



TwoEighty
CONSULTING

Titmore Green Farm

Energy and Sustainability Statement
December 2024



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Audit Sheet

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Executive Summary

This Energy and Sustainability Statement reports how the proposed scheme at Titmore Green Farm, Little Wymondley, Hitchin, SG4 7JR has responded to local policy requirements regarding sustainability, energy and climate change.

This assessment is prepared to support the full planning application for:

Change of use of agricultural building to one x 5 bedroomed single-family dwelling; external alterations and re-cladding; demolition of outdoor menage; re-cladding and external alterations to Atcost Barn for use with dwelling; layout of parking, landscaping and all ancillary works.

This assessment has been prepared in line with the requirements of North Hertfordshire’s local policy surrounding Energy and Climate Change. The scheme complies with all relevant policies contained in the North Hertfordshire Local Plan (2011-2031) and the Sustainability Supplementary Document (SPD) (2024).

The energy strategy follows the energy hierarchy; Be Lean, Be Clean, Be Green to maximise the carbon reduction in lieu of the scheme’s sustainability vision. The proposed energy strategy is set out in this report and the scheme achieves an on-site **CO2 reduction of 100% demonstrating that Net-Zero regulated carbon can be achieved.**

With regards to sustainability, the scheme aspires to reduce its environmental impact by incorporating sustainable measures across the design. Additional sustainability measures that will be integrated are contained in the body of this report.

Table 1: Site-wide Regulated domestic carbon dioxide savings achieved through the energy hierarchy.

	Regulated domestic carbon dioxide emissions	
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	1.3	49%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	1.4	51%
Total regulated carbon dioxide reduction	2.7	100%

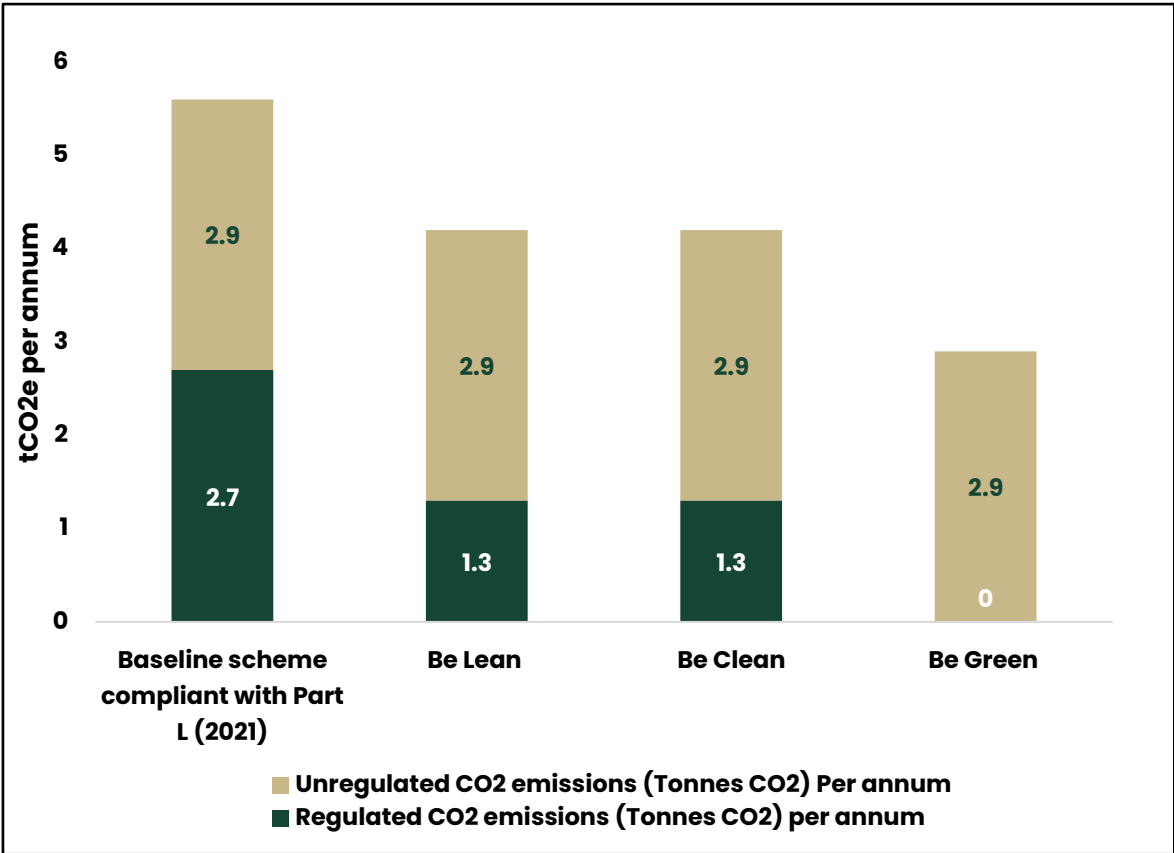


Figure 1: Carbon dioxide emissions per annum at the proposed scheme having utilised the Energy Hierarchy*.

*SAP 10.2 Carbon Factors have been used to assess the scheme, with the following emission rates:

- Natural Gas: 0.210kgCO2/kWh
- Grid Electricity: 0.136 kgCO2/kWh



1. Introduction

1.1 Site Overview

TwoEighty are appointed to prepare this Energy and Sustainability Statement for the proposed scheme at Titmore Green Farm, Little Wymondley, Hitchin, SG4 7JR . The site plan is shown in Figure 2 to the right.

The proposed development entails the change of use of agricultural building to one x 5 bedroomed single-family dwelling; external alterations and re-cladding; demolition of outdoor menage; re-cladding and external alterations to Atcost Barn for use with dwelling; layout of parking, landscaping and all ancillary works.

The site is situated within the jurisdiction of North Hertfordshire District Council. This assessment details how the proposed scheme adheres to local policy requirements regarding energy and sustainability.



Figure 2: Proposed development location (green).



2. Overview of Policies

2.1 National Policy

The National Planning Policy Framework (NPPF) (December 2024) establishes the Government's planning policies for England and denotes how these are expected to be applied. It provides a clear framework for which local authorities can use to develop their own distinctive local and neighbourhood plans. At the heart of the NPPF is a presumption in favour of sustainable development, which should be a core principle of plan making and decision taking. The core elements of the NPPF relating to sustainability focused decisions are listed below:

Plans and decisions should apply a presumption in favour of sustainable development. For plan-making this means that:

- a) all plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects;*
- b) strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas, unless: i. the application of policies in this Framework that protect areas or assets of particular importance provides a strong reason for restricting the overall scale, type or distribution of development in the plan area; or ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole. For decision-taking this means:*
- c) approving development proposals that accord with an up-to-date development plan without delay; or*
- d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:*
 - i. the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or*
 - ii. any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole.*

The NPPF also acknowledges that the planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure. To this extent, the policies relevant to procuring a low carbon future include:

New development should be planned for in ways that:

- a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and*
- b) help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.*

To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, and their future re-powering and life extension, while ensuring that adverse impacts are addressed appropriately (including cumulative landscape and visual impacts);*
- b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
- c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.*



2. Overview of Policies

2.2 North Hertfordshire Local Plan (2011 – 2031)

The North Hertfordshire Local Plan was adopted in 2022. It outlines the borough's strategy to ensure that growth is delivered in the right place and is of the right character and quality. The Local Plan forms part of the Statutory Development Plan for the District that is used to determine planning applications.

The local plan details that energy conservation is an important feature within the district, and the best current energy practices should be achieved without prejudice to the principles of good design and appearance.

The policies included in the Local Plan deemed relevant to this energy and sustainability statement include:

- **Policy SP1: Sustainable Development in North Hertfordshire** which demonstrates the Borough's proactive approach in approving development that supports the principles of sustainable development.
- **Policy D1: Sustainable Design** mandating that development should take all reasonable opportunities, consistent with the scale of the scheme to adopt sustainable design measures, including the reduction of energy consumption and waste and future proof for changes in technology and lifestyle.
- **Policy DP9: Design and Sustainability** which requires new development to consider and identify opportunities to achieve low and zero-carbon schemes and adopt the Government's standards for water efficiency.
- **Policy SP11: Natural Resources and Sustainability** states that the Borough supports proposals for renewable and low carbon energy development in appropriate locations.
- **Policy NE12: Renewable and Low Carbon Energy Development** relates predominantly to large scale solar farms, stating that renewable energy development will be assessed for its impact on surrounding landscape, historical environment, air quality as well as amenity of residents. It is not envisioned that this policy is applicable to this application, however, is included for completeness.

The policies detailed to the left collectively encourage new development to demonstrate adaptation and mitigation to climate change, minimise carbon and energy use through design and construction, use low embodied carbon materials and maximise the use of renewable and low carbon energy. The proposed development has adhered to all principles through a sustainability-focused design.



Figure 3: North Hertfordshire Local Plan (2011 – 2031).



2. Overview of Policies

2.3 North Hertfordshire Sustainability Supplementary Planning Document (SPD) (2024)

The North Hertfordshire Sustainability Supplementary Planning Document (SPD) was adopted in 2024. The SPD sets out information regarding sustainability expectations for development within the Borough. The SPD supports Local Plan Policies SP1 (Sustainable Development in North Hertfordshire) and Policy D1 (Sustainable Design). The SPD sets out a series of sustainability focused requirements that enables proposed developments to achieve Bronze, Silver or Gold Standard, with Bronze being the baseline. It identifies the main sustainable construction requirements to mitigate and adapt to climate change, design and energy saving measures that can result in minimising operational emissions, renewable and low carbon energy solutions as well as providing advice on solutions to water shortages and materials and methods used in construction.

The categories included in the SPD include:

- **Optimising Passive Design and Fabric Performance**
- **Achieving Low Carbon Energy**
- **Minimising Carbon Footprint**
- Healthy Placemaking
- Promoting Biodiversity
- Sustainable Travel
- **Conserving Water**
- Incorporating Sustainable Drainage

Of the categories above, compliance with those in bold are detailed and expanded upon in this report. The proposed development meets all relevant Bronze requirements, and in some instances achieves Silver and Gold, demonstrating exemplary performance. For a detailed comparison of the scheme versus the SPD requirements, please see the table contained at appendix A.



Figure 4: North Herts Council Sustainability SPD (2024).



3. Methodology

3.1 Energy Hierarchy Application

In accordance with best practice, the proposed scheme has adopted the Energy Hierarchy, comprised of:

- Be Lean – use less energy; achieved through implementation of building envelope upgrades and passive design measures.
- Be Clean – supply energy efficiently; connecting to existing or future District Heating networks.
- Be Green – use renewable technology; achieved through the implementation of green measures, such as Air Source Heat Pumps and Solar PV panels.

3.2 Energy Modelling

The latest version (SAP 10.2) of SAP software has been used to model the proposed scheme and accordingly, SAP 10.2 carbon factors have also been used. For the purposes of this report, renewable technology includes the provision of low carbon technologies such as Heat Pump technologies and PV panels. For the purposes of 'Be Lean' energy modelling, space heating and domestic hot water is provided by gas boilers with 89.5% efficiency, to standardise a target for comparison of energy efficiency. The 'Be Green' stage of the energy modelling then utilises an all-electric energy strategy comprised of Air Source Heat Pumps (ASHPs) and Solar Photovoltaic Panels (PV), which is the proposed energy strategy for this scheme.

The scheme has been assessed using SAP software at each stage of the energy hierarchy. The SAP worksheets are included in the appendices of this report. The scheme has been modelled utilising the latest drawing set received from Boast Architects on the 25th November 2024.

3.3 LETI Climate Emergency Design Guide

The London Energy Transformation Initiative (LETI) is a network of professionals in the built environment who are working to achieve a net zero carbon future for the UK. LETI has created several resources to help schemes achieve net zero carbon, this scheme has utilised the Emergency Design Guide to inform its design and achieve regulated net-zero carbon on-site.



Figure 5: Building Regulations Part L (2021) (Left), LETI Climate Emergency Design Guide (Right).



4. Energy: Be Lean

Be Lean refers to the passive design and energy efficient solutions to minimise energy demand on-site.

4.1 Passive Measures

The following passive design measures will be included in the design to reduce energy demand and subsequent CO₂ emissions emanating from the proposed development. The proposed building fabric values represent a significant improvement in comparison to the Part L (2021) backstop values and follow LETI guidance on adopting a fabric first approach. The following typical envelope performance characteristics and passive design measures will be included (see Table 2).

Table 2: Building fabric parameters included in the proposed scheme's energy model.

