panels	South east orientation Array size = 40% of building footprint

5.2 Baseline Results

When the above specification is applied to the sample SAP modelling, the generated results provide the sitewide Baseline, or Notional, target.

All improvements listed in the following section are measured against this Baseline to show how the specification will perform better, requiring lower energy use and therefore generate a lower amount of carbon emissions annually.

Baseline Emissions	2,182 kgCO ₂ per annum
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6. FABRIC FIRST APPROACH

6.1 What Is Fabric First

The first step to improving the energy performance of a building design is to look at the [specification of the fabric](#).

A highly insulated building with minimum air leakage will have a far lower heating demand, requiring less energy to run. This has the added benefit of lower fuel bills and a lower carbon footprint.

This meets the [first principle of The Energy Hierarchy](#) – to use less energy.

There are also several key advantages to adopting a [Fabric First](#) approach:

- It does not require behavioural changes from the occupants
- There are no additional maintenance costs
- There is nothing mechanical that can break down or require replacing

There are several elements of a building specification which can be considered for Fabric First improvements:

- U-Values of the ground floor, external walls, roofs and other heat loss elements
- U-Values of windows, external doors and rooflights
- Thermal bridging: The design of junctions to minimise heat loss
- Air permeability targets
- Reducing the number of open flues and vents.

6.2 Proposed Fabric

The Applicant will integrate the following design measures to reduce energy demand using the Fabric First approach.

1. Improved thermal performance on floor
2. Have Psi values independently calculated

Although some individual elements in the proposed specification are higher than those shown on the Baseline, overall, these changes amount to a reduction in energy demand.

Element	Fabric First Specification
Ground floor U-Value	0.12 W/m ² K
External walls U-Value	0.18 W/m ² K
Walls to corridors / core U-Value	0.18 W/m ² K
Party walls Between dwellings	0.0 W/m ² K
Roof U-Value	0.12 W/m ² K
Glazing U-Value g-value	1.20 W/m ² K 0.63 Maximum 25% glazing ratio
External Doors U-Value	1.00 W/m ² K
Thermal bridging Description	Independently Calculated Psi values
Air permeability 100% blower door testing	5.0

6.3 Proposed Results

The Developer has adopted the following measures to ensure a [suitable improvement in energy performance](#) over the Baseline:

- Energy efficient building fabric and insulation to all heat loss floors, walls and roofs.
- High efficiency double glazed windows throughout.
- Quality of build will be confirmed by achieving good air tightness results throughout.

Baseline Emissions	2,182 kgCO2 per annum
Fabric First Emissions	1638.88 kgCO2 per annum
	Reduction of 543.12 kgCO2 24.89%

7. LZC APPROACH

7.1 What Is LZC

Low and Zero Carbon devices (LZC) can be used to improve the energy performance of a building.

Six LZC technologies are typically considered, although the suitability of each option needs to be assessed on an individual basis.

If a system is considered viable for this development, this can be used to further improve the energy performance on top of the fabric changes, which means an even greater reduction in carbon emissions against the Baseline.

Using LZC meets the second and third principles of The Energy Hierarchy – to supply energy efficiently and to use renewable energy.

There are also several key advantages to using LZC technology:

- Onsite generation of electricity means less reliance on the National Grid
- Enhancements to a boiler heating system will lead to a lower demand on fossil fuels such as gas and oil
- Using heat pumps will futureproof the development in readiness for zero carbon energy supplies.

There are several elements of a building specification which can be considered for Low and Zero Carbon improvements:

- Installation of heat pumps
- Heating controls and supplementary heat recovery aids
- Onsite renewable installations

7.2 Viability options – Wind turbines



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 (the turbine is included within the development), or offsite (investing financially in a nearby wind farm).

Advantages

- Turbines generate clean electricity.
- The UK Government is aiming to generate the majority of the nation's electricity supply through wind turbines.
- Spare electricity can be exported to the National Grid, or fed into a battery store on site to assist with charging electric vehicles.

Disadvantages

- Currently, UK planning policy makes it extremely difficult to install wind turbines on land. The priority of the Government is to encourage offshore turbines only.
- There is a high installation cost associated with wind turbines, as well as annual maintenance costs.
- Turbines work best in windier locations, free from surrounding obstructions. Efficiency is greatly reduced when installed in unideal positions.

Development feasibility

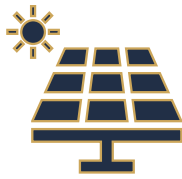
Economical: With limited Government support to install turbines on land, this option is not considered to be economically viable.

Technical: It is technically possible to install a wind turbine in this location.

Practical: Installing a wind turbine is not considered practical. It is not an ideal location to benefit from high efficiencies. The surrounding residents are likely to raise concerns should a turbine be proposed.

Overall: This option is not considered viable.

7.3 Viability options – Photovoltaic panels



The ability to generate electricity through harnessing natural solar energy.

Photovoltaic (PV) panels can be located on buildings to feed into the supply directly, or larger solar farms can be positioned on unused land to produce energy to feed local communities.

Advantages

- PV panels generate clean electricity.
- This is a commonly used technology. National planning policies suggest local authorities should only object to their use on heritage grounds.
- Spare electricity can be exported to the National Grid, or fed into a battery store on site to assist with charging electric vehicles.

Disadvantages

- Efficiency drops up significantly if positioned in a shaded location.
- Less appropriate on high-rise buildings, as roof area is limited.
- Efficiency is reduced when positioned on east or north roofs.

Development feasibility

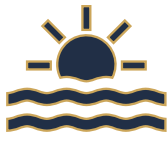
Economical: Although there is limited Government support, the installation costs of PV panels are more viable than other LZC options.

Technical: It is technically possible to install PV panels in this location.

Practical: There are no practical reasons why PV panels cannot be installed in this location.

Overall: This option is viable.

7.4 Viability options – Solar thermal panels



Using energy from the sun to pre-heat the water supply being fed into the building.

Solar thermal panels are usually located on a south facing roof close to the building's water storage cylinder.

Advantages

- Solar thermal panels provide free hot water, reducing reliance on the heating system.
- National planning policies suggest local authorities should only object to their use on heritage grounds.
- Especially beneficial for buildings with a high water use, such as sports clubs and gyms.

Disadvantages

- Efficiency drops up significantly if positioned in a shaded location.
- Less appropriate on high-rise buildings, as roof area is limited.
- Unlike PV panels, solar thermal relies on solar rays, meaning they are far less efficient on cloudy days.

Development feasibility

Economical: This system should be viable to install from a financial point of view, however PV panels are expected to be cheaper and more effective.

Technical: It is technically possible to install solar thermal panels in this location.

Practical: There are no practical reasons why solar thermal panels cannot be installed in this location.

Overall: This option is viable.

7.5 Viability options – Heat pumps



Compressing latent heat in the atmosphere with a refrigerant gas to warm water in a closed circuit.

Heat pumps are able to capture heat from the air, ground or nearby watercourses and use this energy to provide heating and hot water.

Advantages

- The UK Government considers heat pumps to be an essential technology for reducing the energy demand of our buildings and cutting our reliance on fossil fuels for heating our homes.
- On average, modern systems will generate 3 – 4 kilowatts of heat for every kilowatt of electricity used.
- Heat pumps can provide heating via underfloor systems, radiators or air conditioning vents. Some systems also provide cooling and ventilation.

Disadvantages

- Behaviour of occupants needs to adapt, as using a heat pump as if it were a boiler will significantly reduce efficiency and performance.
- Heat pumps require an external fan or underground coils, as well as an internal unit about the size of a full height fridge freezer.
- Heat pumps are better suited to well insulated buildings with low levels of heat loss.

Development feasibility

Economical: The cost of installing heat pumps should be considered an economically viable option.

Technical: It is technically possible to install heat pumps in this location.

Practical: There are no practical reasons why heat pumps cannot be installed in this location.

Overall: This option is viable.

7.6 Viability options – Biomass boilers



A boiler system which burns plant based materials such as wood pellets, crops or food waste instead of fossil fuels.

Biomass boilers come in a wide range of sizes, and can provide heating and hot water to a single dwelling, or as part of a heat network.

Advantages

- Inside the dwelling, the heating system and controls are identical to a conventional gas or oil boiler.
- Biomass is a low carbon fuel source when sourced in the UK. Sites with woodland can use their own supply of biomass.
- No fossil fuels are used.

Disadvantages

- A reliable supply of biomass is required, and the fuel to feed the system must be kept on site.
- Some urban areas do not allow biomass boilers due to concerns over air quality.
- Installation costs of biomass boilers are generally much higher than a conventional gas or oil boiler.

Development feasibility

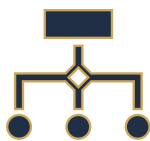
Economical: The cost of installing a biomass boiler and storage in this location is prohibitive.

Technical: It would be technically possible to install a biomass boiler, however site layout changes will be required to accommodate the fuel store.

Practical: Biomass is not considered practical. The storage of fuel on site will require a redesign of the site layout. The local authority is unlikely to approve a solid fuel heating system on grounds of impacting local air quality.

Overall: This option is not considered viable.

7.7 Viability options – Combined heat and power



A Combined Heat and Power (CHP) system works in a similar way to a generator, but on a much larger scale.

A gas fired turbine generates electricity for the building. The bi-product is used to supply heating and hot water.

Advantages

- The CHP unit generates free heat while producing onsite electricity.
- A single CHP plant can be used to provide heat to hundreds of dwellings.
- Excess electricity can be exported to the National Grid, or stored in batteries to assist with electric vehicle charging.

Disadvantages

- CHP systems are powered by gas which is a fossil fuel. This is not in line with the UK Government's futureproofing policy for net zero.
- The system works at its most efficient on a larger scale. Single dwelling CHP boilers are available, but do not show efficiency gains compared to a conventional boiler.
- CHP is unable to provide 100% of the heating demand all of the time, so a back up system, usually a gas boiler, will also need to be installed.

Development feasibility

Economical: Installing a district CHP system for this development is not believed to be financially viable.

Technical: It would not be viable to install this type of system without making significant design changes to accommodate the plant room and pipework.

Practical: CHP is not considered practical. The size of the development does not lean itself towards using CHP, and the Local Authority are unlikely to approve this installation of a fossil fuel led heat network.

Overall: This option is not considered viable.

7.8 Viability options – Waste water heat recovery



Waste water heat recovery systems (WWHRS) reduce demand on the hot water supply by capturing wasted energy from baths and showers.

A specially designed pipe transfers heat from the draining water to pre-heat the cold water entering the supply.

Advantages

- The system is reasonably cheap and does not require maintenance or energy to operate.
- No behavioural changes are required from the occupier. In most cases, the building owner will not know WWHRS has been installed.
- WWHRS reduces demand on the hot water supply, cutting the building's reliance on fossil fuels.

Disadvantages

- WWHRS works best when the pipework is fitted vertically below the shower. Horizontal installations are not as efficient.
- Is not recommended for use with some power showers, as the incoming water temperature can increase quicker than the shower thermostat can adjust.
- Energy savings by using WWHRS are low, and will need to be combined with other options.

Development feasibility

Economical: Installing WWHRS is considered economically viable.

Technical: It is technically feasible to install WWHRS on most house types, but consideration should be given to its appropriateness in bungalows.

Practical: There are no practical reasons why WWHRS cannot be installed in this location.

Overall: This option is viable.

