

Colne Spring Eco-Living

Energy and Sustainability Statement October 2024



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Audit Sheet

Revision	Issued for	Date	Author
0	Draft	08/10/2024	OE
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2	Revised	17/10/2024	OE
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Executive Summary

This Energy and Sustainability Statement reports how the proposed scheme at Colne Spring, Colney Heath, AL4 OPB has responded to local policy requirements regarding sustainability, energy and climate change.

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

The construction of 6x single storey and 3x double storey dwellings, a covered social hub, community garden, allotments and associated landscaping.

This assessment has been prepared in line with the requirements of St Alban's existing and draft local policy surrounding Energy and Climate Change. The scheme complies with all relevant policies contained the City and District of St Albans Local Plan (1994), St Albans Draft Local Plan (Regulation 19 Publication).

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 102% 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 I: 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	2.4	25%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide reduction	9.8	102%

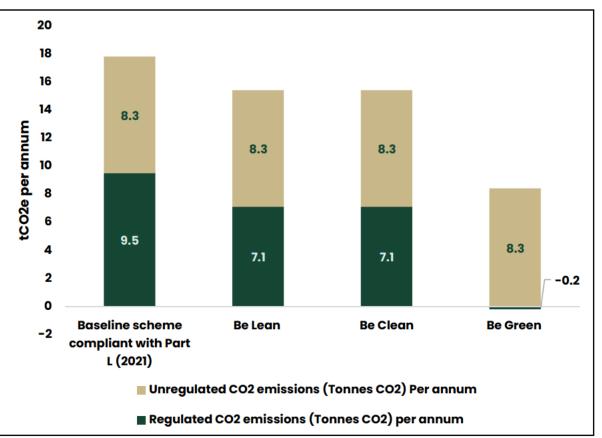


Figure I: Carbon dioxide emissions per annum at the proposed scheme having utilised the Energy Hierarchy*.

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

	Natural Gas:	0.210kgCO2/kWh
	Natural Gas.	0.210kgCO2/kvv11
-	Crid Electricity	0 126 kmc Og /WW/h

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 Colne Spring, Colney Heath, AL4 OPB. The site plan is shown in Figure 2 to the right.

The proposed development entails the construction of 6x single storey and 3x double storey dwellings, a covered social hub, community garden, allotments and associated landscaping.

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

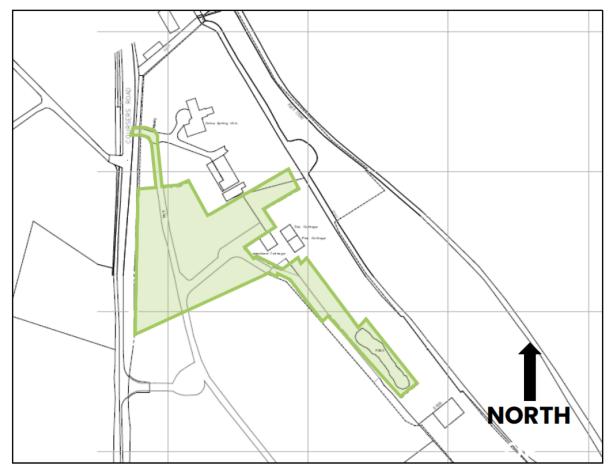


Figure 2: Proposed development location (green).



2. Overview of Policies

2.1 National Policy

The National Planning Policy Framework (NPPF) (December 2023) 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) can 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 colocating potential heat customers and suppliers.



2. Overview of Policies

2.2 St Albans District Local Plan Saved and Deleted Policies Version (July 2020)

The current adopted Local Plan in St Albans is the District Local Plan Review (1994). This is in the process of being replaced by a new Local Plan. The policies listed in the List of Saved Policies (July 2020) are the remaining operational policies that guide development in the district.

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.

2.3 St Albans District Draft Local Plan 2041

St Albans council are in the process of developing a new Local Plan. The intention of the plan is to provide a blueprint for future development in the district, whilst also helping tackle Climate Change and improve biodiversity. The Draft Local Plan is currently undergoing Regulation 19 consultation and is at the pre-submission publication stage. It is envisioned that the local plan will be adopted in March 2026.

Although the document is not currently material in the determination of planning applications, the proposed development has significant sustainability aspirations, and therefore, considering this, has made efforts to comply with draft policies relating to Energy and Sustainability contained within the Draft Local Plan. The policies deemed relevant to this energy and sustainability statement include:

- Strategic Policy SP2 Responding to the Climate Emergency
- CE1 Promoting Sustainable Design, Construction and Building Efficiency
- CE2 Renewable and Low Carbon Energy

The policies detailed above encourage and require 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.

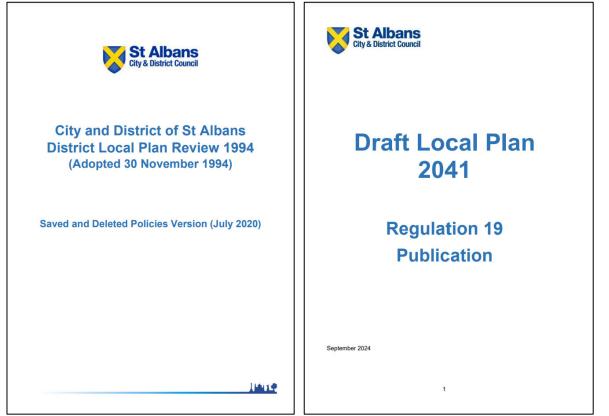


Figure 3: St Albans Local Plan (Left) and Regulation 19 Draft Local Plan (Right).



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 residential portion of 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 Create Design on the 26th September 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 4: 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 are extracted from LETI best-practice guidance. 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	0.08	W/m2K
Roof U-Value	0.10	W/m2K
External Walls U-Value	0.13	W/m2K
Glazing U-Value	0.8 (Triple Glazing)	W/m2K
Glazing G-Value	0.68 (Default)	-
Frame Factor	0.7 (Default)	-
Thermal Mass Parameter	250 (Medium)	kJ/m2K
Thermal Bridge Y- Value	<0.1 (Default)	-
Ventilation Method	Natural Ventilation	-
Other Measures	Wastewater Heat Recovery	Horizontal System (55% Efficiency)
Air Permeability	1.0 @ 50Pa (m3/(h.m2))	-

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 triple glazing will minimise heat loss through glazed areas and reduce levels of solar transmittance in warmer periods. A low air permeability for all dwellings on site has been targeted to minimise heat loss. All units will be capable of capitalising on the benefits of cross-ventilation. The site benefits from an orientation that suits sunlight and daylight access. These measures support the scheme in achieving a site wide Be Lean reduction of 25%.

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.

The scheme will benefit from high efficiency LED lighting throughout, with a minimum efficacy of 100 limens/Watt. Wastewater Heat Recovery Systems (WWHRS) are proposed to capture waste heat and reduce domestic hot water demand. Owing to the single-storey design of most of the dwellings, these systems will be horizontal, and similar units indicate efficiencies of around 55%.

4.3 Be Lean Results

The proposed scheme also has a Dwelling Fabric Energy Efficiency (DFEE) score of 38.75 kWh/m2, which exceeds the Target Fabric Energy Efficiency (TFEE) rating of 51.14 kWh/m2, representing a fabric efficiency improvement of 24% against Building Regulations Part L (2021).

The regulated CO2 savings made through the implementation of these Be Lean measures results in a **25% CO2 reduction** by comparison to the Part L compliant Baseline, or a 2.4 tonne CO2 reduction. This reduction demonstrates an excellent energy efficiency with the scheme adopting the fabric first approach, indicating exemplary performance.



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.
- Careful design of internal spaces to facilitate natural and crossventilation as much as possible at the scheme.
- External shutters will be provided to south facing elevations.
- Generous overhangs (ranging from 900mm to 1200mm) to shade windows and glazed doors from direct sunlight in summer months.
- Active cooling has been avoided in any residential application due to the increased energy consumption associated with its use.

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) <u>Heat Network Planning Database</u>.

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 only nine energy-efficient residential units, it is not envisioned that the on-site space heating and domestic hot water demand would be sufficiently large enough to warrant any form of onsite communal systems. Therefore, there are no carbon savings at this stage of the energy hierarchy.



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 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.

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 occupants needs.

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



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) for the residential units.

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 wellinsulated hot water cylinder. The space 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 2: Summary of Space Heating and Domestic I	lat Water Strategy at the De Creer	Ctaga
Table 3: Summary of Space Heating and Domestic H	101 Waler Strateav at the be Green	i slade.

Space Heating and DHW Strategy	Туре	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	~200 litres, 150 mm foam insulation

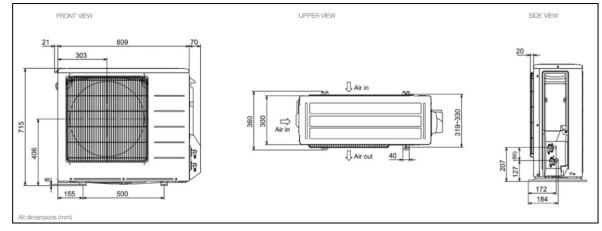


Figure 5: Dimensions of a Mitsubishi external condenser unit.

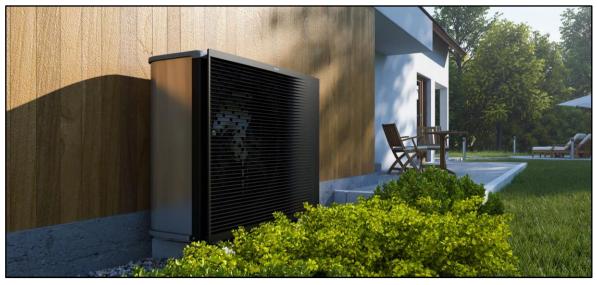


Figure 6: Indicative example of Daikin Altherma External Condenser (Source: Daikin).



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 156 PV panels to the roof area of the dwellings and the covered social hub, indicated in green in the figure to the right, achieving a total estimated annual carbon saving of approximately 2.6 tonnes CO2e.

Table 4: Summary of proposed Solar PV details.

Solar PV Detail	Quantum	Unit
Approx PV array size	275	M2
Length of individual panel	1.6	М
Width of individual panel	1.1	М
Total panel size	1.76	m2
Assumed panel power	450	Watts/panel
Inclination of panel	30	Degrees
Assumed number of panels	156	#
PV Peak power	70.2	kWp
Total CO2 savings (p/a)	2.6	tCO2



Figure 7: Space allocated for Solar PV (green).



6.5 Be Green Results

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

- Individual Air Source Heat Pumps
- Solar Photovoltaic Panels (PV) (70 kWp)

The proposed development achieves a CO2 reduction of 77% at the be green stage of the energy hierarchy, bringing the total CO2 reduction to 102%, demonstrating Net-Zero from an operational regulated carbon perspective, highlighting the sustainability credentials of the scheme. Table 15 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	2.4	25%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide reduction	9.8	102%

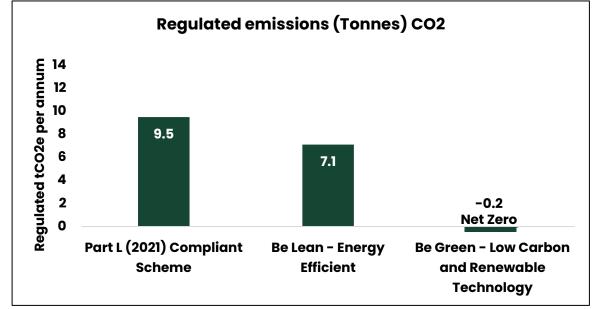


Figure 8: Be Green regulated carbon savings.



7. Site Wide Carbon Reduction Summary

The proposed energy strategy follows the energy hierarchy as stipulated in local policy.

The scheme has adopted the Energy Hierarchy, achieving a 25% 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 77% carbon reduction.

The scheme achieves an overall **on-site regulated CO2 reduction of 102%**, 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	9.5	8.3
After application of Energy Hierarchy at Colne Spring (Proposed Scheme)	-0.2	8.3

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	2.4	25%
Be Clean – Savings from district energy	0.0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide emission savings at Colne Spring	9.8	102%

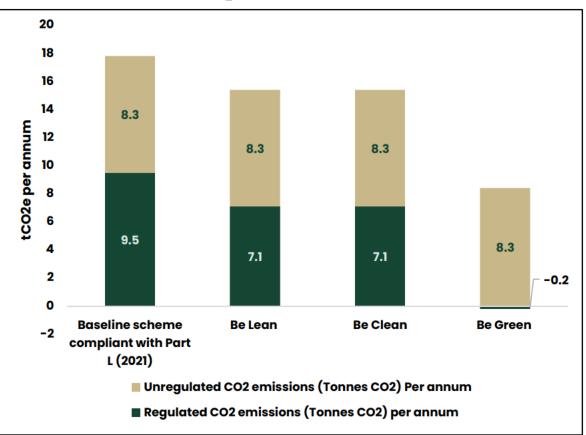


Figure 9: Carbon emissions summary of the proposed scheme across each stage of the energy hierarchy.



8. Sustainability

8.1 Sustainability Summary

Sustainability is a core focal point of the design which constitutes the construction of energy efficient dwellings. The scheme's target is to meet or exceed the required carbon reduction target, 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 Pumps 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 units, and to improve sound insulation between dwellings and external noise sources.

All buildings will be capable of using passive ventilation methods to ensure a constant and fresh flow of air. Cross ventilation has been maximised in accordance with best practice to reduce overheating risk in hotter periods.

8.4 Energy

The proposed scheme demonstrates a carbon reduction that equates to a 9.8 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 units, 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 units.

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. Several bus stops are approximately 600m to the north-east of the site along Tollgate Road, providing frequent connections to bus routes 200, 230, 305, 312, 355 and 356. These services offer connections between Birchwood, Potters Bar, Forty Hill, Welwyn Garden City and Bush Hill Park. In addition, a site shuttle bus will be provided free of use to residents to London Colney Fields (or shopping areas), along with zip cars on-site to reduce the need for private vehicle travel.



8. Sustainability

8.5 Transport Continued

St Albans Railway and Hatfield Railway station are equally located approximately 6km to the site, equating to a 30-minute cycle. Hatfield is served by the Great Northen and Thameslink lines, and St Albans is also served by Thameslink services. Therefore, residents have a reasonable public transport accessibility from the site.

To promote active travel, the site will be bike and pedestrian friendly, with pedestrian accesses and dropped kerbs provided with tactile paving for the internal road network. Cycle Storage spaces will also be provided to all dwellings accommodating 4x bicycles per dwelling. In accordance with Part S of Building Regulations electric Vehicle charging infrastructure will also be incorporated as part of the scheme. 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 110 litres per person per day, as required by Building Regulations Part G.

Water use will be reduced as much as possible, primarily through the specification of efficient sanitary ware and 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 pre-commencement works for the proposed development. 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. Residents will be requested to separate and recycle their waste in dedicated recycling containers provided to each dwelling accordingly.

8.8 Flood Risk

The scheme is situated within flood Zone I, meaning the site has a low risk of fluvial flooding. <u>https://flood-map-for-planning</u>. service.gov.uk/location



Figure 10 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.

To minimise the embodied carbon footprint of the scheme, a timber frame wall and roof structure are currently proposed, to benefit from the use of a regenerative material that contains sequestered carbon. All roofs and external cladding to the second stories (where applicable) will be made cladded in zinc, which is an abundant material, light weight has a long life-span. It can also easily be recycled at the end of its life. Circular economy principles will be adopted and any waste arising from the pre-commencement works will be assessed for practicability of reusing the waste in the new scheme. The walls of the single storey dwellings will be cladded in timber, predominantly larch, which will be sourced from the site. On-site sourcing will support in reducing emissions associated with transportation. Where possible, all materials will be locally sourced and be from either recycled or reclaimed sources.



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 will exceed the 10% Biodiversity Net Gain (BNG) Requirement, demonstrating the improvements to local wildlife and fauna.

An allotment is proposed for the development for use by residents. This will also increase biodiversity, as well as providing locally grown food.

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 draft local policy. The proposed scheme will benefit from:

- Reduced carbon dioxide emissions to provide net-zero carbon regulated dwellings, exceeding all regulatory recommendations.
- No nitrogen oxide emissions from the energy strategy.
- Low flow water appliances.
- 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 BNG improvement.
- Creation of an allotment for residents to grow their own fruit and vegetables.
- Low embodied carbon structures.
- Minimising waste arising from construction and occupation through adoption of circular economy principles.



9. Conclusion

An Energy and Sustainability Statement has been undertaken to demonstrate how the proposed scheme at Colne Spring, Colney Heath, AL4 OPB, has responded to local policy requirements regarding sustainability, energy and climate change.

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

The construction of 6x single storey and 3x double storey dwellings, a covered social hub, community garden, allotments and associated landscaping.

This assessment has been prepared in line with the requirements of St Alban's existing and draft local policy surrounding Energy and Climate Change. The scheme complies with all relevant policies contained the City and District of St Albans Local Plan (1994), St Albans Draft Local Plan (Regulation 19 Publication).

All buildings at the site will benefit from significant passive design and energy efficiency improvements, including an improved building fabric, beyond requirements of Part L (2021), Wastewater Heat Recovery Systems (WWHRS) 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 each dwelling and the covered social hub, to maximise onsite 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 102**% **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 8 Percentage of carbon dioxide reductions achieved at each stage of the energy hierarchy.

	Regulated domestic carbon diox	ide emissions
	Tonnes CO2 saving per annum	% Reduction
Be Lean – Savings from demand reduction	2.4	25%
Be Clean – Savings from district energy	0	0%
Be Green – Savings from renewable energy	7.4	77%
Total regulated carbon dioxide reduction	9.8	102%

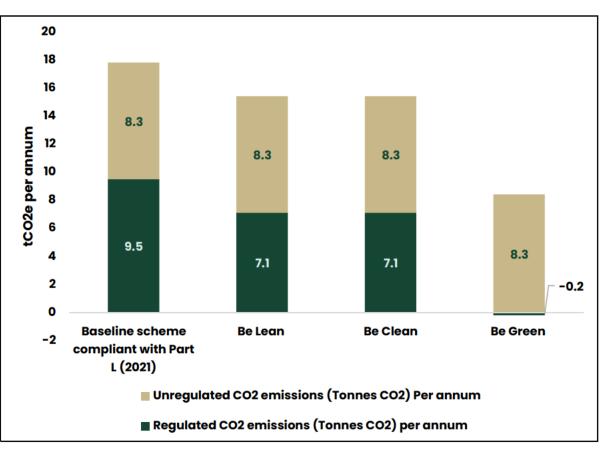


Figure 11 Carbon dioxide emissions per annum at the proposed scheme having utilised the Energy Hierarchy*.

*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 – SAP Worksheets



Property Reference	ce	Ту	pe A_Lean							Issued on Da	te	23/10/2024	
Assessment Refe	rence		001					Prop Type R	ef				
Property													
SAP Rating							DER	40		TER		0.70	
					85 B			13	93	IEK		9.73	
Environmental					88 B		% DER < TER			TEEE		-43.17	
CO ₂ Emissions (t/)					1.13		DFEE	37	.04	TFEE		47.06	
Compliance Check	ĸ				See BREL		% DFEE < TFE	77	22	TPER		21.28	
% DPER < IPER					-47.31		DPER	<u> </u>	22	IPER		52.42	
Assessor Details		Mr. Olive	er Eggenton							Asses	sor ID	AQ01-00	01
Client													
SAP 10 WORKSHEET CALCULATION OF D						7 2022)							
1. Overall dwell	ing charac	teristics						Area	C+	av haisht		Volume	
Ground floor								(m2) 92.9000		ey height (m) 3 0000	(2b) =	(m3)	(1b) - (3
Total floor area	a TFA = (la	1) + (1b) + (1c	:)+(ld)+(le)	(ln)	9	92.9000							(4)
Dwelling volume								(3a)+(3b)+(3c)·	+(3d)+(3e).	(3n) =	278.7000	(5)
2. Ventilation r	ate												
											I	n3 per hour	
Number of open o Number of open f											0 * 80 = 0 * 20 =		
Number of chimne	eys / flues			fire							0 * 10 =	0.0000	(6C)
Number of flues Number of flues	attached t	o other he									0 * 20 = 0 * 35 =	0.0000 0.0000	(6e)
Number of blocke Number of interm												0.0000 20.0000	(7a)
Number of passiv Number of fluele		es									0 * 10 = 0 * 40 =	0.0000	
	guo 111											es per hour	(10)
Infiltration due	to chimne	ys, flues	and fans	= (6a)+(6b))+(6c)+(6d)+	(6e)+(6f)+	(6g) + (7a) + (7	7b)+(7c) =			/ (5) =	0.0718	(8)
Pressure test Pressure Test Me	thod										I	Yes Blower Door	
Measured/design Infiltration rat												3.0000 0.2218	
Number of sides	sheltered												(19)
Shelter factor Infiltration rat	e adjusted	to includ	a shaltan f	factor					(20) = 1 -	[0.075 x 1) = (18) 2		1.0000	
Inilitration rat	e adjusted	to includ	e snerter i	actor					(2.	r) = (18) 3	(20) =	0.2218	(21)
Wind speed Wind factor	1.2750		Mar 4.9000 1.2250		May 4.3000 1.0750			Aug 3.7000 0.9250		Oct 4.3000 1.0750		4.7000	
Adj infilt rate Effective ac	0.2827		0.2717 0.5369		0.2384			0.2051 0.5210	0.2218	0.2384			
3. Heat losses a	and heat lo	ss paramet	er										
Element				Gross		Ne	tArea	U-value	AxU	U K-	-value	A x K	
Mindow (Uw = 0.8	30)			m2	m2	21	.9000	w/m2K 0.7752	W/1 16.976	л. "А	cJ/m2K	kJ/K	(27)
Door Heatloss Floor 1						2 92	.5000	1.0000 0.0800	A x 0 W/I 16.976' 2.5000 7.4320 13.4030	0 D 20	0.0000	1858.0000 15465.0000	(26) (28a)
External Wall 1 External Roof 1				127.5000 92.9000	24.4000	200		0.1300 0.1000	201100		0.0000	15465.0000 0.0000	(29a) (30)
fotal net area o Tabric heat loss	of external						.3000		= 49.601				(31) (33)
leat capacity Cm							,20,((30) + (32)		(32=) -	17323 0000	
Thermal mass par	ameter (TM	1P = Cm / T						(20)	(30) + (32)	, + (32d)	(326) =	186.4693	(35)
Thermal bridges Point Thermal br	idges	ned value	0.050 * tot	ai exposed	area)						(36a) =	15.6650	
Cotal fabric hea	at loss								(33	3) + (36) +	⊦ (36a) =	65.2667	(37)
Ventilation heat			thly (38)m Mar			Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	49.6618				48.5989	48.0265		47.9205		48.5989		49.1078	(38)
1	14.9286		114.6459	113.9886	113.8657	113.2932	113.2932	113.1872	113.5137	113.8657	114.1144		
Average = Sum(39	9)m / 12 =											113.9881	