Parameter	Input	Unit
Floor U-Value	0.10	W/m ² K
Roof U-Value	0.10	W/m ² K
External Walls U-Value	0.15	W/m ² K
Glazing U-Value	1.2	W/m ² K
Glazing G-Value	0.68 (Default)	-
Frame Factor	0.7 (Default)	-
Thermal Mass Parameter	250 (Medium)	kJ/m ² K
Thermal Bridge Y-Value	<0.1 (Default)	-
Ventilation Method	Mechanical Ventilation with Heat Recovery	SFP: 0.99 (86% Efficiency)
Air Permeability	3.0 @ 50Pa (m ³ /(h.m ²))	-

The proposed building fabric will support in maximising energy efficiency, reducing space heating demand, whilst also providing thermal mass to support in passive cooling. The high-performance double glazing will minimise heat loss through glazed areas, whilst the low g-value will support in reducing levels of solar transmittance in warmer periods.

A low air permeability has been targeted to minimise heat loss. The unit benefits from an orientation that suits sunlight and daylight access and will include openable windows to facilitate natural ventilation. These measures contribute towards the scheme's significant Be Lean reduction of 49%.

4.2 Active Measures

To support the high performing building envelope, several active Be Lean measures have also been included to further reduce energy consumption and increase occupant wellbeing. Mechanical Ventilation with Heat Recovery will be provided to the dwelling. This will support in providing a good internal air quality and minimise heat loss in winter, through the recycling of excess heat. The scheme will also benefit from high efficiency LED lighting throughout, with a minimum efficacy of 100 lumens/Watt.

4.3 Be Lean Results

The resultant envelope at the scheme has a Dwelling Fabric Energy Efficiency (DFEE) score which exceeds the Target Fabric Energy Efficiency (TFEE) rating, representing a fabric efficiency improvement against the Part L (2021).

The regulated CO₂ savings made through the implementation of these Be Lean measures result in a **49% CO₂ reduction** by comparison to the Part L compliant Baseline, or a 1.3 tonne CO₂ reduction. This reduction demonstrates an excellent energy efficiency with the scheme adopting the fabric first approach, indicating exemplary performance and surpassing the Gold Standard requirement in the North Herts SPD, which asks for a 10% reduction at this stage of the energy hierarchy.



4. Energy: Be Lean

4.4 Passive Overheating Mitigation Measures

Whilst the Be Lean stage predominantly relates to Energy Reduction through design, passive measures to mitigate overheating risk have also been considered, and include:

- Minimising internal heat through fully insulated pipework.
- Reducing heat entering through the use of, ~200mm window reveals.
- Openable windows with large free area to maximise passive ventilation to habitable spaces.
- Promotion of stratification through the installation of automatically opening rooflights.
- Low G-Value of windows to reduce solar transmittance in hotter periods.
- Careful design of internal spaces to facilitate natural and cross-ventilation as much as possible at the scheme, given the typical constraints associated with conversions that restrict the repositioning of external envelope walls.
- External shutters will be provided to south facing elevations.
- Active cooling has been avoided due to the increased energy consumption associated with its use.
- Inclusion of MVHR with a summer bypass function, which will enable a fresh flow of air to the unit in hotter periods.

It is envisioned that through the combination of the above measures, and by adopting principles included within Part O (2021) Building Regulations, the overheating risk of the scheme is reduced and well adapted to future climate risks.



5. Energy: Be Clean

Be Clean refers to measures that serve to reduce the overall emissions of the development using either District Heating Networks or Combined Heat and Power (CHP) engines. This can be achieved through exploiting local energy resources in proximity to the site boundary, such as secondary heat. The Be Clean stage is reviewed after development has made all reasonable efforts to reduce energy demand at the Be Lean Stage.

5.1 Area Wide Energy Networks: Existing and Planned

The first stage in assessing feasibility of the Be Clean stage is to evaluate localised opportunities for connecting to District Heating Networks (DHN) that are either already existing or planned within the vicinity of the proposed development.

An investigation has been carried out to determine the presence of any area wide district heating networks in the area or if any are planned in the future. This investigation has been conducted utilising the Department for Energy Security and Net Zero's (DESNZ) [Heat Network Planning Database](#).

The investigation concluded that there are no District Heat Networks, either in situ or proposed, in vicinity of the site. In addition, as a development of a singular residential unit, a communal heating network is not considered an appropriate energy strategy.



6. Energy: Be Green

Once all Be Lean and Be Clean measures have been incorporated into the design, the scheme should then look to reduce the overall emissions of the development through the inclusion of renewable and low carbon technologies such as Air Source Heat Pumps or Solar Photovoltaic Panels (PV panels).

6.1 Renewable and Low Carbon Technologies Appraisal

The following renewable and low carbon technologies were reviewed for their compatibility with the proposed scheme in alignment with the North Herts Sustainability SPD and discussed with the design team:

- **Solar Photovoltaic Panels (PV):** PV panels generate electricity on site through exposure to solar radiation.
- **Solar Thermal Panels:** Solar Thermal panels capture long-wave radiation and use it to heat fluid contained in vacuum sealed circuits.
- **Biomass Heating:** Biomass relies on the combustion of organic material such as woodchips to provide space heating and domestic hot water.
- **Air Source Ground Heat Pumps (ASHPs):** ASHPs work by capturing energy from the ambient outdoor air and use it to evaporate and compress refrigerant. This compression generates heat. ASHPs can be used for both space heating and/or domestic hot water supply.
- **Ground Source Heat Pumps (GSHPs):** GSHPs capture heat from the earth or sub-terrain aquifers and use this heat to evaporate and compress refrigerant; generating heat.

6.2 Site Constraints Review

A review of the potential low carbon technologies listed above illustrated that Air Source Heat Pumps were best suited to the proposed scheme, partially for their ability to provide both space heating and domestic hot water at very high efficiencies. Solar Photovoltaic (PV) panels have also been deemed suitable for the site, owing to the large south facing roof areas of the scheme on the adjoining ancillary barn.

Biomass was ruled out as a Be Green measure, owing to its requirements for large storage areas for fuel, and equally because of the potential impact on local Air Quality. Any combustion process can emit oxides of nitrogen and particulate matter.

Ground Source Heat Pumps were assessed for their feasibility at the site, however due to complications with both their requirement for borehole or slinky arrangements and subsequent potential for further environmental complications, they were ruled out.

Solar Thermal panels were considered, however priority was given toward Solar Photovoltaic Panels, as these can produce renewable energy to reduce the demand on the grid for both regulated and unregulated appliances and are therefore more versatile for occupant's needs.

Further information regarding the chosen technologies for the site can be found overleaf.



6. Energy: Be Green

6.3 Included Low Carbon Technologies: Air Source Heat Pump

The scheme has opted to utilise an individual wet Air Source Heat Pump (ASHP) system to provide space heating and domestic hot water (DHW) to the dwelling.

Heat Pumps work by extracting energy from the ambient air temperature outside, and using it to evaporate and compress refrigerant, which in turn, generates hot water or air. They capture the energy from ambient air via an external condenser unit (Figure 6), which connects to an internal heat pump unit. It is currently proposed that the condensers will be discreetly situated at the scheme, away from any local sensitive noise receptors.

All water generated by the Heat Pump system will be stored in a well-insulated hot water cylinder. The spaces will be heated using an underfloor heating system to maximise efficiency. Further details, including specification of systems, will be mapped out at the detailed design stage. The Heat Pumps will seek to comply with the minimum performance standards as set out in the Enhanced Capital Allowances (ECA) criteria and the Microgeneration Certification Scheme (MCS) for Heat Pump Certification.

Table 3: Summary of Space Heating and Domestic Hot Water Strategy at the Be Green Stage.

Space Heating and DHW Strategy	Type	Details
Domestic Space Heating System	ASHP	175% default efficiency. (MCS)
Domestic Heating Emitter	Underfloor Heating	Wet System
Domestic Hot Water System	ASHP	175% default efficiency. (MCS)
DHW Storage	Yes	~400 litres. 1 kWh/day loss.

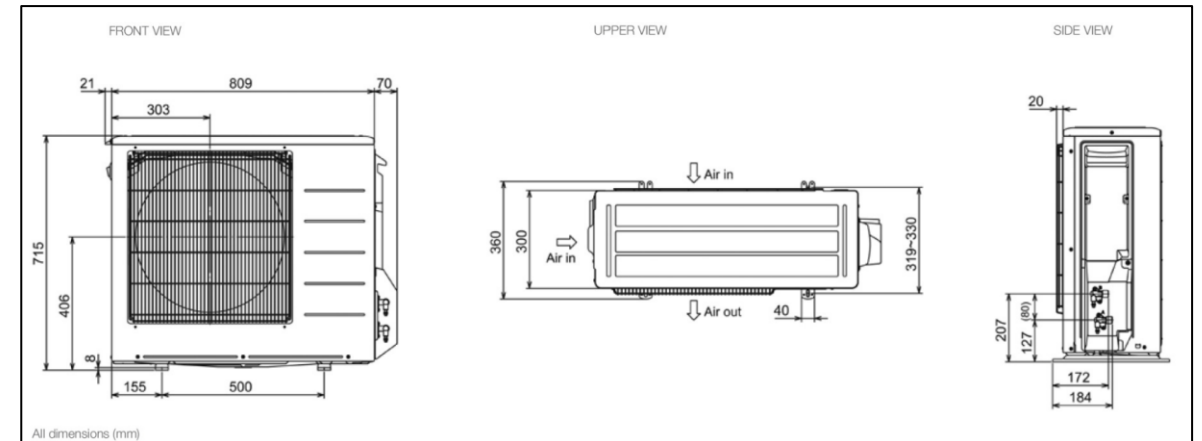


Figure 6: Dimensions of a Mitsubishi external condenser unit.

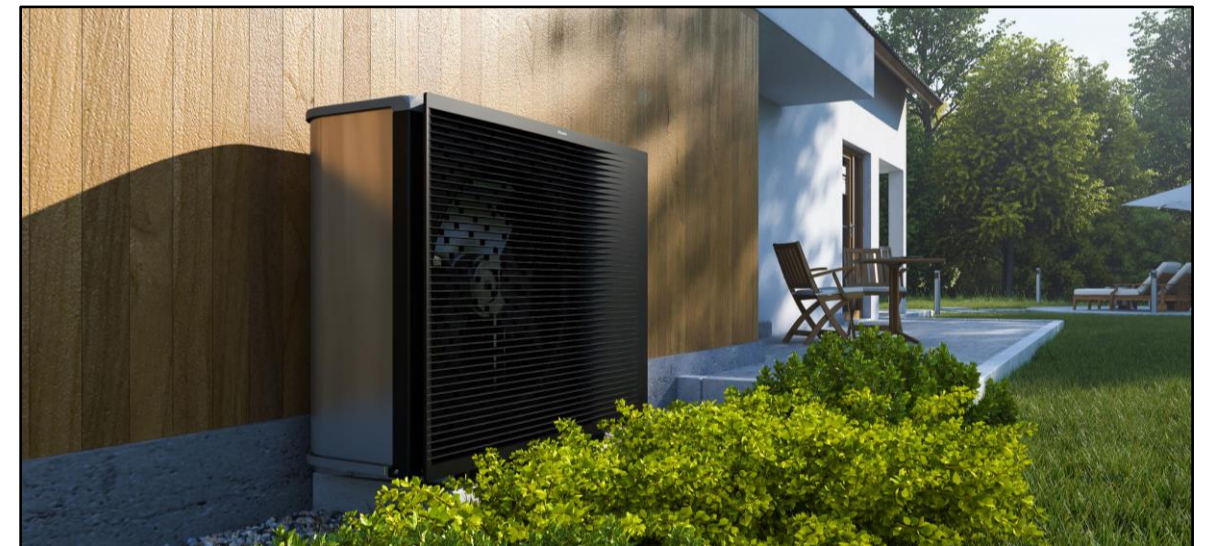


Figure 7: Indicative example of Daikin Altherma External Condenser (Source: Daikin).



6. Energy: Be Green

6.4 Included Renewable Technologies: Solar Photovoltaic (PV) Panels

The proposed scheme intends to maximise its carbon reduction and reduce its environmental impact as much as possible. Therefore, solar PV will be included at the site. This will enable future residents to utilise the energy themselves, reducing the primary energy demand from the grid. The scheme has space for approximately 35 PV panels to the roof area of the buildings. This will be split between the proposed dwelling (with approximately 10 panels) and the remainder to be included on the south facing roof of the ancillary barn to maximise efficiency, indicated in green in the figure to the right, achieving a total estimated annual carbon saving of approximately 1.4 tonnes CO₂e.