7.9 Viability options – Batteries and storage



Homes which are able to generate more electricity than they need at that time, can store excess power for later use instead of instantly exporting power to the National Grid.

Common methods are battery banks, or immersion diverters which heat the dwelling's hot water cylinder.

Advantages

- Less reliance on buying in power from the National Grid.
- Occupants can benefit from free hot water with an immersion diverter.
- Battery banks can be used during power-cuts.

Disadvantages

- A method of generating electricity is required (PV / turbine)
- Benefit depends on the building occupant using saved energy at the best time of day.
- Immersion diverters not viable for combi cylinders or homes with low hot water demand.

Development feasibility

Economical: The cost of installing batteries or immersion diverters is considered to be a viable option.

Technical: It is technically viable to install a battery bank in the garage. It is not viable to use immersion diverters as the dwelling does not include a large hot water cylinder.

Practical: It is practical to consider the installation of a battery bank, as this will work alongside the PV array to further reduce reliance on the National Grid.

Overall: This option is viable.

7.10 Proposed LZC Approach

The applicant will integrate the following additional design measures to reduce energy demand using low and zero carbon technologies.

Element	Fabric First Specification
Wind Turbines	No
Photovoltaic Panels	Yes 2 kWp, south facing
Solar Thermal Panels	No
Heat Pumps	Yes Air source heat pumps to be used on all plots, SCOP = 5.03
Biomass Boilers	No
Combined Heat & Power	No
Waste Water Heat Recovery	YES
Energy Storage	No

7.11 Proposed Results

The Developer has adopted the following measures to ensure a suitable improvement in energy performance over the Baseline:

- Photovoltaic panels
- Air source heat pumps
- Waste water heat recovery

Fabric First Emissions	1638.88 kgCO2 per annum
Fabric & LZC Emissions	366.51 kgCO2 per annum
Improvement using LZC:	Reduction of 1272.37 kgCO2 77.64%

Baseline Emissions	2182.32 kgCO2 per annum
Fabric & LZC Emissions	366.51 kgCO2 per annum
Overall improvement:	Reduction of 1815.81 kgCO2 83.21%

8. CONCLUSIONS

8.1 Final results

The Applicant demonstrates commitment to meeting the required energy standard targets at the land at Pearces Farm by implementing the following improvements over the Baseline specification.

1. Improved fabric performance
2. Installation of heat pump
3. Installation of waste water heat recovery

In doing so, the site will:

- Exceed the minimum standards of Building Regulations Approved Document Part L (2021), with an improvement of 83.21% overall.
- This goes beyond the requirements of the Wokingham LOCAL PLANNING AUTHORITY SPD, Policy CP1 of the Core Strategy, Policy NRM11 which set a minimum improvement target of 10%.

This chart visualises the LPA target against the Baseline specification, and shows the improvements made through fabric and LZC improvements.

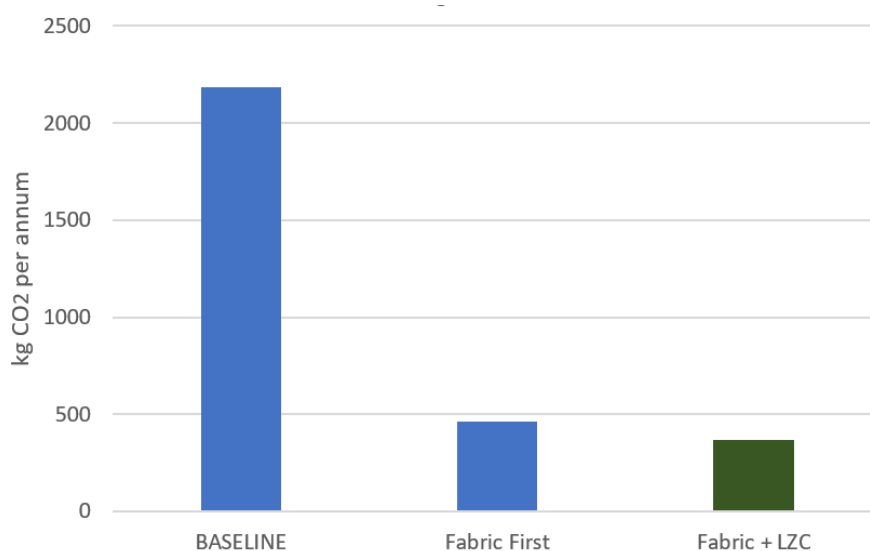


Fig4: Summary of residential kgCO₂ at various stages of improvement

Baseline Emissions	2182.320 kgCO2 per annum
Fabric First Emissions	1638.88 kgCO2 per annum
Improvement (Fabric only)	Reduction of 543.44 kgCO2 24.90%
Fabric & LZC Emissions	366.51 kgCO2 per annum
Improvement (LZC only)	Reduction of 1272.37 kgCO2
Improvement (Combined)	Reduction of kgCO2 83.21%

9. PLANNING POLICY LINKS

9.1 The Climate Change Act (2021 amendments)

This legal documents establishes a framework for the United Kingdom to become net zero carbon by 2050.

Climate Change Act (2008) – 80% reduction by 2050
With 2021 amendments – 100% reduction by 2050

9.2 Approved Document AD-L (2021 amendments)

This Building Regulation targets the Conservation of Fuel and Power on all new construction projects in England.

Latest versions of AD-L

9.3 National Planning Policy Framework (2023 amendments)

This document offers guidance to Local Planning Authorities to assist in developing Local Plans to support the transition to a low carbon future.

Latest version of the NPPF

9.4 Local Authority Policy

Wokingham Council Core Strategy SPD, Policy CP1 of the Core Strategy adopted May 2010. This Energy Statement has been produced based on the guidance written in this local policy document.

<https://shorturl.at/fqAS2>

Summary for Input Data

Property Reference	1090	Issued on Date	28/08/2024
Assessment Reference	00001	Prop Type Ref	
Property	1090		

SAP Rating	85 B	DER	3.61	TER	10.63
Environmental	97 A	% DER < TER			66.04
CO ₂ Emissions (t/year)	0.32	DFEE	32.86	TFEE	38.19
Compliance Check	See BREL	% DFEE < TFEE			13.94
% DPER < TPER	32.92	DPER	37.21	TPER	55.47

Assessor Details	Mr. Ikechukwu Diala-Uka	Assessor ID	W462-0001
Client			

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

Orientation	North	
Property Tenture	ND	
Transaction Type	6	
Terrain Type	Urban	
1.0 Property Type	House, Detached	
2.0 Number of Storeys	2	
3.0 Date Built	2024	
4.0 Sheltered Sides	2	
5.0 Sunlight/Shade	Average or unknown	
6.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	134.42	kJ/m²

7.0 Electricity Tariff	Standard
Smart electricity meter fitted	No
Smart gas meter fitted	No

7.0 Measurements	Ground floor:	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	1st Storey:	30.02 m	50.74 m ²	2.40 m
		30.02 m	50.74 m ²	2.60 m

8.0 Living Area	17.15	m ²
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9.0 External Walls	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Res	Shelter	Openings	Area Calculation Type
	External Wall 1	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.14	60.00	150.10	133.48	0.00	None	16.62	Enter Gross Area

10.0 External Roofs	Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area(m ²)	Nett Area (m ²)	Shelter Code	Shelter Factor	Calculation Type	Openings
	External Roof 1	External Plane Roof	Plasterboard, insulated at ceiling level	0.12	9.00	50.74	50.74	None	0.00	Enter Gross Area	0.00

10.2 Internal Ceilings	Description	Storey	Construction	Area (m ²)
	Internal Ceiling 1	Lowest occupied	Plasterboard ceiling, carpeted chipboard floor	50.74

11.0 Heat Loss Floors	Description	Type	Storey Index	Construction	U-Value (W/m ² K)	Shelter Code	Shelter Factor	Kappa (kJ/m ² K)	Area (m ²)
	Heatloss Floor 1	Ground Floor - Solid	Lowest occupied	Suspended concrete floor, carpeted	0.13	None	0.00	75.00	50.74

11.2 Internal Floors	Description	Storey Index	Construction	Kappa (kJ/m ² K)	Area (m ²)
	Internal Floor 1		Plasterboard ceiling, carpeted chipboard floor	9.00	50.74

12.0 Opening Types	Description	Data Source	Type	Glazing	Glazing Gap	Filling Type	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
	Door	Manufacturer	Solid Door				0.00			1.40

Summary for Input Data

Window	Manufacturer	Window	Double glazed	0.76	0.70	1.30
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13.0 Openings

Name	Opening Type	Location	Orientation	Area (m²)	Pitch
Door	Door	External Wall 1	North	1.95	
Window North	Window	External Wall 1	North	5.99	
Window South	Window	External Wall 1	South	8.68	

14.0 Conservatory

None

15.0 Draught Proofing

100

 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Bridge Type	Source Type	Length	Psi	Adjusted Reference:	Imported
E2 Other lintels (including other steel lintels)	Independently assessed	11.03	0.03	0.03	Yes
E3 Sill	Independently assessed	10.10	0.04	0.04	Yes
E4 Jamb	Independently assessed	22.50	0.01	0.01	Yes
E5 Ground floor (normal)	Independently assessed	30.02	0.04	0.04	Yes
E6 Intermediate floor within a dwelling	Independently assessed	30.02	0.02	0.02	Yes
E16 Corner (normal)	Independently assessed	25.00	0.04	0.04	No
E10 Eaves (insulation at ceiling level)	Independently assessed	21.25	0.05	0.05	No
E12 Gable (insulation at ceiling level)	Independently assessed	8.73	0.03	0.03	No
E17 Corner (inverted – internal area greater than external area)	Independently assessed	5.00	-0.08	-0.08	No

Y-value

0.02

 W/m²K

19.0 Mechanical Ventilation

Mechanical Ventilation

Mechanical Ventilation System Present

No

20.0 Fans, Open Fireplaces, Flues

Number of open chimneys

0

Number of open flues

0

Number of chimneys/flues attached to closed fire

0

Number of flues attached to solid fuel boiler

0

Number of flues attached to other heater

0

Number of blocked chimneys

0

Number of intermittent extract fans

3

Number of passive vents

0

Number of flueless gas fires

0

21.0 Fixed Cooling System

No

22.0 Pressure Testing

Yes

Designed AP₅₀

5.00

 m³/(h.m²) @ 50 Pa

Test Method

Blower Door

22.0 Lighting

No Fixed Lighting

No

Name	Efficacy	Power	Capacity	Count
Lighting 1	100.00	8.00	800.00	25

24.0 Main Heating 1

Database

Percentage of Heat

100.00

 %

Database Ref. No.