HLP	Jan 1.2371	Feb 1.2356	Mar 1.2341	Apr 1.2270	May 1.2257	Jun 1.2195	Jul 1.2195	Aug 1.2184	Sep 1.2219	Oct 1.2257	Nov 1.2284	Dec 1.2312	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.2270 31	
4. Water heat)									
Assumed occup Hot water usa	ge for mixer		66 0004	60 A465	<1 01 CO	50.0410	57 5010	F.0. 0007	co. 700.c	c2 270c	66 00 7 5	2.6634	
Hot water usa	68.8757 ge for baths 29.7420		66.3324 28.6783	63.4465 27.5314	61.3168 26.6726	58.9418 25.7204	57.5919	59.0887	60.7296	63.2796 27.5152	66.2275	68.6118 29.6415	
Hot water usa Average daily	ge for other 41.9056	uses 40.3817	38.8579	37.3341	35.8102	34.2864	25.2060 34.2864	25.8237 35.8102	26.4962 37.3341	38.8579	28.6857 40.3817	41.9056 129.1727	(42c)
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wat Energy conte Energy conten	140.5233 222.5546	137.5227 195.8305	133.8686 205.7510	128.3120 175.6527	123.7997 166.6581	118.9486 146.2611	117.0843 141.6033	120.7226 149.4798	124.5599 153.5948	129.6527 175.9375 Total = S	135.2949 192.7524 um(45)m =	140.1589 219.4550 2145.5309	
Distribution	33.3832	= 0.15 x (29.3746	45)m 30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28,9129	32.9182	(46)
	cturer decla factor from	Table 2b	actor is kn	own (kWh/d	lay):							200.0000 1.5000 0.5400	(48) (49)
Enter (49) or Total storage	loss		25 1100	24 2000	25 1100	24, 2000	25 1100	25 1100	24, 2000	25 1100	24, 2000	0.8100	
If cylinder c	25.1100 ontains dedi 25.1100	22.6800 cated sola 22.6800	25.1100 r storage 25.1100	24.3000 24.3000	25.1100 25.1100	24.3000 24.3000	25.1100 25.1100	25.1100 25.1100	24.3000 24.3000	25.1100 25.1100	24.3000 24.3000	25.1100 25.1100	
Primary loss Combi loss	23.2624	21.0112	23.2624	22.5120 0.0000	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat re	quired for w 270.9270	ater heati 239.5217	ng calculat 254.1234	222.4647	215.0305	193.0731	189.9757	197.8522	200.4068	224.3099	239.5644	267.8274	(62)
WWHRS PV diverter	0.0000	-43.3281 0.0000	-45.3707	-37.5688	-35.0127 0.0000	-29.9606	-28.0833 0.0000	-29.8638	-30.9984 0.0000	-36.5437 0.0000	-41.3996 0.0000	-48.0839 0.0000	(63b)
Solar input 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	
Output from w	221.9359 ear (kWh/yea		208.7527	184.8959	180.0178	163.1125	161.8923		169.4083 er year (kW	187.7662 h/year) = S	198.1648 um(64)m =	219.7435 2259.8720 2260	(64)
Electric show	er(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	
Heat gains fr	om water hea 112.6973			95.8541	al Energy u: 94.1118	86.0814	85.7810	88.4000	88.5199		n(64a)m = 101.5398	0.0000	
5. Internal g	ains (see Ta												
Metabolic gai			Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m Lighting gain	s (calculate	d in Appen	dix L, equa	tion L9 or		see Table 5		133.1685	133.1685	133.1685	133.1685	133.1685	
Appliances ga	ins (calcula	ted in App	endix L, eq	uation L13		lso see Tab	le 5	123.7361	127.8606	123.7361	127.8606	123.7361	
Cooking gains	(calculated	in Append		ion L15 or				180.2397 36.3169	186.6284 36.3169	200.2290 36.3169	217.3974 36.3169	233.5332 36.3169	
Pumps, fans Losses e.g. e	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	
Water heating	-106.5348	-106.5348			-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	-106.5348	(71)
Total interna	l gains				126.4943								
	585.4745	598.7009	574.1114	553.8008	525.8715	503.9234	484.7586	485.7436	500.3838	520.5570	552.2360	573.3095	(73)
6. Solar gain													
[Jan]			A	rea m2	Solar flux Table 6a	Speci	g fic data	Specific	FF data le 6c	Acce fact	ss or	Gains W	
					W/m2	or	Table 6b	or lab	TE OC	Table	bu		
North South West			7.3 13.7 0.9	000 000 000	10.6334 46.7521 19.6403		0.6800 0.6800 0.6800	0 0 0				25.6056 211.2815 5.8308	(78)
North South West	242.7180	406.3647	7.3 13.7 0.9 542.7089	000 000 000 659.1271	10.6334 46.7521 19.6403 732.6177	726.5644	0.6800 0.6800 0.6800 700.6722	0 0 0 0 644.8133	.7000 .7000 .7000 582.2613	0.77 0.77 0.77 445.0038	289.2988	211.2815 5.8308 208.7078	(78) (80) (83)
North South West Solar gains Total gains 7. Mean inter	242.7180 828.1925 nal temperat	406.3647 1005.0656 	7.3 13.7 0.9 542.7089 1116.8203	000 000 659.1271 1212.9279	10.6334 46.7521 19.6403 732.6177 1258.4891	726.5644 1230.4878	0.6800 0.6800 0.6800 700.6722 1185.4308	0 0 0 644.8133 1130.5569	.7000 .7000 .7000 582.2613	0.77 0.77 0.77 445.0038	289.2988	211.2815 5.8308 208.7078	(78) (80) (83)
North South West Solar gains Total gains 7. Mean inter Temperature d	242.7180 828.1925 nal temperat	406.3647 1005.0656 ure (heati g periods	7.3 13.7 0.9 542.7089 1116.8203 ng season) in the livi	000 000 659.1271 1212.9279	10.6334 46.7521 19.6403 732.6177 1258.4891	726.5644 1230.4878	0.6800 0.6800 0.6800 700.6722 1185.4308	0 0 0 644.8133 1130.5569	.7000 .7000 .7000 582.2613	0.77 0.77 0.77 445.0038	289.2988	211.2815 5.8308 208.7078	(78) (80) (83) (84)
North South West Solar gains Total gains 7. Mean inter	242.7180 828.1925 nal temperat uring heatin actor for ga Jan	406.3647 1005.0656 ure (heati g periods ins for li Feb	7.3 13.7 0.9 542.7089 1116.8203 ng season) in the livi ving area, Mar	000 000 659.1271 1212.9279 ng area fro nil,m (see Apr	10.6334 46.7521 19.6403 732.6177 1258.4891 0m Table 9, Table 9, Table 9, May	726.5644 1230.4878 Th1 (C) Jun	0.6800 0.6800 0.6800 700.6722 1185.4308	0 0 644.8133 1130.5569 Aug	.7000 .7000 .7000 582.2613 1082.6451	0.77 0.77 0.77 445.0038 965.5607	00 00 289.2988 841.5349 Nov 42.1677	211.2815 5.8308 208.7078 782.0173 21.0000 Dec	(78) (80) (83) (84) (85)
North South West 	242.7180 828.1925 nal temperat uring heatin actor for ga Jan 41.8690 3.7913 rea	406.3647 1005.0656 ure (heati g periods ins for li Feb 41.9211 3.7947	7.3 13.7 0.9 542.7089 1116.8203 ng season) in the livi ving area, Mar 41.9722 3.7981	000 000 659.1271 1212.9279 ng area fro nil,m (see Apr 42.2142 3.8143	10.6334 46.7521 19.6403 732.6177 1258.4891 0m Table 9, Table 9a) May 42.2598 3.8173	726.5644 1230.4878 Th1 (C) Jun 42.4734 3.8316	0.6800 0.6800 0.6800 700.6722 1185.4308 Jul 42.4734 3.8316	0 0 0 644.8133 1130.5569 Aug 42.5131 3.8342	.7000 .7000 .7000 582.2613 1082.6451 Sep 42.3909 3.8261	0.77 0.77 0.77 445.0038 965.5607 0ct 42.2598 3.8173	Nov 42.1677 3.812	211.2815 5.8308 208.7078 782.0173 21.0000 Dec 42.0718 3.8048	(78) (80) (83) (84) (85)
North South West 	242.7180 828.1925 nal temperat uring heatin actor for ga Jan 41.8690 3.7913 rea 0.9761	406.3647 1005.0656 ure (heati g periods ins for li Feb 41.9211 3.7947 0.9522	7.3 13.7 0.9 542.7089 1116.8203 inthe livio ving season) in the livio ving area, Mar 41.9722 3.7981 0.9149	000 000 659.1271 1212.9279 ng area fro nil,m (see Apr 42.2142 3.8143 0.8399	10.6334 46.7521 19.6403 732.6177 1258.4891 0m Table 9, Table 9a) May 42.2598 3.8173 0.7192	726.5644 1230.4878 Th1 (C) Jun 42.4734 3.8316 0.5547	0.6800 0.6800 0.6800 700.6722 1185.4308 Jul 42.4734 3.8316 0.4116	0 0 0 644.8133 1130.5569 Aug 42.5131 3.8342 0.4475	.7000 .7000 .7000 582.2613 1082.6451 082.6451 Sep 42.3909 3.8261 0.6501	0.77 0.77 0.77 445.0038 965.5607 0ct 42.2598 3.8173 0.8647	Nov 42.1677 3.8112 0.9560	211.2815 5.8308 208.7078 782.0173 21.0000 Dec 42.0718 3.8048 0.9803	(78) (80) (83) (84) (85) (85)
North South West 	242.7180 828.1925 nal temperat uring heatin actor for ga Jan 41.8690 3.7913 rea 0.9761 19.4271 19.8904	406.3647 1005.0656 ure (heati g periods ins for li Feb 41.9211 3.7947 0.9522 19.7380	7.3 13.7 0.9 542.7089 1116.8203 ng season) in the livi ving area, Mar 41.9722 3.7981 0.9149 20.0925	000 000 659.1271 1212.9279 ng area frc nil,m (see Apr 42.2142 3.8143 0.8399 20.4884	10.6334 46.7521 19.6403 732.6177 1258.4891 0m Table 9, Table 9a) May 42.2598 3.8173	726.5644 1230.4878 Th1 (C) Jun 42.4734 3.8316 0.5547 20.9395	0.6800 0.6800 0.6800 700.6722 1185.4308 Jul 42.4734 3.8316 0.4116 20.9849	0 0 0 644.8133 1130.5569 Aug 42.5131 3.8342 0.4475 20.9791	.7000 .7000 .7000 582.2613 1082.6451 Sep 42.3909 3.8261 0.6501 20.8872	0.77 0.77 0.77 445.0038 965.5607 0ct 42.2598 3.8173 0.8647	Nov 42.1677 3.8112 0.9560 19.8911	211.2815 5.8308 208.7078 782.0173 21.0000 Dec 42.0718 3.8048 0.9803 19.3627	(78) (80) (83) (84) (85) (85) (86) (87)
North South West 	242.7180 828.1925 nal temperat Jan 41.8690 3.7913 rea 0.9761 19.4271 19.8904 house	406.3647 1005.0656 ure (heati g periods ins for li Feb 41.9211 3.7947 0.9522 19.7380	7.3 13.7 0.9 542.7089 1116.8203 ng season) in the livi ving area, Mar 41.9722 3.7981 0.9149 20.0925 19.8928	000 000 659.1271 1212.9279 ng area fro nil,m (see Apr 42.2142 3.8143 0.8399 20.4884 19.8985	10.6334 46.7521 19.6403 732.6177 1258.4891 m Table 9, Table 9a) May 42.2598 3.8173 0.7192 20.7816	726.5644 1230.4878 Th1 (C) Jun 42.4734 3.8316 0.5547 20.9395 19.9044	0.6800 0.6800 0.6800 700.6722 1185.4308 Jul 42.4734 3.8316 0.4116 20.9849 19.9044	0 0 0 644.8133 1130.5569 Aug 42.5131 3.8342 0.4475 20.9791	.7000 .7000 .7000 582.2613 1082.6451 42.3909 3.8261 0.6501 20.8872 19.9025	0.77 0.77 0.77 445.0038 965.5607 0ct 42.2598 3.8173 0.8647 20.5042	Nov 42.1677 3.8112 0.9560 19.8911 19.8974	211.2815 5.8308 208.7078 782.0173 21.0000 Dec 42.0718 3.8048 0.9803 19.3627	(78) (80) (83) (84) (85) (85) (86) (87) (88)

19.3939

19.7154

19.8673

19.8988

19.8968

19.8253

19.4258

18.0952

18.4839

18.9207

MIT 2



18.0174 (90)

18.6854

.3117 18.6878 ment .1617 18.5378 equirement 	Mar 0.8764 978.7945 6.5000 1428.6226 334.6721 per year (km 0 0.000 per year (km 0 334.6721 lar contribu	175.5452 Th/year) 0.0000 WTh/year) 175.5452	19.8887 19.7387 May 0.6523 820.9406 11.7000 915.3314 70.2268 0.0000 70.2268	20.0415 19.8915 Jun 0.4708 579.3192 14.6000 599.4954 0.0000 0.0000	20.0753 19.9253 Jul 0.3151 373.5411 16.6000 376.7337 0.0000	20.0727 19.9227 Aug 0.3485 393.9484 16.4000 398.7257	19.9979 19.8479 0.5649 611.5645 14.1000 652.4620	Living area 19.6010 19.4510 0ct 0.8090 0.8090 0.81.1780 10.6000	18.8814 18.7314 Nov 0.9274 780.4800 7.1000	0.1625 18.2361 -0.1500 18.0861 Dec 0.9646 754.3018 4.2000	(92) (93) (94) (95)
.1617 18.5378 equirement an Feb .5500 0.9243 .3849 929.0256 .3000 4.9000 .1083 1565.4229 .9942 427.6590 irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after sc m2 ments - Individu heat from second heat from second heat from second heat from second space heating s space heating s	Mar 0.8764 978.7945 6.5000 1428.6226 334.6721 per year (kw 0.0000 per year (kw 334.6721 lar contribu	Apr 0.7878 955.5533 8.9000 1199.3661 175.5452 h/year) 0.0000 Wh/year) 175.5452	May 0.6523 820.9406 11.7000 915.3314 70.2268 0.0000 70.2268	Jun 0.4708 579.3192 14.6000 599.4954 0.0000	Jul 0.3151 373.5411 16.6000 376.7337	Aug 0.3485 393.9484 16.4000 398.7257	Sep 0.5649 611.5645 14.1000	Oct 0.8090 781.1780 10.6000	Nov 0.9274 780.4800 7.1000	18.0861 Dec 0.9646 754.3018	(93) (94) (95)
an Feb .9580 0.9243 .3849 929.0256 .3000 4.9000 .1083 1565.4229 .9942 427.6590 irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after so m2 ments - Individu heat from main s space heating s space heating s	0.8764 978.7945 6.5000 1428.6226 334.6721 per year (k% 0.0000 per year (k% 334.6721 lar contribu	0.7878 955.5533 8.9000 1199.3661 175.5452 Th/year) 0.0000 Wh/year) 175.5452	0.6523 820.9406 11.7000 915.3314 70.2268 0.0000 70.2268	0.4708 579.3192 14.6000 599.4954 0.0000	0.3151 373.5411 16.6000 376.7337	0.3485 393.9484 16.4000 398.7257	0.5649 611.5645 14.1000	0.8090 781.1780 10.6000	0.9274 780.4800 7.1000	0.9646 754.3018	(95)
an Feb .9580 0.9243 .3849 929.0256 .3000 4.9000 .1083 1565.4229 .9942 427.6590 irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after so m2 ments - Individu heat from main s space heating s space heating s	0.8764 978.7945 6.5000 1428.6226 334.6721 per year (k% 0.0000 per year (k% 334.6721 lar contribu	0.7878 955.5533 8.9000 1199.3661 175.5452 Th/year) 0.0000 Wh/year) 175.5452	0.6523 820.9406 11.7000 915.3314 70.2268 0.0000 70.2268	0.4708 579.3192 14.6000 599.4954 0.0000	0.3151 373.5411 16.6000 376.7337	0.3485 393.9484 16.4000 398.7257	0.5649 611.5645 14.1000	0.8090 781.1780 10.6000	0.9274 780.4800 7.1000	0.9646 754.3018	(95)
.9580 0.9243 .3849 929.0256 .3000 4.9000 .1083 1565.4229 .9942 427.6590 irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after sc m2 ments - Individu heat from second heat from second heat from second space heating s space heating s	0.8764 978.7945 6.5000 1428.6226 334.6721 per year (k% 0.0000 per year (k% 334.6721 lar contribu	0.7878 955.5533 8.9000 1199.3661 175.5452 Th/year) 0.0000 Wh/year) 175.5452	0.6523 820.9406 11.7000 915.3314 70.2268 0.0000 70.2268	0.4708 579.3192 14.6000 599.4954 0.0000	0.3151 373.5411 16.6000 376.7337	0.3485 393.9484 16.4000 398.7257	0.5649 611.5645 14.1000	0.8090 781.1780 10.6000	0.9274 780.4800 7.1000	0.9646 754.3018	(95)
.3849 929.0256 .3000 4.9000 .1083 1565.4229 .9942 427.6590 irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after sc m2 ments - Individu heat from second heat from second heat from second space heating s space heating s	978.7945 6.5000 1428.6226 334.6721 per year (km 0.0000 per year (km 334.6721 lar contribu	955.5533 8.9000 1199.3661 175.5452 Jh/year) 0.0000 Wh/year) 175.5452	820.9406 11.7000 915.3314 70.2268 0.0000 70.2268	579.3192 14.6000 599.4954 0.0000	373.5411 16.6000 376.7337	393.9484 16.4000 398.7257	611.5645 14.1000	781.1780 10.6000	780.4800 7.1000	754.3018	(95)
.9942 427.6590 irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after so m2 ments - Individu heat from main s space heating s space heating s	334.6721 per year (KW 0.0000 per year (k 334.6721 lar contribu	175.5452 Th/year) 0.0000 WTh/year) 175.5452	70.2268 0.0000 70.2268	0.0000			652.4620	1007 8307			(30)
irement - total .0000 0.0000 ribution - total .9942 427.6590 irement after so m2 ments - Individu heat from second heat from main s space heating s space heating s	per year (kW 0.0000 per year (k 334.6721 lar contribu	Nh/year) 0.0000 Wh/year) 175.5452	0.0000		0.0000			1007.0007	1327.3081	1588.2131	(97)
ribution - total .9942 427.6590 irement after so m2 ments - Individu heat from second heat from main s space heating s space heating s	. per year (k 334.6721 lar contribu lar heating s	Wh/year) 175.5452	70.2268	0.0000		0.0000	0.0000	168.6296	393.7162	620.4300 2785.8730	(98a
irement after so m2 ments - Individu heat from second heat from main s space heating s space heating s	lar contribu				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
heat from second heat from main s space heating s space heating s				0.0000 (kWh/year)	0.0000	0.0000	0.0000	168.6296 (98c)	393.7162) / (4) =	620.4300 2785.8730 29.9879	
heat from second heat from main s space heating s space heating s											
heat from main s space heating s space heating s	lary/suppleme										
space heating s	ystem(s)		n (Table 11	L)						0.0000 1.0000	(202
	ystem 2 (in	응)								84.5000 0.0000 0.0000	(207
an Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
irement .9942 427.6590		175.5452	70.2268	0.0000	0.0000	0.0000	0.0000	168.6296	393.7162	620.4300	(98)
ciency (main hea .5000 84.5000	84.5000	1) 84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(21)
(main heating s .1351 506.1053	396.0617	207.7458	83.1086	0.0000	0.0000	0.0000	0.0000	199.5616	465.9363	734.2367	(21
ciency (main hea .0000 0.0000 (main heating s	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(21
.0000 0.0000 (secondary)		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(21
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219
irement 9359 196 1936	208 7527	184 8050	180 0178	163 1125	161 9023	167 0995	169 4083	197 7662	109 1649	210 7425	(64)
r heater										89.5000	(21)
ting, kWh/month											
requirement					0.0000	0.0000					
.3041 6.5973	7.3041	7.0685	7.3041 9.7792	7.0685	7.3041 8.9209	7.3041 11.5957	7.0685	7.3041 19.7618	7.0685	7.3041 24.5881	(23)
ted by PVs (Appe	ndix M) (neg	ative quanti 0.0000	.ty) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23:
		lix M) (negat 0.0000	ive quanti: 0.0000	ity) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234
.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23
.0000 0.0000	0.0000	0.0000	0.0000		ve if net ge 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(23
.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23
.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23)
.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(23
.0000 0.0000					ve if net ge 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(23
- main system 1										3296.8912	
 secondary 										0.0000	(21
used										89.5000 2674.4048 0.0000	(21
mps and fans:											
		lix L)								41.0000 45.0000 86.0000 193.0741	(23 (23
ration technolog	jies (Appendi	ices M ,N and	i Q)							0.0000	122
										0.0000	(234
	(Appendix N)									0.0000 0.0000	
i.r.tt.t.r.t.t.r.y r m ufg	rement 9359 196.1936 :heater 5000 84.5000 ing, kWh/month 6461 232.1818 requirement 0000 0.0000 3041 6.5973 9232 19.1921 ed by PV3 (Appe 0000 0.0000 ed by hydro-ele 0000 0.0000 in et electricit 0000 0.0000 ed by PV5 (Appe 0000 0.0000 ed by hydro-ele 0000 0.0000 ed by hydro-ele 0000 0.0000 ed by hydro-ele 0000 0.0000 ed by hydro-ele 0000 0.0000 er et electricit - main system 1 - main system 2 - secondary : heater used mps and fans: pump te fan for the above, k hting (calculat cation technolog	rement 9359 196.1936 208.7527 :heater 5000 84.5000 84.5000 ing, KWh/month 6461 232.1818 247.0446 requirement 0000 0.0000 0.0000 3041 6.5973 7.3041 9232 19.1921 17.2804 wed by PVS (Appendix M) (neg 0000 0.0000 0.0000 .ed by wind turbines (Append 0000 0.0000 0.0000 cod by PVS (Appendix M) (neg 0000 0.0000 0.0000 cod by hydro-electric generated 0000 0.0000 0.0000 cod by hydro-electric generated cod by hydro-electric generated	<pre>rement 9359 196.1936 208.7527 184.8959 :heater 5000 84.5000 84.5000 84.5000 ing, KWh/month 6461 232.1818 247.0446 218.8118 requirement 0000 0.0000 0.0000 0.0000 9232 19.1921 17.2804 12.6603 9232 19.1921 17.2804 12.6603 9232 19.1921 17.2804 12.6603 0000 0.0000 0.0000 0.0000 ied by Wind turbines (Appendix M) (negative quanti 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ied by hydro-electric generators (Append 0000 0.0000 0.0000 0.0000 ied by Wind turbines (Appendix M) (negative quanti M) (negative 0000 0.0000 0.0000 0.0000 ied by Ydro-electric generators (Append 0000 0.0000 0.0000 0.0000 ied by hydro-electric generators (Append 0000 0.0000 0.0000 0.0000 ied by hydro-electric generators (Append 0000 0.0000 0.0000 0.0000 ied by hydro-electric generators (Append 0000 0.0000 0.0000 0.0000 ied be hydro-electric generators (Append 0000 0.0000 0.0000 0.0000 ied by hydro-electric generators (Append ied by hydro-electric generator</pre>	<pre>.rement 9359 196.1936 208.7527 184.8959 180.0178 :heater 5000 84.5000 84.5000 84.5000 84.5000 ing, KWh/month 6461 232.1818 247.0446 218.8118 213.0388 requirement 0000 0.0000 0.0000 0.0000 0.0000 3041 6.5973 7.3041 7.0685 7.3041 9232 19.1921 17.2804 12.6603 9.7792 edb yFVs (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 edby wind turbines (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 c. net electricity generators (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 ed by PVs (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 edby ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 edby hydro-electric generators (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 edby hydro-electric generators (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 edby hydro-electric generators (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 edby hydro-electric generators (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 edby hydro-electric generators (Appendix M) (negative guantity) 0000 0.0000 0.0000 0.0000 0.0000 edby hydro-electric generators (Appendix M) (negative guantity) edby hydro-electric generators (Appendix M) (negative guantity) effan for the above, kWh/year hhting (calculated in Appendix L) eation technologies (Appendices M ,N and Q) eration (Appendix N)</pre>	<pre>rement 9359 196.1936 208.7527 184.8959 180.0178 163.1125 heater 5000 84.5000 84.5000 84.5000 84.5000 84.5000 ing, KWh/month 6461 232.1818 247.0446 218.8118 213.0388 193.0325 requirement 0000 0.0000 0.0000 0.0000 0.0000 0.0000 3041 6.5973 7.3041 7.0685 7.3041 7.0685 9232 19.1921 17.2804 12.6603 9.7792 7.9897 wed by FVs (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 wed by hydro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. net electricity generated by micro-CHP (Appendix N) (negative 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by PVs (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ced by ind turbines (Appendix L) cation technologies (Appendices M, N and Q) eration (Appendix N)</pre>	<pre>rement 9359 196.1936 208.7527 184.8959 180.0178 163.1125 161.8923 cheater 5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 check and a state and a state</pre>	<pre>rement 9359 196.1936 208.7527 184.8959 180.0178 163.1125 161.8923 167.9885 :heater 5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 0.0000 0.0000 84.5000 84.5000 1000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 3041 6.5873 7.3041 7.0685 7.3041 7.0685 7.3041 7.3041 9232 19.1921 17.2804 12.6603 9.7792 7.9897 8.9209 11.5957 ed by FVS (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by wind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ret electricity generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by Widro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by wind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by Widro-electric generators (Appendix M) (negative if net generation) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by Widro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by hydro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by hydro-electric generators (Appendix M) (negative if net generation) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by hydro-electric generators (Appendix M) (negative if net generation) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed at the hydro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed at the hydro-electric generators (Appendix M) (negative if net generation) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed at the hydro-electric generators (Appendix M) (negative if net generation) 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 0.0000 0.0000 0.0000 0.000</pre>	<pre>rement 9359 196.1936 208.7527 184.8959 180.0178 163.1125 161.8923 167.9885 169.4083 iheater 5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 6461 232.1818 247.0446 218.8118 213.0388 193.0325 191.5886 198.8029 200.4833 requirement 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 924 19.1921 17.2804 12.6603 9.7792 7.9897 8.9209 11.5957 15.0617 ed by FVs (Appendix M) (negative quantity) 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 0.0000 0.0000 0.0000 ed by wind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. net electricity generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. net electricity generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. net electricity generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. not eleby FVs (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. not belative generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. not belative generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. not 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. not 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 c. 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 0.0000 0.0000 0.0000 0.0000</pre>	<pre>rement 9359 196.1936 208.7527 184.8959 180.0178 163.1125 161.8923 167.9885 169.4083 187.7662 . heater 5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 84.5000 100, WHA/MONTH 6461 232.1818 247.0446 218.8118 213.0388 193.0325 191.5886 198.8029 200.4833 222.2085 requirement 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 3041 6.5973 7.3041 7.0685 7.3041 7.0685 7.3041 7.0685 7.3041 9232 19.1921 17.2804 12.6603 9.7792 7.9897 8.9209 11.5957 15.0617 19.7618 e0 by FVs (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by vind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by vind turbines (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by Nydro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by Nydro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by Nydro-electric generators (Appendix M) (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by NM (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by NM (negative quantity) 0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 ed by NM (negative quantity) 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0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 3041 6.5973 7.3041 7.0685 7.3041 7.0685 7.3041 7.0685 7.3041 7.0685 9232 19.121 17.2004 12.6603 9.7792 7.3987 8.3209 11.5957 15.0617 19.7618 22.3209 ed by FVs (Appendix M) (negative quantity) 0000 0.0000 ed by wind turbines (Appendix M) (negative quantity) 0000 0.</pre>	rement 9353 195.1936 208.7527 184.8959 180.0178 163.1125 161.8923 167.9885 169.4083 187.7662 198.1648 219.7435 5. heater 5. heate