Table 4: Summary of proposed Solar PV details.

Solar PV Detail	Quantum	Unit
Approx PV array size	62	M2
Length of individual panel	1.6	M
Width of individual panel	1.1	M
Total panel size	1.76	m2
Assumed panel power	450	Watts/panel
Inclination of panel	30	Degrees
Assumed number of panels	35	#
PV Peak power	15.5	kWp
Battery Storage	9.2	kWh Storage
Total CO₂ savings (p/a)	1.4	tCO₂

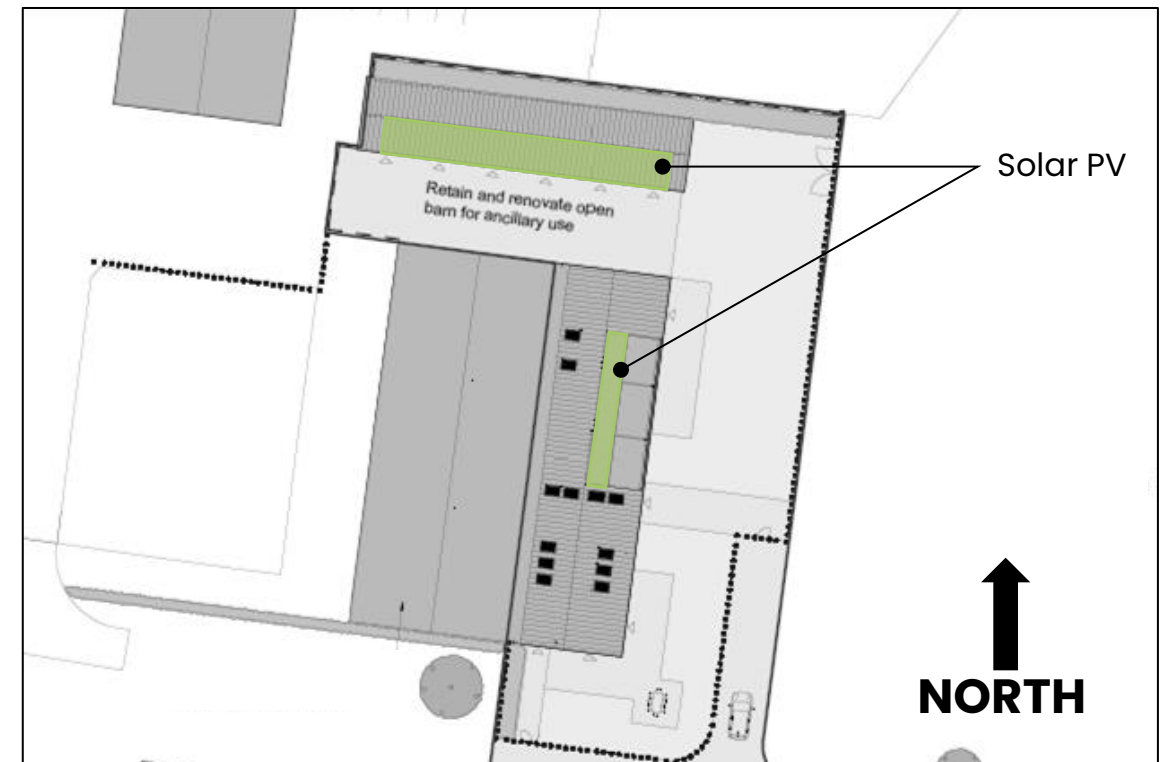


Figure 8: Space allocated for Solar PV (green).



6. Energy: Be Green

6.5 Be Green Results

In summary, the proposed scheme benefits from the following low-carbon and renewable technologies on-site:

- **Individual Air Source Heat Pump**
- **Solar Photovoltaic Panels (PV) (15.5 kWp)**

The proposed development achieves a CO2 reduction of 51% at the be green stage of the energy hierarchy, bringing the total CO2 reduction to 100%, demonstrating Net-Zero from an operational regulated carbon perspective, highlighting the sustainability credentials of the scheme.

Table 5: Site-wide Regulated domestic carbon dioxide savings achieved through the energy hierarchy.

	Regulated domestic carbon dioxide emissions	
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	1.3	49%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	1.4	51%
Total regulated carbon dioxide reduction	2.7	100%

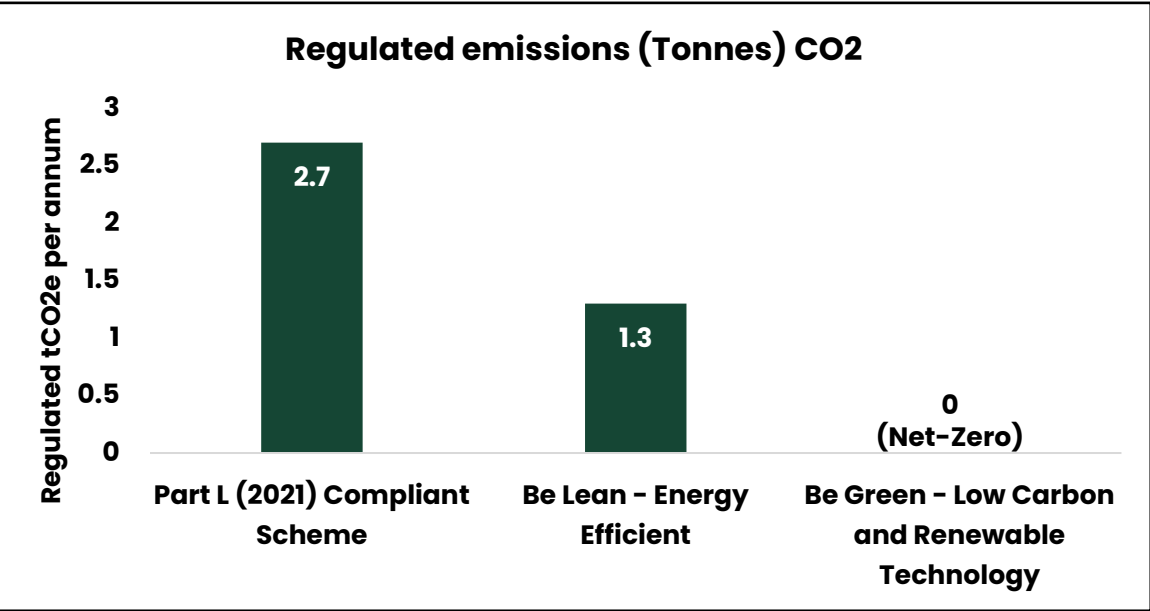


Figure 9: Be Green regulated carbon savings.



7. Site Wide Carbon Reduction Summary

The proposed energy strategy follows the energy hierarchy as stipulated in the Sustainable Supplementary Planning Document.

The scheme has adopted the Energy Hierarchy, achieving a 49% carbon reduction the Be Lean Stage, and opting for a low-carbon individual Air Source Heat Pump solution with Solar PV at the Be Green Stage, resulting in an additional 51% carbon reduction.

The scheme achieves an overall **on-site regulated CO2 reduction of 100%**, to achieve net-zero from an operational regulated carbon perspective.

Table 6: Summary of carbon dioxide emissions from the baseline scheme.

	Carbon dioxide emissions (tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline Scheme Compliant with Part L (2021) Building Regulations	2.7	2.9
After application of Energy Hierarchy at Titmore Green Farm	0	2.9

Table 7: Percentage of carbon dioxide reductions achieved through use of energy hierarchy.

	Regulated domestic carbon dioxide savings	
	Tonnes CO2 per annum	% Reduction
Be Lean – Savings from demand reduction	1.3	49%
Be Clean – Savings from district energy	0.0	0%
Be Green – Savings from renewable energy	1.4	51%
Total regulated carbon dioxide emission savings at Titmore Green Farm	2.7	100%

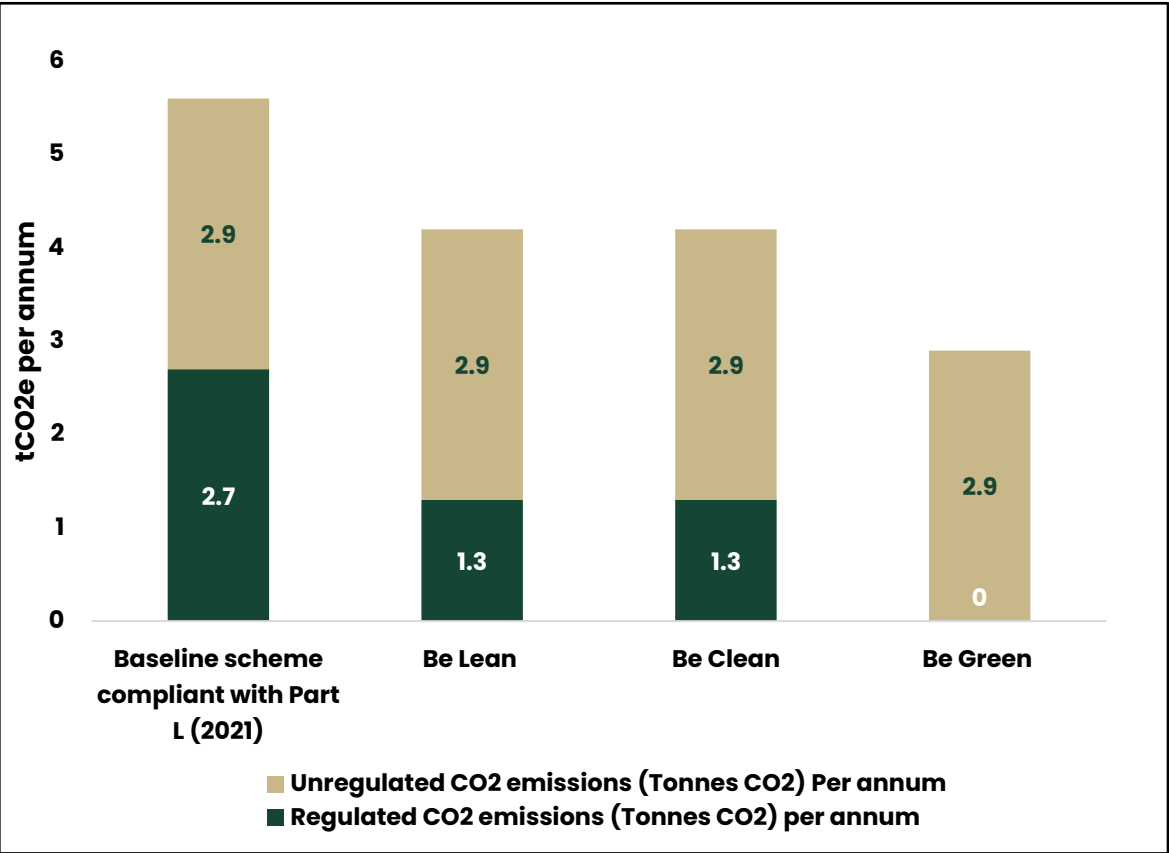


Figure 10: Carbon emissions summary of the proposed scheme across each stage of the energy hierarchy.



8. Sustainability

8.1 Sustainability Summary

Sustainability is a core focal point of the design which constitutes the construction of an energy efficient dwelling. The scheme's target is to achieve compliance with best practice energy and carbon targets, and compliance at the design stage has been demonstrated in the body of this report.

Additional sustainability measures that will be incorporated and adhered to are detailed below, to assist with compliance with both local and regional policies regarding Energy and Sustainability.

8.2 Management

To ensure that the construction site is managed in a way that is not detrimental to the environment or neighbours, the contractor will be selected with consideration of their ability to comply with the principles of the Considerate Constructors Scheme. The principal contractors and subcontractors will be encouraged to monitor their energy and water consumption on-site to promote conservation use and all timber used will be legally harvested and FSC certified.

To ensure that the proposed building services and energy strategy are sufficiently installed, the scheme will look to achieve MCS certification for the Air Source Heat Pump and Solar Photovoltaic Panels proposed.

Post completion, a building user guide will be provided to occupants to ensure that the occupants are familiar with the building systems and to answer any questions that might impact on the use of the space. This will ensure that the proposed scheme is used in an efficient manner.

8.3 Health and Wellbeing

The development is designed to encourage a healthy and safe internal and external environment. All habitable spaces will look to meet daylight targets set by the Building Research Establishment's publication on *Site Layout: Planning for Daylight and Sunlight – A guide to good practice* (2022).

Building materials will be specified to improve both the thermal efficiency of the unit, and to improve sound insulation between the dwelling and external noise sources.