103746

Fuel Type

Electricity

In Winter

222.32

In Summer

179.02

Model Name

aroTHERM 5kW

Manufacturer

Vaillant Group UK Ltd

System Type

Heat Pump

Controls SAP Code

2210

Summary for Input Data

Is MHS Pumped	Pump in heated space
Heating Pump Age	2013 or later
Heat Emitter	Radiators
Flow Temperature	Enter value
Flow Temperature Value	55.00

25.0 Main Heating 2

26.0 Heat Networks

	Heat Source	Fuel Type	Heating Use	Efficiency	Percentage Of Heat	Heat	Heat Power Ratio	Electrical	Fuel Factor	Efficiency type
Heat source 1	None									
Heat source 2	None									
Heat source 3	None									
Heat source 4	None									
Heat source 5	None									

27.0 Secondary Heating

28.0 Water Heating

Water Heating	Main Heating 1
SAP Code	901
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	Yes
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
Cold Water Source	From mains
Bath Count	1
Immersion Only Heating Hot Water	No

28.1 Showers

Description	Shower Type	Flow Rate [l/min]	Rated Power [kW]	Connected	Connected To
Shower	Combi boiler or unvented hot water system	11.00		No	

28.3 Waste Water Heat Recovery System Instantaneous System 1

Database ID	80071
Brand Model	RECOUP, Drain+
Details	Year: 2012 + current Efficiency: 0 Utilisation factor: 0.975

29.0 Hot Water Cylinder

Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	150.00	L
Loss	1.00	kWh/day
Pipes insulation	Fully insulated primary pipework	
In Airing Cupboard	No	

31.0 Thermal Store

32.0 Photovoltaic Unit

One Dwelling	
Export Capable Meter?	No
Connected To Dwelling	Yes

Summary for Input Data



Diverter

No

Battery Capacity [kWh]

0.00

PV Cells kWp

Orientation

Elevation

Overshading

FGHRS

MCS Certificate

Overshading

Factor

MCS

Certificate

Reference

Panel

Manufacturer

2.00

South

30°

Modest

No

0.80

34.0 Small-scale Hydro

None

Jan

Feb

Mar

Apr

May

Jun

Jul

Aug

Sep

Oct

Nov

Dec

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

Typical Cost
£4,000 - £6,000

Typical savings per year
£82

Ratings after improvement
SAP rating
B 86
0
0
Environmental Impact
A 97
0
0

Thermal Bridging

Property Reference	1090	Issued on Date	28/08/2024
Assessment Reference	00001	Prop Type Ref	Detached House
Property	1090		

SAP Rating	85 B	DER	3.61	TER	10.63
Environmental	97 A	% DER < TER			66.04
CO ₂ Emissions (t/year)	0.32	DFEE	32.86	TFEE	38.19
Compliance Check	See BREL	% DFEE < TFEE			13.94
% DPER < TPER	32.92	DPER	37.21	TPER	55.47

Assessor Details	Mr. Ikechukwu Diala-Uka	Assessor ID	W462-0001
Client			

	Junction details	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.026	11.03	0.29	
External wall	E3 Sill	Independently assessed	0.040	10.10	0.40	
External wall	E4 Jamb	Independently assessed	0.014	22.50	0.32	
External wall	E5 Ground floor (normal)	Independently assessed	0.042	30.02	1.26	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.020	30.02	0.60	
External wall	E16 Corner (normal)	Independently assessed	0.041	25.00	1.03	
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.046	21.25	0.98	
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.033	8.73	0.29	
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.079	5.00	-0.40	

Total: 163.65 W/mK:
Y-Value: 0.02 W/m²K:

Full SAP Calculation Printout



Property Reference	1090	Issued on Date	28/08/2024
Assessment Reference	00001	Prop Type Ref	
Property	1090		
SAP Rating	85 B	DER	3.61
Environmental	97 A	% DER < TER	66.04
CO ₂ Emissions (t/year)	0.32	DFEE	32.86
Compliance Check	See BREL	% DFEE < TFEE	13.94
% DPER < TPER	32.92	DPER	37.21
Assessor Details	Mr. Ikechukwu Diala-Uka	Assessor ID	W462-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.7400 (1b)	x 2.4000 (2b)	= 121.7760 (1b) - (3b)
First floor	50.7400 (1c)	x 2.6000 (2c)	= 131.9240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.7000 (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) = 0.1182 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3682 (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) = 0.3130 (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	0.3991	0.3913	0.3834	0.3443	0.3365	0.2974	0.2974	0.2895	0.3130	0.3365	0.3521	0.3678 (22b)
Effective ac	0.5796	0.5765	0.5735	0.5593	0.5566	0.5442	0.5442	0.5419	0.5490	0.5566	0.5620	0.5676 (25)

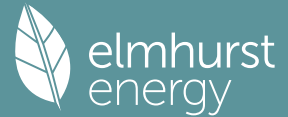
3. Heat losses and heat loss parameter

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
Door			1.9500	1.4000	2.7300		(26)
Window (Uw = 1.30)			14.6700	1.2357	18.1283		(27)
Heatloss Floor 1			50.7400	0.1300	6.5962	75.0000	3805.5000 (28a)
External Wall 1	150.1000	16.6200	133.4800	0.1400	18.6872	60.0000	8008.8000 (29a)
External Roof 1	50.7400		50.7400	0.1200	6.0888	9.0000	456.6600 (30)
Total net area of external elements Aum(A, m ²)			251.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.2305		(33)
Internal Floor 1			50.7400			18.0000	913.3200 (32d)
Internal Ceiling 1			50.7400			9.0000	456.6600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 13640.9400 (34)
134.4200 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	11.0300	0.0260	0.2868
E2 Other lintels (including other steel lintels)	10.1000	0.0400	0.4040
E3 Sill	22.5000	0.0140	0.3150
E4 Jamb	30.0200	0.0420	1.2608
E5 Ground floor (normal)	30.0200	0.0200	0.6004
E6 Intermediate floor within a dwelling			

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E16 Corner (normal)	25.0000	0.0410	1.0250										
E10 Eaves (insulation at ceiling level)	21.2500	0.0460	0.9775										
E12 Gable (insulation at ceiling level)	8.7300	0.0330	0.2881										
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0790	-0.3950										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												4.7626	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		56.9931	(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	48.5278	48.2689	48.0151	46.8231	46.6001	45.5620	45.5620	45.3697	45.9619	46.6001	47.0513	47.5229	(38)
Average = Sum(39)m / 12 =	105.5209	105.2620	105.0082	103.8163	103.5933	102.5551	102.5551	102.3629	102.9550	103.5933	104.0444	104.5161	(39)
												103.8152	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0398	1.0373	1.0348	1.0230	1.0208	1.0106	1.0106	1.0087	1.0145	1.0208	1.0253	1.0299	(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												
Hot water usage for mixer showers												2.7528 (42)
	96.7661	95.3119	93.1929	89.1384	86.1463	82.8096	80.9130	83.0160	85.3213	88.9040	93.0455	96.3954 (42a)
Hot water usage for baths												
	30.3869	29.9356	29.3001	28.1284	27.2510	26.2781	25.7526	26.3836	27.0707	28.1118	29.3077	30.2842 (42b)
Hot water usage for other uses												
	42.8215	41.2644	39.7072	38.1501	36.5929	35.0358	35.0358	36.5929	38.1501	39.7072	41.2644	42.8215 (42c)
Average daily hot water use (litres/day)												156.3173 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	169.9746	166.5120	162.2002	155.4169	149.9903	144.1235	141.7014	145.9926	150.5422	156.7230	163.6176	169.5011 (44)
Energy content (annual)	269.1982	237.1108	249.2957	212.7579	201.9157	177.2166	171.3755	180.7693	185.6335	212.6716	233.1032	265.3978 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2596.4461
	40.3797	35.5666	37.3944	31.9137	30.2874	26.5825	25.7063	27.1154	27.8450	31.9007	34.9655	39.8097 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.0000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5400 (55)
Total storage loss												
	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400 (56)
If cylinder contains dedicated solar storage												
	16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400 (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												
	309.2006	273.2420	289.2981	251.4699	241.9181	215.9286	211.3779	220.7717	224.3455	252.6740	271.8152	305.4002 (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	309.2006	273.2420	289.2981	251.4699	241.9181	215.9286	211.3779	220.7717	224.3455	252.6740	271.8152	305.4002 (64)
												3067.4421 (64)
12Total per year (kWh/year)												3067 (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												
	121.5103	107.7443	114.8928	101.7116	99.1389	89.8941	88.9843	92.1077	92.6927	102.7152	108.4764	120.2467 (65)

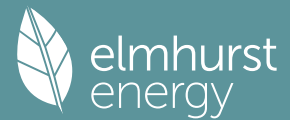
5. Internal gains (see Table 5 and 5a)												

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	139.0187	153.9136	139.0187	143.6527	139.0187	143.6527	139.0187	139.0187	143.6527	139.0187	143.6527	139.0187 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	258.6984	261.3829	254.6181	240.2166	222.0374	204.9514	193.5370	190.8525	197.6173	212.0188	230.1980	247.2840 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641 (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)												
	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124 (71)
Water heating gains (Table 5)												
	163.3203	160.3338	154.4257	141.2661	133.2512	124.8530	119.6025	123.8007	128.7399	138.0581	150.6617	161.6219 (72)
Total internal gains												
	625.3296	639.9224	612.3547	589.4276	558.5994	537.7492	516.4504	517.9641	534.3020	553.3877	588.8045	612.2167 (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				5.9900	10.6334	0.7600	0.7000	0.7700			23.4825 (74)				
South				8.6800	46.7521	0.7600	0.7000	0.7700			149.6116 (78)				
Solar gains				173.0941	289.9015	388.3744	475.2480	532.5997	530.4021	510.5632	466.5116	417.7289	317.7020	206.3094	148.8544 (83)
Total gains				798.4237	929.8239	1000.7291	1064.6756	1091.1992	1068.1513	1027.0136	984.4756	952.0309	871.0897	795.1140	761.0711 (84)

7. Mean internal temperature (heating season)

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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	35.9090	35.9973	36.0843	36.4986	36.5772	36.9475	36.9475	37.0168	36.8039	36.5772	36.4186	36.2542
alpha	3.3939	3.3998	3.4056	3.4332	3.4385	3.4632	3.4632	3.4678	3.4536	3.4385	3.4279	3.4169
util living area	0.9616	0.9369	0.9026	0.8337	0.7242	0.5650	0.4247	0.4582	0.6516	0.8490	0.9377	0.9666 (86)
Living	19.2904	19.5830	19.9336	20.3633	20.7007	20.9083	20.9739	20.9657	20.8440	20.4160	19.7902	19.2409
Non living	18.5040	18.7906	19.1313	19.5445	19.8480	20.0217	20.0641	20.0615	19.9741	19.6029	19.0047	18.4616
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	20.1254	19.5830	19.9336	20.3633	20.7007	20.9083	20.9739	20.9657	20.8440	20.4160	19.7902	19.4870 (87)
Th 2	20.0503	20.0524	20.0545	20.0642	20.0660	20.0745	20.0745	20.0761	20.0712	20.0660	20.0623	20.0585 (88)
util rest of house	0.9550	0.9266	0.8865	0.8061	0.6786	0.4971	0.3411	0.3737	0.5868	0.8182	0.9258	0.9609 (89)
MIT 2	19.2593	18.7906	19.1313	19.5445	19.8480	20.0217	20.0641	20.0615	19.9741	19.6029	19.0047	18.6850 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.4056	18.9245	19.2669	19.6829	19.9921	20.1716	20.2179	20.2143	20.1211	19.7403	19.1374	0.1690 (91)
Temperature adjustment												0.0000
adjusted MIT	19.4056	18.9245	19.2669	19.6829	19.9921	20.1716	20.2179	20.2143	20.1211	19.7403	19.1374	18.8205 (93)