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

Emission factor kg CO2/kWh

Energy kWh/year

/Wh

Emissions kg CO2/year



Space heating -	main syste	em 1						3296.8912			0.2100		692.3471	(261)
Total CO2 associ Water heating (o	ated with	community s	systems					2674.4048			0.2100		0.0000 561.6250	
Space and water Pumps, fans and	electric k	eep-hot						86.0000			0.1387		1253.9722 11.9293	
Energy for light Total CO2, kg/ye	ar							193.0741			0.1443		27.8666 1293.7680	(272)
EPC Dwelling Car	bon Dioxid	le Emission	Rate (DER)										13.9300	(273)
13a. Primary ene	rgy - Indi	ividual heat	ting system	s including	micro-CHP				D		6	Duri		
Space heating -	main syste	-m 1						kWh/year 3296.8912	Primary		CO2/kWh 1.1300		imary energy kWh/year 3725.4870	
Total CO2 associ Water heating (o	ated with	community s	systems					2674.4048					0.0000	(473)
Space and water Pumps, fans and	heating							86.0000			1.5128		6747.5644 130.1008	(279)
Energy for light Total Primary en	ergy kWh/y							193.0741			1.5338		296.1435 7173.8088	(286)
Dwelling Primary	y energy Ra	ate (DPER)											77.2200	(287)
SAP 10 WORKSHEET CALCULATION OF T	FOR New E ARGET EMIS	Build (As De SSIONS	esigned)	(Version 10	.2, February	y 2022)								
1. Overall dwell														
								Area (m2)		-	height (m)		Volume (m3)	
Fround floor Total floor area	TFA = (la	a)+(lb)+(lc)	+(ld)+(le)	(ln)	9	92.9000						(2b) =		(4)
Owelling volume								(;	3a)+(3b)·	+(3c)+(3d)+(3e)	(3n) =	278.7000	(5)
. Ventilation r	ate													
													m3 per hour	
Number of open of Number of open f Number of chinne Number of flues Number of flues Number of blocke Number of interm Number of passiv Number of fluele	lues ys / flues attached t attached t d chimneys ittent ext re vents	to solid fue to other hea s tract fans	el boiler	ire								0 * 20 = 3 * 10 = 0 * 10 =	0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
infiltration due	to chimne	evs, flues a	and fans	= (6a)+(6b)-	+(6c)+(6d)+	(6e)+(6f)+(6g) + (7a) + ('	7b)+(7c) =			30.0000	Air chang) / (5) =	ges per hour 0.1076	
Pressure test Pressure Test Me	thod						27 . 7 .						Yes Blower Door	
Measured/design Infiltration rat	e												5.0000 0.3576	(18)
Number of sides Shelter factor									(20) =			(19)] =	1.0000	
infiltration rat	-											x (20) =		(21)
Wind speed Wind factor	Jan 5.1000 1.2750			Apr 4.4000 1.1000		Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	4.0	000		4.5000	4.7000	
dj infilt rate			0.4381			0.3398	0.3398			000 576				
ffective ac				0.5774				0.5547				0.5809		
. Heat losses a lement				Gross	Openings	Net	Area	U-value		AxU	ī	(-value	AxB	:
ER Opaque door				m2	m2	2.	m2 5000	W/m2K	:	W/K 2.5000		kJ/m2K	kJ/K	(26)
ER Opening Type Weatloss Floor 1		20)				92.		1.1450 0.1300	13	3.7366 2.0770				(27) (28a)
External Wall 1 External Roof 1		olomonto 1		27.5000 92.9000	23.2300	92.	9000	0.1800 0.1100		8.7686 0.2190				(29a) (30)
otal net area o abric heat loss			sum(A, M∠)			313.	3000 (26)(30) + (32)	= 6'	7.3012				(31) (33)
hermal mass par ist of Thermal		1P = Cm / TH	FA) in kJ/m	2K									186.4693	(35)
Kl Eleme E5 Groun	nt d floor (n							43	Length 2.5000		-value 0.1600	6.8	otal 8000	
hermal bridges			ated using	Appendix K)				1:	2.0000		0.0900		7.8800	
Point Thermal br Notal fabric hea										(33)	+ (36)	(36a) = + (36a) =		

Jun

Jul Aug Sep

Oct

Nov

Dec

 $\begin{array}{c} \mbox{Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) \\ \mbox{Jan} & \mbox{Feb} & \mbox{Mar} & \mbox{Apr} & \mbox{May} \end{array}$



(38)m	55.5473	55,1760	54.8121	53.1026	52.7828	51,2939	51.2939	51.0182	51.8674	52,7828	53,4298	54.1062	(3)
leat transfer c	oeff 130.7285	130.3572	129.9933	128.2839	127.9640	126.4752	126.4752	126.1995	127.0487	127.9640	128.6111	129.2875	(3
LP	Jan 1.4072	Feb 1.4032	Mar 1.3993	Apr 1.3809	May 1.3774	Jun 1.3614	Jul 1.3614	Aug 1.3584	Sep 1,3676	Oct 1.3774	Nov 1.3844	Dec 1.3917	(4)
LP (average) ays in mont	31	28	31	30	31	30	31	31	30	31	30	1.3809	
Water heatin	g energy	requirement	s (kWh/year)									
ssumed occupan ot water usage	for mixe		66,0004	60 A465	<1 A1 CA	50.0410	55 5010	F0 0007	co. 700.c	62.0706	66 00 7 5	2.6634	
ot water usage	68.8757 for bath 29.7420		66.3324 28.6783	63.4465 27.5314	61.3168 26.6726	58.9418 25.7204	57.5919 25.2060	59.0887 25.8237	60.7296 26.4962	63.2796 27.5152	66.2275 28.6857	68.6118 29.6415	
ot water usage			38.8579	37.3341	35.8102	34.2864	34.2864	35.8102	37.3341	38.8579	40.3817	41.9056	
verage daily h												129.1727	
aily hot water		Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
ergy conte hergy content stribution lo	(annual)	137.5227 195.8305	133.8686 205.7510	128.3120 175.6527	123.7997 166.6581	118.9486 146.2611	117.0843 141.6033	120.7226 149.4798	124.5599 153.5948	129.6527 175.9375 Total = S	135.2949 192.7524 um(45)m =		(4
ter storage 1	33.3832			26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(4
core volumé If manufact Temperature f	urer decl actor fro	m Table 2b	actor is kn	own (kWh/d	lay):							200.0000 1.6525 0.5400	(4 (4
nter (49) or (otal storage l	oss		00.000	06 7710	07.007	06 8810	00.000	00.000	06 7710	00.000	06 8810	0.8924	
f cylinder con	27.6637 tains ded 27.6637	24.9865 icated sola 24.9865	27.6637 r storage 27.6637	26.7713 26.7713	27.6637	26.7713 26.7713	27.6637 27.6637	27.6637 27.6637	26.7713 26.7713	27.6637 27.6637	26.7713 26.7713	27.6637	
rimary loss ombi loss otal heat requ	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120	23.2624	23.2624 0.0000	22.5120	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	(5
	273.4807 -31.4871		256.6771 -29.1603	224.9360 -24.1458	217.5842 -22.5031	195.5444 -19.2560	192.5293 -18.0495	200.4059 -19.1938	202.8781 -19.9230	226.8636 -23.4870	242.0357 -26.6080	270.3810 -30.9040	
diverter lar input HRS	-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 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 0.0000	-0.0000 0.0000 0.0000	-0.0000 0.0000 0.0000	-0.0000 0.0000 0.0000	(6
tput from w/h		213.9808	227.5168	200.7901	195.0812	176.2884	174.4799	181.2121	182.9551	203.3765	215.4277	239.4770	
Total per yea		ar)						Total p	er year (kW	h/year) = S	um(64)m =	2452.5793 2453	
ectric shower	(s) 0.0000	0.0000	0.0000	0.0000	0.0000 al Energy u	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
at gains from		ating, kWh/ 101.9118		97.8312	96.1547	88.0585	87.8239	90.4429	90.4969		103.5168		
Internal gai													
etabolic gains 56)m	Jan	Feb	Mar 133.1685	Apr 133.1685	May 133.1685	Jun 133.1685	Jul 133.1685	Aug 133.1685	Sep 133.1685	Oct 133.1685	Nov 133.1685	Dec 133.1685	(6
ighting gains	(calculat	ed in Appen	dix L, equa	tion L9 or		see Table 5		123.2258					
	244.3130	246.8482	240.4595	226.8589	209.6905	193.5547	182.7749	180.2397	186.6284	200.2290	217.3974	233.5332	(6
ooking gains (36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169	36.3169		
sses e.g. eva	poration	(negative v	alues) (Tab	le 5)	3.0000 -106.5348				0.0000				
ater heating g	ains (Tab	le 5)			129.2402								
otal internal	gains				528.1071								
. Solar gains													
Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci: or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	ss or 6d	Gains W	
orth outh est					10.6334 46.7521 19.6403					0.77 0.77 0.77	00 00 00	22.4554 185.3159 5.1020	(7
olar gains otal gains			475.9618	578.0480	642.4879	637.1752	614.4701	565.4906	510.6447	390.2785	253.7257		
, var garns	000.0004	551.2155	1032.3000	1134.00/4	11,0.3743	1173.3176	1101.4044	1000.4090	1013.64/1	515.0711	000.1004	130.3507	(0
Mean interna													
mperature dur				ng area fro	m Table 9	Th1 (C)						21.0000	15

	during heatin factor for ga					Thl (C)						21.0000 (85)
tau	Jan 36.8087	Feb 36.9135	Mar 37.0169	Apr 37.5101	May 37.6039	Jun 38.0466	Jul 38.0466	Aug 38.1297	Sep 37.8748	Oct 37.6039	Nov 37.4147	Dec 37.2190
alpha util living a	3.4539 area	3.4609	3.4678	3.5007	3.5069	3.5364	3.5364	3.5420	3.5250	3.5069	3.4943	3.4813
-	0.9800	0.9629	0.9368	0.8813	0.7845	0.6309	0.4818	0.5189	0.7195	0.8975	0.9648	0.9831 (86)



NTT 10.0000	10, 2022	19,7715	20. 2417	20, 5250	20.0707	20,9645	20.0524	20.7070	20,2980	10 (104	10.0401	(07)
MIT 19.0922 Th 2 19.7578 util rest of house	19.3932 19.7609	19.7715	20.2417 19.7780	20.6269 19.7807	20.8787 19.7930	19.7930	20.9534 19.7953	20.7970 19.7883	19.7807	19.6184 19.7753	19.0481 19.7697	
MIT 2 0.9749 Living area fraction	0.9539 17.9669	0.9210 18.4401	0.8507	0.7276 19.4595	0.5370 19.7173	0.3599 19.7799	0.3966 19.7764	0.6339 19.6464 fLA =	0.8644 19.1015 Living are	0.9546 18.2650 a / (4) =	0.9789 17.5387 0.1625	(90)
MIT 17.8317 Temperature adjustment	18.1987	18.6565	19.2184	19.6493	19.9061	19.9724	19.9677	19.8334	19.2960			
adjusted MIT 17.8317	18.1987	18.6565	19.2184	19.6493	19.9061	19.9724	19.9677	19.8334	19.2960	18.4849	17.7840	(93)
8. Space heating require	ment											
Jan Utilisation 0.9635 Useful gains 771.3819 Ext temp. 4.3000	Feb 0.9383 898.2038 4.9000	Mar 0.9026 949.8141 6.5000	Apr 0.8337 945.4676 8.9000	May 0.7206 843.5520 11.7000	Jun 0.5465 624.8466 14.6000	Jul 0.3788 417.2813 16.6000	Aug 0.4151 437.2761 16.4000	Sep 0.6375 645.9147 14.1000	Oct 0.8480 774.2621 10.6000	Nov 0.9397 759.4178 7.1000	Dec 0.9687 734.8538 4.2000	(95)
	1733.5881	1580.2599	1323.6816	1017.2195	671.0910	426.5296	450.2462	728.4181	1112.7756	1464.2303	1756.2447	(97)
Space heating requiremen			272.3141 h/year)	129.2086	0.0000	0.0000	0.0000	0.0000	251.8540	507.4650	759.9148 3693.3949	(98a)
Solar heating kWh 0.0000 Solar heating contributi Space heating kWh	0.0000 on - total p	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
742.2083 Space heating requiremen			272.3141 tion - tota		0.0000 (kWh/year)	0.0000	0.0000	0.0000	251.8540		759.9148 3693.3949	
Space heating per m2									(98c) / (4) =	39.7567	(99)
9a. Energy requirements												
Fraction of space heat f Fraction of space heat f Efficiency of main space Efficiency of main space Efficiency of secondary/	rom main sy: heating sy: heating sy:	stem(s) stem 1 (in stem 2 (in	ક) ક)	n (Table ll	.)						0.0000 1.0000 92.3000 0.0000 0.0000	(202) (206) (207)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	561.3783			129.2086	0.0000	0.0000	0.0000	0.0000	251.8540	507.4650	759.9148	(98)
Space heating efficiency 92.3000	92.3000	92.3000		92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
	608.2105	508.1817		139.9876	0.0000	0.0000	0.0000	0.0000	272.8646	549.7996	823.3097	(211)
Space heating efficiency 0.0000 Space heating fuel (main	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 0.0000 Space heating fuel (seco	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
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 requiremen	t											
	213.9808	227.5168	200.7901	195.0812	176.2884	174.4799	181.2121	182.9551	203.3765	215.4277	239.4770 79.8000	
(217)m 86.4040 Fuel for water heating,	86.1195	85.6451	84.7437	83.1581	79.8000	79.8000	79.8000	79.8000	84.5404	85.9125	86.4633	
Space cooling fuel requi	248.4696 rement 0.0000	265.6509 0.0000	236.9382 0.0000	234.5907 0.0000	220.9128 0.0000	218.6465 0.0000	227.0829 0.0000	229.2670 0.0000	240.5674 0.0000	250.7525 0.0000		
(221)m 0.0000 Pumps and Fa 7.3041 Lighting 25.6039	6.5973 20.5404	7.3041 18.4943	7.0685	7.3041	7.0685	7.3041 9.5476	7.3041 12.4104	7.0685	7.3041 21.1501	7.0685	0.0000 7.3041 26.3155	(231)
Electricity generated by	PVs (Append	dix M) (neg	ative quant:	ity)	-117.0482				-99.3661			
Electricity generated by (234a)m 0.0000	wind turbin					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity generated by (235a)m 0.0000				dix M) (neg 0.0000		ity) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net (235c)m 0.0000		generated	by micro-CH	P (Appendix 0.0000		ve if net g 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity generated by (233b)m -65.7934	-134.2378	-259.5323	-379.8089	-493.0118	-492.1280	-486.3793	-415.9565	-310.5101	-188.5009	-86.6388	-52.3570	(233b)
Electricity generated by (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 (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 (235d)m 0.0000	electricity 0.0000	generated 0.0000	0.0000	P (Appendix 0.0000		ve if net g 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - mai Space heating fuel - mai Space heating fuel - sec Efficiency of water heat	n system 2 ondary										4001.5112 0.0000 0.0000 79.8000	(213) (215)
Water heating fuel used Space cooling fuel											2929.9202 0.0000	
Electricity for pumps an Total electricity for th Electricity for lighting	e above, kWI		ix L)								86.0000 206.6381	
Energy saving/generation PV generation	technologie	es (Appendi	ces M ,N and	1 Q)							-4591.8153	(233)
Wind generation Hydro-electric generatio Electricity generated - 1	Micro CHP (A										0.0000 0.0000 0.0000	(234) (235a)
Appendix Q - special fea Energy saved or generate Energy used Total delivered energy f	d										-0.0000 0.0000 2632.2542	(237)

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



	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4001.5112	0.2100	840.3174 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2929.9202	0.2100	615.2832 (264)
Space and water heating			1455.6006 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	206.6381	0.1443	29.8243 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1226.9604	0.1363	-167.2196
PV Unit electricity exported	-3364.8548	0.1267	-426.2501
Total			-593.4696 (269)
Total CO2, kg/year			903.8845 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.7300 (273)

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

	Energy Pr kWh/year	rimary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	4001.5112	1.1300	4521.7077 (275)
Total CO2 associated with community systems	4001.0112	1.1300	0.0000 (473)
Water heating (other fuel) Space and water heating	2929.9202	1.1300	3310.8098 (278) 7832.5175 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	206.6381	1.5338	316.9484 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1226.9604	1.5038	-1845.0887
PV Unit electricity exported Total	-3364.8548	0.4650	-1564.7459 -3409.8345 (283)
Total Primary energy kWh/year Target Primary Energy Rate (TPER)			4869.7321 (286) 52.4200 (287)



Property Reference	:e	T	pe A_Green							ssued on Da	ite	23/10/2024	
Assessment Refe			001					Prop Type R				23/10/2024	
Property			001										
Topolty													
SAP Rating					100 A		DER	-0.	07	TER		9.80	
Environmental					100 A		% DER < TER					100.71	
CO ₂ Emissions (t/	year)				-0.09		DFEE	36.	.76	TFEE		47.25	
Compliance Chec	k				See BREL		% DFEE < TFI	EE				22.19	
% DPER < TPER					91.52		DPER	4.4	8	TPER	l	52.78	
Assessor Details		Mr Olive	er Eggenton							Asses	ssor ID	AQ01-000)1
Client													
SAP 10 WORKSHEET CALCULATION OF I						7 2022)							
1. Overall dwell	ing charact	teristics											
Ground floor Total floor area Dwelling volume	a TFA = (la))+(lb)+(lc	c)+(ld)+(le)	(ln)	S	2.9000		Area (m2) 92.9000 (:			(2b) = (3n) =		(1b) - (3b) (4) (5)
2. Ventilation r	ate												
											п	n3 per hour	
Number of open c Number of open f Number of chinne Number of flues Number of flues Number of blocke Number of passiv Number of fluele	lues ys / flues attached to attached to d chimneys hittent extr ve vents	o solid fu o other he ract fans	lel boiler	fire							$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(6b) (6c) (6d) (6e) (6f) (7a) (7b)
												es per hour	
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	thod AP50	/s, flues	and fans	= (6a)+(6b)+(6c)+(6d)+((6e) + (6f) +	(6g)+(7a)+('	7b)+(7c) =		20.0000	/ (5) = F	Yes Blower Door 3.0000 0.2218	(17)
Shelter factor Infiltration rat	e adjusted	to includ	de shelter f	actor					(20) = 1 - (21)		(19)] = x (20) =	1.0000 0.2218	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500		Aug 3.7000 0.9250		Oct 4.3000 1.0750			
	0.2827		0.2717 0.5369		0.2384 0.5284			0.2051 0.5210		0.2384 0.5284	0.2495 0.5311		
3. Heat losses a	and heat los	ss paramet	er										
Element				Gross			tArea	U-value	AxU		-value	A x K	
Window (Uw = 0.8 Door Heatloss Floor 1 External Wall 1 External Roof 1 Total net area co Fabric heat loss	of external			m2 .27.5000 92.9000	m2 24.4000	21 2 92 103 92	.5000 .9000 .1000 .9000 .3000	0.1300 0.1000	2.5000 7.4320 13.4030	7 0 2(0 19(0 (kJ/m2K 0.0000 0.0000 0.0000	kJ/K 1858.0000 19589.0000 0.0000	(27) (26) (28a) (29a)
Heat capacity Cm Thermal mass par Thermal bridges Point Thermal br Total fabric hea	n = Sum(A x cameter (TMF (User defin ridges	k) ? = Cm / 1			area)				(30) + (32)		(36a) =	21447.0000 230.8611 15.6650 0.0000 65.2667	(34) (35) (36)
Ventilation heat	: loss calcu Jan	Feb	nthly (38)m Mar 49.3791	Apr	25)m x (5) May 48.5989	Jun 48.0265	Jul 48.0265	Aug 47.9205	Sep	Oct 48.5989	Nov	Dec 49.1078	
Heat transfer co	eff 14.9286 1								113.5137				(39)