The dwelling will be capable of using passive ventilation methods to ensure a constant and fresh flow of air. Cross ventilation has been maximised where feasible in accordance with best practice to reduce overheating risk in hotter periods. MVHR is also proposed, to increase energy efficiency and enable good ventilation rates all year round, without loss of heat through openable windows.

8.4 Energy

The proposed scheme demonstrates a carbon reduction that equates to a 2.7 tonne CO₂ reduction beyond Building Regulations Part L (2021) requirements, to achieve net-zero on-site for regulated operational carbon.

To further support with energy conservation, the scheme will benefit from the ability to display energy consumption data and record energy use, which will enable residents to reduce their unregulated energy use.

Where white goods are provided to the unit, the scheme will look to procure A-rated energy efficient appliances where feasible. This will reduce both energy consumption and carbon emissions from appliance use within the unit.

All external lighting will use energy efficient bulbs and operate on either a timer or passive infrared (PIR) sensor to minimise use when the spaces aren't in use.

8.5 Transport

To promote the use of public transport, occupants will be provided with details of the local public transport connections in the vicinity of the site. There are two bus stops approximately 800m to the east of the site entrance along Stevenage Road, providing frequent connections to bus route 391 running between Stevenage and Weston. Hitchin Railway Station is approximately 5km to the north-west of the site, and Stevenage equidistant to the south-east. Both stations can be accessed by active travel, using a combination of existing road-networks and public rights of way.



8. Sustainability

8.5 Transport Continued

To promote active travel, the development will be bike and pedestrian friendly. Cycle Storage spaces will also be provided to the dwelling and in accordance with Part S of Building Regulations, Electric Vehicle charging infrastructure will be incorporated as part of the scheme. The solar PV panels will contribute toward the energy requirements of charging any electric bikes or cars on-site. This will encourage electric vehicle trips and reduce the use of Internal Combustion Engine (ICE) vehicles, benefitting local air quality.

8.6 Water

Reducing the consumption of potable water will be a significant consideration for the scheme. The water consumption criteria for occupants will be in line with the 95 litres per person per day, exceeding Building Regulations Part G and aligning with the RIBA 2025 Climate Challenge.

Water use will be reduced as much as possible, primarily through the specification of efficient sanitary ware and low-flow water efficient fittings. External water use will be reduced through providing rainwater harvesting butts and used for irrigation purposes.

8.7 Waste

To minimise waste in the construction process, a pre-commencement audit will be conducted to identify materials that can be removed and reused arising from the proposed works. Where possible, closed loop recycling will be practiced on site, and where this isn't possible, open loop recycling will be undertaken to minimise the amount of waste generated. Additionally, a construction site waste management strategy will be implemented to set out targets to minimise waste and procedures for handling any hazardous materials that may arise as a result of the proposed works.

Municipal waste will be minimised through the installation of on-site recycling space and storage. The residents will separate and recycle their waste in dedicated recycling containers provided.

8.8 Flood Risk

The scheme is situated within flood Zone 1, meaning the site has a low risk of fluvial flooding.

<https://flood-map-for-planning.service.gov.uk/location>

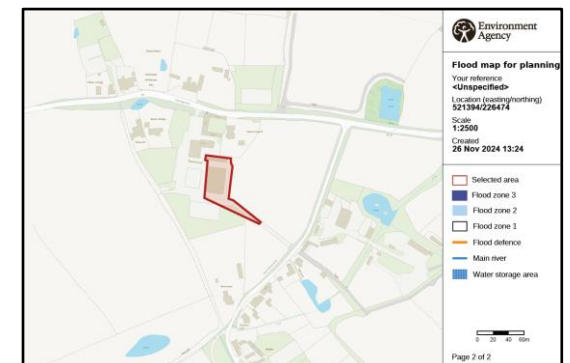


Figure 11: Flood risk map for planning. Site (red).

8.9 Materials and Embodied Carbon

Materials with a low environmental impact and low embodied carbon footprint will be implemented where feasible. Recycled, sustainable and locally sourced materials will be prioritised. Where possible, building materials should achieve a rating of A+ to D in the BRE's Green Guide on Materials.

The development has followed the principles of the LETI Embodied Carbon Primer, to minimise the embodied carbon footprint of the scheme. The existing steel superstructure is being refurbished and retained as part of the proposed development. This will result in significant embodied carbon savings at Modules A1-A5. Portions of the substructure will also be retained and reused. The external envelope will benefit from timber cladding owing to its regenerative nature and ability to sequester carbon from the atmosphere. The roof will be made from cladded zinc, which is an abundant material, light weight and has a long life-span. It is also easily recyclable at the end of its life. Circular economy principles have been adopted, and any waste arising from the works will be assessed for its practicability of re-use in the proposed dwelling.



8. Sustainability

8.10 Pollution

To reduce both the carbon dioxide and nitrogen oxide (NOX) emissions associated with the proposed site, there will be no combustion boilers provided as the site benefits from an all-electric energy strategy. All external lighting provided will be designed with the consideration of reducing nighttime pollution.

8.11 Land Use and Ecology

To promote an improvement in ecological value, the site will look to protect existing ecological features during the construction stage. The scheme will also benefit from new planting of shrubs and other native species in the garden areas and green spaces of the development. The scheme has demonstrated an ability to provide a 44.68% Biodiversity Net Gain (BNG) improvement on existing conditions, exceeding regulatory requirements. Further information is detailed in the accompanying Ecology Report provided by the Ecology Partnership.

8.12 Sustainability Conclusion

The measures identified and detailed in this section promote a holistically sustainable scheme that demonstrates a significant improvement beyond building regulation requirements and local policy. The proposed scheme will benefit from:

- Reduced carbon dioxide emissions to provide a net-zero carbon regulated dwelling, exceeding all regulatory recommendations.
- No nitrogen oxide emissions from the energy strategy.
- Low flow water appliances to achieve 95 litres per person per day.
- Promotion of public transport and active travel, supported by proximity of local transport links and amenities.
- Planting of new shrubs and native species resulting in a diversification of the natural habitat and a 44.68% BNG improvement.
- Low embodied carbon structures maximising re-use and adopting principles of LETI Embodied Carbon Primer.
- Minimising waste arising from construction and occupation through implementation of circular economy principles.

8.13 SPD Summary

The proposed development achieves the 'Gold' standard of the North Herts SPD across the following categories:

- Optimising Passive Design and Fabric Performance
- Achieving Low Carbon Energy

As a minor development, a Whole Life Cycle Carbon Assessment is not required. However, owing to the sustainable approach adopted, it is very likely that were such an assessment to be undertaken, the development would achieve compliance with the 'Gold' standard for the 'minimising carbon footprint' category.

Finally, owing to the scheme's ambition to minimise water consumption, the development will achieve compliance with 'Silver' rating of the Conserving Water category at <95 litres per person per day.

The achievement on Gold across the two categories above demonstrates compliance with the North Herts SPD; which states that "applicants... select individual themes on which to excel (SPD gold level) depending on site context, type and scale of development".



Figure 12: North Herts Sustainability SPD.



9. Conclusion

An Energy and Sustainability Statement has been undertaken to demonstrate how the proposed scheme at Titmore Green Farm, Little Wymondley, Hitchin, SG4 7JR, has responded to local policy requirements regarding sustainability, energy and climate change.

This assessment is prepared to support the full planning application for:

Change of use of agricultural building to one x 5 bedroomed single-family dwelling; external alterations and re-cladding; demolition of outdoor menage; re-cladding and external alterations to Atcost Barn for use with dwelling; layout of parking, landscaping and all ancillary works.

This assessment has been prepared in line with the requirements of North Hertfordshire’s local policy surrounding Energy and Climate Change. The scheme complies with all relevant policies contained in the North Hertfordshire Local Plan (2011-2031) and the Sustainability Supplementary Document (SPD) (2024).

The dwelling benefit from significant passive design and energy efficiency improvements, including an improved building fabric, beyond requirements of Part L (2021), Mechanical Ventilation with Heat Recovery (MVHR) and low energy lighting. The energy strategy is comprised of an Air Source Heat Pump solution providing space heating and domestic hot water, combined with Solar Photovoltaic (PV) panels to the dwelling and ancillary barn, to maximise on-site CO2 reduction.

The energy strategy follows the energy hierarchy; Be Lean, Be Clean, Be Green to maximise the carbon reduction in lieu of the scheme’s sustainability vision. The proposed energy strategy is set out in this report and the scheme achieves an on-site **CO2 reduction of 100% beyond Part L (2021) demonstrating that Net-Zero regulated carbon can be achieved.**

With regards to sustainability, the scheme aspires to reduce its environmental impact by incorporating sustainable measures across the design. Additional sustainability measures that will be integrated are contained in the body of this report. The dwelling currently demonstrates compliance with some Gold Standards of the Sustainability SPD and will endeavour to target additional categories to excel in as the design develops.

Table 8 Percentage of carbon dioxide reductions achieved at each stage of the energy hierarchy.

	Regulated domestic carbon dioxide emissions	
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	1.3	49%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	1.4	51%
Total regulated carbon dioxide reduction	2.7	100%

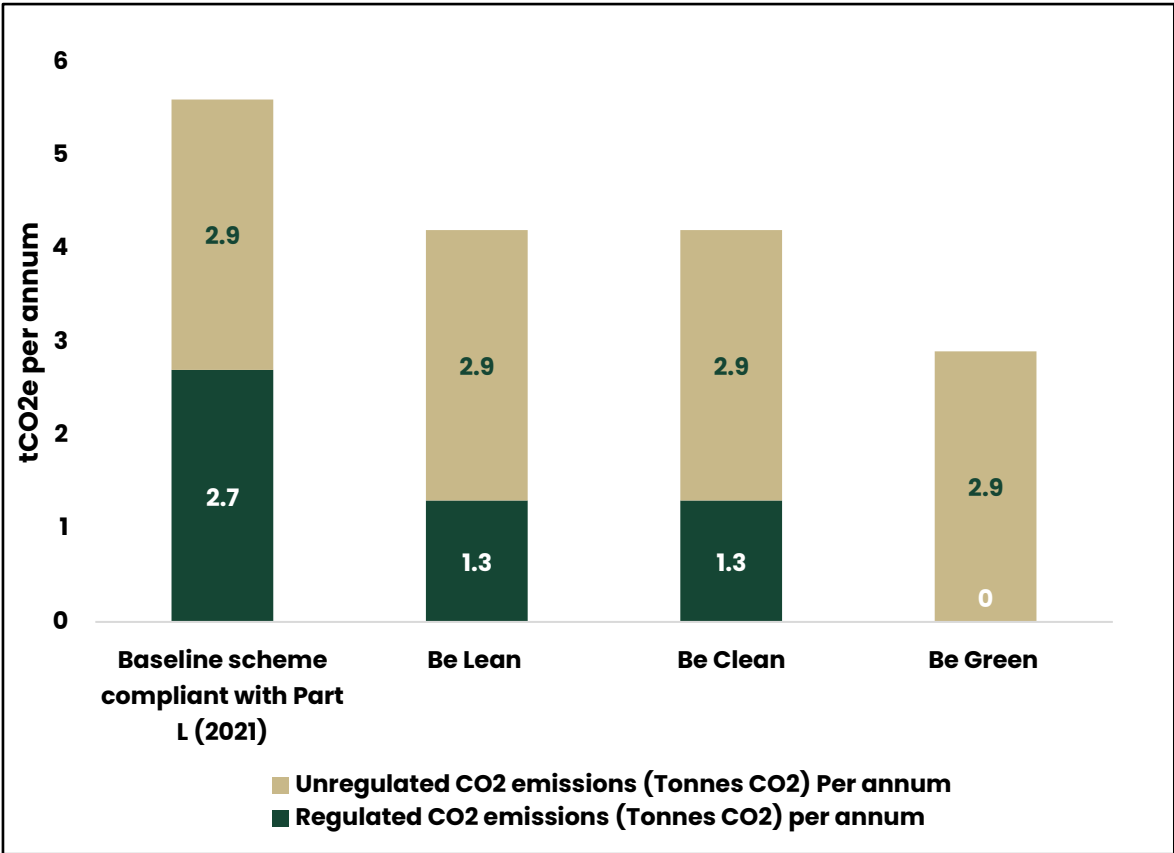


Figure 13: Carbon dioxide emissions per annum at the proposed scheme having utilised the Energy Hierarchy*.