8. Space heating requirement

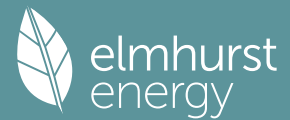
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9498	0.9115	0.8707	0.7934	0.6747	0.5046	0.3544	0.3868	0.5906	0.8059	0.9112	0.9514 (94)
Useful gains	758.3605	847.5764	871.3137	844.7616	736.2780	538.9599	363.9816	380.7547	562.2233	701.9708	724.5082	724.0748 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1593.9604	1476.2466	1340.6284	1119.4402	859.0026	571.3922	371.0297	390.4458	619.9032	946.8711	1252.4259	1528.0768 (97)
Space heating kWh	621.6863	422.4664	349.1702	197.7686	91.3071	0.0000	0.0000	0.0000	0.0000	182.2059	380.1007	598.1775 (98a)
Space heating requirement - total per year (kWh/year)												2842.8827
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	621.6863	422.4664	349.1702	197.7686	91.3071	0.0000	0.0000	0.0000	0.0000	182.2059	380.1007	598.1775 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2842.8827
Space heating per m2										(98c) / (4) =		28.0142 (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 %)													222.3175 (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	621.6863	422.4664	349.1702	197.7686	91.3071	0.0000	0.0000	0.0000	0.0000	182.2059	380.1007	598.1775 (98)	
Space heating efficiency (main heating system 1)	222.3175	222.3175	222.3175	222.3175	222.3175	0.0000	0.0000	0.0000	0.0000	222.3175	222.3175	222.3175 (210)	
Space heating fuel (main heating system)	279.6389	190.0284	157.0592	88.9577	41.0706	0.0000	0.0000	0.0000	0.0000	81.9575	170.9720	269.0645 (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	309.2006	273.2420	289.2981	251.4699	241.9181	215.9286	211.3779	220.7717	224.3455	252.6740	271.8152	305.4002 (64)	
Efficiency of water heater	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189	179.0189 (216)	
Fuel for water heating, kWh/month	172.7196	152.6331	161.6020	140.4712	135.1355	120.6178	118.0758	123.3231	125.3195	141.1438	151.8361	170.5966 (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	26.8780	21.5625	19.4146	14.2240	10.9870	8.9765	10.0227	13.0279	16.9220	22.2026	25.0778	27.6250 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-32.0077	-48.4019	-74.4159	-88.1135	-97.7379	-89.8663	-88.5533	-81.6097	-69.4888	-56.3334	-35.9891	-27.2218 (233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)	
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)	
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)	
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)	
Annual totals kWh/year													
Space heating fuel - main system 1													1278.7487 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													179.0189
Water heating fuel used													1713.4740 (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)													216.9207 (232)

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

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PV generation	-789.7393	(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	2419.4041	(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	1278.7487	0.1556	198.9785 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1713.4740	0.1411	241.8367 (264)
Space and water heating			440.8152 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	216.9207	0.1443	31.3084 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.7393	0.1337	-105.6130
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-105.6130 (269)
Total CO2, kg/year			366.5106 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.6100 (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	1278.7487	1.5760	2015.3606 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1713.4740	1.5219	2607.7191 (278)
Space and water heating			4623.0797 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	216.9207	1.5338	332.7202 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-789.7393	1.4942	-1180.0361
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1180.0361 (283)
Total Primary energy kWh/year			3775.7638 (286)
Dwelling Primary energy Rate (DPER)			37.2100 (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)
Ground floor	50.7400 (1b)	x 2.4000 (2b)	= 121.7760 (1b) - (3b)
First floor	50.7400 (1c)	x 2.6000 (2c)	= 131.9240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.7000 (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) = 0.1577 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4077 (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) = 0.3465 (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	1.1750	1.1750 (22a)
Adj infilt rate	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (Uw = 1.20)			14.6700	1.1450	16.7977			(27)
Heatloss Floor 1			50.7400	0.1300	6.5962			(28a)
External Wall 1	150.1000	16.6200	133.4800	0.1800	24.0264			(29a)
External Roof 1	50.7400		50.7400	0.1100	5.5814			(30)
Total net area of external elements Aum(A, m2)			251.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	54.9517			(33)

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

134.4200 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	11.0300	0.0500	0.5515	
E3 Sill	10.1000	0.0500	0.5050	
E4 Jamb	22.5000	0.0500	1.1250	
E5 Ground floor (normal)	30.0200	0.1600	4.8032	
E6 Intermediate floor within a dwelling	30.0200	0.0000	0.0000	
E16 Corner (normal)	25.0000	0.0900	2.2500	
E10 Eaves (insulation at ceiling level)	21.2500	0.0600	1.2750	
E12 Gable (insulation at ceiling level)	8.7300	0.0600	0.5238	
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500	

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

10.5835 (36)

Point Thermal Bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 65.5352 (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	50.0315	49.7142	49.4032	47.9424	47.6691	46.3968	46.3968	46.1612	46.8868	47.6691	48.2220	48.8000	(38)
Average = Sum(39)m / 12 =	115.5667	115.2494	114.9384	113.4776	113.2043	111.9320	111.9320	111.6964	112.4221	113.2043	113.7572	114.3352	(39)
												113.4763	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1388	1.1357	1.1326	1.1182	1.1155	1.1030	1.1030	1.1007	1.1078	1.1155	1.1210	1.1267	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

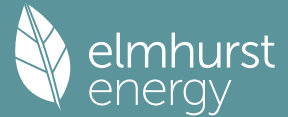
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7528 (42)
Hot water usage for mixer showers													
70.3754	69.3178	67.7766	64.8279	62.6519	60.2252	58.8458	60.3753	62.0519	64.6574	67.6695	70.1057	(42a)	
Hot water usage for baths													
30.3869	29.9356	29.3001	28.1284	27.2510	26.2781	25.7526	26.3836	27.0707	28.1118	29.3077	30.2842	(42b)	
Hot water usage for other uses													
42.8215	41.2644	39.7072	38.1501	36.5929	35.0358	35.0358	36.5929	38.1501	39.7072	41.2644	42.8215	(42c)	
Average daily hot water use (litres/day)													131.9859 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.5838	140.5178	136.7840	131.1064	126.4958	121.5390	119.6342	123.3519	127.2727	132.4764	138.2415	143.2115	(44)
Energy content	227.4017	200.0955	210.2319	179.4781	170.2877	149.4464	144.6872	152.7354	156.9400	179.7693	196.9504	224.2346	(45)
Energy content (annual)										Total = Sum(45)m =		2192.2580	
Distribution loss (46)m = 0.15 x (45)m													
34.1103	30.0143	31.5348	26.9217	25.5431	22.4170	21.7031	22.9103	23.5410	26.9654	29.5426	33.6352	(46)	
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss													
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	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	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													
273.9966	242.1812	256.8268	224.5700	216.8826	194.5383	191.2821	199.3303	202.0318	226.3642	242.0422	270.8295	(62)	
WWHRS	-32.1727	-28.4538	-29.7952	-24.6716	-22.9930	-19.6753	-18.4424	-19.6117	-20.3568	-23.9984	-27.1873	-31.5769	(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													
241.8239	213.7274	227.0317	199.8984	193.8895	174.8630	172.8396	179.7186	181.6750	202.3658	214.8549	239.2526	(64)	
12Total per year (kWh/year)													2441.9403 (64)
Electric shower(s)													2442 (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	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													
112.8870	100.2003	107.1780	95.7499	93.8966	85.7644	85.3844	88.0604	88.2560	97.0492	101.5595	111.8339	(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	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.0187	153.9136	139.0187	143.6527	139.0187	143.6527	139.0187	139.0187	143.6527	139.0187	143.6527	139.0187	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.6984	261.3829	254.6181	240.2166	222.0374	204.9514	193.5370	190.8525	197.6173	212.0188	230.1980	247.2840	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	(71)
Water heating gains (Table 5)	151.7298	149.1076	144.0565	132.9860	126.2051	119.1172	114.7640	118.3608	122.5778	130.4425	141.0548	150.3144	(72)

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Total internal gains
616.7391 631.6963 604.9855 584.1475 554.5533 532.0135 511.6118 512.5241 528.1399 548.7721 582.1977 603.9092 (73)

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	5.9900				10.6334	0.6300		0.7000	0.7700	19.4657 (74)
South	8.6800				46.7521	0.6300		0.7000	0.7700	124.0202 (78)
Solar gains	143.4859	240.3131	321.9419	393.9556	441.4971	439.6754	423.2300	386.7136	346.2752	263.3583 171.0197 123.3924 (83)
Total gains	760.2250	872.0093	926.9274	978.1031	996.0504	971.6889	934.8419	899.2377	874.4151	812.1304 753.2173 727.3017 (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	32.7876	32.8778	32.9668	33.3912	33.4718	33.8523	33.8523	33.9237	33.7047	33.4718	33.3091	33.1407
alpha	3.1858	3.1919	3.1978	3.2261	3.2315	3.2568	3.2568	3.2616	3.2470	3.2315	3.2206	3.2094
util living area	0.9682	0.9503	0.9257	0.8735	0.7844	0.6385	0.4937	0.5279	0.7169	0.8821	0.9497	0.9720 (86)
MIT	19.0060	19.2835	19.6472	20.1286	20.5435	20.8381	20.9478	20.9340	20.7492	20.2249	19.5464	18.9655 (87)
Th 2	19.9693	19.9718	19.9743	19.9860	19.9882	19.9984	19.9984	20.0003	19.9944	19.9882	19.9837	19.9791 (88)
util rest of house	0.9625	0.9415	0.9120	0.8491	0.7404	0.5642	0.3937	0.4287	0.6501	0.8545	0.9394	0.9669 (89)
MIT 2	17.6565	18.0070	18.4643	19.0644	19.5549	19.8770	19.9717	19.9642	19.7906	19.1924	18.3507	17.6116 (90)
Living area fraction	fLA = Living area / (4) =											0.1690 (91)
MIT	17.8846	18.2227	18.6642	19.2442	19.7220	20.0394	20.1366	20.1281	19.9526	19.3669	18.5528	17.8404 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8846	18.2227	18.6642	19.2442	19.7220	20.0394	20.1366	20.1281	19.9526	19.3669	18.5528	17.8404 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9462	0.9217	0.8898	0.8277	0.7273	0.5675	0.4082	0.4421	0.6470	0.8338	0.9198	0.9519 (94)
Useful gains	719.3519	803.7187	824.8147	809.6197	724.3851	551.3885	381.5977	397.5539	565.7129	677.1686	692.8284	692.3392 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.0000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1569.9251	1535.4339	1398.1323	1173.8376	908.1204	608.8450	395.8638	416.4157	657.9642	992.4509	1302.8396	1559.5789 (97)
Space heating kWh	632.8264	491.7126	426.5483	262.2369	136.6991	0.0000	0.0000	0.0000	0.0000	234.5701	439.2080	645.2263 (98a)
Space heating requirement - total per year (kWh/year)												3269.0277
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	632.8264	491.7126	426.5483	262.2369	136.6991	0.0000	0.0000	0.0000	0.0000	234.5701	439.2080	645.2263 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3269.0277
Space heating per m2												(98c) / (4) = 32.2135 (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	632.8264	491.7126	426.5483	262.2369	136.6991	0.0000	0.0000	0.0000	0.0000	234.5701	439.2080	645.2263 (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)	685.6191	532.7331	462.1325	284.1136	148.1030	0.0000	0.0000	0.0000	0.0000	254.1387	475.8484	699.0534 (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	241.8239	213.7274	227.0317	199.8984	193.8895	174.8630	172.8396	179.7186	181.6750	202.3658	214.8549	239.2526 (64)
Efficiency of water heater	86.1148	85.8660	85.4523	84.6695	83.2906	79.8000	79.8000	79.8000	79.8000	84.3918	85.6277	79.8000 (216)
Fuel for water heating, kWh/month	280.8159	248.9081	265.6824	236.0927	232.7868	219.1265	216.5910	225.2112	227.6629	239.7931	250.9176	277.6482 (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	28.8853	23.1729	20.8646	15.2863	11.8076	9.6469	10.7713	14.0009	18.1858	23.8608	26.9507	29.6882 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-46.3885	-64.8424	-92.4010	-102.9383	-110.1634	-102.4819	-101.1740	-95.9038	-86.5031	-73.6664	-50.7854	-40.1678 (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	-27.9049	-58.5088	-115.9572	-173.6976	-229.2540	-230.2371	-227.5648	-192.8972	-141.6536	-83.5604	-37.2159	-22.0841 (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													3541.7418	(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													2921.2364	(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)													233.1213	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2507.9516	(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													4274.1479	(238)