HLP	Jan 1.2371	Feb 1.2356	Mar 1.2341	Apr 1.2270	May 1.2257	Jun 1.2195	Jul 1.2195	Aug 1.2184	Sep 1.2219	Oct 1.2257	Nov 1.2284	Dec 1.2312	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.2270 31	
4. Water heati)									
Assumed occupa Hot water usag	ge for mixer											2.6634	
Hot water usag			66.3324	63.4465	61.3168	58.9418	57.5919	59.0887	60.7296	63.2796 27.5152	66.2275	68.6118	
Hot water usag Average daily	41.9056	uses 40.3817	28.6783 38.8579 /day)	27.5314 37.3341	26.6726 35.8102	25.7204 34.2864	25.2060 34.2864	25.8237 35.8102	26.4962 37.3341	38.8579	28.6857 40.3817	29.6415 41.9056 129.1727	(42c)
Deile bet unt	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wate Energy conte Energy content	140.5233 222.5546	137.5227 195.8305	133.8686 205.7510	128.3120 175.6527	123.7997 166.6581	118.9486 146.2611	117.0843 141.6033	120.7226 149.4798	124.5599 153.5948	129.6527 175.9375 Total = S	135.2949 192.7524 um(45)m =	140.1589 219.4550 2145.5309	
Distribution 1	33.3832	= 0.15 x (29.3746	45)m 30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(46)
Water storage Store volume a) If manufac Temperature	turer decla factor from	Table 2b	actor is kn	own (kWh/c	lay):							200.0000 1.5000 0.5400	(48) (49)
Enter (49) or Total storage	loss	22.6800	25 1100	24.3000	25 1100	24 2000	25 1100	25 1100	24 2000	25 1100	24 2000	0.8100	
If cylinder co	25.1100 ontains dedi 25.1100		25.1100 r storage 25.1100	24.3000	25.1100 25.1100	24.3000 24.3000	25.1100 25.1100	25.1100 25.1100	24.3000 24.3000	25.1100 25.1100	24.3000 24.3000	25.1100 25.1100	
Primary loss Combi loss	23.2624 0.0000	21.0112 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624	23.2624 0.0000	22.5120 0.0000	23.2624	22.5120 0.0000	23.2624	(59)
Total heat rec	270.9270	239.5217	254.1234	222.4647	215.0305	193.0731	189.9757	197.8522	200.4068	224.3099	239.5644	267.8274	
WWHRS PV diverter Solar input		-43.3281 -101.3236 0.0000	-45.3707 -199.4623 0.0000	-37.5688 -297.7076 0.0000	-35.0127 -390.8702 0.0000	-29.9606 -392.0219 0.0000	-28.0833 -386.8271 0.0000	-29.8638 -327.2046 0.0000	-30.9984 -240.6683 0.0000	-36.5437 -143.2734 0.0000	-41.3996 -64.6009 0.0000	-48.0839 -38.6338 0.0000	(63b)
FGHRS Output from w/	0.0000 /h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12Total per ye Electric showe		94.8700 r)	9.2904	0.0000	0.0000	0.0000	0.0000	0.0000 Total p	0.0000 er year (kW	44.4928 h/year) = S	133.5639 um(64)m =	181.1097 636.4299 636	(64)
	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 sed by inst	0.0000 antaneous e	0.0000 lectric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000	
Heat gains fro	om water hea 112.6973			95.8541	94.1118	86.0814	85.7810	88.4000	88.5199	97.1971	101.5398	111.6667	(65)
5. Internal ga	ains (see Ta	ble 5 and	5a)										
Metabolic gair					Marr				Sen	Oat	New	Dec	
(66)m Lighting gains					May 133.1685 L9a), also:		Jul 133.1685	Aug 133.1685	Sep 133.1685	Oct 133.1685	Nov 133.1685	Dec 133.1685	(66)
Appliances gai	123.7361 ins (calcula	136.9935 ted in App	123.7361 endix L, eq	127.8606 uation L13	123.7361 or L13a), a	127.8606 lso see Tab	123.7361 ole 5	123.7361	127.8606	123.7361	127.8606	123.7361	(67)
Cooking gains	(calculated	l in Append	240.4595 lix L, equat 36.3169	ion L15 or	L15a), also			180.2397 36.3169	186.6284 36.3169	200.2290 36.3169	217.3974 36.3169	233.5332 36.3169	
Pumps, fans Losses e.g. ev	3.0000	3.0000	3.0000	3.0000		36.3169 0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	
	-106.5348 gains (Tabl	-106.5348 e 5)	-106.5348	-106.5348	-106.5348								
Total internal	l gains				126.4943								
	585.4745	598.7009	574.1114	553.8008	525.8715	503.9234	484.7586	485.7436	500.3838	520.5570	552.2360	573.3095	(73)
6. Solar gains													
									_				
[Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	ss or 6d	Gains W	
North South West			7.3 13.7 0.9	000 000 000	10.6334 46.7521 19.6403		0.6800 0.6800 0.6800	0 0 0		0.77 0.77 0.77	00 00 00	25.6056 211.2815 5.8308	(78)
Solar gains Total gains	242.7180	406.3647	542.7089	659.1271	732.6177	726.5644	700.6722	644.8133	582.2613 1082.6451	445.0038 965.5607	289.2988 841.5349	208.7078 782.0173	(83) (84)
7. Mean interr	nal temperat	ure (heati	ng season)										
Temperature du	aring heatin	g periods	in the livi	ng area fro	om Table 9, 1	Thl (C)						21.0000	(85)
Utilisation fa	Jan	Feb	Mar	Apr	Mav	Jun	Jul 52.5848	Aug 52,6340	Sep 52,4826	Oct 52.3204	Nov 52,2064	Dec 52.0877	
alpha util living an	rea				52.3204 4.4880								
-	0.9864	0.9687				0.5656				0.8904			
MIT Th 2 util rest of h	19.8904				20.8164 19.8995		20.9260 19.9044			20.6365 19.8995			
util rest of h		0.9601	0.9201	0.8309	0.6796	0.4783	0.3146	0.3489	0.5811	0.8534	0.9623	0.9861	(89)



MIT 2 18.6644 Living area fraction MIT 18.8704 Temperature adjustment adjusted MIT 18.8704 8. Space heating requirer	18.9238 19.1212 19.1212	19.2133 19.4018 19.4018	19.5236 19.7039 19.7039	19.7198 19.8981 19.8981	19.8018 19.9811 19.9811	19.8147 19.9953 19.9953	19.8146 19.9949 19.9949	19.7799 fLA = 19.9581 19.9581	19.5374 Living area 19.7161 19.7161	19.0513 a / (4) = 19.2435 19.2435	18.6148 0.1625 18.8221 0.0000 18.8221	(91) (92)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation 0.9776 Useful gains 809.6240 Ext temp. 4.3000	0.9525 957.2769 4.9000	0.9109 1017.3595 6.5000	0.8238 999.2377 8.9000	0.6796 855.2163 11.7000	0.4847 596.3748 14.6000	0.3231 383.0308 16.6000	0.3576 404.2854 16.4000	0.5858 634.2357 14.1000	0.8461 816.9331 10.6000	0.9550 803.7057 7.1000	0.9819 767.8980 4.2000	(95)
Heat loss rate W 1674.5595 Space heating kWh	1632.3902	1479.1373	1231.5169	933.4791	609.6472	384.6648	406.8926	664.9733	1038.0079	1385.7499	1672.3912	(97)
	453.6762 t - total pe		167.2410 h/year)	58.2275	0.0000	0.0000	0.0000	0.0000	164.4797	419.0718	672.9429 2922.7138	(98a)
0.0000 Solar heating contribution Space heating kWh	0.0000 on - total p	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
	453.6762 t after sola		167.2410 tion - total	58.2275 1 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	164.4797 (98c)	419.0718) / (4) =	672.9429 2922.7138 31.4609	
9a. Energy requirements Fraction of space heat f: Fraction of space heat f: Efficiency of main space Efficiency of main space Efficiency of secondary/	rom seconda: rom main sy: heating sy: heating sy:	ry/suppleme stem(s) stem 1 (in stem 2 (in	ntary system %) %)								0.0000 1.0000 219.3000 0.0000 0.0000	(202) (206) (207)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(200)
Space heating requirement 643.5120		343.5627	167.2410	58.2275	0.0000	0.0000	0.0000	0.0000	164.4797	419.0718	672.9429	(98)
Space heating efficiency 219.3000	(main heat:			219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	
Space heating fuel (main		stem)	76.2613	26.5515	0.0000	0.0000	0.0000	0.0000	75.0021	191.0952	306.8595	
Space heating efficiency 0.0000			2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating fuel (main 0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating fuel (second 0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Water heating Water heating requiremen 173.1032	t 94.8700	9.2904	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	44.4928	133.5639	181.1097	(64)
Efficiency of water heat (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 190.4000	
Fuel for water heating, 1 90.9155	49.8267	4.8794	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	23.3680	70.1491	95.1206	(219)
Space cooling fuel requi: (221)m 0.0000 Pumps and Fa 0.0000 Lighting 22.0222	0.0000	0.0000	0.0000	0.0000 0.0000 9.7792	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting 23.9232 Electricity generated by (233a)m -94.0319			12.6603 ative quanti -152.8430	ity)	7.9897	8.9209	11.5957	15.0617	19.7618	22.3209 -99.1995	24.5881 -82.1256	
Electricity generated by (234a)m 0.0000						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity generated by (235a)m 0.0000	hydro-elect	tric genera	tors (Append	dix M) (neg	ative quant	ity)	0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity used or net (235c)m 0.0000	electricity	generated	by micro-CHE	P (Appendix		ve if net g	eneration)	0.0000	0.0000	0.0000	0.0000	
Electricity generated by (233b)m -1.9690					-143.9485	-142.2608	-123.6641	-93.9388	-39.8396	-7.2511	-0.6895	(233b)
Electricity generated by (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 (235b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net (235d)m 0.0000								0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - main Space heating fuel - main Space heating fuel - sec Efficiency of water heat Water heating fuel used Space cooling fuel	n system 2 ondary										1332.7468 0.0000 0.0000 190.4000 334.2594 0.0000	(213) (215) (219)
Electricity for pumps and Total electricity for the Electricity for lighting	e above, kWI		ix L)								0.0000 193.0741	(231)
Energy saving/generation PV generation Wind generation Hydro-electric generation Electricity generated - 1 Appendix Q - special fea	n (Appendix Micro CHP (A	N)	ces M ,N and	1 Q)							-2257.9111 0.0000 0.0000 0.0000	(234) (235a)
Energy saved or generate Energy used Total delivered energy fo	d										-0.0000 0.0000 -397.8307	(237)
12a. Carbon dioxide emis:	sions - Ind	ividual hea	ting systems	s including	micro-CHP			Fmiss	ion factor		Emissions	

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1332.7468	0.1564	208.3840 (261)
Total CO2 associated with community systems			0.0000 (373)



Space heating - main system 1	kWh/year 1332.7468	ry energy factor kg CO2/kWh 1.5788	Primary energy kWh/year 2104.1831	(275 (473
3a. Primary energy - Individual heating systems including micro-CHP		u energy factor	Drimanu energy	
Total Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)			-295.8514 -6.7876 -0.0700	(272
Energy saving/generation technologies 7V Unit electricity used in dwelling 7V Unit electricity exported	-1422.9704 -834.9407	0.1385 0.1183	-197.1005	
pace and water heating wmps, fans and electric keep-hot nergy for lighting	0.0000 193.0741	0.0000 0.1443	261.1972 0.0000 27.8666	(267
Nater heating (other fuel)	334.2594	0.1580	52.8133	

Space and water neating Pumps, fans and electric keep-hot Energy for lighting	0.0000 193.0741	0.0000 1.5338	2633.8660 (279) 0.0000 (281) 296.1435 (282)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy kWh/year Dwelling Primary energy Rate (DPER)	-1422.9704 -834.9407	1.5122 0.4339	-2151.7694 -362.2810 -2514.0504 (283) 415.9591 (286) 4.4800 (287)

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

1. Overall dwelling characteristics	

		Area	Storey	height		Volume
		(m2)		(m)		(m3)
Ground floor		92.9000 (1b)	x	3.0000 (2b)	=	278.7000 (1b) - (3b)
Total floor area TFA = $(la)+(lb)+(lc)+(ld)+(le)(ln)$	92.9000					(4)
Dwelling volume		(3a) + (3b)+(3c)+(3d)+(3e)(3r	1) =	278.7000 (5)

2. Ventilation rate m3 per hour Number of open chimneys Number of open flues Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler Number of flues attached to other heater Number of blocked chimneys Number of intermittent extract fans 0.0000 (6a) 0.0000 (6b) 0.0000 (6c) 0.0000 (6c) 0.0000 (6d) 0.0000 (6f) 30.0000 (7a) 0.0000 (7b) 0.0000 (7c) Number of passive vents Number of flueless gas fires * 10 = * 40 = 0 Air changes per hour 30.0000 / (5) = 0.1076 (8) Yes Blower Door 5.0000 (17) 0.3576 (18) 0 (19) $\label{eq:intermediate} \text{Infiltration due to chimneys, flues and fans} = (6a) + (6b) + (6c) + (6d) + (6e) + (6f) + (6g) + (7a) + (7b) + (7c) = (6a) + (7b) + (7c) + (7c$ Infiltration due to chimne Pressure test Pressure Test Method Measured/design AP50 Infiltration rate Number of sides sheltered - [0.075 x (19)] = (21) = (18) x (20) = 1.0000 (20) 0.3576 (21) Shelter factor (20) = 1 -Infiltration rate adjusted to include shelter factor

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)
Adj infilt rate	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)
Effective ac	0.4560 0.6040	0.4471 0.5999	0.4381 0.5960	0.3934 0.5774	0.3845	0.3398	0.3398	0.3308 0.5547	0.3576 0.5640	0.3845	0.4023	0.4202 (22b) 0.5883 (25)

llement	Gross	Openings	NetArea	U-value	AxU	K-value	АхК
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K
TER Opaque door			2.5000	1.0000	2.5000		(26
TER Opening Type (Uw = 1.20)			20.7300	1.1450	23.7366		(27
Heatloss Floor 1			92.9000	0.1300	12.0770		(28
External Wall 1	127.5000	23.2300	104.2700	0.1800	18.7686		(29
External Roof 1	92.9000		92.9000	0.1100	10.2190		(30
Notal net area of external elements	Aum (A, m2)		313.3000				(31
Sabric heat loss, $W/K = Sum (A \times U)$			(26)	.(30) + (32) =	67.3012		(33
Thermal mass parameter (TMP = Cm / 1							230.8611 (35



										55	
EF Council filmer (non	1)					42	.5000	0.1600	6.80		
E5 Ground floor (nor E16 Corner (normal)							.0000	0.0900	1.08	00	
Thermal bridges (Sum(L x Psi Point Thermal bridges) calculated using	Appendix K)						(36a) =	7.8800 0.0000	(36)
Total fabric heat loss							(33) + (36)		75.1812	(37)
Ventilation heat loss calcul	ated monthly (38)m	n = 0.33 x (25)m x (5)								
Jan	Feb Mar 5.1760 54.8121	Apr 53.1026	May 52.7828	Jun 51.2939	Jul 51.2939	Aug 51.0182	Sep 51.8674	Oct 52.7828	Nov 53.4298	Dec 54.1062	(38)
Heat transfer coeff											
130.7285 13 Average = Sum(39)m / 12 =	0.3572 129.9933	128.2839	127.9640	126.4752	126.4752	126.1995	127.0487	127.9640	128.6111	129.2875 128.2823	(39)
Jan	Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP 1.4072	1.4032 1.3993	1.3809	1.3774	1.3614	1.3614	1.3584	1.3676	1.3774	1.3844	1.3917	(40)
HLP (average) Days in mont 31	28 31	30	31	30	31	31	30	31	30	1.3809 31	
4. Water heating energy requ		:)									
Assumed occupancy										2.6634	(42)
	0Wers 7.8407 66.3324	63.4465	61.3168	58.9418	57.5919	59.0887	60.7296	63.2796	66.2275	68.6118	(42a)
Hot water usage for baths 29.7420 2	9.3003 28.6783	27.5314	26.6726	25,7204	25.2060	25.8237	26.4962	27.5152	28,6857	29.6415	(42b)
Hot water usage for other us		37.3341	35.8102	34.2864	34.2864	35.8102	37.3341	38.8579	40.3817	41.9056	
Average daily hot water use		37.3341	33.0102	34.2004	34.2004	33.0102	37.3341	30.0375	40.3017	129.1727	
Jan	Feb Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use 140.5233 13	7.5227 133.8686	128.3120	123.7997	118,9486	117.0843	120,7226	124,5599	129.6527	135.2949	140.1589	(44)
Energy conte 222.5546 19	5.8305 205.7510	175.6527	166.6581	146.2611	141.6033	149.4798	153.5948	175.9375	192.7524	219.4550	
Energy content (annual) Distribution loss (46)m = 0								Total = S	5um(45)m =	2145.5309	
33.3832 2 Water storage loss:	9.3746 30.8627	26.3479	24.9987	21.9392	21.2405	22.4220	23.0392	26.3906	28.9129	32.9182	(46)
a) If manufacturer declared	loss factor is la	orm (ld.Th./d								200.0000 1.6525	(47)
Temperature factor from Ta		IOWII (KWII/G	ay):							0.5400	(49)
Enter (49) or (54) in (55) Total storage loss										0.8924	(55)
27.6637 2 If cylinder contains dedicat	4.9865 27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
27.6637 2	4.9865 27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	
	1.0112 23.2624 0.0000 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	
Total heat required for wate 273.4807 24	r heating calculat 1.8283 256.6771	ed for each 224.9360	month 217.5842	195.5444	192.5293	200.4059	202.8781	226.8636	242.0357	270.3810	(62)
WWHRS -31.4871 -2	7.8475 -29.1603	-24.1458	-22.5031	-19.2560	-18.0495	-19.1938	-19.9230	-23.4870	-26.6080	-30.9040	(63a)
	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	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	
FGHRS 0.0000 Output from w/h	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
241.9936 21	3.9808 227.5168	200.7901	195.0812	176.2884	174.4799		182.9551	203.3765 h/year) = S	215.4277	239.4770	
12Total per year (kWh/year)						iotai p	er year (kw	m/year) = 5	um (64) m =	2452.5793 2453	
Electric shower(s) 0.0000	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heatin	a Muh (month	Tot	al Energy u	sed by inst	antaneous e	lectric sho	wer(s) (kWh	/year) = Su	m(64a)m =	0.0000	(64a)
	1.9118 109.1531	97.8312	96.1547	88.0585	87.8239	90.4429	90.4969	99.2401	103.5168	113.7096	(65)
5. Internal gains (see Table											
Metabolic gains (Table 5), W	atts										
	Feb Mar 3.1685 133.1685	Apr 133.1685	May 133.1685	Jun 133.1685	Jul 133.1685	Aug 133.1685	Sep 133.1685	Oct 133.1685	Nov 133.1685	Dec 133.1685	(66)
Lighting gains (calculated i		tion L9 or	L9a), also :	see Table 5				123.2258	127.3334	123.2258	
Appliances gains (calculated	in Appendix L, eq	uation L13	or L13a), a	lso see Tab	le 5						
244.3130 24 Cooking gains (calculated in		ion L15 or	L15a), also			180.2397	186.6284	200.2290	217.3974	233.5332	(68)
36.3169 3			36.3169 3.0000		36.3169	36.3169 0.0000	36.3169 0.0000	36.3169 3.0000	36.3169 3.0000	36.3169 3.0000	
Losses e.g. evaporation (neg	ative values) (Tab	le 5)									
Water heating gains (Table 5	6.5348 -106.5348)										
154.2208 15 Total internal gains	1.6545 146.7111	135.8766	129.2402	122.3034	118.0429	121.5630	125.6901	133.3872	143.7733	152.8355	(72)
	0.8818 576.3470	556.0194	528.1071	506.1420	486.9943	487.9792	502.6024	522.7926	554.4546	575.5451	(73)
6. Solar gains											
			Solon flum				F F			California	

[Jan]			А	m2	Solar flux Table 6a W/m2	a Speci	g fic data Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
North South West			12.9	100 700 500	10.6334 46.7521 19.6403	L	0.6300 0.6300 0.6300	0	.7000 .7000 .7000	0.77 0.77 0.77	00	22.4554 185.3159 5.1020	(78)
Solar gains Total gains	212.8733 800.5834	356.3937 957.2755	475.9618 1052.3088	578.0480 1134.0674	642.4879 1170.5949	637.1752 1143.3172	614.4701 1101.4644	565.4906 1053.4698	510.6447 1013.2471	390.2785 913.0711	253.7257 808.1804	183.0455 758.5907	

7. Mean internal temperature (heating season)



Cemperature du Utilisation fa						1111 (0)						21.0000	(05
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
au Lpha	45.5715 4.0381	45.7013 4.0468	45.8293 4.0553	46.4400 4.0960	46.5560 4.1037	47.1041 4.1403	47.1041 4.1403	47.2070 4.1471	46.8915 4.1261	46.5560 4.1037	46.3218 4.0881	46.0795 4.0720	
il living a		4.0466	4.0555	4.0960	4.1037	4.1405	4.1405	4.14/1	4.1201	4.1057	4.0001	4.0720	
iii iiving u	0.9889	0.9769	0.9561	0.9067	0.8106	0.6484	0.4900	0.5291	0.7427	0.9217	0.9783	0.9910	(86
т	19.3721	19,6377	19,9705	20.3840	20,7163	20,9196	20,9802	20,9727	20.8538	20,4244	19.8286	19.3336	(8)
2	19.7578	19.7609	19.7639	19.7780	19.7807	19.7930	19.7930	19.7953	19.7883	19.7807	19.7753	19.7697	(8
il rest of l													
IT 2	0.9855	0.9700 18.2455	0.9427 18.6630	0.8772	0.7513 19.5473	0.5483	0.3630 19.7869	0.4009	0.6516 19.6939	0.8906	0.9705	0.9882	
iving area fi		10.2455	10.0050	19.1/5/	19.5475	19.7470	19.7009	19.7000		Living are		0.1625	
IT	18.1465	18.4718	18.8755	19.3704	19.7373	19.9383	19.9809	19.9789	19.8824	19.4281	18.7161	18.1060	
emperature ad	ljustment											0.0000	
djusted MIT	18.1465	18.4718	18.8755	19.3704	19.7373	19.9383	19.9809	19.9789	19.8824	19.4281	18.7161	18.1060	(9:
. Space heat:	ing require	ment											
	Jan	Feb	Mar	Apr	Maria	Tue	Jul		Com	0-+	Nov	Dec	
ilisation	0.9790	0.9600	0.9300	0.8653	May 0.7489	Jun 0.5613	0.3834	Aug 0.4213	Sep 0.6595	Oct 0.8792	0.9611	0.9826	/0
seful gains		918.9592	978.5973	981.3001	876.6387	641.7013	422.3537	443.8600	668.2717	802.7699	776.7025	745.3626	
t 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	(9
at loss rate													
ace heating		1769.1810	1608.7386	1343.1840	1028.4909	675.1572	427.5972	451.6558	734.6442	1129.6852	1493.9626	1797.8756	(9
ace neating	763.6347	571.3491	468.8251	260.5564	112,9780	0.0000	0.0000	0.0000	0.0000	243.2250	516.4273	783.0697	(9
ace heating lar heating	requiremen				110.0700	0.0000			0.0000	21012200	010112/0	3720.0653	
ar neating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(9
lar heating ace heating												0.0000	
-	763.6347		468.8251	260.5564	112.9780	0.0000	0.0000	0.0000	0.0000	243.2250	516.4273		
ace heating		t after sol	lar contribu	ition - tota	l per year	(kWh/year)				(0.9 -	:) / (4) =	3720.0653 40.0438	
ace heating	per mz									(960	;) / (4) =	40.0430	(9
. Energy red													
action of sp				entary syste	m (Table 11	L)						0.0000	
action of sp				• \								1.0000	
ficiency of ficiency of												92.3000 0.0000	
ficiency of												0.0000	