*SAP 10.2 Carbon Factors have been used to assess the scheme, with the following emission rates:

- Natural Gas: 0.210kgCO2/kWh
- Grid Electricity: 0.136 kgCO2/kWh



10. Appendices



10.1 Appendix A – SPD Compliance Checklist

SPD Category and Requirements	Measures Included in Development
Optimising Passive Design and Fabric Performance	
1. Achieve an EPC rating of at least C (Bronze) 2. Submit an Energy and Sustainability Statement including EUI and SHD (Bronze) 3. Achieve an EPC rating of B (Silver) 4. Submit an Energy and Sustainability Statement showing maximisation of solar gain, measures to prevent over-heating, lower carbon alternatives to gas boilers (Silver) 5. On-site reductions of 35% beyond Part L (2021) BR, including 10% through fabric first measures (Be Lean) (Silver) 6. On-site reduction of 50% beyond Part L (2021) BR, including 10% through fabric first measures (Be Lean) (Gold). 7. Commitment to achieve Passivhaus certification at planning stage. (Gold) 8. Operational energy modelling to demonstrate compliance with EUI of <35 kWh/m²/yr and SHD of <15kWh/m²/yr. (Gold)	1. The proposed scheme achieves an EPC rating of A. 2. The Regulated Energy Use Intensity of the Scheme based on SAP (Be Green) energy modelling is -3.26kWh/sqm. Including an estimated Unregulated Energy Consumption of 25kWh/sqm, would bring the total EUI to 22kWh/sqm. The total space heating demand, based on SAP calculations is 4,918 kWh/ year, or 10 kWh/sqm. 3. The proposed scheme achieves an EPC rating of A. 4. This statement addresses the relevant requirements 5. The proposed development achieves a 100% CO₂ reduction beyond Part L (2021), with 49% achieved at the Be Lean stage, and 51% at the Be Green Stage. 6. The proposed scheme achieves the relevant CO₂ reductions as per (5) above. 7. The scheme is not seeking Passivhaus certification. 8. The scheme, based on SAP energy modelling, achieves an EUI of 22kWh/sqm and SHD of 10kWh/sqm, surpassing targets.
Achieving Low Carbon Energy	
1. Ensure development is Policy and Building Regulations compliant 2. Show that 75% or more of dwellings energy demand is supplied from onsite renewable technology. 3. Show that roof shape and orientation is optimised to maximise solar PV outputs. 4. Show that the development commits to investigating better uses of PV. 5. Show that 100% of dwelling's energy demand is supplied from onsite renewable technology.	1. The appended SAP calculations indicate that the proposed scheme is compliant with Part L (2021) Building Regulations – post construction testing will be required to confirm this point. 2. 100% of the regulated energy demand is met from on-site renewable energy, as per appended SAPs. 3. The site is constrained by use of existing buildings, however the orientation of both suits PV. PV has been maximised on the ancillary barn owing to its south orientation, maximising efficiency. 4. The development will utilise the solar to power the home, reducing energy demand from the grid. The energy generated will be stored in an on-site battery, with surplus sold back to the grid. 5. 100% of the regulated energy demand is met from on-site renewables, as per the appended SAPs.



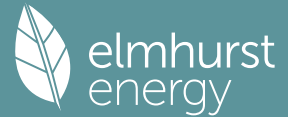
10.1 Appendix A – SPD Compliance Checklist

SPD Category and Requirements	Measures Included in Development
Minimising carbon footprint	
1. Ensure compliance with policy and Building Regulations including Part Z when it is introduced. 2. Incorporate the findings of pre-demolition audits into a WLC where applicable. 3. Commit to updating WLCAs at all development stages. 4. Ensure the scheme achieves following kgCO₂e/m² scores for development. 5. Achieve 500kgCO₂e/ m² A1-A5 and <300 at B-C.	1. The scheme will have a significantly lower embodied carbon footprint than a conventional new build, owing to its retention of the existing superstructure and portions of the substructure. As a minor development, a WLCA is not required and therefore none will be provided. However, the retention of the existing elements was a conscious decision made by the design team to maximise the sustainability of the scheme. 2. – 4. As above. 5. As above.
Conserving Water	
1. Ensure compliance with 110 litres per person per day. 2. Achieve water consumption target of <95 litres per person per day.	1. The scheme will achieve compliance with this target through the use of low-flow appliances, in line with Building Regulations Part G. 2. The proposed water strategy will aim to align with this target.



10.2 Appendix B – SAP Worksheets

Full SAP Calculation Printout



Property Reference	Titmore Green Farm_MVHR_Lea				Issued on Date	12/12/2024
Assessment Reference	00001		Prop Type Ref			
Property	Titmore Green Farm, Little Wymondley , Hitchin, SG4 7JR					
SAP Rating	89 B	DER	6.59	TER	5.40	
Environmental	92 A	% DER < TER				-22.04
CO ₂ Emissions (t/year)	3	DFEE	33.36	TFEE	36.02	
Compliance Check	See BREL	% DFEE < TFEE				7.38
% DPER < TPER	-29.11	DPER	39.04	TPER	30.24	
Assessor Details	Mr. Oliver Eggenton				Assessor ID	AQ01-0001
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	298.2500 (1b)	x 2.6000 (2b)	= 775.4500 (1b) - (3b)
First floor	195.3500 (1c)	x 2.5000 (2c)	= 488.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	493.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1263.8250 (5)

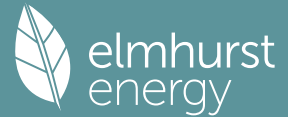
2. Ventilation rate

											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											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											3.0000 (17)	
Infiltration rate											0.1500 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1388 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2899	0.2864	0.2830	0.2656	0.2622	0.2448	0.2448	0.2413	0.2518	0.2622	0.2691	0.2760 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 0.80)			61.7600	0.7752	47.8760		(27)
Door			2.5000	1.0000	2.5000		(26)
Heatloss Floor 1			298.2500	0.1000	29.8250		(28a)
External Wall 1	261.8850	64.2600	197.6250	0.1500	29.6437		(29a)
External Roof 1	300.0000		300.0000	0.1100	33.0000		(30)
Total net area of external elements Aum(A, m ²)			860.1350				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	142.8447		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							43.0068 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	185.8515 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							

Full SAP Calculation Printout



(38)m	Jan 120.9090	Feb 119.4623	Mar 118.0156	Apr 110.7822	May 109.3355	Jun 102.1021	Jul 102.1021	Aug 100.6554	Sep 104.9954	Oct 109.3355	Nov 112.2288	Dec 115.1222	(38)
Heat transfer coeff	306.7604	305.3137	303.8671	296.6336	295.1869	287.9535	287.9535	286.5068	290.8469	295.1869	298.0803	300.9737	(39)
Average = Sum(39)m / 12 =												296.2720	
HLP	Jan 0.6215	Feb 0.6185	Mar 0.6156	Apr 0.6010	May 0.5980	Jun 0.5834	Jul 0.5834	Aug 0.5804	Sep 0.5892	Oct 0.5980	Nov 0.6039	Dec 0.6098	(40)
HLP (average)												0.6002	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.3836 (42)
Hot water usage for mixer showers													
78.9067	77.6987	75.9184	73.1796	70.7257	67.2927	64.5775	67.7518	69.3483	72.7485	76.2895	78.8356	(42a)	
Hot water usage for baths													
34.1564	33.6408	32.9073	31.8088	30.8188	29.4560	28.4221	29.6864	30.3499	31.7003	33.1042	34.1293	(42b)	
Hot water usage for other uses													
49.2816	47.4895	45.6974	43.9054	42.1133	40.3213	40.3213	42.1133	43.9054	45.6974	47.4895	49.2816	(42c)	
Average daily hot water use (litres/day)												149.2184	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
162.3447	158.8290	154.5231	148.8938	143.6579	137.0700	133.3208	139.5515	143.6036	150.1462	156.8832	162.2465	(44)	
Energy conte	238.9995	210.1629	220.8103	194.4925	185.1177	158.5169	147.3235	164.2547	166.5730	193.4786	212.0329	238.2709	(45)
Energy content (annual)										Total = Sum(45)m =		2330.0332	
Distribution loss (46)m = 0.15 x (45)m													
35.8499	31.5244	33.1215	29.1739	27.7677	23.7775	22.0985	24.6382	24.9860	29.0218	31.8049	35.7406	(46)	
Water storage loss:													
Store volume												400.0000	(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													
279.0019	246.2941	260.8127	233.2045	225.1201	197.2289	187.3259	204.2571	205.2850	233.4810	250.7449	278.2733	(62)	
WWHRS	-46.3037	-40.9117	-42.7891	-36.8757	-34.4523	-28.3191	-24.7472	-28.7713	-29.3207	-35.4376	-40.3199	-46.1100	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
232.6982	205.3824	218.0237	196.3288	190.6678	168.9098	162.5787	175.4857	175.9643	198.0433	210.4250	232.1633	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2366.6710	(64)
Electric shower(s)												2367	(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													
111.4692	98.7841	105.4214	95.6383	93.5535	83.6765	80.9870	86.6166	86.3551	96.3335	101.4705	111.2270	(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	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	343.3242	380.1089	343.3242	354.7683	343.3242	354.7683	343.3242	343.3242	354.7683	343.3242	354.7683	343.3242	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	601.0110	607.2476	591.5315	558.0739	515.8396	476.1454	449.6272	443.3906	459.1066	492.5643	534.7985	574.4928	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	(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)	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	(71)
Water heating gains (Table 5)	149.8243	147.0002	141.6954	132.8310	125.7440	116.2173	108.8535	116.4202	119.9377	129.4806	140.9313	149.4986	(72)
Total internal gains	1170.9136	1211.1108	1153.3052	1122.4274	1061.6620	1020.8852	975.5590	976.8891	1007.5668	1042.1232	1107.2523	1144.0697	(73)

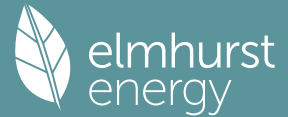
6. Solar gains

[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				0.5000	10.6334		0.6800		0.7000		0.7700		1.7538 (74)
East				44.1300	19.6403		0.6800		0.7000		0.7700		285.9048 (76)
South				17.1300	46.7521		0.6800		0.7000		0.7700		264.1790 (78)
Solar gains	551.8376	995.2992	1477.8954	1975.3709	2307.7171	2323.1379	2227.1083	1980.6962	1653.8107	1134.2962	671.7955	464.8513	(83)
Total gains	1722.7512	2206.4101	2631.2006	3097.7983	3369.3791	3344.0231	3202.6672	2957.5853	2661.3775	2176.4194	1779.0478	1608.9210	(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	111.7412	112.2707	112.8052	115.5559	116.1223	119.0393	119.0393	119.6403	117.8551	116.1223	114.9951	113.8896	
alpha	8.4494	8.4847	8.5203	8.7037	8.7415	8.9360	8.9360	8.9760	8.8570	8.7415	8.6663	8.5926	
util living area													
	0.9999	0.9994	0.9950	0.9500	0.7856	0.5499	0.3955	0.4454	0.7378	0.9851	0.9996	1.0000 (86)	