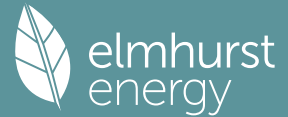
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3541.7418	0.2100	743.7658 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2921.2364	0.2100	613.4597 (264)
Space and water heating			1357.2254 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	233.1213	0.1443	33.6466 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-967.4161	0.1348	-130.3925
PV Unit electricity exported	-1540.5355	0.1260	-194.0619
Total			-324.4544 (269)
Total CO2, kg/year			1078.3469 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.6300 (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	3541.7418	1.1300	4002.1683 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2921.2364	1.1300	3300.9972 (278)
Space and water heating			7303.1654 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	233.1213	1.5338	357.5692 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-967.4161	1.4982	-1449.3357
PV Unit electricity exported	-1540.5355	0.4624	-712.3451
Total			-2161.6808 (283)
Total Primary energy kWh/year			5629.1545 (286)
Target Primary Energy Rate (TPER)			55.4700 (287)

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Property Reference	1090	Issued on Date	28/08/2024
Assessment Reference	FAB 1ST	Prop Type Ref	
Property	1090		
SAP Rating	84 B	DER	16.15
Environmental	85 B	% DER < TER	-47.62
CO ₂ Emissions (t/year)	1.48	DFEE	34.17
Compliance Check	See BREL	% DFEE < TFEE	10.52
% DPER < TPER	-56.03	DPER	89.17
Assessor Details	Mr. Ikechukwu Diala-Uka	Assessor ID	W462-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.7400 (1b)	x 2.4000 (2b)	= 121.7760 (1b) - (3b)
First floor	50.7400 (1c)	x 2.6000 (2c)	= 131.9240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.7000 (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) = 0.1182 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3682 (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) = 0.3130 (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	0.3991	0.3913	0.3834	0.3443	0.3365	0.2974	0.2974	0.2895	0.3130	0.3365	0.3521	0.3678 (22b)
Effective ac	0.5796	0.5765	0.5735	0.5593	0.5566	0.5442	0.5442	0.5419	0.5490	0.5566	0.5620	0.5676 (25)

3. Heat losses and heat loss parameter

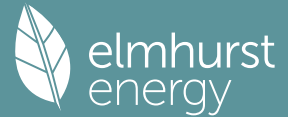
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Door			1.9500	1.0000	1.9500		(26)
Window (Uw = 1.20)			14.6700	1.1450	16.7977		(27)
Heatloss Floor 1			50.7400	0.1200	6.0888	75.0000	3805.5000 (28a)
External Wall 1	150.1000	16.6200	133.4800	0.1800	24.0264	60.0000	8008.8000 (29a)
External Roof 1	50.7400		50.7400	0.1200	6.0888	9.0000	456.6600 (30)
Total net area of external elements Aum(A, m ²)			251.5800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.9517		(33)
Internal Floor 1			50.7400			18.0000	913.3200 (32d)
Internal Ceiling 1			50.7400			9.0000	456.6600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 13640.9400 (34)
134.4200 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	11.0300	0.0260	0.2868
E3 Sill	10.1000	0.0400	0.4040
E4 Jamb	22.5000	0.0140	0.3150
E5 Ground floor (normal)	30.0200	0.0420	1.2608
E6 Intermediate floor within a dwelling	30.0200	0.0200	0.6004

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E16 Corner (normal)	25.0000	0.0410	1.0250										
E10 Eaves (insulation at ceiling level)	21.2500	0.0460	0.9775										
E12 Gable (insulation at ceiling level)	8.7300	0.0330	0.2881										
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0790	-0.3950										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												4.7626	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		59.7143	(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	48.5278	48.2689	48.0151	46.8231	46.6001	45.5620	45.5620	45.3697	45.9619	46.6001	47.0513	47.5229	(38)
Average = Sum(39)m / 12 =	108.2421	107.9832	107.7294	106.5375	106.3145	105.2763	105.2763	105.0840	105.6762	106.3145	106.7656	107.2373	(39)
												106.5364	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0666	1.0641	1.0616	1.0498	1.0476	1.0374	1.0374	1.0355	1.0413	1.0476	1.0521	1.0567	(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													2.7528	(42)
Hot water usage for mixer showers														
	96.7661	95.3119	93.1929	89.1384	86.1463	82.8096	80.9130	83.0160	85.3213	88.9040	93.0455	96.3954	(42a)	
Hot water usage for baths														
	30.3869	29.9356	29.3001	28.1284	27.2510	26.2781	25.7526	26.3836	27.0707	28.1118	29.3077	30.2842	(42b)	
Hot water usage for other uses														
	42.8215	41.2644	39.7072	38.1501	36.5929	35.0358	35.0358	36.5929	38.1501	39.7072	41.2644	42.8215	(42c)	
Average daily hot water use (litres/day)													156.3173	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	169.9746	166.5120	162.2002	155.4169	149.9903	144.1235	141.7014	145.9926	150.5422	156.7230	163.6176	169.5011	(44)	
Energy conte	269.1982	237.1108	249.2957	212.7579	201.9157	177.2166	171.3755	180.7693	185.6335	212.6716	233.1032	265.3978	(45)	
Energy content (annual)													2596.4461	
Distribution loss (46)m = 0.15 x (45)m														
	40.3797	35.5666	37.3944	31.9137	30.2874	26.5825	25.7063	27.1154	27.8450	31.9007	34.9655	39.8097	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month														
	320.1571	283.1382	300.2546	262.0730	252.8746	226.5317	222.3344	231.7282	234.9486	263.6305	282.4183	316.3567	(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														
	320.1571	283.1382	300.2546	262.0730	252.8746	226.5317	222.3344	231.7282	234.9486	263.6305	282.4183	316.3567	(64)	
12Total per year (kWh/year)													3196.4461	(64)
Electric shower(s)													3196	(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)	
													0.0000	(64a)
Heat gains from water heating, kWh/month														
	102.2481	90.3462	95.6306	83.0708	79.8767	71.2533	69.7221	72.8455	74.0519	83.4530	89.8356	100.9845	(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	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	(66)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	139.0187	153.9136	139.0187	143.6527	139.0187	143.6527	139.0187	139.0187	143.6527	139.0187	143.6527	139.0187	(67)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	258.6984	261.3829	254.6181	240.2166	222.0374	204.9514	193.5370	190.8525	197.6173	212.0188	230.1980	247.2840	(68)	
Pumps, fans	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	(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)	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	(71)	
Total internal gains	137.4303	134.4437	128.5357	115.3761	107.3612	98.9629	93.7125	97.9107	102.8499	112.1681	124.7716	135.7318	(72)	
	602.4396	617.0324	589.4647	566.5376	535.7094	511.8592	490.5603	492.0740	508.4120	530.4977	565.9145	589.3267	(73)	

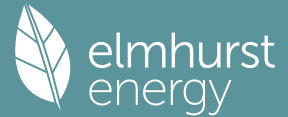
6. Solar gains

[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			5.9900		10.6334		0.7600		0.7000		0.7700		23.4825	(74)
South			8.6800		46.7521		0.7600		0.7000		0.7700		149.6116	(78)
Solar gains	173.0941	289.9015	388.3744	475.2480	532.5997	530.4021	510.5632	466.5116	417.7289	317.7020	206.3094	148.8544	(83)	
Total gains	775.5337	906.9339	977.8390	1041.7856	1068.3091	1042.2612	1001.1235	958.5856	926.1409	848.1997	772.2239	738.1810	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		

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tau	35.0063	35.0902	35.1728	35.5664	35.6410	35.9924	35.9924	36.0583	35.8562	35.6410	35.4904	35.3343
alpha	3.3338	3.3393	3.3449	3.3711	3.3761	3.3995	3.3995	3.4039	3.3904	3.3761	3.3660	3.3556
util living area	0.9651	0.9421	0.9102	0.8456	0.7408	0.5857	0.4440	0.4787	0.6728	0.8614	0.9435	0.9698 (86)
MIT	19.1935	19.4910	19.8521	20.3003	20.6615	20.8910	20.9677	20.9578	20.8178	20.3568	19.7060	19.1428 (87)
Th 2	20.4667	20.4680	20.4692	20.4751	20.4762	20.4813	20.4813	20.4822	20.4793	20.4762	20.4740	20.4716 (88)
util rest of house	0.9619	0.9370	0.9022	0.8315	0.7168	0.5484	0.3964	0.4310	0.6382	0.8460	0.9377	0.9671 (89)
MIT 2	18.7544	19.0491	19.4055	19.8461	20.1892	20.3994	20.4611	20.4550	20.3365	19.9060	19.2685	18.7079 (90)
Living area fraction	18.8286	19.1238	19.4810	19.9228	20.2690	20.4825	20.5467	20.5400	20.4178	19.9822	19.3425	18.7814 (92)
MIT												0.0000
Temperature adjustment												0.0000
adjusted MIT	18.8286	19.1238	19.4810	19.9228	20.2690	20.4825	20.5467	20.5400	20.4178	19.9822	19.3425	18.7814 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9496	0.9215	0.8848	0.8151	0.7066	0.5485	0.4026	0.4365	0.6339	0.8296	0.9226	0.9558 (94)
Useful gains	736.4741	835.7491	865.1510	849.1125	754.9197	571.6409	403.0094	418.3906	587.0525	703.6594	712.4735	705.5451 (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	1572.6094	1535.9283	1398.4330	1174.3460	911.0092	619.2846	415.4987	435.0479	667.6458	997.4606	1307.0731	1563.6710 (97)
Space heating kWh	622.0846	470.5204	396.7618	234.1681	116.1306	0.0000	0.0000	0.0000	0.0000	218.5881	428.1117	638.4456 (98a)
Space heating requirement - total per year (kWh/year)												3124.8111
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	622.0846	470.5204	396.7618	234.1681	116.1306	0.0000	0.0000	0.0000	0.0000	218.5881	428.1117	638.4456 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3124.8111
Space heating per m2										(98c) / (4) =		30.7924 (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 %)	83.4000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	622.0846	470.5204	396.7618	234.1681	116.1306	0.0000	0.0000	0.0000	0.0000	218.5881	428.1117	638.4456 (98)
Space heating efficiency (main heating system 1)	83.4000	83.4000	83.4000	83.4000	83.4000	0.0000	0.0000	0.0000	0.0000	83.4000	83.4000	83.4000 (210)
Space heating fuel (main heating system)	745.9049	564.1732	475.7336	280.7771	139.2453	0.0000	0.0000	0.0000	0.0000	262.0961	513.3234	765.5223 (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	320.1571	283.1382	300.2546	262.0730	252.8746	226.5317	222.3344	231.7282	234.9486	263.6305	282.4183	316.3567 (64)
Efficiency of water heater (217)m	85.2773	84.9602	84.4782	83.6397	82.3204	79.8000	79.8000	79.8000	79.8000	83.4814	84.7689	79.8000 (216)
Fuel for water heating, kWh/month	375.4307	333.2599	355.4227	313.3358	307.1835	283.8743	278.6145	290.3862	294.4218	315.7953	333.1627	370.6482 (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	26.8780	21.5625	19.4146	14.2240	10.9870	8.9765	10.0227	13.0279	16.9220	22.2026	25.0778	27.6250 (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												3746.7759 (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												3851.5356 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:												
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												86.0000 (231)
Electricity for lighting (calculated in Appendix L)												216.9207 (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