0.0000 (208) Efficiency of secondary/supplementary heating system, % Sep Oct Jan Feb Mar May Jun Jul Nov Dec Apr Aug Space heating require 571.3491 468.8251 260.5564 112.9780 0.0000 0.0000 0.0000 243.2250 516.4273 783.0697 (98) 763.6347 0.0000 Space heating efficiency (main heating system 1) 92.3000 92.3000 92.3000
 Space heating efficiency (main heating system

 92.3000
 92.3000
 92.3000

 Space heating fuel (main heating system)
 827.3399
 619.0131
 507.9362
 92.3000 92.3000 0.0000 0.0000 0.0000 0.0000 92.3000 92.3000 92.3000 (210) 282.2930 122.4031 0.0000 0.0000 0.0000 0.0000 263.5157 559.5095 848.3962 (211)
 827.3399
 619.0131
 307.3302

 Space heating efficiency (main heating system 2)
 0.0000
 0.0000
 0.0000
 Space heating full (main heating sys 0.0000 0.0000 0.000 Space heating fuel (main heating system 2) 0.0000 0.0000 0.0000 0.0 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (212) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (213) Space heating fuel (secondary) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (215) Water heating Water heating requirement 241.9936 213.9808 227.5168 200.7901 195.0812 176.2884 174.4799 181.2121 182,9551 203.3765 215.4277 239.4770 (64) Efficiency of water heater 79.8000 (216)86.1525 85.6441 82,8807 79,8000 79.8000 79,8000 79,8000 85.9467 (217)m 86.4537 84.6451 84.4621 86.5149 (217) Fuel for water heating, kWh/month 279.9113 248.3744 265.6539 237.2140 235.3760 220.9128 218.6465 227.0829 229.2670 240.7903 250.6526 276.8045 (219) Space cooling fuel requirement 0.0000 (221)m Pumps and Fa Lighting 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (221) 7.3041 18.4943 6.5973 7.0685 7.3041 7.0685 7.3041 7.3041 7.0685 7.3041 7.0685 7.3041 (231 20.5404 13.5498 10.4662 8.5510 9.5476 21.1501 26.3155 (232) 25,6039 12,4104 16.1199 23.8890 Electricity generated by PVs (Appendix M) (negative quantity) (233a)m -70.2305 -91.6063 -121.9514 -126.6847 -128.4283 -117.0482-115.5094 -112.8099 -107.2226 -99.3661 -74.4829 -61.6201 (233a)
 (233a)m
 -70.2305
 -91.6063
 -121.9514
 -120.0047
 -120.0205
 -111.0002
 121

 Electricity generated by wind turbines (Appendix M)
 (negative quantity)
 (234a)m
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 r:101ty generated by
 -134.2378
 -259.5323
 -379.8089
 -495.0110
 -495.0110

 r:icity generated by wind turbines (Appendix M)
 (negative quantity)

 o)m
 0.0000
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 o)m
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 (233b)m -486.3793 -415.9565 -310.5101 -188.5009 -86,6388 -52.3570 (233b) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (234b) (234b)m
 (234b)m
 0.0000
 0.0000
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 0.0000
 0.0000

 Electricity generated by hydro-electric generators (Appendix M) (negative quantity)
 (235b)m
 0.0000
 0.0000
 0.0000
 0.0000
 0.0000
 0.0000

 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 (235b) 0.0000 0.0000 0.0000 0.0000 (235d) 0.0000 (235d)m 0.0000 0.0000 Annual totals kWh/year Space heating fuel - main system 1 Space heating fuel - main system 2 Space heating fuel - secondary Efficiency of water heater Water heating fuel used Space cooling fuel 4030.4066 (211) 0.0000 (213) 0.0000 (215) 79.8000 2930.6862 (219) 0.0000 (221) Space cooling fuel Electricity for pumps and fans: Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L) 86.0000 (231) 206.6381 (232) Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation -4591.8153 (233) 0.0000 (234) (235a) Hydro-electric generation (Appendix N) 0.0000 Appendix Q - special features Energy saved or generated 0.0000 (235) -0.0000 (236)

elmhurst energy

Energy used Total delivered energy for all uses

0.0000 (237) 2661.9157 (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	4030.4066	0.2100	846.3854 (261)
Total CO2 associated with community systems Water heating (other fuel)	2930,6862	0.2100	0.0000 (373) 615.4441 (264)
Space and water heating			1461.8295 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	206.6381	0.1443	29.8243 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1226.9604	0.1363	-167.2196
PV Unit electricity exported	-3364.8548	0.1267	-426.2501
Total Total CO2, kg/year			-593.4696 (269) 910.1134 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.8000 (273)

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

	Energy Priman kWh/year	ry energy factor kg CO2/kWh	Primary energy kWh/year		
Space heating - main system 1	4030.4066	1.1300	4554.3595 (2	275)	
Total CO2 associated with community systems			0.0000 (4	173)	
Water heating (other fuel)	2930.6862	1.1300	3311.6754 (2	278)	
Space and water heating			7866.0349 (2	279)	
Pumps, fans and electric keep-hot	86.0000	1.5128	130,1008 (2	281)	
Energy for lighting	206.6381	1.5338	316.9484 (2	282)	
Energy saving/generation technologies	1006.0504	1 5000	1045 0005		
PV Unit electricity used in dwelling	-1226.9604	1.5038	-1845.0887		
PV Unit electricity exported	-3364.8548	0.4650	-1564.7459		
Total Total Primary energy kWh/year			-3409.8345 (2 4903.2496 (2		
Target Primary Energy Rate (TPER)			52.7800 (2	287)	



Property Reference	e	Tv	/pe B_Lean						ls	sued on Da	ate	23/10/2024	
Assessment Refer)001					Prop Type R		e B_Lean		Last Tore Det	
Property									176				
					005					TEP			
SAP Rating					86 B			13.	00	TER		12.17	
Environmental					88 B		% DER < TER					-6.82	
CO₂ Emissions (t/y					1.34		DFEE	39.	33	TFEE		53.53	
Compliance Check	(See BREL		% DFEE < TFI					26.53	
% DPER < TPER					-12.05		DPER	71.	94	TPER	(64.20	
Assessor Details		Mr. Olive	er Eggenton							Asse	ssor ID	AQ01-000)1
Client													
AP 10 WORKSHEET ALCULATION OF D Overall dwell Fround floor irst floor otal floor area	WELLING EM	IISSIONS FO	DR RĒGULĀTIO	NNS COMPLIA	NCE	9.6600		Area (m2) 76.8600 42.8000	(1b) x	7 height (m) 3.0000 2.5500		Volume (m3) 230.5800 109.1400	
. Ventilation re- umber of open cl umber of open f umber of chimnes umber of flues umber of flues umber of flues umber of flues umber of passiv umber of fluele	himneys lues ys / flues attached t attached t d chimneys ittent ext e vents	o solid fu o other he ract fans	lel boiler	fire					a)+(3b)+(3c)+		0 * 80 = 0 * 20 =	339.7200 n3 per hour 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6a) (6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design J Infiltration rat Number of sides	thod AP50 e	ys, flues	and fans	= (6a)+(6b)+(6c)+(6d)+	6e)+(6f)+	(6g) + (7a) + ('	7b)+(7c) =			/ (5) =		(17) (18) (19)
Shelter factor Infiltration rate	e adjusted	l to includ	ie shelter f	factor							(19)] = x (20) =		
dj infilt rate	Jan 5.1000 1.2750	1.2500	Mar 4.9000 1.2250	1.1000	1.0750	Jun 3.8000 0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Iffective ac	0.2663 0.5355		0.2559 0.5327		0.2245 0.5252			0.1932 0.5187			0.2350 0.5276		
. Heat losses a													
. Heat losses a				Gross m2		Net	Jree.	II_value	A x U W/K		-value kJ/m2K	A x K kJ/K	
3. Heat losses and lement Mindow (Uw = 0.80 Joor leatloss Floor 1 External Wall 1 External Roof 1 Jotal net area o 'abric heat loss	0) f external	elements	2	Gross	Openings	Net 26. 2. 76. 190. 80.	Area m2 8900 3000 8600 2195 0000 2695	U-value W/m2K 0.7752 1.0000 0.0800 0.1300 0.1000	W/K 20.8450 2.3000	14			(27) (26) (28a) (29a)
Heat losses and lement Mindow (Uw = 0.80 Noor Leatloss Floor 1 External Wall 1 External Roof 1 otal net area of	0) f external , W/K = Su = Sum(A x ameter (IM (User defi idges	. elements m (A x U) : k) IP = Cm / I	2 Aum(A, m2) CFA) in kJ/m	Gross m2 219.4095 80.0000	Openings m2 29.1900	Net 26. 2. 76. 190. 80.	Area m2 8900 3000 8600 2195 0000 2695	U-value W/m2K 0.7752 1.0000 0.0800 0.1300 0.1000 30) + (32)	W/K 20.8450 2.3000 6.1488 24.7285 8.0000 = 62.0223 (30) + (32)	14 + (32a).	kJ/m2K 0.0000 0.0000 0.0000 (32e) = (36a) =	kJ/K 0.0000 26630.7300 0.0000	(27) (26) (28a) (29a) (30) (31) (31) (33) (34) (35) (36)
Heat losses and lement Nindow (Uw = 0.8) Joor Leatloss Floor 1 External Wall 1 Notal net area o abric heat loss Heat capacity Cm Thermal mass par- thermal bridges Joint Thermal br Jotal fabric heat Yentilation heat	0) f external , W/K = Su = Sum(A x ameter (IM (User defi idges t loss loss calc Jan 60.0292	. elements m (A x U) : k) IP = Cm / I ned value rulated mon Feb	2 Aum(A, m2) IFA) in kJ/m 0.050 * tot nthly (38)m Mar	Gross m2 219.4095 80.0000 m2K cal exposed = 0.33 x (Apr	Openings m2 29.1900 area) 25)m x (5)	Net 26. 2. 76. 190. 80.	Area m2 8900 3000 8600 2195 0000 2695 (26)(3	U-value W/m2K 0.7752 1.0000 0.0800 0.1300 0.1000 30) + (32)	W/K 20.8450 2.3000 6.1488 24.7285 8.0000 = 62.0223 (30) + (32) (33) Sep	14 + (32a).	kJ/m2K 0.0000 0.0000 0.0000 (32e) = (36a) = + (36a) = Nov	kJ/K 0.0000 26630.7300 0.0000 26630.7300 222.5533 18.8135 0.0000	(27) (26) (28a) (29a) (30) (31) (33) (34) (35) (36) (37)



Average = Sum												139.8480	
ILP	Jan 1.1772	Feb 1.1759	Mar 1.1747	Apr 1.1687	May 1.1676	Jun 1.1624	Jul 1.1624	Aug 1.1615	Sep 1.1644	Oct 1.1676	Nov 1.1699	Dec 1.1722	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.1687 31	
. Water heati	ing energy	requirement	s (kWh/year)									
ssumed occupa ot water usag	ancy											2.8620	(42)
ot water usag	72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	(42a)
lot water usag		r uses	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	
Average daily	43.9397 hot water	42.3418 use (litres	40.7440 /day)	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397 135.4200	
aily hot wate	Jan er use	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
nergy conte nergy content	147.3198 233.3186 t (annual)	205.3017	140.3429 215.7018	134.5176 184.1479	129.7870 174.7182	124.7012 153.3347	122.7469 148.4517	126.5614 156.7094	130.5843 161.0235	135.9234 184.4468 Total = S	141.8385 202.0749 um(45)m =	146.9378 230.0691 2249.2984	(45)
Distribution] Nater storage	34.9978		45)m 32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
ater storage Store volume a) If manufac		ared loss f	actor is kno	own (kWh/d	lav):							200.0000 1.5000	
Temperature Inter (49) or Total storage	factor fro (54) in (5 loss	m Table 2b 5)										0.5400	(49)
If cylinder co		licated sola	r storage	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	
Primary loss Combi loss Cotal heat rec	23.2624 0.0000	0.0000	23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	(59)
WWHRS		248.9929		230.9599 -50.9630	223.0906	200.1467 -40.6424	196.8241 -38.0958	205.0818 -40.5110	207.8355	232.8192 -49.5725	248.8869 -56.1597	278.4415 -65.2270	
PV diverter Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
GHRS Output from w	0.0000 /h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
2Total non w			202.5277	179.9969	175.5950	159.5043	158.7283			183.2467 h/year) = S		2201.3470	(64)
l2Total per ye Electric showe		ar) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64) (64a)
eat gains fro					al Energy us							0.0000	
. Internal gair	ns (Table 5	able 5 and	5a)		Мау				Sep	Oct	Nov	Dec	
(66)m Lighting gains	143.0996	143.0996	143.0996		143.0996	143.0996	143.0996		143.0996		143.0996	143.0996	(66)
Appliances gai	144.9153 ins (calcul	160.4419 ated in App	144.9153 endix L, eq	149.7458 uation L13	144.9153 or L13a), al	149.7458 lso see Tab	144.9153 le 5				149.7458	144.9153	
Cooking gains	(calculate	d in Append	ix L, equat:	ion L15 or		see Table	5						
Pumps, fans	3.0000	3.0000	3.0000	3.0000	37.3100 3.0000		37.3100 0.0000			37.3100 3.0000			
Losses e.g. ev Water heating	-114.4796	-114.4796			-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	(71)
Total internal	156.2854		148.4123	137.0538	130.0964	122.8242	118.3577	122.0481	126.3749	134.4442	145.3327	154.8332	(72)
		670.6916	642.5358	620.1550	588.3557	564.1061	542.2443	542.9797	559.5835	581.6752	617.4055	640.8834	(73)
6. Solar gains													
[Jan]			A	rea m2	Solar flux Table 6a W/m2	Speci	g fic data Table 6b	Specific or Tab	FF data le 6c	Acce fact Table	ss or 6d	Gains W	
Northeast												40.0102	
Southeast Southwest Northwest			0.8 11.7 3.6	000 400 000	11.2829 36.7938 36.7938 11.2829		0.6800 0.6800 0.6800	0 0 0	.7000 .7000 .7000	0.77 0.77 0.77	00 00 00	9.7097 142.4896 13.3988	(79)
Solar gains Sotal gains	205.6083 860.5088	367.9673 1038.6589	550.5904 1193.1263	761.1910 1381.3460	924.6891 1513.0448	949.7130 1513.8191	902.4281 1444.6724	775.6032 1318.5829	622.7580 1182.3415	419.3875 1001.0627	249.5021 866.9076	173.8674 814.7508	(83) (84)
7. Mean intern	nal tempera	ture (heati	ng season)										
Cemperature du Jtilisation fa	uring heati	ng periods	in the livi	ng area fro	om Table 9, 1	[hl (C)						21.0000	(85)
tau	Jan	Feb	Mar	Apr		Jun	Jul 53.1819		Sep 53.0909	Oct 52.9463	Nov 52.8445	Dec 52.7386	
alpha util living an	4.5010 rea	4.5048	4.5086	4.5264	4.5298	4.5455	4.5455	4.5484	4.5394	4.5298	4.5230	4.5159	
					0.7518					0.9341			
MIT Th 2	19.5385 19.9383	19.7861 19.9393	20.1296 19.9403	20.5495 19.9451	20.8419 19.9460	20.9661 19.9502	20.9930 19.9502	20.9878 19.9509	20.8993 19.9486	20.4937 19.9460	19.9335 19.9442	19.4900 19.9423	



util rest of house 0.9911	0.9790	0.9496	0.8616	0.6935	0.4815	0.3213	0.3716	0.6439	0.9091	0.9805	0.9930	
MIT 2 18.2480 Living area fraction	18.5625	18.9931	19.5006	19.8171	19.9310	19.9479	19.9465		19.4496 Living area		18.1889 0.1003	(91)
MIT 18.3774 Temperature adjustment	18.6852	19.1071	19.6058	19.9199	20.0348	20.0527	20.0509	19.9834	19.5543	18.8738	18.3194 -0.1500	(92)
adjusted MIT 18.2274	18.5352	18.9571	19.4558	19.7699	19.8848	19.9027	19.9009	19.8334	19.4043	18.7238	18.1694	(93)
9 Space heating require												
 Space heating require 												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation 0.9861 Useful gains 848.5488	0.9701 1007.5834	0.9357 1116.4284	0.8451 1167.4408	0.6828	0.4760 720.6530	0.3168 457.6714	0.3665 483.2557	0.6339 749.5355	0.8923 893.2598	0.9721 842.6808	0.9888 805.6308	
Ext temp. 4.3000 Heat loss rate W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
	1918.6222	1750.9586	1476.2100	1127.4915	735.0934	459.3892	486.5639	798.8644	1230.0941	1627.1475	1959.4293	(97)
828.3257	612.2181		222.3139	70.2064	0.0000	0.0000	0.0000	0.0000	250.6047	564.8160	858.4260	(98a)
Space heating requirement Solar heating kWh											3879.0012	
0.0000 Solar heating contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(986)
Space heating kWh 828.3257	612.2181	472.0905	222.3139	70.2064	0.0000	0.0000	0.0000	0.0000	250.6047	564.8160	858.4260	(98c)
Space heating requiremen Space heating per m2	t after sol	ar contribu	tion - tota	l per year	(kWh/year)				(98c) / (4) =	3879.0012 32.4169	(99)
space nearing per ms									(500	, , (-)	0211200	(22)
9a. Energy requirements												
Fraction of space heat f					L)						0.0000	(201)
Fraction of space heat f Efficiency of main space			<u></u> \$)								1.0000 84.5000	
Efficiency of main space Efficiency of secondary/	heating sy	stem 2 (in	8)								0.0000	(207)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(200)
Space heating requirement	t		-	-			-	-				(00)
828.3257 Space heating efficiency	(main heat			70.2064	0.0000	0.0000	0.0000	0.0000	250.6047	564.8160	858.4260	
84.5000 Space heating fuel (main	84.5000 heating sy	84.5000 stem)	84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
980.2671 Space heating efficiency		558.6869 ing system	263.0933 2)	83.0844	0.0000	0.0000	0.0000	0.0000	296.5736	668.4213	1015.8888	(211)
0.0000 Space heating fuel (main	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
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 (seco 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 requiremen 215.2333	t 190.2172	202.5277	179.9969	175.5950	159.5043	158.7283	164.5708	165.7853	183.2467	192.7273	213.2144	(64)
Efficiency of water heat (217)m 84,5000		84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	89.5000 84.5000	(216)
Fuel for water heating,		239.6777	213.0140	207.8047	188.7625	187.8442	194.7583	196.1956	216.8600	228.0796	252.3248	
Space cooling fuel requi		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Pumps and Fa 7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting 28.0180 Electricity generated by					9.3572	10.4479	13.5805	17.6398	23.1443	26.1414	28.7967	
(233a)m 0.0000 Electricity generated by						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
(234a)m 0.0000 Electricity generated by			0.0000 tors (Append			0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m 0.0000 Electricity used or net	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m 0.0000 Electricity generated by	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(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 (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 (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 (235d)m 0.0000	electricity 0.0000		by micro-CHI 0.0000			7e if net g 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - mai											4590.5339	
Space heating fuel - mai Space heating fuel - sec	n system 2										0.0000	(213)
Efficiency of water heat											89.5000	
Water heating fuel used Space cooling fuel											2605.1444 0.0000	
Electricity for pumps an	d fans:											
central heating pump main heating flue fan											41.0000 45.0000	
Total electricity for th Electricity for lighting	e above, kW		ix L)								86.0000 226.1215	(231)
				4.0)							22011213	(202)
Energy saving/generation PV generation	cecnno10g1	es (Appendi	ces n , N and	u (2)							0.0000	
Wind generation Hydro-electric generation											0.0000	(235a)
Electricity generated - Appendix Q - special fea	Micro CHP (0.0000	
Energy saved or generate Energy used											-0.0000 0.0000	
Total delivered energy f	or all uses	I									7507.7998	

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



Space heating - main system 1 Total CO2 associated with community s Water heating (other fuel) Space and water heating Pumps, fans and electric keep-hot Energy for lighting Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission 	Rate (DER)				kWh/year 4590.5339 2605.1444 86.0000 226.1215	kg Primary energy kg	C02/kWh 0.2100 0.2100 0.1387 0.1443	Prim	Emissions gr CO2/year 964.0121 0.0000 547.0803 1511.0925 11.9293 32.6363 1555.6580 13.0000 13.0000 13.0000 13.0000 2943.8132 8131.1165 130.1008 8466.8326 8608.0500 71.9400	(273) (264) (265) (267) (268) (272) (273) (273) (273) (278) (279) (281) (281) (282) (286)
SAP 10 WORKSHEET FOR New Build (As De CALCULATION OF TARGET EMISSIONS 	signed) (Version 1	0.2, February			Area (m2) 76.8600 42.8000	(lb) x	3.0000 2.5500	(2c) =		(1b) - (3b) (1c) - (3c) (4) (5)
2. Ventilation rate 2. Ventilation rate Number of open flues Number of chimeys / flues attached to Number of flues attached to solid fue Number of flues attached to other hea Number of intermittent extract fans Number of passive vents Number of flueless gas fires Infiltration due to chimneys, flues a Pressure test	l boiler tter	5)+(6c)+(6d)+((6e)+(6f)+(7b)+(7c) =		40.0000	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000 0.0000 0.0000 40.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b) (7c)
Pressure Test Method Measured/design AP50 Infiltration rate Number of sides sheltered Shelter factor Infiltration rate adjusted to include	shelter factor					(20) = 1 - (21)	[0.075 x = (18)	-	81ower Door 5.0000 0.3677 0	(18) (19) (20)
Jan Feb Wind speed 5.1000 5.0000 Wind factor 1.2750 1.2500 Adj infilt rate 0.4689 0.4597 Effective ac 0.6099 0.6057	Mar Apr 4.9000 4.4000 1.2250 1.1000 0.4505 0.4045 0.6015 0.5818	May 4.3000 1.0750 0.3953 0.5781	Jun 3.8000 0.9500 0.3494 0.5610	Jul 3.8000 0.9500 0.3494 0.5610	Aug 3.7000 0.9250 0.3402 0.5579	1.0000 0.3677	Oct 4.3000 1.0750 0.3953 0.5781	0.4137	0.4321	(22a) (22b)
3. Heat losses and heat loss parameter Element TER Opening Type (Uw = 1.20) Heatloss Floor 1 External Wall 1 External Roof 1 Total net area of external elements A Fabric heat loss, W/K = Sum (A x U)	Gross m2 219.4095 80.0000		Net 2. 26. 76. 190. 80.	Area m2 3000 8900 8600 2195 0000 2695	U-value W/m2K 1.0000 1.1450 0.1300 0.1800 0.1100 30) + (32)	A x U W/K 2.3000 30.7901 9.9918 34.2395 8.8000 = 86.1214		(-value kJ/m2K	A x K kJ/K	
Thermal mass parameter (TMP = Cm / Th List of Thermal Bridges Kl Element E5 Ground floor (normal) E6 Intermediate floor within E16 Corner (normal) Thermal bridges (Sum(L x Psi) calcula Point Thermal bridges	a dwelling	0			42	2.8000 5.6900	-value 0.1600 0.0000 0.0900	Tot 6.84 0.00 11.71 (36a) =	180	