Full SAP Calculation Printout



MIT	20.1829	20.3483	20.5698	20.8440	20.9763	20.9990	21.0000	20.9999	20.9896	20.7764	20.4297	20.1696 (87)
Th 2	20.4107	20.4133	20.4160	20.4291	20.4318	20.4450	20.4450	20.4476	20.4397	20.4318	20.4265	20.4212 (88)
util rest of house	0.9999	0.9992	0.9933	0.9355	0.7463	0.5028	0.3457	0.3920	0.6844	0.9785	0.9995	1.0000 (89)
MIT 2	19.4179	19.6322	19.9174	20.2675	20.4123	20.4444	20.4450	20.4476	20.4327	20.1924	19.7475	19.4095 (90)
Living area fraction									fLA = Living area / (4) =			0.0608 (91)
MIT	19.4644	19.6757	19.9570	20.3025	20.4466	20.4781	20.4787	20.4812	20.4665	20.2279	19.7889	19.4557 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4644	19.6757	19.9570	20.3025	20.4466	20.4781	20.4787	20.4812	20.4665	20.2279	19.7889	19.4557 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9999	0.9988	0.9915	0.9318	0.7474	0.5056	0.3487	0.3953	0.6870	0.9754	0.9992	0.9999	(94)
Useful gains	1722.5056	2203.7973	2608.9482	2886.4175	2518.2328	1690.7219	1116.8260	1169.1070	1828.3648	2122.9806	1777.6812	1608.7934	(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	4651.8476	4511.2203	4089.1446	3382.3776	2581.8751	1692.6283	1116.8853	1169.2776	1851.6883	2842.0298	3782.3229	4591.5583	(97)
Space heating kWh	2179.4304	1550.5883	1101.2661	357.0913	47.3499	0.0000	0.0000	0.0000	0.0000	534.9726	1443.3420	2219.1771	(98a)
Space heating requirement - total per year (kWh/year)												9433.2176	
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	2179.4304	1550.5883	1101.2661	357.0913	47.3499	0.0000	0.0000	0.0000	0.0000	534.9726	1443.3420	2219.1771	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9433.2176	
Space heating per m2											(98c) / (4) =	19.1111	(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 %)	84.5000	(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	2179.4304	1550.5883	1101.2661	357.0913	47.3499	0.0000	0.0000	0.0000	0.0000	534.9726	1443.3420	2219.1771	(98)
Space heating efficiency (main heating system 1)	84.5000	84.5000	84.5000	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
Space heating fuel (main heating system)	2579.2076	1835.0157	1303.2735	422.5932	56.0353	0.0000	0.0000	0.0000	0.0000	633.1036	1708.0970	2626.2450	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating													
Water heating requirement	232.6982	205.3824	218.0237	196.3288	190.6678	168.9098	162.5787	175.4857	175.9643	198.0433	210.4250	232.1633	(64)
Efficiency of water heater (217)m	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	(216)
Fuel for water heating, kWh/month	275.3825	243.0560	258.0162	232.3418	225.6424	199.8933	192.4008	207.6754	208.2418	234.3708	249.0237	274.7495	(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	149.9120	135.4044	149.9120	145.0761	149.9120	145.0761	149.9120	149.9120	145.0761	149.9120	145.0761	149.9120	(231)
Lighting	66.3785	53.2513	47.9469	35.1280	27.1339	22.1686	24.7524	32.1741	41.7910	54.8321	61.9327	68.2234	(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												11163.5711	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												89.5000	
Water heating fuel used												2800.7941	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)													
mechanical ventilation fans (SFP = 1.0890)												1679.0926	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												1765.0926	(231)
Electricity for lighting (calculated in Appendix L)												535.7129	(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												16265.1707	(238)

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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	11163.5711	0.2100	2344.3499 (261)
Total CO ₂ associated with community systems			0.0000 (373)
Water heating (other fuel)	2800.7941	0.2100	588.1668 (264)
Space and water heating			2932.5167 (265)
Pumps, fans and electric keep-hot	1765.0926	0.1387	244.8401 (267)
Energy for lighting	535.7129	0.1443	77.3199 (268)
Total CO ₂ , kg/year			3254.6767 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.5900 (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	11163.5711	1.1300	12614.8353 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	2800.7941	1.1300	3164.8974 (278)
Space and water heating			15779.7327 (279)
Pumps, fans and electric keep-hot	1765.0926	1.5128	2670.2321 (281)
Energy for lighting	535.7129	1.5338	821.6943 (282)
Total Primary energy kWh/year			19271.6591 (286)
Dwelling Primary energy Rate (DPER)			39.0400 (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	298.2500 (1b)	x 2.6000 (2b)	= 775.4500 (1b) - (3b)
First floor	195.3500 (1c)	x 2.5000 (2c)	= 488.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	493.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	1263.8250 (5)

2. Ventilation rate

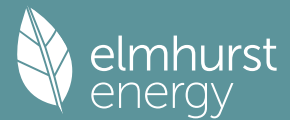
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) = 0.0316 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2816 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2605 (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	0.3322	0.3257	0.3191	0.2866	0.2801	0.2475	0.2475	0.2410	0.2605	0.2801	0.2931	0.3061 (22b)
Effective ac	0.5552	0.5530	0.5509	0.5411	0.5392	0.5306	0.5306	0.5290	0.5339	0.5392	0.5430	0.5469 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.5000	1.0000	2.5000		(26)
TER Opening Type (Uw = 1.20)			61.7600	1.1450	70.7176		(27)
Heatloss Floor 1			298.2500	0.1300	38.7725		(28a)
External Wall 1	261.8850	64.2600	197.6250	0.1800	35.5725		(29a)
External Roof 1	300.0000		300.0000	0.1100	33.0000		(30)
Total net area of external elements Aum(A, m ²)			860.1350				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		180.5626		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	

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E5 Ground floor (normal)	51.3500	0.1600	8.2160										
E6 Intermediate floor within a dwelling	51.3500	0.0000	0.0000										
E16 Corner (normal)	10.2000	0.0900	0.9180										
E18 Party wall between dwellings	10.2000	0.0600	0.6120										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				9.7460 (36)									
Point Thermal bridges			(36a) =	0.0000									
Total fabric heat loss			(33) + (36) + (36a) =	190.3086 (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	231.5399	230.6465	229.7707	225.6572	224.8876	221.3049	221.3049	220.6415	222.6849	224.8876	226.4446	228.0722	(38)
Average = Sum(39)m / 12 =	421.8485	420.9550	420.0793	415.9658	415.1962	411.6135	411.6135	410.9500	412.9935	415.1962	416.7531	418.3808	(39)
												415.9621	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8546	0.8528	0.8511	0.8427	0.8412	0.8339	0.8339	0.8326	0.8367	0.8412	0.8443	0.8476	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												0.8427	
												31	

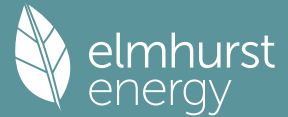
4. Water heating energy requirements (kWh/year)												

Assumed occupancy												3.3836 (42)
Hot water usage for mixer showers												
	80.9520	79.7354	77.9627	74.5708	72.0677	69.2763	67.6897	69.4490	71.3776	74.3747	77.8394	80.6418 (42a)
Hot water usage for baths												
	34.9352	34.4164	33.6858	32.3386	31.3299	30.2113	29.6072	30.3327	31.1227	32.3195	33.6944	34.8171 (42b)
Hot water usage for other uses												
	49.2816	47.4895	45.6974	43.9054	42.1133	40.3213	40.3213	42.1133	43.9054	45.6974	47.4895	49.2816 (42c)
Average daily hot water use (litres/day)												151.8269 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
	165.1688	161.6413	157.3459	150.8148	145.5109	139.8089	137.6181	141.8950	146.4056	152.3917	159.0233	164.7405 (44)
Energy content												
	261.5869	230.1751	241.8347	206.4580	195.8857	171.9114	166.4372	175.6957	180.5327	206.7940	226.5579	257.9438 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2521.8131
	39.2380	34.5263	36.2752	30.9687	29.3829	25.7867	24.9656	26.3544	27.0799	31.0191	33.9837	38.6916 (46)
Water storage loss:												
Store volume												400.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.5234 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.3626 (55)
Total storage loss												
	42.2417	38.1538	42.2417	40.8791	42.2417	40.8791	42.2417	42.2417	40.8791	42.2417	40.8791	42.2417 (56)
If cylinder contains dedicated solar storage												
	42.2417	38.1538	42.2417	40.8791	42.2417	40.8791	42.2417	42.2417	40.8791	42.2417	40.8791	42.2417 (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												
	327.0911	289.3401	307.3389	269.8490	261.3898	235.3025	231.9413	241.1998	243.9238	272.2982	289.9489	323.4479 (62)
WWHRS												
	-37.0079	-32.7301	-34.2730	-28.3794	-26.4486	-22.6323	-21.2141	-22.5591	-23.4162	-27.6051	-31.2733	-36.3225 (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												
	290.0832	256.6100	273.0658	241.4696	234.9412	212.6702	210.7272	218.6407	220.5076	244.6930	258.6757	287.1254 (64)
12Total per year (kWh/year)												2949.2096 (64)
Electric shower(s)												2949 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
	139.3810	123.8652	132.8133	119.3601	117.5353	107.8734	107.7437	110.8221	110.7400	121.1623	126.0434	138.1696 (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	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	333.3721	369.0906	333.3721	344.4845	333.3721	344.4845	333.3721	333.3721	344.4845	333.3721	344.4845	333.3721	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	601.0110	607.2476	591.5315	558.0739	515.8396	476.1454	449.6272	443.3906	459.1066	492.5643	534.7985	574.4928	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	(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)	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	(71)
Water heating gains (Table 5)	187.3400	184.3232	178.5126	165.7780	157.9775	149.8242	144.8167	148.9544	153.8056	162.8526	175.0602	185.7118	(72)
Total internal gains	1198.4772	1237.4155	1180.1704	1145.0905	1083.9434	1044.2082	1001.5702	999.4713	1031.1509	1065.5431	1131.0974	1170.3309	(73)

6. Solar gains													
[Jan]													
	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	W/m2	Specific data	factor	W							
				or Table 6b	Table 6d								
North	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)						
East	44.1300	19.6403	0.6300	0.7000	0.7700	264.8824	(76)						
South	17.1300	46.7521	0.6300	0.7000	0.7700	244.7541	(78)						
Solar gains	511.2613	922.1154	1369.2266	1830.1231	2138.0321	2152.3189	2063.3503	1835.0568	1532.2070	1050.8921	622.3987	430.6710	(83)
Total gains	1709.7386	2159.5310	2549.3970	2975.2136	3221.9755	3196.5271	3064.9205	2834.5280	2563.3579	2116.4352	1753.4961	1601.0019	(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	81.2561	81.4286	81.5984	82.4053	82.5580	83.2766	83.2766	83.4111	82.9983	82.5580	82.2496	81.9296
alpha	6.4171	6.4286	6.4399	6.4937	6.5039	6.5518	6.5518	6.5607	6.5332	6.5039	6.4833	6.4620
util living area	0.9999	0.9996	0.9979	0.9863	0.9313	0.7710	0.5831	0.6506	0.9085	0.9950	0.9997	0.9999 (86)
MIT	19.7754	19.9395	20.1853	20.5172	20.8020	20.9609	20.9945	20.9893	20.8800	20.4910	20.0709	19.7525 (87)
Th 2	20.2062	20.2078	20.2093	20.2165	20.2178	20.2240	20.2240	20.2252	20.2216	20.2178	20.2151	20.2123 (88)
util rest of house	0.9999	0.9994	0.9971	0.9807	0.9035	0.6978	0.4845	0.5494	0.8612	0.9924	0.9996	0.9999 (89)
MIT 2	18.7335	18.9451	19.2612	19.6882	20.0331	20.1991	20.2220	20.2208	20.1269	19.6588	19.1194	18.7087 (90)
Living area fraction	18.7968	19.0056	19.3173	19.7386	20.0798	20.2454	20.2690	20.2675	20.1726	19.7094	19.1772	18.7721 (92)
MIT	18.7968	19.0056	19.3173	19.7386	20.0798	20.2454	20.2690	20.2675	20.1726	19.7094	19.1772	18.7721 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7968	19.0056	19.3173	19.7386	20.0798	20.2454	20.2690	20.2675	20.1726	19.7094	19.1772	18.7721 (93)

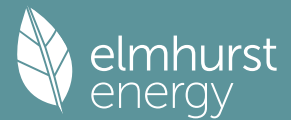
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9998	0.9990	0.9957	0.9761	0.8976	0.7000	0.4903	0.5551	0.8576	0.9898	0.9993	0.9999 (94)
Useful gains	1709.3929	2157.4685	2538.4689	2903.9877	2892.0320	2237.4177	1502.7407	1573.4763	2198.3181	2094.7979	1752.2684	1600.7931 (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	6115.4626	5937.8147	5384.2922	4508.4787	3479.2764	2323.7106	1510.1952	1589.3632	2507.9646	3782.1909	5033.2091	6096.6914 (97)
Space heating kWh	3278.1158	2540.3927	2117.2925	1155.2336	436.9098	0.0000	0.0000	0.0000	0.0000	1255.4204	2362.2773	3344.9483 (98a)
Space heating requirement - total per year (kWh/year)												16490.5904
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	3278.1158	2540.3927	2117.2925	1155.2336	436.9098	0.0000	0.0000	0.0000	0.0000	1255.4204	2362.2773	3344.9483 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16490.5904
Space heating per m2										(98c) / (4) =		33.4088 (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	3278.1158	2540.3927	2117.2925	1155.2336	436.9098	0.0000	0.0000	0.0000	0.0000	1255.4204	2362.2773	3344.9483 (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)	3551.5881	2752.3214	2293.9247	1251.6074	473.3584	0.0000	0.0000	0.0000	0.0000	1360.1521	2559.3470	3623.9960 (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	290.0832	256.6100	273.0658	241.4696	234.9412	212.6702	210.7272	218.6407	220.5076	244.6930	258.6757	287.1254 (64)	
Efficiency of water heater (217)m	87.9932	87.8906	87.6705	87.1017	85.4307	79.8000	79.8000	79.8000	79.8000	87.1959	87.8224	88.0153 (217)	
Fuel for water heating, kWh/month	329.6654	291.9653	311.4684	277.2273	275.0079	266.5040	264.0691	273.9858	276.3253	280.6245	294.5439	326.2222 (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	69.2681	55.5695	50.0342	36.6572	28.3150	23.1336	25.8299	33.5747	43.6103	57.2190	64.6287	71.1933 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-201.7992	-252.6498	-322.5018	-320.1493	-312.4610	-279.8152	-275.4210	-274.4933	-270.6821	-265.2892	-209.6637	-178.3568 (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	-234.8975	-472.4094	-902.2292	-1305.9186	-1682.6361	-1675.9092	-1656.9074	-1423.0803	-1070.4243	-658.8911	-307.6080	-187.5601 (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													17866.2951 (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													3467.6094 (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)													559.0336 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-14741.7535 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)