7901.2322 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	3746.7759	0.2100	786.8229	(261)
Total CO ₂ associated with community systems			0.0000	(373)
Water heating (other fuel)			808.8225	(264)
Space and water heating	3851.5356	0.2100	1595.6454	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	216.9207	0.1443	31.3084	(268)
Total CO ₂ , kg/year			1638.8830	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			16.1500	(273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year	
Space heating - main system 1	3746.7759	1.1300	4233.8567	(275)
Total CO ₂ associated with community systems			0.0000	(473)
Water heating (other fuel)			4352.2353	(278)
Space and water heating	3851.5356	1.1300	8586.0920	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	216.9207	1.5338	332.7202	(282)
Total Primary energy kWh/year			9048.9130	(286)
Dwelling Primary energy Rate (DPER)			89.1700	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Ground floor	50.7400 (1b)	x 2.4000 (2b)	= 121.7760	(1b) - (3b)
First floor	50.7400 (1c)	x 2.6000 (2c)	= 131.9240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.4800			(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.7000	(5)

2. Ventilation rate

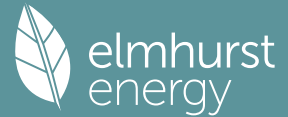
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
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) =	0.1577 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4077	(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) =	0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072	(22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			1.9500	1.0000	1.9500			(26)
TER Opening Type (U _w = 1.20)			14.6700	1.1450	16.7977			(27)
Heatloss Floor 1			50.7400	0.1300	6.5962			(28a)
External Wall 1	150.1000	16.6200	133.4800	0.1800	24.0264			(29a)
External Roof 1	50.7400		50.7400	0.1100	5.5814			(30)
Total net area of external elements A _{um} (A, m ²)			251.5800					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	54.9517			(33)
Thermal mass parameter (TMP = C _m / TFA) in kJ/m ² K							134.4200	(35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	11.0300	0.0500	0.5515
E3 Sill	10.1000	0.0500	0.5050
E4 Jamb	22.5000	0.0500	1.1250
E5 Ground floor (normal)	30.0200	0.1600	4.8032
E6 Intermediate floor within a dwelling	30.0200	0.0000	0.0000
E16 Corner (normal)	25.0000	0.0900	2.2500
E10 Eaves (insulation at ceiling level)	21.2500	0.0600	1.2750
E12 Gable (insulation at ceiling level)	8.7300	0.0600	0.5238
E17 Corner (inverted - internal area greater than external area)	5.0000	-0.0900	-0.4500
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.5835 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	65.5352 (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	50.0315	49.7142	49.4032	47.9424	47.6691	46.3968	46.3968	46.1612	46.8868	47.6691	48.2220	48.8000	(38)
Heat transfer coeff	115.5667	115.2494	114.9384	113.4776	113.2043	111.9320	111.9320	111.6964	112.4221	113.2043	113.7572	114.3352	(39)
Average = Sum(39)m / 12 =												113.4763	
HLP	1.1388	1.1357	1.1326	1.1182	1.1155	1.1030	1.1030	1.1007	1.1078	1.1155	1.1210	1.1267	(40)
HLP (average)												1.1182	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7528 (42)
Hot water usage for mixer showers	70.3754	69.3178	67.7766	64.8279	62.6519	60.2252	58.8458	60.3753	62.0519	64.6574	67.6695	70.1057	(42a)
Hot water usage for baths	30.3869	29.9356	29.3001	28.1284	27.2510	26.2781	25.7526	26.3836	27.0707	28.1118	29.3077	30.2842	(42b)
Hot water usage for other uses	42.8215	41.2644	39.7072	38.1501	36.5929	35.0358	35.0358	36.5929	38.1501	39.7072	41.2644	42.8215	(42c)
Average daily hot water use (litres/day)												131.9859	(43)
Daily hot water use	143.5838	140.5178	136.7840	131.1064	126.4958	121.5390	119.6342	123.3519	127.2727	132.4764	138.2415	143.2115	(44)
Energy conte	227.4017	200.0955	210.2319	179.4781	170.2877	149.4464	144.6872	152.7354	156.9400	179.7693	196.9504	224.2346	(45)
Energy content (annual)										Total = Sum(45)m =		2192.2580	
Distribution loss (46)m = 0.15 x (45)m	34.1103	30.0143	31.5348	26.9217	25.5431	22.4170	21.7031	22.9103	23.5410	26.9654	29.5426	33.6352	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	278.3606	246.1229	261.1908	228.7932	221.2466	198.7615	195.6461	203.6943	206.2550	230.7282	246.2655	275.1935	(62)
WWHRS	-32.1727	-28.4538	-29.7952	-24.6716	-22.9930	-19.6753	-18.4424	-19.6117	-20.3568	-23.9984	-27.1873	-31.5769	(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	246.1879	217.6691	231.3957	204.1216	198.2535	179.0862	177.2036	184.0826	185.8982	206.7298	219.0781	243.6166	(64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2493.3229	(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	88.3508	78.0386	82.6418	72.0052	69.3604	62.0197	60.8482	63.5242	64.5113	72.5130	77.8148	87.2977	(65)

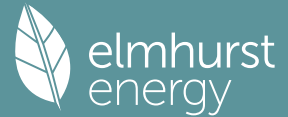
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.0187	153.9136	139.0187	143.6527	139.0187	143.6527	139.0187	139.0187	143.6527	139.0187	143.6527	139.0187	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.6984	261.3829	254.6181	240.2166	222.0374	204.9514	193.5370	190.8525	197.6173	212.0188	230.1980	247.2840	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	(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)	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	(71)
Water heating gains (Table 5)	118.7511	116.1289	111.0777	100.0073	93.2263	86.1385	81.7852	85.3820	89.5990	97.4637	108.0761	117.3356	(72)
Total internal gains	583.7604	598.7175	572.0067	551.1687	521.5745	499.0347	478.6331	479.5454	495.1612	515.7934	549.2189	570.9305	(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					5.9900	10.6334	0.6300	0.7000	0.7700		19.4657 (74)	
South					8.6800	46.7521	0.6300	0.7000	0.7700		124.0202 (78)	
Solar gains	143.4859	240.3131	321.9419	393.9556	441.4971	439.6754	423.2300	386.7136	346.2752	263.3583	171.0197	123.3924 (83)
Total gains	727.2463	839.0306	893.9486	945.1243	963.0717	938.7101	901.8631	866.2589	841.4364	779.1516	720.2386	694.3229 (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	32.7876	32.8778	32.9668	33.3912	33.4718	33.8523	33.8523	33.9237	33.7047	33.4718	33.3091	33.1407	
alpha	3.1858	3.1919	3.1978	3.2261	3.2315	3.2568	3.2568	3.2616	3.2470	3.2315	3.2206	3.2094	
util living area	0.9717	0.9549	0.9318	0.8823	0.7965	0.6535	0.5087	0.5439	0.7326	0.8921	0.9551	0.9753 (86)	
MIT	18.9569	19.2375	19.6052	20.0941	20.5196	20.8263	20.9431	20.9280	20.7315	20.1891	19.5003	18.9156 (87)	
Th 2	19.9693	19.9718	19.9743	19.9860	19.9882	19.9984	19.9984	20.0003	19.9944	19.9882	19.9837	19.9791 (88)	
util rest of house	0.9665	0.9468	0.9190	0.8590	0.7536	0.5792	0.4067	0.4431	0.6667	0.8661	0.9457	0.9708 (89)	
MIT 2	17.5949	17.9499	18.4131	19.0242	19.5297	19.8672	19.9690	19.9606	19.7745	19.1512	18.2938	17.5487 (90)	
Living area fraction									fLA = Living area / (4) =				0.1690 (91)
MIT	17.8250	18.1675	18.6145	19.2050	19.6970	20.0293	20.1336	20.1241	19.9362	19.3266	18.4977	17.7797 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.8250	18.1675	18.6145	19.2050	19.6970	20.0293	20.1336	20.1241	19.9362	19.3266	18.4977	17.7797 (93)	

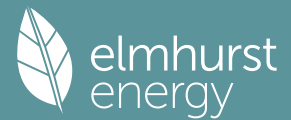
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9513	0.9277	0.8972	0.8374	0.7395	0.5817	0.4212	0.4563	0.6624	0.8452	0.9270	0.9568 (94)
Useful gains	691.8290	778.3767	802.0711	791.4293	712.2243	546.0230	379.8999	395.2960	557.3543	658.5125	667.6368	664.3065 (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	1563.0440	1529.0671	1392.4257	1169.3889	905.2971	607.7142	395.5258	415.9631	656.1217	987.8893	1296.5703	1552.6400 (97)
Space heating kWh	648.1840	504.4640	439.2238	272.1309	143.6462	0.0000	0.0000	0.0000	0.0000	245.0564	452.8321	660.9201 (98a)
Space heating requirement - total per year (kWh/year)												3366.4575
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	648.1840	504.4640	439.2238	272.1309	143.6462	0.0000	0.0000	0.0000	0.0000	245.0564	452.8321	660.9201 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3366.4575
Space heating per m2										(98c) / (4) =		33.1736 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	648.1840	504.4640	439.2238	272.1309	143.6462	0.0000	0.0000	0.0000	0.0000	245.0564	452.8321	660.9201 (98)	
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)	
Space heating fuel (main heating system)	701.4978	545.9567	475.3505	294.5140	155.4612	0.0000	0.0000	0.0000	0.0000	265.2125	490.0781	715.2815 (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	246.1879	217.6691	231.3957	204.1216	198.2535	179.0862	177.2036	184.0826	185.8982	206.7298	219.0781	243.6166 (64)	
Efficiency of water heater	86.3543	86.1199	85.7319	84.9984	83.7019	80.3000	80.3000	80.3000	80.3000	84.7469	85.9004	86.4076 (217)	
Fuel for water heating, kWh/month	285.0907	252.7513	269.9063	240.1477	236.8565	223.0214	220.6770	229.2436	231.5046	243.9380	255.0374	281.9388 (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 (221)	
Lighting	28.8853	23.1729	20.8646	15.2863	11.8076	9.6469	10.7713	14.0009	18.1858	23.8608	26.9507	29.6882 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-46.3885	-64.8424	-92.4010	-102.9383	-110.1634	-102.4819	-101.1740	-95.9038	-86.5031	-73.6664	-50.7854	-40.1678 (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)	-27.9049	-58.5088	-115.9572	-173.6976	-229.2540	-230.2371	-227.5648	-192.8972	-141.6536	-83.5604	-37.2159	-22.0841 (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													3643.3523 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													80.3000
Water heating fuel used													2970.1132 (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)													233.1213 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-2507.9516 (233)
Wind generation													0.0000 (234)