Total fabric he	eat loss								(33) + (36) ·	+ (36a) =	104.6874	(37)
Ventilation hea													
(38)m Heat transfer (Jan 68.3768	Feb 67.8983	Mar 67.4292	Apr 65.2262	May 64.8140	Jun 62.8952	Jul 62.8952	Aug 62.5398	Sep 63.6343	Oct 64.8140	Nov 65.6478	Dec 66.5196	(38)
Average = Sum(3	173.0642		172.1166	169.9136	169.5014	167.5826	167.5826	167.2272	168.3217	169.5014	170.3352	171.2070 169.9116	(39)
HLP HLP (average)	Jan 1.4463	Feb 1.4423	Mar 1.4384	Apr 1.4200	May 1.4165	Jun 1.4005	Jul 1.4005	Aug 1.3975	Sep 1.4067	Oct 1.4165	Nov 1.4235	Dec 1.4308 1.4200	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
4. Water heating			s (kWh/year)									
Assumed occupan	ncy											2.8620	(42)
Hot water usage	72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	(42a)
Hot water usage	31.1742	30.7112	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	(42b)
Hot water usage Average daily h	43.9397	42.3418		39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397 135.4200	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water		144 1739	140.3429	- 134.5176	129.7870	124.7012	122.7469	126.5614	130.5843	135.9234	141.8385	146.9378	(44)
Energy conte Energy content Distribution 10	233.3186 (annual)	205.3017	215.7018	184.1479	174.7182	153.3347	148.4517	156.7094	161.0235	184.4468		230.0691	
	34.9978		45)m 32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
Water storage 1 Store volume a) If manufact Temperature 1 Enter (49) or	turer decla factor from	ı Table 2b	actor is kno	own (kWh/d	ay):							200.0000 1.6525 0.5400 0.8924	(48) (49)
Total storage 1	loss 27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder con		icated sola 24.9865		26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	22 6622	(57)
Primary loss Combi loss	23.2624 0.0000	24.9865 21.0112 0.0000	27.6637 23.2624 0.0000	20.7713 22.5120 0.0000	23.2624	20.7713 22.5120 0.0000	23.2624	23.2624	20.7713 22.5120 0.0000	23.2624	20.7713 22.5120 0.0000	27.6637 23.2624 0.0000	(59)
Total heat requ	uired for w	water heati	ng calculat	ed for each	month								
WWHRS		251.2995 -29.1939	266.6279 -30.5702	233.4312 -25.3133	225.6443 -23.5911	202.6180 -20.1871	199.3778 -18.9222	207.6355 -20.1218	210.3068 -20.8863	235.3729 -24.6227	251.3582 -27.8945	280.9951 -32.3983	(62) (63a)
		-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	
Solar input 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	
Output from w/h	h		236.0577	208.1178				187.5136	189.4204	210.7502	223.4637	248.5969	(64)
12Total per yea		ar)						Total pe	er year (kW	h/year) = S	um (64) m =	2542.2007 2542	
Electric shower	c(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	
Heat gains from	n water hea	ting, kWh/	month	lot	al Energy u	sed by insta	antaneous e.	lectric show	wer(s) (kwn	/year) = Su	m(64a)m =	0.0000	(64a)
	118.3193	105.0610	112.4617	100.6558	98.8347	90.4104	90.1011	92.8467	92.9669	102.0694	106.6166	117.2388	(65)
5. Internal ga	ins (see Ta	able 5 and											
Metabolic gain: (66)m	s (Table 5) Jan	, Watts Feb	Mar 143.0996	Apr	May	Jun 143.0996	Jul	Aug	Sep	Oct 143.0996	Nov 143.0996	Dec 143.0996	(66)
Lighting gains								2.0.0000	2.010000	2.0.0000	2.010000	2.0.0000	(00)

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[Jan]			А	m2	Solar flux Table 6a W/m2	Speci	g fic data. Table 6b	Specific or Tab		Acce fact Table	or	Gains W	
Northeast Southeast Southwest Northwest			10.7500 0.8000 11.7400 3.6000		11.2829 0.6300 36.7938 0.6300 36.7938 0.6300 11.2829 0.6300		0.6300	0.7000 0.7000 0.7000 0.7000 0.7000		0.7700 0.7700 0.7700 0.7700		37.0683 8.9957 132.0125 12.4136	(77 (79
Solar gains Total gains	190.4901 846.8367	340.9109 1012.9094	510.1058 1154.0878	705.2210 1326.7789	856.6973 1446.4991	879.8812 1445.3901	836.0731 1379.7636	718.5735 1262.9994	576.9670 1137.9533	388.5502 971.6715	231.1563 849.9647	161.0830 803.4126	

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 alpha util living a	42.7438 3.8496	42.8623 3.8575	42.9791 3.8653	43.5364 3.9024	43.6423 3.9095	44.1420 3.9428	44.1420 3.9428	44.2358 3.9491	43.9481 3.9299	43.6423 3.9095	43.4286 3.8952	43.2075 3.8805
utii iiving a	0.9937	0.9869	0.9721	0.9273	0.8290	0.6655	0.5124	0.5723	0.8052	0.9538	0.9881	0.9949 (86)
MIT Th 2 util rest of 1	19.1024 19.7280	19.3510 19.7311	19.7256 19.7340	20.2315 19.7481	20.6487 19.7507	20.8966 19.7630	20.9716 19.7630	20.9566 19.7652	20.7712 19.7582	20.2213 19.7507	19.5787 19.7454	19.0706 (87) 19.7398 (88)
MIT 2 Living area f	0.9918 17.5528	0.9829 17.8707	0.9630 18.3456	0.9030 18.9774	0.7725 19.4552	0.5641 19.7032	0.3787 19.7539	0.4352 19.7496	0.7209 19.6001 fLA =	0.9333 18.9807 Living area	0.9836 18.1722 / (4) =	0.9933 (89) 17.5196 (90) 0.1003 (91)
MIT Temperature a adjusted MIT	17.7082 djustment 17.7082	18.0192 18.0192	18.4840 18.4840	19.1032 19.1032	19.5749 19.5749	19.8229 19.8229	19.8760 19.8760	19.8706 19.8706	19.7175 19.7175	19.1051 19.1051	18.3133 18.3133	17.6752 (92) 0.0000 17.6752 (93)

8. Space heating requirement

Utilisation Useful gains Ext temp. Heat loss rate	Jan 0.9868 835.6516 4.3000	Feb 0.9747 987.2498 4.9000	Mar 0.9504 1096.8156 6.5000	Apr 0.8869 1176.6930 8.9000	May 0.7631 1103.8834 11.7000	Jun 0.5695 823.1158 14.6000	Jul 0.3915 540.1726 16.6000	Aug 0.4478 565.5128 16.4000	Sep 0.7176 816.5990 14.1000	Oct 0.9185 892.5111 10.6000	Nov 0.9759 829.4384 7.1000	Dec 0.9891 794.6258 4.2000	(95)
	2320.4728	2264.1796	2062.6514	1733.6543	1334.8050	875.2595	548.9993	580.3822	945.5504	1441.6230	1910.0178	2307.0439	(97)
Space heating	kWh												
	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(98a)
Space heating Solar heating		t - total p	er year (kW	h/year)								5565.9989	
Solar neating	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					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(505)
Space heating													
	1104.7069	858.0969	718.5818	401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	(98c)
Space heating Space heating		t after sol	ar contribu	tion - tota	l per year	(kWh/year)				(98c) / (4) =	5565.9989 46.5151	(99)

9a. Energy requirements - 1 Fraction of space heat from Fraction of space heat from Efficiency of main space he Efficiency of main space hyperbolic Efficiency of secondary/sup	n secondar n main sys eating sys eating sys	y/supplement tem(s) tem 1 (in tem 2 (in	ntary system %) %)								0.0000 1.0000 92.3000 0.0000 0.0000	(202) (206) (207)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(200)
Space heating requirement												
1104.7069 8 Space heating efficiency (m	nain heati	ng system	1)	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392		1125.2391	
92.3000 Space heating fuel (main he		92.3000 tem)	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
1196.8656 Space heating efficiency (m	929.6824	778.5285		186.1383	0.0000	0.0000	0.0000	0.0000	442.6211	842.9222	1219.1106	(211)
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)
	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (seconda 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												
251.2351 2 Efficiency of water heater		236.0577	208.1178	202.0532	182.4309	180.4556	187.5136	189.4204	210.7502	223.4637	248.5969 79.8000	
(217)m 86.9824 Fuel for water heating, kWr		86.3907	85.5052	83.6983	79.8000	79.8000	79.8000	79.8000	85.5178	86.6202	87.0240	(217)
288.8346 2 Space cooling fuel requirem	255.9190	273.2443	243.3979	241.4065	228.6102	226.1349	234.9795	237.3690	246.4403	257.9811	285.6647	(219)
(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
	6.5973 23.9391	7.3041 21.5545	7.0685 15.7918	7.3041 12.1980	7.0685 9.9659	7.3041 11.1274	7.3041 14.4639	7.0685 18.7871	7.3041 24.6497	7.0685 27.8418	7.3041 30.6698	
Electricity generated by PV (233a)m -64.4326 -	/s (Append -87.2757	ix M) (neg -120.5723	ative quanti -130.0922	ty) -135.7803	-125.0745	-123.3990	-118.5555	-109.5427	-96.9990	-69.5010	-56.1222	(233a)
Electricity generated by wi (234a)m 0.0000	ind turbin					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Electricity generated by hy	/dro-elect	ric genera	tors (Append	lix M) (nega	ative quant		0.0000	0.0000	0.0000			
(235a)m 0.0000 Electricity used or net ele	ectricity		by micro-CHE		N) (negati	ve if net g	eneration)			0.0000	0.0000	· ·
(235c)m 0.0000 Electricity generated by PV	/s (Append	ix M) (neg	ative quanti					0.0000	0.0000	0.0000	0.0000	(235c)
(233b)m -48.1055 - Electricity generated by wi						-374.5683	-318.9148	-236.0648	-141.1653	-63.8016	-38.1758	(233b)
(234b)m 0.0000 Electricity generated by hy	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(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 ele (235d)m 0.0000								0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - main s	system 1										6030.3347	(211)
Space heating fuel - main s Space heating fuel - second											0.0000	
Efficiency of water heater Water heating fuel used	and l										79.8000	
Space cooling fuel used											3019.9819 0.0000	
Electricity for pumps and f	fans:											
Total electricity for the a Electricity for lighting (o			ix L)								86.0000 240.8297	
Energy saving/generation te PV generation	echnologie	s (Appendi	ces M ,N and	1 Q)							-3798.9981	(232)
Wind generation											0.0000	(234)
Hydro-electric generation Electricity generated - Mic	cro CHP (A										0.0000	
Appendix Q - special featur Energy saved or generated											-0.0000	
Energy used											0.0000	(237)
Total delivered energy for	all uses										5578.1482	(230)



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

	Energy kWh/vear	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1 Total CO2 associated with community systems	6030.3347	0.2100	1266.3703 (261) 0.0000 (373)
Water heating (other fuel) Space and water heating	3019.9819	0.2100	634.1962 (264) 1900.5665 (265)
Pumps, fans and electric keep-hot Energy for lighting	86.0000 240.8297	0.1387 0.1443	11.9293 (267) 34.7592 (268)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)	-1237.3470 -2561.6511	0.1355 0.1263	-167.6235 -323.5351 -491.1586 (269) 1456.0963 (272) 12.1700 (273)

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

	Energy Primar	y energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	6030.3347	1.1300	6814.2782 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3019.9819	1.1300	3412.5795 (278)
Space and water heating			10226.8577 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	240.8297	1.5338	369.3926 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1237.3470	1.5007	-1856,9152
PV Unit electricity exported	-2561.6511	0.4636	-1187.6416
Total			-3044.5568 (283)
Total Primary energy kWh/year			7681.7943 (286)
Target Primary Energy Rate (TPER)			64.2000 (287)



Property Referenc	:e	Tyr	pe B_Green						ls	sued on D	ate	23/10/2024	
Assessment Refer	rence	000	001					Prop Type Re	ef Typ	e B_Lean			
Property													
SAP Rating					99 A		DER	-0.0	12	TER		12.17	
Environmental					100 A		% DER < TER	-0.0	12			12.17	
CO ₂ Emissions (t/)	vear)				-0.1		DFEE	39.3	33	TFE	F	53.53	
Compliance Check					See BREL		% DFEE < TFE		35		-	26.53	
% DPER < TPER					92.68		DPER	4.7	0	TPE	R	64.20	
		_			02.00								
Assessor Details Client		Mr. Olive	r Eggenton							Asse	essor ID	AQ01-00	D1
SAP 10 WORKSHEET ALCULATION OF D						2022)							
. Overall dwell	ing charac	teristics											
								Area		height		Volume	
round floor								(m2) 76.8600	(lb) x	(m) 3.0000			
'irst floor 'otal floor area	TFA = (la	a)+(1b)+(1c)+(1d)+(1e)	(ln)	11	9.6600		42.8000	(lc) x	2.5500	(2c) =	109.1400	(1c) - ((4)
Welling volume								(3	3a)+(3b)+(3c)+(3d)+(3e)	(3n) =	339.7200	(5)
. Ventilation r	ate												
												m3 per hour	
Number of open c Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of interm Number of passiv Number of fluele	lues ys / flues attached t attached t ed chimneys hittent ext ve vents	to solid fu to other he s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 2 * 10 = 0 * 10 = 0 * 40 =	0.0000 0.0000 0.0000 0.0000 0.0000 20.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
-filtustics due	to chime	flues.	and fana	- (6-) ((6-)	1 (Ca) 1 (Ca) 1 ((-) . ((F)	(Ser) + (7er) + (7	(7a) -		20.0000		ges per hour	
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	thod AP50	rys, llues	anu Tans	- (6a)+(6D)	+(00)+(00)+(02)+(01)+((og) + (/a) + (/	D)+(7C) =		20.0000	5 7 (3) -	0.0589 Yes Blower Door 3.0000 0.2089 0	(17)
helter factor									(20) = 1 -				
infiltration rat	e adjusted	d to includ	e shelter f	actor					(21)	= (18)	x (20) =	0.2089	(21)
lind speed lind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750		0 4.7000	
dj infilt rate	0.2663		0.2559			0.1984		0.1932			0.235		
ffective ac	0.5355	0.5341	0.5327	0.5264	0.5252	0.5197	0.5197	0.5187	0.5218	0.5252	0.527		
				Gross m2	Openings m2		:Area m2	W/m2K	W/K		K-value kJ/m2K	A x K kJ/K	
lement						2.	3000	0.7752	2.3000				(27) (26)
lement indow (Uw = 0.8	-						8600	0.0800	6.1488		0.0000	0.0000	
lement indow (Uw = 0.8 oor eatloss Floor 1 xternal Wall 1 xternal Roof 1		l elements i		19.4095 80.0000	29.1900	190. 80.	2195 0000 2695		24.7285 8.0000	14	10.0000 0.0000	26630.7300 0.0000	
. Heat losses a lement lindow (Uw = 0.8 oor eatloss Floor 1 xternal Wall 1 xternal Roof 1 otal net area o abric heat loss	of external				29.1900	190. 80.	2195 0000 2695		= 62.0223	14			(30)
lement indow (Uw = 0.8 oor eatloss Floor 1 xternal Wall 1 xternal Roof 1 otal net area o abric heat loss eat capacity Cm hermal mass par hermal bridges oint Thermal br	of external , W/K = Su n = Sum(A x cameter (The (User definition) ridges	um (AxU) xk) 4P = Cm / T	Aum(A, m2) FA) in kJ/m	80.0000 12K		190. 80.	2195 0000 2695	80) + (32)	= 62.0223 (30) + (32)	+ (32a).	0.0000 (32e) = (36a) =	0.0000 26630.7300 222.5533 18.8135 0.0000	(30) (31) (33) (34) (35) (36)
lement indow (Uw = 0.8 oor eatloss Floor 1 xternal Wall 1 txternal Roof 1 otal net area o abric heat loss eat capacity Cm hermal mass par hermal bridges point Thermal br otal fabric hea	of external , W/K = Su a = Sum(A x cameter (Th (User defi ridges tt loss	um (A x U) x k) MP = Cm / T ined value	Aum(A, m2) FA) in kJ/m 0.050 * tot	80.0000 h2K al exposed	area)	190. 80.	2195 0000 2695	80) + (32)	= 62.0223 (30) + (32)	+ (32a).	0.0000 (32e) =	0.0000 26630.7300 222.5533 18.8135 0.0000	(30) (31) (33) (34) (35) (36)
lement indow (Uw = 0.8 oor eatloss Floor 1 xternal Wall 1 vternal Roof 1 otal net area o abric heat loss eat capacity Cm hermal mass par hermal bridges oint Thermal br otal fabric hea entilation heat	of external , W/K = Su a = Sum(A x ameter (Th (User defi- idges t loss loss calc Jan	um (A x U) (k) (AP = Cm / T) (ined value) culated mon Feb	Aum(A, m2) FA) in kJ/m 0.050 * tot thly (38)m Mar	80.0000 2K cal exposed = 0.33 x (2 Apr	area) 25)m x (5) May	190. 80. 376. Jun	2195 0000 2695 (26)(3 Jul	30) + (32) (28). Aug	= 62.0223 (30) + (32) (33) Sep	+ (32a). + (36) Oct	0.0000 (32e) = (36a) = + (36a) = Nov	0.0000 26630.7300 222.5533 18.8135 0.0000 80.8358 Dec	(30) (31) (33) (34) (35) (36) (37)
lement indow (Uw = 0.8 oor eatloss Floor 1 xternal Wall 1 txternal Roof 1 otal net area o abric heat loss eat capacity Cm hermal mass par hermal bridges pint Thermal br otal fabric hea entilation heat	of external , W/K = Su h = Sum(A y ameter (The (User defi- idges to loss : loss calco Jan 60.0292	um (A x U) (k) (AP = Cm / T) (ined value) culated mon Feb	Aum(A, m2) FA) in kJ/m 0.050 * tot thly (38)m	80.0000 2K cal exposed = 0.33 x (2 Apr	area) 25)m x (5)	190. 80 376.	2195 0000 2695 (26)(3	30) + (32) (28).	= 62.0223 (30) + (32) (33) Sep	+ (32a). + (36)	0.0000 (32e) = (36a) = + (36a) = Nov	0.0000 26630.7300 222.5533 18.8135 0.0000 80.8358 Dec	(30) (31) (33) (34) (35) (36) (37)



Average = Sum((39)m / 12											139.8480	
LP	Jan 1.1772	Feb 1.1759	Mar 1.1747	Apr 1.1687	May 1.1676	Jun 1.1624	Jul 1.1624	Aug 1.1615	Sep 1.1644	Oct 1.1676	Nov 1.1699	Dec 1.1722	(40)
LP (average) ays in mont	31	28	31	30	31	30	31	31	30	31	30	1.1687 31	
Water heati	ing energy	requirement	s (kWh/year	:)									
ssumed occupa ot water usag	ge for mixe											2.8620	(42)
ot water usag	ge for bath		69.5397		64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	
lot water usag		r uses	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	
verage daily	43.9397 hot water	42.3418 use (litres	40.7440 s/day)	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397 135.4200	
aily hot upto	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
aily hot wate nergy conte nergy content	147.3198 233.3186 : (annual)	205.3017	140.3429 215.7018	134.5176 184.1479	129.7870 174.7182	124.7012 153.3347	122.7469 148.4517	126.5614 156.7094	130.5843 161.0235	135.9234 184.4468 Total = S	141.8385 202.0749 um(45)m =	146.9378 230.0691 2249.2984	
istribution 1	34.9978		(45)m 32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
ater storage tore volume				(1.77)	1) -							200.0000	
) If manufac Temperature Inter (49) or Iotal storage	factor fro (54) in (5	m Table 2b	actor 15 km	own (kwh/o	lay):							1.5000 0.5400 0.8100	(49)
f cylinder co	25.1100 ontains ded		25.1100 ar storage	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
Primary loss Combi loss Cotal heat req	0.0000	21.0112 0.0000	23.2624 0.0000	24.3000 22.5120 0.0000	23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	(59)
WHRS	281.6910	248.9929 -58.7758		230.9599 -50.9630	223.0906	200.1467 -40.6424	196.8241 -38.0958	205.0818 -40.5110	207.8355	232.8192 -49.5725	248.8869 -56.1597	278.4415 -65.2270	
V diverter					-509.7994						-85.7761	-51.5116	(63b)
GHRS Wutput from w/	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
2Total per ye	150.2283		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 Total p	0.0000 er year (kW	0.0000 h/year) = S	106.9511 um(64)m =	475.0601	
lectric showe	er(s) 0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
eat gains fro		ating, kWh/ 103.2158		98.6788	tal Energy u 96.7917	88.4334	88.0581	90.8038		/year) = 5u 100.0265		0.0000	
etabolic gain 66)m ighting gains ppliances gai	ns (Table 5 Jan 143.0996 3 (calculat 144.9153 ins (calcul), Watts Feb 143.0996 ed in Appen 160.4419 ated in App	Mar 143.0996 dix L, equa 144.9153 pendix L, eq	Apr 143.0996 tion L9 or 149.7458 puation L13	May 143.0996 L9a), also 144.9153 or L13a), a	Jun 143.0996 see Table 5 149.7458 lso see Tab	Jul 143.0996 144.9153 ble 5	Aug 143.0996 144.9153		144.9153	Nov 143.0996 149.7458	Dec 143.0996 144.9153	(67)
Cooking gains	284.7699 (calculate	287.7249 d in Append	280.2784 lix L, equat	264.4255 ion L15 or	244.4142 L15a), also	225.6063 see Table	213.0415 5						
umps, fans	3.0000	3.0000	3.0000	3.0000	37.3100 3.0000					37.3100 3.0000			
	-114.4796	-114.4796			-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	-114.4796	(71)
ater heating	156.2854		148.4123	137.0538	130.0964	122.8242	118.3577	122.0481	126.3749	134.4442	145.3327	154.8332	(72)
otal internal		670.6916	642.5358	620.1550	588.3557	564.1061	542.2443	542.9797	559.5835	581.6752	617.4055	640.8834	(73)
. Solar gains													
Jan]			А	m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acces facto Table	ss or 6d	Gains W	
lortheast												40.0102	(75)
outheast			0.8	400	11.2829 36.7938 36.7938 11.2829		0.6800	0	.7000	0.77	00 00	9.7097 142.4896	(79)
orthwest			3.6		11.2829		0.6800		. 7000	0.77	00	13.3988	(81)
olar gains otal gains	205.6083 860.5088	367.9673 1038.6589	550.5904 1193.1263	761.1910 1381.3460	924.6891 1513.0448	949.7130 1513.8191	902.4281 1444.6724	775.6032 1318.5829	622.7580 1182.3415	419.3875 1001.0627	249.5021 866.9076	173.8674 814.7508	(83) (84)
. Mean intern	hal tempera	ture (heati	ng season)										
Cemperature du Ntilisation fa	uring heati	ng periods	in the livi	ng area fro	om Table 9,	Thl (C)						21.0000	(85)
au	Jan	Feb	Mar	Apr		Jun	Jul 53.1819		Sep 53.0909	Oct 52,9463	Nov 52.8445	Dec 52.7386	
lpha til living ar	4.5010	4.5048			4.5298							4.5159	
			0.9609	0.8913	0.7518	0.5652	0.4187	0.4754	0.7260	0.9341	0.9855	0.9946	(86)
MIT Th 2	19.5385 19.9383	19.7861 19.9393	20.1296 19.9403	20.5495 19.9451	20.8419 19.9460	20.9661 19.9502	20.9930 19.9502	20.9878 19.9509	20.8993 19.9486	20.4937 19.9460	19.9335 19.9442	19.4900 19.9423	