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Appendix Q - special features
 Energy saved or generated
 Energy used
 Total delivered energy for all uses

-0.0000 (236)
 0.0000 (237)
 7237.1846 (238)

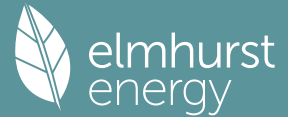
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	17866.2951	0.2100	3751.9220 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3467.6094	0.2100	728.1980 (264)
Space and water heating			4480.1199 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	559.0336	0.1443	80.6858 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3163.2823	0.1373	-434.4129
PV Unit electricity exported	-11578.4712	0.1270	-1470.5905
Total			-1905.0034 (269)
Total CO2, kg/year			2667.7316 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			5.4000 (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	17866.2951	1.1300	20188.9135 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3467.6094	1.1300	3918.3986 (278)
Space and water heating			24107.3120 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	559.0336	1.5338	857.4644 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3163.2823	1.5077	-4769.2641
PV Unit electricity exported	-11578.4712	0.4663	-5398.6188
Total			-10167.8829 (283)
Total Primary energy kWh/year			14926.9943 (286)
Target Primary Energy Rate (TPER)			30.2400 (287)

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Property Reference	Titmore Green Farm_MVHR_Green			Issued on Date	12/12/2024
Assessment Reference	00001	Prop Type Ref			
Property	Titmore Green Farm, Little Wymondley , Hitchin, SG4 7JR				
SAP Rating	97 A	DER	-0.03	TER	5.40
Environmental	100 A	% DER < TER			100.56
CO ₂ Emissions (t/year)	-0.17	DFEE	35.69	TFEE	36.02
Compliance Check	See BREL	% DFEE < TFEE			0.90
% DPER < TPER	77.64	DPER	6.76	TPER	30.24
Assessor Details	Mr. Oliver Eggenton			Assessor ID	AQ01-0001
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	298.2500 (1b)	x 2.6000 (2b)	= 775.4500 (1b) - (3b)
First floor	195.3500 (1c)	x 2.5000 (2c)	= 488.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	493.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1263.8250 (5)

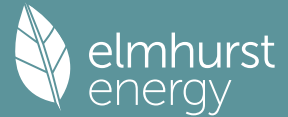
2. Ventilation rate

											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											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											3.0000 (17)	
Infiltration rate											0.1500 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1388 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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												
	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2899	0.2864	0.2830	0.2656	0.2622	0.2448	0.2448	0.2413	0.2518	0.2622	0.2691	0.2760 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			61.7600	1.1450	70.7176		(27)
Door			2.5000	1.0000	2.5000		(26)
Heatloss Floor 1			298.2500	0.1000	29.8250		(28a)
External Wall 1	261.8850	64.2600	197.6250	0.1500	29.6437		(29a)
External Roof 1	300.0000		300.0000	0.1000	30.0000		(30)
Total net area of external elements Aum(A, m ²)			860.1350				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	162.6863		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							43.0068 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	205.6931 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							

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(38)m	Jan 120.9090	Feb 119.4623	Mar 118.0156	Apr 110.7822	May 109.3355	Jun 102.1021	Jul 102.1021	Aug 100.6554	Sep 104.9954	Oct 109.3355	Nov 112.2288	Dec 115.1222	(38)
Heat transfer coeff	326.6020	325.1553	323.7086	316.4752	315.0285	307.7951	307.7951	306.3484	310.6885	315.0285	317.9219	320.8153	(39)
Average = Sum(39)m / 12 =												316.1135	
HLP	Jan 0.6617	Feb 0.6587	Mar 0.6558	Apr 0.6412	May 0.6382	Jun 0.6236	Jul 0.6236	Aug 0.6206	Sep 0.6294	Oct 0.6382	Nov 0.6441	Dec 0.6499	(40)
HLP (average)												0.6404	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.3836 (42)
Hot water usage for mixer showers													
78.9067	77.6987	75.9184	73.1796	70.7257	67.2927	64.5775	67.7518	69.3483	72.7485	76.2895	78.8356	(42a)	
Hot water usage for baths													
34.1564	33.6408	32.9073	31.8088	30.8188	29.4560	28.4221	29.6864	30.3499	31.7003	33.1042	34.1293	(42b)	
Hot water usage for other uses													
49.2816	47.4895	45.6974	43.9054	42.1133	40.3213	40.3213	42.1133	43.9054	45.6974	47.4895	49.2816	(42c)	
Average daily hot water use (litres/day)												149.2184	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
162.3447	158.8290	154.5231	148.8938	143.6579	137.0700	133.3208	139.5515	143.6036	150.1462	156.8832	162.2465	(44)	
Energy conte	238.9995	210.1629	220.8103	194.4925	185.1177	158.5169	147.3235	164.2547	166.5730	193.4786	212.0329	238.2709	(45)
Energy content (annual)										Total = Sum(45)m =		2330.0332	
Distribution loss (46)m = 0.15 x (45)m													
35.8499	31.5244	33.1215	29.1739	27.7677	23.7775	22.0985	24.6382	24.9860	29.0218	31.8049	35.7406	(46)	
Water storage loss:													
Store volume												400.0000	(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													
279.0019	246.2941	260.8127	233.2045	225.1201	197.2289	187.3259	204.2571	205.2850	233.4810	250.7449	278.2733	(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													
279.0019	246.2941	260.8127	233.2045	225.1201	197.2289	187.3259	204.2571	205.2850	233.4810	250.7449	278.2733	(64)	
12Total per year (kWh/year)												2801.0292	(64)
Electric shower(s)												2801	(64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
111.4692	98.7841	105.4214	95.6383	93.5535	83.6765	80.9870	86.6166	86.3551	96.3335	101.4705	111.2270	(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	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	343.3242	380.1089	343.3242	354.7683	343.3242	354.7683	343.3242	343.3242	354.7683	343.3242	354.7683	343.3242	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	601.0110	607.2476	591.5315	558.0739	515.8396	476.1454	449.6272	443.3906	459.1066	492.5643	534.7985	574.4928	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	(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)	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	(71)
Water heating gains (Table 5)	149.8243	147.0002	141.6954	132.8310	125.7440	116.2173	108.8535	116.4202	119.9377	129.4806	140.9313	149.4986	(72)
Total internal gains	1170.9136	1211.1108	1153.3052	1122.4274	1061.6620	1020.8852	975.5590	976.8891	1007.5668	1042.1232	1107.2523	1144.0697	(73)

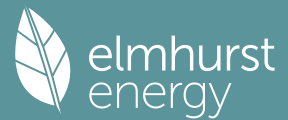
6. Solar gains

[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				0.5000	10.6334		0.6800		0.7000		0.7700		1.7538 (74)
East				44.1300	19.6403		0.6800		0.7000		0.7700		285.9048 (76)
South				17.1300	46.7521		0.6800		0.7000		0.7700		264.1790 (78)
Solar gains	551.8376	995.2992	1477.8954	1975.3709	2307.7171	2323.1379	2227.1083	1980.6962	1653.8107	1134.2962	671.7955	464.8513	(83)
Total gains	1722.7512	2206.4101	2631.2006	3097.7983	3369.3791	3344.0231	3202.6672	2957.5853	2661.3775	2176.4194	1779.0478	1608.9210	(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	104.9527	105.4197	105.8908	108.3111	108.8085	111.3656	111.3656	111.8915	110.3284	108.8085	107.8182	106.8458	
alpha	7.9968	8.0280	8.0594	8.2207	8.2539	8.4244	8.4244	8.4594	8.3552	8.2539	8.1879	8.1231	
util living area	0.9999	0.9994	0.9958	0.9610	0.8202	0.5863	0.4227	0.4760	0.7759	0.9883	0.9997	1.0000	(86)

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MIT	20.2939	20.4192	20.5902	20.8091	20.9324	20.9613	20.9629	20.9629	20.9485	20.7601	20.4882	20.2841 (87)
Th 2	20.3748	20.3774	20.3800	20.3931	20.3957	20.4088	20.4088	20.4115	20.4036	20.3957	20.3905	20.3853 (88)
util rest of house	0.9999	0.9993	0.9944	0.9487	0.7807	0.5334	0.3660	0.4154	0.7200	0.9828	0.9995	0.9999 (89)
MIT 2	19.5156	19.6786	19.8994	20.1836	20.3222	20.3604	20.3614	20.3641	20.3460	20.1291	19.7783	19.5120 (90)
Living area fraction									fLA = Living area / (4) =			0.0608 (91)
MIT	19.5629	19.7236	19.9414	20.2216	20.3593	20.3969	20.3979	20.4005	20.3826	20.1674	19.8215	19.5589 (92)
Temperature adjustment												0.0000
adjusted MIT	19.5629	19.7236	19.9414	20.2216	20.3593	20.3969	20.3979	20.4005	20.3826	20.1674	19.8215	19.5589 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9999	0.9990	0.9931	0.9446	0.7782	0.5323	0.3650	0.4142	0.7179	0.9801	0.9993	0.9999	(94)
Useful gains	1722.5210	2204.1512	2612.9574	2926.0821	2622.0630	1780.0679	1168.8294	1225.1349	1910.6415	2133.1282	1777.8501	1608.7990	(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	4984.9020	4819.9620	4351.1064	3583.0163	2727.9327	1784.2671	1168.9819	1225.5512	1951.9358	3014.0065	4044.4278	4927.3840	(97)
Space heating kWh	2427.2114	1757.8249	1293.1829	472.9926	78.7670	0.0000	0.0000	0.0000	0.0000	655.3735	1631.9359	2469.0272	(98a)
Space heating requirement - total per year (kWh/year)												10786.3155	
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	2427.2114	1757.8249	1293.1829	472.9926	78.7670	0.0000	0.0000	0.0000	0.0000	655.3735	1631.9359	2469.0272	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												10786.3155	
Space heating per m2										(98c) / (4) =		21.8523	(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 %)		219.3000 (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	2427.2114	1757.8249	1293.1829	472.9926	78.7670	0.0000	0.0000	0.0000	0.0000	655.3735	1631.9359	2469.0272	(98)
Space heating efficiency (main heating system 1)	219.3000	219.3000	219.3000	219.3000	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	(210)
Space heating fuel (main heating system)	1106.7996	801.5617	589.6867	215.6829	35.9175	0.0000	0.0000	0.0000	0.0000	298.8479	744.1568	1125.8674	(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	279.0019	246.2941	260.8127	233.2045	225.1201	197.2289	187.3259	204.2571	205.2850	233.4810	250.7449	278.2733 (64)	
Efficiency of water heater (217)m	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 (216)	
Fuel for water heating, kWh/month	146.5346	129.3561	136.9815	122.4813	118.2353	103.5866	98.3854	107.2779	107.8178	122.6266	131.6937	146.1519 (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	142.6079	128.8071	142.6079	138.0076	142.6079	138.0076	142.6079	142.6079	138.0076	142.6079	138.0076	142.6079 (231)	
Lighting	66.3785	53.2513	47.9469	35.1280	27.1339	22.1686	24.7524	32.1741	41.7910	54.8321	61.9327	68.2234 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-243.0745	-373.3753	-561.4483	-597.1186	-579.5894	-520.7451	-513.9200	-497.4426	-450.4462	-415.3896	-275.2964	-205.7946 (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	-34.3180	-98.4837	-264.0329	-537.6434	-844.6341	-888.0575	-872.6886	-699.6095	-466.7844	-193.9497	-55.5479	-25.0834 (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												4918.5205 (211)	
Space heating fuel - main system 2												0.0000 (213)	
Space heating fuel - secondary												0.0000 (215)	
Efficiency of water heater												190.4000	
Water heating fuel used												1471.1288 (219)	
Space cooling fuel												0.0000 (221)	