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Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	4424.6352 (238)

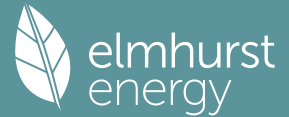
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3643.3523	0.2100	765.1040 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2970.1132	0.2100	623.7238 (264)
Space and water heating			1388.8278 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	233.1213	0.1443	33.6466 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-967.4161	0.1348	-130.3925
PV Unit electricity exported	-1540.5355	0.1260	-194.0619
Total			-324.4544 (269)
Total CO2, kg/year			1109.9492 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.9400 (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	3643.3523	1.1300	4116.9881 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2970.1132	1.1300	3356.2280 (278)
Space and water heating			7473.2161 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	233.1213	1.5338	357.5692 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-967.4161	1.4982	-1449.3357
PV Unit electricity exported	-1540.5355	0.4624	-712.3451
Total			-2161.6808 (283)
Total Primary energy kWh/year			5799.2052 (286)
Target Primary Energy Rate (TPER)			57.1500 (287)

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Property Reference	1090	Issued on Date	28/08/2024
Assessment Reference	BASELINE	Prop Type Ref	
Property	1090		
SAP Rating	80 C	DER	21.50
Environmental	80 C	% DER < TER	11.14
CO ₂ Emissions (t/year)	1.98	DFEE	56.69
Compliance Check	See BREL	TFEE	39.14
% DPER < TPER	-102.58	% DFEE < TFEE	-44.81
		TPER	58.24
Assessor Details	Mr. Ikechukwu Diala-Uka	Assessor ID	W462-0001
Client			

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.7400 (1b)	x 2.4000 (2b)	= 121.7760 (1b) - (3b)
First floor	50.7400 (1c)	x 2.6000 (2c)	= 131.9240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.7000 (5)

2. Ventilation rate

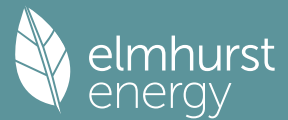
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1182 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3682 (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) = 0.3130 (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	0.3991	0.3913	0.3834	0.3443	0.3365	0.2974	0.2974	0.2895	0.3130	0.3365	0.3521	0.3678 (22b)
Effective ac	0.5796	0.5765	0.5735	0.5593	0.5566	0.5442	0.5442	0.5419	0.5490	0.5566	0.5620	0.5676 (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					
Door			1.9500	1.0000	1.9500		(26)					
Window (Uw = 1.20)			14.6700	1.1450	16.7977		(27)					
Heatloss Floor 1			50.7400	0.1300	6.5962	75.0000	3805.5000 (28a)					
External Wall 1	150.1000	16.6200	133.4800	0.1800	24.0264	60.0000	8008.8000 (29a)					
External Roof 1	50.7400		50.7400	0.1800	9.1332	9.0000	456.6600 (30)					
Total net area of external elements Aum(A, m2)			251.5800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.5035		(33)					
Internal Floor 1			50.7400			18.0000	913.3200 (32d)					
Internal Ceiling 1			50.7400			9.0000	456.6600 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13640.9400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.4200 (35)					
Thermal bridges (Default value 0.200 * total exposed area)							50.3160 (36)					
Point Thermal bridges						(36a) =	0.0000					
Total fabric heat loss					(33) + (36) + (36a) =		108.8195 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.5278	Feb 48.2689	Mar 48.0151	Apr 46.8231	May 46.6001	Jun 45.5620	Jul 45.5620	Aug 45.3697	Sep 45.9619	Oct 46.6001	Nov 47.0513	Dec 47.5229 (38)

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Heat transfer coeff
157.3473 157.0884 156.8346 155.6427 155.4196 154.3815 154.3815 154.1892 154.7814 155.4196 155.8708 156.3424 (39)
Average = Sum(39)m / 12 = 155.6416

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5505	1.5480	1.5455	1.5337	1.5315	1.5213	1.5213	1.5194	1.5252	1.5315	1.5360	1.5406 (40)
HLP (average)												1.5337
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7528 (42)
Hot water usage for mixer showers 96.7661 95.3119 93.1929 89.1384 86.1463 82.8096 80.9130 83.0160 85.3213 88.9040 93.0455 96.3954 (42a)
Hot water usage for baths 30.3869 29.9356 29.3001 28.1284 27.2510 26.2781 25.7526 26.3836 27.0707 28.1118 29.3077 30.2842 (42b)
Hot water usage for other uses 42.8215 41.2644 39.7072 38.1501 36.5929 35.0358 35.0358 36.5929 38.1501 39.7072 41.2644 42.8215 (42c)
Average daily hot water use (litres/day) 156.3173 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	169.9746	166.5120	162.2002	155.4169	149.9903	144.1235	141.7014	145.9926	150.5422	156.7230	163.6176	169.5011 (44)
Energy conte	269.1982	237.1108	249.2957	212.7579	201.9157	177.2166	171.3755	180.7693	185.6335	212.6716	233.1032	265.3978 (45)
Energy content (annual)												2596.4461
Distribution loss (46)m = 0.15 x (45)m	40.3797	35.5666	37.3944	31.9137	30.2874	26.5825	25.7063	27.1154	27.8450	31.9007	34.9655	39.8097 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	320.1571	283.1382	300.2546	262.0730	252.8746	226.5317	222.3344	231.7282	234.9486	263.6305	282.4183	316.3567 (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	320.1571	283.1382	300.2546	262.0730	252.8746	226.5317	222.3344	231.7282	234.9486	263.6305	282.4183	316.3567 (64)
12Total per year (kWh/year)												3196.4461 (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	102.2481	90.3462	95.6306	83.0708	79.8767	71.2533	69.7221	72.8455	74.0519	83.4530	89.8356	100.9845 (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	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.0187	153.9136	139.0187	143.6527	139.0187	143.6527	139.0187	139.0187	143.6527	139.0187	143.6527	139.0187 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.6984	261.3829	254.6181	240.2166	222.0374	204.9514	193.5370	190.8525	197.6173	212.0188	230.1980	247.2840 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641 (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)	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124 (71)
Water heating gains (Table 5)	137.4303	134.4437	128.5357	115.3761	107.3612	98.9629	93.7125	97.9107	102.8499	112.1681	124.7716	135.7318 (72)
Total internal gains	602.4396	617.0324	589.4647	566.5376	535.7094	511.8592	490.5603	492.0740	508.4120	530.4977	565.9145	589.3267 (73)

6. Solar gains

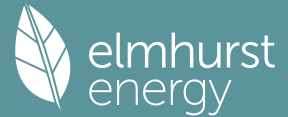
[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
North	5.9900	10.6334	0.7600	0.7000	0.7700	23.4825 (74)						
South	8.6800	46.7521	0.7600	0.7000	0.7700	149.6116 (78)						
Solar gains	173.0941	289.9015	388.3744	475.2480	532.5997	530.4021	510.5632	466.5116	417.7289	317.7020	206.3094	148.8544 (83)
Total gains	775.5337	906.9339	977.8390	1041.7856	1068.3091	1042.2612	1001.1235	958.5856	926.1409	848.1997	772.2239	738.1810 (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	24.0814	24.1211	24.1602	24.3452	24.3801	24.5441	24.5441	24.5747	24.4807	24.3801	24.3096	24.2362
alpha	2.6054	2.6081	2.6107	2.6230	2.6253	2.6363	2.6363	2.6383	2.6320	2.6253	2.6206	2.6157
util living area	0.9703	0.9547	0.9339	0.8929	0.8228	0.7054	0.5747	0.6093	0.7741	0.9032	0.9558	0.9737 (86)
MIT	18.2001	18.5149	18.9654	19.5708	20.1502	20.6196	20.8437	20.8116	20.4724	19.7242	18.8591	18.1442 (87)
Th 2	19.6498	19.6517	19.6536	19.6623	19.6639	19.6716	19.6716	19.6730	19.6686	19.6639	19.6606	19.6572 (88)
util rest of house	0.9642	0.9455	0.9197	0.8675	0.7751	0.6152	0.4364	0.4757	0.6982	0.8751	0.9452	0.9683 (89)
MIT 2	17.1601	17.4705	17.9138	18.5056	19.0492	19.4584	19.6155	19.5997	19.3450	18.6640	17.8203	17.1097 (90)
Living area fraction									fLA = Living area / (4) =			0.1690 (91)

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MIT	17.3359	17.6470	18.0915	18.6856	19.2353	19.6546	19.8231	19.8045	19.5355	18.8432	17.9959	17.2845 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3359	17.6470	18.0915	18.6856	19.2353	19.6546	19.8231	19.8045	19.5355	18.8432	17.9959	17.2845 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9491	0.9264	0.8975	0.8439	0.7565	0.6139	0.4541	0.4907	0.6890	0.8525	0.9266	0.9544	(94)
Useful gains	736.0859	840.2257	877.6407	879.1332	808.2278	639.8634	454.5699	470.3449	638.1408	723.0582	715.5781	704.5392	(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	2051.1556	2002.4096	1817.9558	1523.0636	1171.1280	780.3389	497.5800	524.9369	841.3185	1281.1474	1698.3481	2045.6658	(97)
Space heating kWh	978.4119	780.9875	699.5944	463.6298	269.9977	0.0000	0.0000	0.0000	0.0000	415.2184	707.5944	997.7982	(98a)
Space heating requirement - total per year (kWh/year)												5313.2323	
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	978.4119	780.9875	699.5944	463.6298	269.9977	0.0000	0.0000	0.0000	0.0000	415.2184	707.5944	997.7982	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5313.2323	
Space heating per m2										(98c) / (4) =		52.3574	(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 %)												83.4000 (206)	
Efficiency of main space heating system 2 (in %)												0.0000 (207)	
Efficiency of secondary/supplementary heating system, %												0.0000 (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	978.4119	780.9875	699.5944	463.6298	269.9977	0.0000	0.0000	0.0000	0.0000	415.2184	707.5944	997.7982	(98)
Space heating efficiency (main heating system 1)	83.4000	83.4000	83.4000	83.4000	83.4000	0.0000	0.0000	0.0000	0.0000	83.4000	83.4000	83.4000	(210)
Space heating fuel (main heating system)	1173.1557	936.4359	838.8422	555.9111	323.7383	0.0000	0.0000	0.0000	0.0000	497.8638	848.4345	1196.4007	(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	320.1571	283.1382	300.2546	262.0730	252.8746	226.5317	222.3344	231.7282	234.9486	263.6305	282.4183	316.3567	(64)
Efficiency of water heater	86.1120	85.9358	85.6288	85.0885	84.0208	79.8000	79.8000	79.8000	79.8000	84.8489	85.7634	79.8000	(216)
Fuel for water heating, kWh/month	371.7916	329.4764	350.6469	308.0007	300.9666	283.8743	278.6145	290.3862	294.4218	310.7059	329.2994	367.1539	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
(221)m	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(221)
Pumps and Fa	26.8780	21.5625	19.4146	14.2240	10.9870	8.9765	10.0227	13.0279	16.9220	22.2026	25.0778	27.6250	(231)
Lighting													(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(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	(234a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
(235d)m													
Annual totals kWh/year													
Space heating fuel - main system 1												6370.7822 (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												3815.3383 (219)	
Space cooling fuel												0.0000 (221)	
Electricity for pumps and fans:													
central heating pump												41.0000 (230c)	
main heating flue fan												45.0000 (230e)	
Total electricity for the above, kWh/year												86.0000 (231)	
Electricity for lighting (calculated in Appendix L)												216.9207 (232)	