util rest of house 0.9911 MIT 2 18.2480	0.9790	0.9496	0.8616	0.6935	0.4815	0.3213	0.3716	0.6439	0.9091	0.9805	0.9930 18.1889	
Living area fraction MIT 18.3774	18.6852	19.1071	19.6058	19.0171	20.0348	20.0527	20.0509		Living are 19.5543		0.1003	(91)
Temperature adjustment adjusted MIT 18,3774	18,6852	19.1071	19.6058	19,9199	20.0348	20.0527	20.0509	19,9834	19.5543	18.8738	0.0000 18.3194	
												()
 Space heating requir 												
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
			0.8504	0.6920 1046.9859	0.4885 739.4936	0.3309 478.1016	0.3817 503.3363	0.6469 764.8649	0.8973 898.2076	0.9733 843.7641	0.9893 805.9986	(95)
Ext temp. 4.3000 Heat loss rate W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Space heating kWh	625.6113	1772.0425	232.1978	75.4884	755.9579 0.0000	480.2537	507.4112 0.0000	0.0000	1251.0514 262.5158	1648.1452 579.1543	873.8061	
Space heating requireme Solar heating kWh				/5.4004	0.0000	0.0000	0.0000	0.0000	202.0100	575.1545	3978.1392	(504)
0.0000 Solar heating contribut	0.0000 ion - total	0.0000 per vear (k	0.0000 Wh/vear)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Space heating kWh		485.6728		75.4884	0.0000	0.0000	0.0000	0.0000	262.5158	579.1543	873.8061	(98c)
Space heating requireme Space heating per m2	nt after sol	lar contribu	tion - tota	l per year	(kWh/year)				(98c) / (4) =	3978.1392 33.2454	(99)
9a. Energy requirements												
Fraction of space heat Fraction of space heat	from main sy	ystem(s)		m (Table I.	L)						0.0000	(202)
Efficiency of main spac Efficiency of main spac	e heating sy	ystem 2 (in	8)								219.3000 0.0000 0.0000	(207)
Efficiency of secondary Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(200)
Space heating requireme 843.6926	nt	485.6728	232.1978	75.4884	0.0000	0.0000	0.0000	0.0000	262.5158	579.1543	873.8061	(98)
Space heating efficienc 219.3000	y (main heat		1)	219.3000	0.0000	0.0000	0.0000	0.0000	219.3000	219.3000	219.3000	
Space heating fuel (mai		ystem)	105.8814	34.4225	0.0000	0.0000	0.0000	0.0000	119,7062	264.0923	398.4524	
Space heating efficienc 0.0000			2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating fuel (mai 0.0000	n heating sy 0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (sec 0.0000	ondary) 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 requireme 150.2283	56.1779	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	106.9511	161.7028	
	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000	190.4000 190.4000	
Fuel for water heating, 78.9014	29.5052	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	56.1718	84.9279	(219)
Space cooling fuel requ (221)m 0.0000 Pumps and Fa 0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Lighting 28.0180 Electricity generated b	22.4771	20.2381	14.8273	11.4531	9.3572	10.4479	13.5805	17.6398	23.1443	26.1414	28.7967	
(233a)m -117.1780 Electricity generated b	-155.1246	-199.2409	-187.3632	-164.3194	-134.3304	-132.2591	-130.9402	-127.5250	-148.0411	-123.3123	-102.4684	(233a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 itv)	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m 0.0000 Electricity generated b	0.0000 y PVs (Apper	0.0000 ndix M) (neg	0.0000 ative quant	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
(233b)m -0.9230 Electricity generated b	y wind turbi	ines (Append	lix M) (nega	tive quant:	ity)					-7.1381	0.4310	
(234b)m 0.0000 Electricity generated b	y hydro-eled	ctric genera	tors (Appen		gative quant		0.0000	0.0000	0.0000	0.0000	0.0000	
(235b)m 0.0000 Electricity used or net	electricity	y generated	by micro-CH	P (Appendi:	<pre>x N) (negative</pre>	ve if net g		0.0000	0.0000	0.0000	0.0000	
(235d)m 0.0000 Annual totals kWh/year Space heating fuel - ma		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating fuel - ma Space heating fuel - ma Space heating fuel - se	in system 2										1814.0170 0.0000 0.0000	(213)
Efficiency of water hea Water heating fuel used											190.4000 249.5064	
Space cooling fuel											0.0000	
Electricity for pumps a Total electricity for t Electricity for lightin	he above, kW		lix L)								0.0000 226.1215	
Energy saving/generatio	n technologi	ies (Appendi	.ces M ,N an	dQ)							-2726 6007	(222)
PV generation Wind generation Hydro-electric generati	on (Appendia	v N)									-2736.6097 0.0000 0.0000	(234)
Electricity generated - Appendix Q - special fe	Micro CHP										0.0000	
Energy saved or generat Energy used											-0.0000	
Total delivered energy	for all uses	в									-446.9649	
12a. Carbon dioxide emi	eeione - Tro	dividual bea	ting evetam		micro-CHP							

Emission factor kg CO2/kWh

Energy kWh/year

Les

Emissions kg CO2/year



											55	
Space heating - main sys Total CO2 associated wit		austora					1814.0170		0.1560		283.0284 0.0000	
Water heating (other fue Space and water heating		systems					249.5064		0.1599		39.9070 322.9353	(264)
Pumps, fans and electric Energy for lighting	keep-hot						0.0000 226.1215		0.0000 0.1443		0.0000 32.6363	(267)
Energy saving/generatio PV Unit electricity used	in dwelling						-1722.1026		0.1390		-239.3668	
PV Unit electricity expo Total Total CO2, kg/year	rtea						-1014.5071		0.1172		-118.8729 -358.2397 -2.6680	
EPC Dwelling Carbon Diox	ide Emission	Rate (DER)									-0.0200	
13a. Primary energy - In								Primary energ	v factor	Davi	ary energy	
Space heating - main sys								kg			kWh/year 2861.8215	(275)
Total CO2 associated wit Water heating (other fue Space and water heating		systems					249.5064		1.5917		0.0000 397.1419 3258.9634	(278)
Pumps, fans and electric Energy for lighting	keep-hot						0.0000 226.1215		0.0000 1.5338		0.0000 346.8326	(281)
Energy saving/generation PV Unit electricity used	in dwelling						-1722.1026		1.5140		-2607.2424	
PV Unit electricity expo Total	rted						-1014.5071		0.4298		-436.0408 -3043.2832	
Total Primary energy kWh Dwelling Primary energy	/year Rate (DPER)										562.5129 4.7000	
SAP 10 WORKSHEET FOR New		esigned)	(Version 10	.2, February	2022)							
CALCULATION OF TARGET EM												
1. Overall dwelling char	acteristics											
							Area (m2)		y height (m)		Volume (m3)	
Ground floor First floor							76.8600	(1b) x (1c) x	3.0000 (2b) = 2c) =	230.5800	(1b) - (3b (1c) - (3c
Total floor area TFA = (Dwelling volume	la)+(lb)+(lc)+(ld)+(le).	(ln)	11	9.6600		(3	3a)+(3b)+(3c)+	(3d)+(3e).	(3n) =	339.7200	(4) (5)
2. Ventilation rate												
										π	13 per hour	
Number of open chimneys Number of open flues										0 * 20 =		(6b)
Number of chimneys / flu Number of flues attached Number of flues attached	to solid fu	el boiler	ire							0 * 20 =	0.0000 0.0000 0.0000	(6d)
Number of blocked chimne Number of intermittent e	ys									0 * 20 =	0.0000	(6f)
Number of passive vents Number of flueless gas f	ires									0 * 10 = 0 * 40 =	40.0000 0.0000 0.0000	(7b) (7c)
Infiltration due to chim Pressure test	neys, flues	and fans =	= (6a)+(6b)·	+(6c)+(6d)+(6e)+(6f)+(6g) + (7a) + (1	7b)+(7c) =			Air change / (5) =	es per hour 0.1177 Yes	
Pressure Test Method Measured/design AP50										В	Slower Door 5.0000	(17)
Infiltration rate Number of sides sheltere	d										0.3677	(18) (19)
Shelter factor Infiltration rate adjust	ed to includ	e shelter fa	actor					(20) = 1 - (21			1.0000 0.3677	
Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed 5.1000 Wind factor 1.2750 Adj infilt rate	5.0000 1.2500	4.9000 1.2250	4.4000 1.1000	4.3000 1.0750	3.8000 0.9500	3.8000 0.9500	3.7000 0.9250		4.3000 1.0750	4.5000 1.1250	4.7000 1.1750	
	0.4597 0.6057	0.4505 0.6015	0.4045 0.5818	0.3953 0.5781	0.3494 0.5610	0.3494 0.5610	0.3402 0.5579	0.3677 0.5676	0.3953 0.5781	0.4137 0.5856		(22b) (25)
2 Woot lands and be -												
3. Heat losses and heat Element			Gross	Openings	Net	Area	U-value	AxU		value	АхК	
TER Opaque door	20)		m2	m2	2.	m2 3000 8900	W/m2K 1.0000	W/K 2.3000 30.7901	k	J/m2K	kJ/K	(26)
TER Opening Type (Uw = 1 Heatloss Floor 1 External Wall 1	.20)	21	19.4095	29.1900		8600 2195	0.1300 0.1800	9.9918 34.2395				(27) (28a) (29a)
External Roof 1 Total net area of extern		8	30.0000		80. 376.	2695	0.1100	8.8000				(30) (31)
Fabric heat loss, W/K =	Sum (A x U)					(26) (3	30) + (32)	= 86.1214				(33)



Thermal mass p List of Therma		[MP = Cm / 1	IFA) in kJ/n	n2K								222.5533	(35)
Kl Ele E5 Gro E6 Int		loor within	n a dwelling	а				42 35	ength .8000 .6900 .2000	Psi-value 0.1600 0.0000 0.0900	Tot 6.84 0.00 11.71	180 000	
Thermal bridge	es (Sum (L x		lated using	Appendix K	()			100	.2000	0.0500		18.5660	
Point Thermal Total fabric h									(33) + (36)	(36a) = + (36a) =	0.0000 104.6874	
Ventilation he						-			-			-	
(38)m Heat transfer	Jan 68.3768 coeff	Feb 67.8983	Mar 67.4292	Apr 65.2262	May 64.8140	Jun 62.8952	Jul 62.8952	Aug 62.5398	Sep 63.6343	Oct 64.8140	Nov 65.6478	Dec 66.5196	(38)
Average = Sum(173.0642	172.5857	172.1166	169.9136	169.5014	167.5826	167.5826	167.2272	168.3217	169.5014	170.3352	171.2070 169.9116	
HLP	Jan 1.4463	Feb 1.4423	Mar 1.4384	Apr 1.4200	May 1.4165	Jun 1.4005	Jul 1.4005	Aug 1.3975	Sep 1.4067	Oct 1.4165	Nov 1.4235	Dec 1.4308	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.4200 31	
4. Water heati													
Assumed occupa												2.8620	(42)
Hot water usag Hot water usag	72.2060	71.1209	69.5397	66.5143	64.2816	61.7918	60.3765	61.9458	63.6660	66.3393	69.4297	71.9294	(42a)
Hot water usad	31.1742	30.7112	30.0592	28.8571	27.9570	26.9589	26.4197	27.0671	27.7721	28.8401	30.0669	31.0688	(42b)
Average daily	43.9397	42.3418	40.7440 /day)	39.1462	37.5484	35.9506	35.9506	37.5484	39.1462	40.7440	42.3418	43.9397 135.4200	
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wate	147.3198	144.1739	140.3429	134.5176	129.7870	124.7012	122.7469	126.5614	130.5843	135.9234	141.8385	146.9378	
Energy conte Energy content	t (annual)	205.3017	215.7018	184.1479	174.7182	153.3347	148.4517	156.7094	161.0235	184.4468 Total = S	202.0749 Sum(45)m =	230.0691 2249.2984	(45)
Distribution 1	34.9978	= 0.15 x (4 30.7953	45)m 32.3553	27.6222	26.2077	23.0002	22.2678	23.5064	24.1535	27.6670	30.3112	34.5104	(46)
Water storage Store volume a) If manufac Temperature	cturer decla		actor is kno	own (kWh/d	lay):							200.0000 1.6525 0.5400	(48)
Enter (49) or Total storage	(54) in (55 loss	5)										0.8924	(55)
If cylinder co			27.6637 r storage	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	
Primary loss	27.6637 23.2624	24.9865 21.0112	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	
Combi loss Total heat req	0.0000 quired for w	0.0000 Water heatin	0.0000 ng calculate	0.0000 ed for each	0.0000 month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	284.2447 -33.0096	251.2995 -29.1939	266.6279 -30.5702	233.4312 -25.3133	225.6443 -23.5911	202.6180 -20.1871	199.3778 -18.9222	207.6355 -20.1218	210.3068 -20.8863	235.3729 -24.6227	251.3582 -27.8945	280.9951 -32.3983	
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 FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	
Output from w/	/h 251.2351	222.1056	236.0577	208.1178	202.0532	182.4309	180.4556		189.4204 er vear (kW	210.7502 Th/year) = S	223.4637 Sum(64)m =	248.5969 2542.2007	
12Total per ye Electric showe	er(s)	-						-				2542	(64)
Woot going fro	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy u	0.0000 used by inst	0.0000 antaneous e	0.0000 electric sho	0.0000 wer(s) (kWh	0.0000 /year) = Su	0.0000 m(64a)m =	0.0000	
Heat gains fro			112.4617	100.6558	98.8347	90.4104	90.1011	92.8467	92.9669	102.0694	106.6166	117.2388	(65)
5. Internal ga Metabolic gain	·												
(66)m	Jan	Feb	Mar 143.0996	Apr 143.0996	May 143.0996	Jun 143.0996	Jul 143.0996	Aug 143.0996	Sep 143.0996	Oct 143.0996	Nov 143.0996	Dec 143.0996	(66)
Lighting gains	3 (calculate	ed in Append	dix L, equat	tion L9 or	L9a), also					143.6155		143.6155	
Appliances gai	284.7699	287.7249	280.2784	264.4255	244.4142	225.6063	213.0415	210.0865	217.5330	233.3859	253.3972	272.2051	(68)
Cooking gains	(calculated 37.3100	l in Appendi 37.3100	ix L, equat: 37.3100	ion L15 or 37.3100	L15a), also 37.3100	see Table 37.3100	5 37.3100	37.3100					
Losses e.g. ev							0.0000		0.0000	3.0000			
Water heating	gains (Tabl	le 5)						-114.4796					
Total internal	l gains							124.7940				157.5791	
	656.3466	671.9985	643.9820	621.5578	589.8019	565.5089	543.6905	544.4259	560.9864	583.1214	618.8084	642.3296	(73)

6. Solar gains

[Jan]				Area Solar flux m2 Table 6a W/m2			g ific data Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
Northeast Southeast Southwest Northwest			11.7	000	11.2829 36.7938 36.7938 11.2829		0.6300 0.6300 0.6300 0.6300	0	.7000 .7000 .7000 .7000	0.77 0.77 0.77 0.77	00 00	37.0683 8.9957 132.0125 12.4136	(77) (79)	
Solar gains Total gains	190.4901 846.8367	340.9109 1012.9094	510.1058 1154.0878	705.2210 1326.7789	856.6973 1446.4991	879.8812 1445.3901	836.0731 1379.7636	718.5735 1262.9994	576.9670 1137.9533	388.5502 971.6715	231.1563 849.9647	161.0830 803.4126		