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.0890)		
mechanical ventilation fans (SFP = 1.0890)		1679.0926 (230a)
Total electricity for the above, kWh/year		1679.0926 (231)
Electricity for lighting (calculated in Appendix L)		535.7129 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-10214.4735 (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		-1610.0187 (238)

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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	4918.5205	0.1568	770.9914 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1471.1288	0.1411	207.5680 (264)
Space and water heating			978.5594 (265)
Pumps, fans and electric keep-hot	1679.0926	0.1387	232.9108 (267)
Energy for lighting	535.7129	0.1443	77.3199 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5233.6406	0.1355	-708.9663
PV Unit electricity exported	-4980.8330	0.1194	-594.7867
Total			-1303.7530 (269)
Total CO2, kg/year			-14.9629 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-0.0300 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4918.5205	1.5803	7772.7685 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1471.1288	1.5217	2238.6523 (278)
Space and water heating			10011.4208 (279)
Pumps, fans and electric keep-hot	1679.0926	1.5128	2540.1313 (281)
Energy for lighting	535.7129	1.5338	821.6943 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-5233.6406	1.5007	-7854.3401
PV Unit electricity exported	-4980.8330	0.4380	-2181.7311
Total			-10036.0712 (283)
Total Primary energy kWh/year			3337.1753 (286)
Dwelling Primary energy Rate (DPER)			6.7600 (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	298.2500 (1b)	x 2.6000 (2b)	= 775.4500 (1b) - (3b)
First floor	195.3500 (1c)	x 2.5000 (2c)	= 488.3750 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	493.6000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1263.8250 (5)

2. Ventilation rate

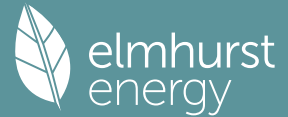
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.0316 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2816 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2605 (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	0.3322	0.3257	0.3191	0.2866	0.2801	0.2475	0.2475	0.2410	0.2605	0.2801	0.2931	0.3061 (22b)
Effective ac	0.5552	0.5530	0.5509	0.5411	0.5392	0.5306	0.5306	0.5290	0.5339	0.5392	0.5430	0.5469 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.5000	1.0000	2.5000		(26)
TER Opening Type (Uw = 1.20)			61.7600	1.1450	70.7176		(27)
Heatloss Floor 1			298.2500	0.1300	38.7725		(28a)

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External Wall 1	261.8850	64.2600	197.6250	0.1800	35.5725	(29a)
External Roof 1	300.0000		300.0000	0.1100	33.0000	(30)
Total net area of external elements Aum(A, m2)			860.1350			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		180.5626	(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E5 Ground floor (normal)	51.3500	0.1600	8.2160
E6 Intermediate floor within a dwelling	51.3500	0.0000	0.0000
E16 Corner (normal)	10.2000	0.0900	0.9180
E18 Party wall between dwellings	10.2000	0.0600	0.6120

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.7460 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 190.3086 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(38)
Heat transfer coeff	231.5399	230.6465	229.7707	225.6572	224.8876	221.3049	221.3049	220.6415	222.6849	224.8876	226.4446	228.0722	(39)
Average = Sum(39)m / 12 =	421.8485	420.9550	420.0793	415.9658	415.1962	411.6135	411.6135	410.9500	412.9935	415.1962	416.7531	418.3808	(39)
												415.9621	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP	0.8546	0.8528	0.8511	0.8427	0.8412	0.8339	0.8339	0.8326	0.8367	0.8412	0.8443	0.8476	(40)
HLP (average)												0.8427	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	(40)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.3836 (42)

Hot water usage for mixer showers	80.9520	79.7354	77.9627	74.5708	72.0677	69.2763	67.6897	69.4490	71.3776	74.3747	77.8394	80.6418	(42a)
Hot water usage for baths	34.9352	34.4164	33.6858	32.3386	31.3299	30.2113	29.6072	30.3327	31.1227	32.3195	33.6944	34.8171	(42b)
Hot water usage for other uses	49.2816	47.4895	45.6974	43.9054	42.1133	40.3213	40.3213	42.1133	43.9054	45.6974	47.4895	49.2816	(42c)
Average daily hot water use (litres/day)												151.8269	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(44)
Daily hot water use	165.1688	161.6413	157.3459	150.8148	145.5109	139.8089	137.6181	141.8950	146.4056	152.3917	159.0233	164.7405	(44)
Energy conte	261.5869	230.1751	241.8347	206.4580	195.8857	171.9114	166.4372	175.6957	180.5327	206.7940	226.5579	257.9438	(45)
Energy content (annual)										Total = Sum(45)m =		2521.8131	(45)
Distribution loss (46)m = 0.15 x (45)m	39.2380	34.5263	36.2752	30.9687	29.3829	25.7867	24.9656	26.3544	27.0799	31.0191	33.9837	38.6916	(46)

Water storage loss:
Store volume 400.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 2.5234 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.3626 (55)

Total storage loss	42.2417	38.1538	42.2417	40.8791	42.2417	40.8791	42.2417	42.2417	40.8791	42.2417	40.8791	42.2417	(56)
If cylinder contains dedicated solar storage	42.2417	38.1538	42.2417	40.8791	42.2417	40.8791	42.2417	42.2417	40.8791	42.2417	40.8791	42.2417	(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	327.0911	289.3401	307.3389	269.8490	261.3898	235.3025	231.9413	241.1998	243.9238	272.2982	289.9489	323.4479	(62)
WWHRS	-37.0079	-32.7301	-34.2730	-28.3794	-26.4486	-22.6323	-21.2141	-22.5591	-23.4162	-27.6051	-31.2733	-36.3225	(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	290.0832	256.6100	273.0658	241.4696	234.9412	212.6702	210.7272	218.6407	220.5076	244.6930	258.6757	287.1254	(64)
Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2949.2096	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
												0.0000	(64a)

Heat gains from water heating, kWh/month
139.3810 123.8652 132.8133 119.3601 117.5353 107.8734 107.7437 110.8221 110.7400 121.1623 126.0434 138.1696 (65)

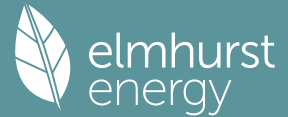
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	169.1805	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	333.3721	369.0906	333.3721	344.4845	333.3721	344.4845	333.3721	333.3721	344.4845	333.3721	344.4845	333.3721	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	601.0110	607.2476	591.5315	558.0739	515.8396	476.1454	449.6272	443.3906	459.1066	492.5643	534.7985	574.4928	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	39.9181	(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)	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	-135.3444	(71)
Water heating gains (Table 5)	187.3400	184.3232	178.5126	165.7780	157.9775	149.8242	144.8167	148.9544	153.8056	162.8526	175.0602	185.7118	(72)
Total internal gains	1198.4772	1237.4155	1180.1704	1145.0905	1083.9434	1044.2082	1001.5702	999.4713	1031.1509	1065.5431	1131.0974	1170.3309	(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	0.5000	10.6334	0.6300	0.7000	0.7700	1.6249	(74)
East	44.1300	19.6403	0.6300	0.7000	0.7700	264.8824	(76)
South	17.1300	46.7521	0.6300	0.7000	0.7700	244.7541	(78)

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Solar gains	511.2613	922.1154	1369.2266	1830.1231	2138.0321	2152.3189	2063.3503	1835.0568	1532.2070	1050.8921	622.3987	430.6710 (83)
Total gains	1709.7386	2159.5310	2549.3970	2975.2136	3221.9755	3196.5271	3064.9205	2834.5280	2563.3579	2116.4352	1753.4961	1601.0019 (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	81.2561	81.4286	81.5984	82.4053	82.5580	83.2766	83.2766	83.4111	82.9983	82.5580	82.2496	81.9296
alpha	6.4171	6.4286	6.4399	6.4937	6.5039	6.5518	6.5518	6.5607	6.5332	6.5039	6.4833	6.4620
util living area	0.9999	0.9996	0.9979	0.9863	0.9313	0.7710	0.5831	0.6506	0.9085	0.9950	0.9997	0.9999 (86)
MIT	19.7754	19.9395	20.1853	20.5172	20.8020	20.9609	20.9945	20.9893	20.8800	20.4910	20.0709	19.7525 (87)
Th 2	20.2062	20.2078	20.2093	20.2165	20.2178	20.2240	20.2240	20.2252	20.2216	20.2178	20.2151	20.2123 (88)
util rest of house	0.9999	0.9994	0.9971	0.9807	0.9035	0.6978	0.4845	0.5494	0.8612	0.9924	0.9996	0.9999 (89)
MIT 2	18.7335	18.9451	19.2612	19.6882	20.0331	20.1991	20.2220	20.2208	20.1269	19.6588	19.1194	18.7087 (90)
Living area fraction									fLA =	Living area / (4) =		0.0608 (91)
MIT	18.7968	19.0056	19.3173	19.7386	20.0798	20.2454	20.2690	20.2675	20.1726	19.7094	19.1772	18.7721 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7968	19.0056	19.3173	19.7386	20.0798	20.2454	20.2690	20.2675	20.1726	19.7094	19.1772	18.7721 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9998	0.9990	0.9957	0.9761	0.8976	0.7000	0.4903	0.5551	0.8576	0.9898	0.9993	0.9999 (94)
Useful gains	1709.3929	2157.4685	2538.4689	2903.9877	2892.0320	2237.4177	1502.7407	1573.4763	2198.3181	2094.7979	1752.2684	1600.7931 (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	6115.4626	5937.8147	5384.2922	4508.4787	3479.2764	2323.7106	1510.1952	1589.3632	2507.9646	3782.1909	5033.2091	6096.6914 (97)
Space heating kWh	3278.1158	2540.3927	2117.2925	1155.2336	436.9098	0.0000	0.0000	0.0000	0.0000	1255.4204	2362.2773	3344.9483 (98a)
Space heating requirement - total per year (kWh/year)												16490.5904
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	3278.1158	2540.3927	2117.2925	1155.2336	436.9098	0.0000	0.0000	0.0000	0.0000	1255.4204	2362.2773	3344.9483 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												16490.5904
Space heating per m2										(98c) / (4) =		33.4088 (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	3278.1158	2540.3927	2117.2925	1155.2336	436.9098	0.0000	0.0000	0.0000	0.0000	1255.4204	2362.2773	3344.9483 (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)	3551.5881	2752.3214	2293.9247	1251.6074	473.3584	0.0000	0.0000	0.0000	0.0000	1360.1521	2559.3470	3623.9960 (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	290.0832	256.6100	273.0658	241.4696	234.9412	212.6702	210.7272	218.6407	220.5076	244.6930	258.6757	287.1254 (64)
Efficiency of water heater (217)m	87.9932	87.8906	87.6705	87.1017	85.4307	79.8000	79.8000	79.8000	79.8000	87.1959	87.8224	79.8000 (216)
Fuel for water heating, kWh/month	329.6654	291.9653	311.4684	277.2273	275.0079	266.5040	264.0691	273.9858	276.3253	280.6245	294.5439	326.2222 (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	69.2681	55.5695	50.0342	36.6572	28.3150	23.1336	25.8299	33.5747	43.6103	57.2190	64.6287	71.1933 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-201.7992	-252.6498	-322.5018	-320.1493	-312.4610	-279.8152	-275.4210	-274.4933	-270.6821	-265.2892	-209.6637	-178.3568 (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	-234.8975	-472.4094	-902.2292	-1305.9186	-1692.6361	-1675.9092	-1656.9074	-1423.0803	-1070.4243	-658.8911	-307.6080	-187.5601 (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												17866.2951 (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												3467.6094 (219)
Space cooling fuel												0.0000 (221)

Electricity for pumps and fans:

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Total electricity for the above, kWh/year	86.0000 (231)
Electricity for lighting (calculated in Appendix L)	559.0336 (232)

Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-14741.7535 (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	7237.1846 (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	17866.2951	0.2100	3751.9220 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3467.6094	0.2100	728.1980 (264)
Space and water heating			4480.1199 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	559.0336	0.1443	80.6858 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3163.2823	0.1373	-434.4129
PV Unit electricity exported	-11578.4712	0.1270	-1470.5905
Total			-1905.0034 (269)
Total CO2, kg/year			2667.7316 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			5.4000 (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	17866.2951	1.1300	20188.9135 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3467.6094	1.1300	3918.3986 (278)
Space and water heating			24107.3120 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	559.0336	1.5338	857.4644 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3163.2823	1.5077	-4769.2641
PV Unit electricity exported	-11578.4712	0.4663	-5398.6188
Total			-10167.8829 (283)
Total Primary energy kWh/year			14926.9943 (286)
Target Primary Energy Rate (TPER)			30.2400 (287)