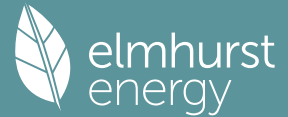
Energy saving/generation technologies (Appendices M ,N and Q)

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	10489.0411 (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	6370.7822	0.2100	1337.8643 (261)	
Total CO2 associated with community systems			0.0000 (373)	

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Water heating (other fuel)	3815.3383	0.2100	801.2210 (264)
Space and water heating			2139.0853 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	216.9207	0.1443	31.3084 (268)
Total CO ₂ , kg/year			2182.3229 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			21.5000 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	6370.7822	1.1300	7198.9839 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	3815.3383	1.1300	4311.3322 (278)
Space and water heating			11510.3161 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	216.9207	1.5338	332.7202 (282)
Total Primary energy kWh/year			11973.1370 (286)
Dwelling Primary energy Rate (DPER)			117.9900 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.7400 (1b)	x 2.4000 (2b)	= 121.7760 (1b) - (3b)
First floor	50.7400 (1c)	x 2.6000 (2c)	= 131.9240 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 253.7000 (5)

2. Ventilation rate

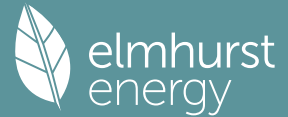
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.1577 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.4077 (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) = 0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.20)			14.6700	1.1450	16.7977		(27)
Heatloss Floor 1			50.7400	0.1300	6.5962		(28a)
External Wall 1	150.1000	16.6200	133.4800	0.1800	24.0264		(29a)
External Roof 1	50.7400		50.7400	0.1100	5.5814		(30)
Total net area of external elements Aum(A, m ²)			251.5800				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 54.9517		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.4200 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							12.5790 (36)
Point Thermal Bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	67.5307 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	50.0315	49.7142	49.4032	47.9424	47.6691	46.3968	46.3968
Heat transfer coeff	117.5622	117.2449	116.9339	115.4731	115.1998	113.9275	113.9275
Average = Sum(39)m / 12 =							115.4718

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1585	1.1553	1.1523	1.1379	1.1352	1.1227	1.1227	1.1203	1.1275	1.1352	1.1406	1.1463	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.7528 (42)
Hot water usage for mixer showers													
70.3754	69.3178	67.7766	64.8279	62.6519	60.2252	58.8458	60.3753	62.0519	64.6574	67.6695	70.1057	(42a)	
Hot water usage for baths													
30.3869	29.9356	29.3001	28.1284	27.2510	26.2781	25.7526	26.3836	27.0707	28.1118	29.3077	30.2842	(42b)	
Hot water usage for other uses													
42.8215	41.2644	39.7072	38.1501	36.5929	35.0358	35.0358	36.5929	38.1501	39.7072	41.2644	42.8215	(42c)	
Average daily hot water use (litres/day)												131.9859	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
143.5838	140.5178	136.7840	131.1064	126.4958	121.5390	119.6342	123.3519	127.2727	132.4764	138.2415	143.2115	(44)	
Energy content	227.4017	200.0955	210.2319	179.4781	170.2877	149.4464	144.6872	152.7354	156.9400	179.7693	196.9504	224.2346	(45)
Energy content (annual)										Total = Sum(45)m =		2192.2580	
Distribution loss (46)m = 0.15 x (45)m													
34.1103	30.0143	31.5348	26.9217	25.5431	22.4170	21.7031	22.9103	23.5410	26.9654	29.5426	33.6352	(46)	
Water storage loss:													
Total storage loss													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
278.3606	246.1229	261.1908	228.7932	221.2466	198.7615	195.6461	203.6943	206.2550	230.7282	246.2655	275.1935	(62)	
WWHRS	-32.1727	-28.4538	-29.7952	-24.6716	-22.9930	-19.6753	-18.4424	-19.6117	-20.3568	-23.9984	-27.1873	-31.5769	(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													
246.1879	217.6691	231.3957	204.1216	198.2535	179.0862	177.2036	184.0826	185.8982	206.7298	219.0781	243.6166	(64)	
12Total per year (kWh/year)									Total per year (kWh/year) = Sum(64)m =			2493.3229	(64)
Electric shower(s)												2493	(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	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													
88.3508	78.0386	82.6418	72.0052	69.3604	62.0197	60.8482	63.5242	64.5113	72.5130	77.8148	87.2977	(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	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405	137.6405 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.0187	153.9136	139.0187	143.6527	139.0187	143.6527	139.0187	139.0187	143.6527	139.0187	143.6527	139.0187 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	258.6984	261.3829	254.6181	240.2166	222.0374	204.9514	193.5370	190.8525	197.6173	212.0188	230.1980	247.2840 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641	36.7641 (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)	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124	-110.1124 (71)
Water heating gains (Table 5)	118.7511	116.1289	111.0777	100.0073	93.2263	86.1385	81.7852	85.3820	89.5990	97.4637	108.0761	117.3356 (72)
Total internal gains	583.7604	598.7175	572.0067	551.1687	521.5745	499.0347	478.6331	479.5454	495.1612	515.7934	549.2189	570.9305 (73)

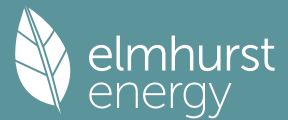
6. Solar gains

[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					5.9900	10.6334		0.6300	0.7000	0.7700	19.4657 (74)	
South					8.6800	46.7521		0.6300	0.7000	0.7700	124.0202 (78)	
Solar gains	143.4859	240.3131	321.9419	393.9556	441.4971	439.6754	423.2300	386.7136	346.2752	263.3583	171.0197	123.3924 (83)
Total gains	727.2463	839.0306	893.9486	945.1243	963.0717	938.7101	901.8631	866.2589	841.4364	779.1516	720.2386	694.3229 (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	32.2310	32.3183	32.4042	32.8141	32.8920	33.2593	33.2593	33.3282	33.1169	32.8920	32.7349	32.5722	
alpha	3.1487	3.1546	3.1603	3.1876	3.1928	3.2173	3.2173	3.2219	3.2078	3.1928	3.1823	3.1715	
util living area	0.9719	0.9554	0.9328	0.8845	0.8004	0.6594	0.5151	0.5503	0.7375	0.8940	0.9557	0.9755 (86)	
MIT	18.9134	19.1948	19.5664	20.0623	20.4975	20.8151	20.9384	20.9223	20.7170	20.1616	19.4632	18.8717 (87)	
Th 2	19.9534	19.9559	19.9584	19.9700	19.9722	19.9824	19.9824	19.9843	19.9784	19.9722	19.9678	19.9632 (88)	
util rest of house	0.9668	0.9474	0.9201	0.8613	0.7575	0.5842	0.4110	0.4475	0.6712	0.8682	0.9463	0.9709 (89)	
MIT 2	17.5300	17.8862	18.3546	18.9748	19.4928	19.8429	19.9507	19.9415	19.7466	19.1072	18.2372	17.4834 (90)	
Living area fraction													
MIT	17.7638	18.1073	18.5594	19.1586	19.6626	20.0072	20.1176	20.1073	fLA = Living area / (4) =				0.1690 (91)
Temperature adjustment									19.9106	19.2853	18.4444	17.7180 (92)	
adjusted MIT	17.7638	18.1073	18.5594	19.1586	19.6626	20.0072	20.1176	20.1073	19.9106	19.2853	18.4444	17.7180 (93)	

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9514	0.9281	0.8980	0.8391	0.7426	0.5862	0.4256	0.4608	0.6663	0.8467	0.9273	0.9568	(94)
Useful gains	691.8788	778.6729	802.7635	793.0477	715.2085	550.2871	383.8166	399.1776	560.6201	659.7159	667.8998	664.3222	(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	1582.8350	1548.4932	1410.1539	1184.5881	917.2875	616.0270	400.7507	421.4891	664.8380	1000.5504	1313.1437	1572.5613	(97)
Space heating kWh	662.8714	517.3192	451.8984	281.9091	150.3467	0.0000	0.0000	0.0000	0.0000	253.5809	464.5756	675.7299	(98a)
Space heating requirement - total per year (kWh/year)												3458.2313	
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	662.8714	517.3192	451.8984	281.9091	150.3467	0.0000	0.0000	0.0000	0.0000	253.5809	464.5756	675.7299	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3458.2313	
Space heating per m2										(98c) / (4) =		34.0780	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	662.8714	517.3192	451.8984	281.9091	150.3467	0.0000	0.0000	0.0000	0.0000	253.5809	464.5756	675.7299	(98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)	717.3933	559.8693	489.0676	305.0964	162.7129	0.0000	0.0000	0.0000	0.0000	274.4382	502.7874	731.3095	(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	246.1879	217.6691	231.3957	204.1216	198.2535	179.0862	177.2036	184.0826	185.8982	206.7298	219.0781	243.6166	(64)
Efficiency of water heater (217)m	86.3942	86.1670	85.7886	85.0735	83.7961	80.3000	80.3000	80.3000	80.3000	84.8202	85.9502	80.3000	(216)
Fuel for water heating, kWh/month	284.9588	252.6131	269.7278	239.9356	236.5904	223.0214	220.6770	229.2436	231.5046	243.7269	254.8896	281.8115	(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	28.8853	23.1729	20.8646	15.2863	11.8076	9.6469	10.7713	14.0009	18.1858	23.8608	26.9507	29.6882	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.3885	-64.8424	-92.4010	-102.9383	-110.1634	-102.4819	-101.1740	-95.9038	-86.5031	-73.6664	-50.7854	-40.1678	(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	-27.9049	-58.5088	-115.9572	-173.6976	-229.2540	-230.2371	-227.5648	-192.8972	-141.6536	-83.5604	-37.2159	-22.0841	(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												3742.6745	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2968.7002	(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)												233.1213	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2507.9516	(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												4522.5444	(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	3742.6745	0.2100	785.9617	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2968.7002	0.2100	623.4271	(264)
Space and water heating			1409.3887	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	233.1213	0.1443	33.6466	(268)
Energy saving/generation technologies				

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PV Unit electricity used in dwelling	-967.4161	0.1348	-130.3925
PV Unit electricity exported	-1540.5355	0.1260	-194.0619
Total			-324.4544 (269)
Total CO2, kg/year			1130.5102 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1400 (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	3742.6745	1.1300	4229.2222 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2968.7002	1.1300	3354.6313 (278)
Space and water heating			7583.8535 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	233.1213	1.5338	357.5692 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-967.4161	1.4982	-1449.3357
PV Unit electricity exported	-1540.5355	0.4624	-712.3451
Total			-2161.6808 (283)
Total Primary energy kWh/year			5909.8426 (286)
Target Primary Energy Rate (TPER)			58.2400 (287)