												21.0000	(85)
Temperature du Utilisation fa						Jun	Jul	Aug	Sep	Oct	Nov	21.0000 Dec	(05)
tau alpha util living ar	42.7438 3.8496	42.8623 3.8575	42.9791 3.8653	43.5364 3.9024	43.6423 3.9095	44.1420 3.9428	44.1420 3.9428	44.2358 3.9491	43.9481 3.9299	43.6423 3.9095	43.4286 3.8952	43.2075 3.8805	
	0.9937	0.9869	0.9721	0.9273	0.8290	0.6655	0.5124	0.5723	0.8052	0.9538	0.9881	0.9949	(86)
MIT Th 2 util rest of h	19.1024 19.7280 house	19.3510 19.7311	19.7256 19.7340	20.2315 19.7481	20.6487 19.7507	20.8966 19.7630	20.9716 19.7630	20.9566 19.7652	20.7712 19.7582	20.2213 19.7507	19.5787 19.7454	19.0706 19.7398	
MIT 2 Living area fr	0.9918 17.5528 raction	0.9829 17.8707	0.9630 18.3456	0.9030 18.9774	0.7725 19.4552	0.5641 19.7032	0.3787 19.7539	0.4352 19.7496	0.7209 19.6001 fLA =	0.9333 18.9807 Living area	0.9836 18.1722 4 / (4) =	0.9933 17.5196 0.1003	(90)
MIT Temperature ad	17.7082	18.0192	18.4840	19.1032	19.5749	19.8229	19.8760	19.8706	19.7175	19.1051	18.3133	17.6752	(92)
adjusted MIT	17.7082	18.0192	18.4840	19.1032	19.5749	19.8229	19.8760	19.8706	19.7175	19.1051	18.3133	17.6752	(93)
8. Space heati	ing requirem	nent											
Utilisation Useful gains Ext temp.	Jan 0.9868 835.6516 4.3000	Feb 0.9747 987.2498 4.9000	Mar 0.9504 1096.8156 6.5000	Apr 0.8869 1176.6930 8.9000	May 0.7631 1103.8834 11.7000	Jun 0.5695 823.1158 14.6000	Jul 0.3915 540.1726 16.6000	Aug 0.4478 565.5128 16.4000	Sep 0.7176 816.5990 14.1000	Oct 0.9185 892.5111 10.6000	Nov 0.9759 829.4384 7.1000	Dec 0.9891 794.6258 4.2000	(95)
Heat loss rate	e W		2062.6514			875.2595	548.9993	580.3822	945.5504	1441.6230		2307.0439	
Space heating				401.0121	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392		1125.2391	
Space heating Solar heating		- total p 0.0000	per year (kW 0.0000	h/year) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	5565.9989 0.0000	
Solar heating Space heating		on - total	per year (k	Wh/year)								0.0000	
Space heating Space heating	requirement		718.5818 lar contribu	401.0121 tion - tota	171.8057 1 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	408.5392 (98c)	778.0172 / (4) =	1125.2391 5565.9989 46.5151	· · ·
Efficiency of Efficiency of Efficiency of	main space secondary/s	heating sy supplementa	ystem 2 (in ary heating	%) system, %	May	T						0.0000 0.0000	
Space heating	Jan	Feb	Mar	Apr	Matz								
			710 5010	-	-	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(0.9.)
	1104.7069 efficiency	858.0969 (main heat	ting system	401.0121 1)	171.8057	0.0000	0.0000	0.0000	0.0000	408.5392	778.0172	1125.2391	
Space heating Space heating	1104.7069 efficiency 92.3000	858.0969 (main heat 92.3000	ting system 92.3000 ystem)	401.0121	-			-	-		778.0172 92.3000		(210)
Space heating Space heating	1104.7069 efficiency 92.3000 fuel (main 1196.8656	858.0969 (main heat 92.3000 heating sy 929.6824	ting system 92.3000 ystem) 778.5285	401.0121 1) 92.3000 434.4660	171.8057 92.3000	0.0000	0.0000	0.0000	0.0000	408.5392 92.3000	778.0172 92.3000	1125.2391 92.3000	(210) (211)
Space heating Space heating Space heating Space heating	1104.7069 efficiency 92.3000 fuel (main 1196.8656 efficiency 0.0000 fuel (main 0.0000	858.0969 (main heat 92.3000 heating sy 929.6824 (main heat 0.0000 heating sy 0.0000	ting system 92.3000 ystem) 778.5285 ting system 0.0000	401.0121 1) 92.3000 434.4660 2)	171.8057 92.3000 186.1383	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	0.0000 0.0000 0.0000	408.5392 92.3000 442.6211	778.0172 92.3000 842.9222	1125.2391 92.3000 1219.1106	(210) (211) (212)
Space heating Space heating Space heating Space heating Space heating	1104.7069 efficiency 92.3000 fuel (main 1196.8656 efficiency 0.0000 fuel (main 0.0000	858.0969 (main heat 92.3000 heating sy 929.6824 (main heat 0.0000 heating sy 0.0000	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2)	401.0121) 92.3000 434.4660 2) 0.0000	171.8057 92.3000 186.1383 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	0.0000 0.0000 0.0000 0.0000	408.5392 92.3000 442.6211 0.0000	778.0172 92.3000 842.9222 0.0000	1125.2391 92.3000 1219.1106 0.0000	(210) (211) (212) (213)
Space heating Space heating	1104.7069 efficiency 92.3000 fuel (main 1196.8656 efficiency 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement	858.0969 (main heat 92.3000 heating sy 929.6824 (main heat 0.0000 heating sy 0.0000 dary) 0.0000	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2) 0.0000	401.0121) 92.3000 434.4660 2) 0.0000 0.0000 0.0000	171.8057 92.3000 186.1383 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 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	408.5392 92.3000 442.6211 0.0000 0.0000	778.0172 92.3000 842.9222 0.0000 0.0000	1125.2391 92.3000 1219.1106 0.0000 0.0000	(210) (211) (212) (213) (213) (215)
Space heating Space heating Space heating Space heating Space heating Water heating Water heating Efficiency of (217)m	1104.7069 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secor 0.0000 fuel (secor 0.0000 requirement 251.2351 water heate 86.9824	858.0969 (main heat 92.3000 heating sy 929.6824 (main heat 0.0000 heating sy 0.0000 dary) 0.0000 ; 222.1056 r 86.7874	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2) 0.0000 0.0000 236.0577	401.0121) 92.3000 434.4660 2) 0.0000 0.0000 0.0000	171.8057 92.3000 186.1383 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 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 0.0000	408.5392 92.3000 442.6211 0.0000 0.0000 0.0000	778.0172 92.3000 842.9222 0.0000 0.0000 0.0000	1125.2391 92.3000 1219.1106 0.0000 0.0000 0.0000	(210) (211) (212) (213) (213) (215) (64) (216)
Space heating Space heating Space heating Space heating Space heating Water heating Water heating Efficiency of (217)m Fuel for water	1104.7069 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement 251.2351 water heate 86.9824 r heating, 1 288.8346	858.0969 (main heat 92.3000 heating sy 0.0000 heating sy 0.0000 dary) 222.1056 rr 86.7874 (Wh/month 255.9190	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2) 0.0000 0.0000 236.0577	401.0121) 92.3000 434.4660 2) 0.0000 0.0000 0.0000 208.1178 85.5052	171.8057 92.3000 186.1383 0.0000 0.0000 0.0000 202.0532 83.6983	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 182.4309	0.0000 0.0000 0.0000 0.0000 0.0000 180.4556 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 187.5136 79.8000	0.0000 0.0000 0.0000 0.0000 0.0000 189.4204 79.8000	408.5392 92.3000 442.6211 0.0000 0.0000 0.0000 210.7502	778.0172 92.3000 842.9222 0.0000 0.0000 0.0000 223.4637 86.6202	1125.2391 92.3000 1219.1106 0.0000 0.0000 0.0000 248.5969 79.8000 87.0240	(210) (211) (212) (213) (215) (215) (64) (216) (217)
Space heating Space heating Space heating Space heating Space heating Water heating Efficiency of (217)m Fuel for water Space cooling (221)m Pumps and Fa	1104.7069 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement 251.2351 water heate 86.9824 r heating, H 288.8346 fuel requin 0.0000 7.3041	858.0969 (main heat 92.3000 heating sy 929.6824 (main heat 0.0000 heating sy 0.0000 dary) 222.1056 fr 86.7874 KMh/month 255.9190 rement 0.0000 6.5973	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2) 0.0000 236.0577 86.3907 273.2443 0.0000 7.3041	401.0121) 92.3000 434.4660 2) 0.0000 0.0000 208.1178 85.5052 243.3979 0.0000 7.0685	171.8057 92.3000 186.1383 0.0000 0.0000 202.0532 83.6983 241.4065 0.0000 7.3041	0.0000 0.0000 0.0000 0.0000 0.0000 182.4309 79.8000 228.6102 0.0000 7.0685	0.0000 0.0000 0.0000 0.0000 0.0000 180.4556 79.8000 226.1349 0.0000 7.3041	0.0000 0.0000 0.0000 0.0000 0.0000 187.5136 79.8000 234.9795 0.0000 7.3041	0.0000 0.0000 0.0000 0.0000 0.0000 189.4204 79.8000 237.3690 0.0000 7.0685	408.5392 92.3000 442.6211 0.0000 0.0000 210.7502 85.5178 246.4403 0.0000 7.3041	778.0172 92.3000 842.9222 0.0000 0.0000 223.4637 86.6202 257.9811 0.0000 7.0685	1125.2391 92.3000 1219.1106 0.0000 0.0000 0.0000 248.5969 79.8000 87.0240 285.6647 0.0000 7.3041	(210) (211) (212) (213) (213) (215) (215) (216) (217) (219) (221) (231)
Space heating Space heating Space heating Space heating Space heating Water heating Water heating Efficiency of (217)m Fuel for water Space cooling (221)m Pumps and Fa Lighting	1104.7069 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement 251.2351 water heate 86.9824 fuel require 1.288.8346 fuel require 0.0000 7.3041 2.98.8405 enerated by	858.0969 (main heat 92.3000 heating sy 0.0000 heating sy 0.0000 dary) 0.0000 ; 222.1056 PT 86.7874 (Wh/month 255.9190 rement 0.0000 6.5973 23.9391 PVs (Appen	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2) 0.0000 236.0577 86.3907 273.2443 0.0000 7.3041 21.5545	401.0121) 92.3000 434.4660 2) 0.0000 0.0000 208.1178 85.5052 243.3979 0.0000 7.0685 15.7918 ative quant:	171.8057 92.3000 186.1383 0.0000 0.0000 202.0532 83.6983 241.4065 0.0000 7.3041 12.1980 ity)	0.0000 0.0000 0.0000 0.0000 0.0000 182.4309 79.8000 228.6102 0.0000 7.0685 9.9659	0.0000 0.0000 0.0000 0.0000 0.0000 180.4556 79.8000 226.1349 0.0000 7.3041 11.1274	0.0000 0.0000 0.0000 0.0000 0.0000 187.5136 79.8000 234.9795 0.0000 7.3041 14.4639	0.0000 0.0000 0.0000 0.0000 0.0000 189.4204 79.8000 237.3690 0.0000 7.0685 18.7871	408.5392 92.3000 442.6211 0.0000 0.0000 210.7502 85.5178 246.4403 0.0000	778.0172 92.3000 842.9222 0.0000 0.0000 223.4637 86.6202 257.9811 0.0000	1125.2391 92.3000 1219.1106 0.0000 0.0000 0.0000 248.5969 79.8000 87.0240 285.6647 0.0000	(210) (211) (212) (213) (215) (215) (215) (216) (217) (219) (219) (221) (231) (232)
Space heating Space heating Space heating Space heating Space heating Water heating Efficiency of (217)m Fuel for water Space cooling (221)m Pumps and Fa Lighting Electricity ge (233a)m	1104.7069 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement 251.2351 water heate 86.9824 r heating, 1 288.8346 fuel requir 0.0000 7.3041 298.405 enerated by -64.4326 enerated by 0.0000	858.0969 (main heat 92.3000 heating sy 0.0000 heating sy 0.0000 dary) 2222.1056 2222.1056 2222.1056 er 86.7874 (Wh/month 255.9190 ement 0.0000 6.5973 23.9391 FVS (Apper -87.2757 wind turbi 0.0000	ting system 92.3000 ystem) 778.5285 ting system 0.0000 (stem 2) 0.0000 236.0577 86.3907 273.2443 0.0000 7.3041 21.5545 dix M) (neg -120.5723 ines (Append 0.0000	401.0121) 92.3000 434.4660 2) 0.0000 0.0000 0.0000 208.1178 85.5052 243.3979 0.0000 7.0685 15.7918 ative quant: -130.0922 ix M) (nega: 0.0000	- 171.8057 92.3000 186.1383 0.0000 0.0000 0.0000 202.0532 83.6983 241.4065 0.0000 7.3041 12.1980 ityy -135.7803 tive quanti 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 182.4309 79.8000 228.6102 0.0000 7.0685 9.9659 -125.0745 LTY) 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 180.4556 79.8000 226.1349 0.0000 7.3041 11.1274 -123.3990 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 187.5136 79.8000 234.9795 0.0000 7.3041 14.4639	0.0000 0.0000 0.0000 0.0000 0.0000 189.4204 79.8000 237.3690 0.0000 7.0685 18.7871	408.5392 92.3000 442.6211 0.0000 0.0000 210.7502 85.5178 246.4403 0.0000 7.3041 24.6497	778.0172 92.3000 842.9222 0.0000 0.0000 223.4637 86.6202 257.9811 0.0000 7.0685 27.8418	1125.2391 92.3000 1219.1106 0.0000 0.0000 0.0000 248.5969 79.8000 87.0240 285.6647 0.0000 7.3041 30.6698	(210) (211) (212) (213) (213) (215) (215) (215) (216) (217) (219) (219) (221) (232) (233a
Space heating Space heating Space heating Space heating Space heating Water heating Water heating Efficiency of (217)m Fuel for water Space cooling (221)m Pumps and Fa Lighting Electricity ge (235a)m Electricity ge (235a)m	1104.7069 efficiency 92.3000 fuel (main 0.0000 fuel (main 0.0000 fuel (secor 0.0000 requirement 251.2351 water heate 86.9824 r heating, h 288.8346 fuel requin 0.0000 7.3041 29.8405 enerated by 0.0000 enerated by 0.0000	858.0969 (main heat 92.3000 heating sy 0.0000 dary) 0.0000 dary) 0.0000 222.1056 er 86.7874 (Mh/month 255.9190 ement 0.0000 6.5973 23.9391 FVS (Appen -87.2757 wind turbi 0.0000 hydro-elec 0.0000	ting system 92.3000 ystem) 778.5285 ting system 0.0000 ystem 2) 0.0000 236.0577 86.3907 273.2443 0.0000 7.3041 21.5545 bdix M) (neg -120.5723 mes (Append 0.0000 ctric genera 0.0000	401.0121 1) 92.3000 434.4660 2) 0.0000 0.0000 208.1178 85.5052 243.3979 0.0000 7.0685 15.7918 ative quant: -130.0922 ix M) (negai 0.0000 tors (Appendi 0.0000	- 171.8057 92.3000 186.1383 0.0000 0.0000 0.0000 202.0532 83.6983 241.4065 0.0000 7.3041 12.1980 ity) -135.7803 tive quanti 0.0000 dix M) (nec 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 182.4309 79.8000 228.6102 0.0000 7.0685 9.9659 9.9659 125.0745 1.ty) 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 180.4556 79.8000 226.1349 0.0000 7.3041 11.1274 -123.3990 0.0000 ity) 0.0000	- 0.0000 0.0000 0.0000 0.0000 0.0000 187.5136 79.8000 234.9795 0.0000 7.3041 14.4639 -118.5555 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 189.4204 79.8000 237.3690 0.0000 7.0685 18.7871 -109.5427	408.5392 92.3000 442.6211 0.0000 0.0000 210.7502 85.5178 246.4403 0.0000 7.3041 24.6497 -96.9990	778.0172 92.3000 842.9222 0.0000 0.0000 223.4637 86.6202 257.9811 0.0000 7.0685 27.8418 -69.5010	1125.2391 92.3000 1219.1106 0.0000 0.0000 0.0000 248.5969 79.8000 87.0240 285.6647 0.0000 7.3041 30.6698 -56.1222	(210) (211) (212) (213) (215) (215) (215) (216) (217) (219) (221) (231) (232) (233a (233a)
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Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features Energy saved or generated Energy used Total delivered energy for all uses

0.0000	(234)
0.0000	(235a)
0.0000	(235)
-0.0000	(236)
0.0000	(237)
5578.1482	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-	-снр		
Space heating - main system 1	Energy kWh/year 6030.3347	Emission factor kg CO2/kWh 0.2100	Emissions kg CO2/year 1266.3703 (261)
Total CO2 associated with community systems Water heating (other fuel)	3019.9819	0.2100	0.0000 (373) 634.1962 (264)
Space and water heating Pumps, fans and electric keep-hot Energy for lighting	86.0000 240.8297	0.1387 0.1443	1900.5665 (265) 11.9293 (267) 34.7592 (268)
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)	-1237.3470 -2561.6511	0.1355 0.1263	-167.6235 -323.5351 -491.1586 (269) 1456.0963 (272) 12.1700 (273)

13a. Primary energy - Individual heating systems including micro-CHP				
Space heating - main system 1	Energy Prima kWh/year 6030.3347	ry energy factor kg CO2/kWh 1.1300	Primary energy kWh/year 6814.2782 (275))
Total CO2 associated with community systems Water heating (other fuel) Space and water heating	3019.9819	1.1300	0.0000 (473) 3412.5795 (278) 10226.8577 (279))
Pumps, fans and electric keep-hot Energy for lighting	86.0000 240.8297	1.5128 1.5338	130.1008 (281) 369.3926 (282)	
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy kWh/year Target Primary Energy Rate (TPER)	-1237.3470 -2561.6511	1.5007 0.4636	-1856.9152 -1187.6416 -3044.5568 (283) 7681.7943 (286) 64.2000 (287))



Assessment Reference Property SAP Rating Environmental CO ₂ Emissions (t/year Compliance Check % DPER < TPER Assessor Details Client		000	201		85 B		DER	Prop Type Re					
SAP Rating Environmental CO ₂ Emissions (t/year Compliance Check % DPER < TPER Assessor Details	r)				85 B		DEP			750			
Environmental CO ₂ Emissions (t/year Compliance Check % DPER < TPER Assessor Details	r)				85 B		DEP			TCD			
CO ₂ Emissions (t/year Compliance Check % DPER < TPER Assessor Details	r)						JEK	15.2	21	TER		11.65	
Compliance Check % DPER < TPER Assessor Details	r)				88 B		% DER < TER					-30.56	
% DPER < TPER Assessor Details					0.96		DFEE	39.3	32	TFEE		50.66	
Assessor Details					See BREL		% DFEE < TFE	E				22.37	
					-35.32		DPER	84.4	44	TPER		62.40	
Client		Mr. Oliver	r Eggenton							Asses	sor ID	AQ01-000)1
AP 10 WORKSHEET FC ALCULATION OF DWEI . Overall dwelling round floor btal floor area Th welling volume	LLING EMI	SSIONS FOR	R RÉGULÀTIO	NS COMPLIAN	ce' -	7 2022)		Area (m2) 72.3000	-		(2b) = (3n) =		(4)
Ventilation rate mber of open chim mber of open flue mber of flues att mber of flues att mber of intermitt mber of intermitt mber of jassive v mber of flueless	nneys es / flues tached to chimneys tent extr vents) solid fue) other hea cact fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 = 0 * 20 = 0 * 35 = 0 * 20 = 2 * 10 =	0.0000 0.0000 0.0000 0.0000 0.0000 20.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
filtration due to essure test essure Test Metho	o chimney		and fans 🗧	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7	/b)+(7c) =			/ (5) =	s per hour 0.0922 Yes Blower Door	(8)
easured/design APS nfiltration rate umber of sides she												3.0000 0.2422 0	
nelter factor nfiltration rate a	adjusted	to include	shelter fa	actor					(20) = 1 - (21)	[0.075 x = (18) x		1.0000 0.2422	
nd speed 5. nd factor 1. lj infilt rate	an 1000 .2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250		
	.3088 .5477	0.3028 0.5458	0.2967 0.5440		0.2604 0.5339	0.2301 0.5265	0.2301 0.5265	0.2240 0.5251		0.2604 0.5339			
Heat losses and	heat los	s paramete	er										
ement				Gross	Openings		Area	U-value	AxU		value	A x K	
ndow (Uw = 0.80)				m2	m2	24.	m2 2000	W/m2K 0.7752	W/K 18.7597		cJ/m2K	kJ/K	(27)
atloss Floor 1 ternal Wall 1 ternal Roof 1 tal net area of e bric heat loss, W				11.6300 72.3000	24.2000	87. 72.	3000 4300 3000 2300 (26)(3	0.0800 0.1300 0.1000 30) + (32)	5.7840 11.3659 7.2300 = 43.1396	190 0	0.0000 0.0000 0.0000	0.0000 16611.7000 0.0000	(29a)
	eter (TMP ser defin	P = Cm / TE			area)			(28).	(33) (33)	+ (32a) + (36) +	(36a) =	16611.7000 229.7607 12.8115 0.0000 55.9511	(35) (36)
at capacity Cm = ermal mass parama ermal bridges (Us int Thermal bridg tal fabric heat]													
ermal mass parame ermal bridges (Us int Thermal bridg tal fabric heat 1 ntilation heat 1 Ja	loss oss calcu an .2015	ilated mont Feb 39.0690	thly (38)m = Mar 38.9391	= 0.33 x (2 Apr 38.3289	5)m x (5) May 38.2148	Jun 37.6833	Jul 37.6833	Aug 37.5849	Sep 37.8880	Oct 38.2148	Nov 38.4457	Dec 38.6872	(38)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP HLP (average) Days in mont	1.3161 31	1.3142 28	1.3125	1.3040 30	1.3024	1.2951	1.2951	1.2937	1.2979 30	1.3024	1.3056 30	1.3090 1.3040 31	(40)
ays in mont	51	20	51	50	51	30	51	51	30	51	30	51	
. Water heati													
Assumed occupa Not water usag		showers										2.3006	(42)
Hot water usag			60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533	
Hot water usag Average daily	38.1909	36.8021	26.1565 35.4134 /day)	25.1104 34.0246	24.3272 32.6359	23.4586 31.2471	22.9895 31.2471	23.5529 32.6359	24.1663 34.0246	25.0956 35.4134	26.1632 36.8021	27.0349 38.1909 117.7635	(42c
	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot wate Energy conte Energy content	128.1114 202.8972	125.3761 178.5339	122.0449 187.5785	116.9791 160.1385	112.8654 151.9386	108.4429 133.3432	106.7430 129.0964	110.0598 136.2770	113.5579 140.0283	118.2009 160.3975 Total = Su	123.3448 175.7273 um(45)m =	127.7791 200.0712 1956.0277	
)istribution 1	30.4346	= 0.15 x (4 26.7801	45)m 28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107	(46)
Nater storage Store volume) If manufac Temperature Snter (49) or	turer decla factor from	Table 2b	actor is kno	wn (kWh/d	lay):							200.0000 1.5000 0.5400 0.8100	(48) (49)
otal storage	loss 25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	
If cylinder co Primary loss Combi loss	ontains dedi 25.1100 23.2624 0.0000	cated sola: 22.6800 21.0112 0.0000	r storage 25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	24.3000 22.5120 0.0000	25.1100 23.2624 0.0000	(59)
Cotal heat req WHRS	uired for w 251.2696 -44.6651	222.2251	235.9509	206.9505	200.3110	180.1552	177.4688	184.6494	186.8403	208.7699	222.5393	248.4436	(62)
PV diverter Solar input FGHRS	0.0000 0.0000 0.0000	-39.5022 0.0000 0.0000 0.0000	-41.3644 0.0000 0.0000 0.0000	-34.2514 0.0000 0.0000 0.0000	-31.9210 0.0000 0.0000 0.0000	-27.3151 0.0000 0.0000 0.0000	-25.6035 0.0000 0.0000 0.0000	-27.2268 0.0000 0.0000 0.0000	-28.2612 0.0000 0.0000 0.0000	-33.3169 0.0000 0.0000 0.0000	-37.7440 0.0000 0.0000 0.0000	-43.8380 0.0000 0.0000 0.0000	(63b (63c
Output from w/ 12Total per ye	206.6045		194.5865	172.6992	168.3899	152.8401	151.8653		158.5791 er year (kWl			204.6057 2110.5642 2111	(64)
lectric showe	er(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	
Heat gains fro	m water hea 106.1612		nonth 101.0678	Tot 90.6957	al Energy us 89.2175	81.7862	antaneous e 81.6225	lectric sho 84.0100	wer(s) (kWh, 84.0090	/year) = Sur 92.0301	m(64a)m = 95.8789	0.0000	
5. Internal ga													
Metabolic gain (66)m	Jan 115.0322	Feb 115.0322			May 115.0322		Jul 115.0322	Aug 115.0322	Sep 115.0322	Oct 115.0322	Nov 115.0322	Dec 115.0322	(66)
lighting gains Appliances gai	102.1907 ns (calcula	113.1397 ted in Appe	102.1907 endix L, equ	105.5970 ation L13	102.1907	105.5970 Lso see Tab	102.1907 le 5	102.1907 149.4697	105.5970 154.7676	102.1907 166.0464	105.5970 180.2839	102.1907 193.6650	
Cooking gains Pumps, fans	(calculated 34.5032 3.0000	34.5032	34.5032		L15a), also 34.5032 3.0000		5 34.5032 0.0000	34.5032 0.0000	34.5032 0.0000	34.5032 3.0000	34.5032 3.0000	34.5032 3.0000	
osses e.g. ev	aporation (negative va		.e 5)		-92.0257	-92.0257	-92.0257		-92.0257	-92.0257		
Nater heating	gains (Tabl 142.6898	e 5)		125.9662		113.5919	109.7076	112.9167	116.6792	123.6964	133.1652		
fotal internal		518.7067	497.9530	480.2030	456 . 5090	437.2102	420.9800	422.0867	434.5535	452.4431	479.5557	497.7923	(73)
5. Solar gains													
[Jan]			Aı	m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acces facto Table (or	Gains W	
North East South West			8.90 1.90 6.40 7.00	000 000 000 000	10.6334 19.6403 46.7521 19.6403		0.6800 0.6800 0.6800 0.6800	0 0 0 0	.7000 .7000 .7000 .7000	0.77(0.77(0.77(0.77(DO DO DO DO	31.2178 12.3095 98.7009 45.3509	(76) (78)
Solar gains Sotal gains	187.5790	334.1013	493.0428	666.4741	793.8834	808.0886	770.8488	673.3373					
. Mean intern	al temperat	ure (heatin	ng season)										
Cemperature du Ntilisation fa	ring heatin	g periods :	in the livir	ng area fro	m Table 9, 1							21.0000	(85)
au alpha	Jan 48.4943 4.2330	Feb 48.5619	Mar 48.6284	Apr 48.9431			Jul 49.2806 4.2854	49.3325		Oct 49.0025 4.2668	Nov 48.8826 4.2588	Dec 48.7579 4.2505	
til living ar	ea 0.9827	0.9610	0.9153	0.8079	0.6461	0.4701	0.3433	0.3884	0.6141	0.8699	0.9655	0.9862	(86)
1IT Th 2	19.6106 19.8283	19.9097 19.8297		20.6703 19.8377		20.9787 19.8447	20.9956 19.8447		20.9368	20.6064 19.8389			
itil rest of h	ouse	0.9504	0.8935	0.7647		0.3899	0.2544		0.5263	0.8279			



MIT 2 Living area fr	18.2581	18.6319	19.0832	19.5331	19.7604	19.8337	19.8434	19.8434	19.8047 fLA =	19.4807 Living area	18.7954	18.1880 0.1757	
MIT Temperature ad	18.4957	18.8563	19.2934	19.7329	19.9599	20.0348	20.0458	20.0453	20.0036	19.6785	19.0127	18.4276	
adjusted MIT	18.3457	18.7063	19.1434	19.5829	19.8099	19.8848	19.8958	19.8953	19.8536	19.5285	18.8627	18.2776	(93)
8. Space heati	ing require	ment											
Utilisation	Jan 0.9688	Feb 0.9370	Mar 0.8778	Apr 0.7541	May 0.5794	Jun 0.3927	Jul 0.2583	Aug 0.2973	Sep 0.5272	Oct 0.8145	Nov 0.9414	Dec 0.9743	
Useful gains Ext temp.	673.8412 4.3000	799.0638 4.9000	869.8924 6.5000	864.7137 8.9000	724.4910 11.7000	489.0848 14.6000	307.9006 16.6000	325.6469 16.4000	520.6311 14.1000	677.3948 10.6000	665.5501 7.1000	639.6644 4.2000	
Heat loss rate Space heating	1336.4814	1311.8802	1199.7388	1007.1819	763.6711	494.8422	308.6002	326.9324	539.9085	840.7576	1110.3585	1332.2762	(97)
Space heating	493.0043 requirement		245.4058 per year (kW	102.5771 h/year)	29.1500	0.0000	0.0000	0.0000	0.0000	121.5419	320.2620	515.3032 2171.8569	
Solar heating	0.0000 contributi	0.0000 on - total	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating Space heating Space heating	493.0043 requirement	344.6127 t after sol		102.5771 tion - total	29.1500 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	121.5419 (98c	320.2620) / (4) =	515.3032 2171.8569 30.0395	
9a. Energy req	nuirements	- Individua	al heating s	ystems, incl	luding micr	ro-CHP							
Fraction of sp Fraction of sp				ntary system	n (Table 11	.)						0.0000 1.0000	
Efficiency of Efficiency of Efficiency of	main space main space	heating sy heating sy	ystem 1 (in ystem 2 (in	8)								84.5000 0.0000 0.0000	(206) (207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	493.0043	344.6127	245.4058	102.5771	29.1500	0.0000	0.0000	0.0000	0.0000	121.5419	320.2620	515.3032	(98)
Space heating	84.5000	84.5000	84.5000	1) 84.5000	84.5000	0.0000	0.0000	0.0000	0.0000	84.5000	84.5000	84.5000	(210)
Space heating	583.4370	407.8256	290.4210	121.3930	34.4970	0.0000	0.0000	0.0000	0.0000	143.8366	379.0083	609.8263	(211)
Space heating Space heating	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	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 nearing	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		t 182.7230	194.5865	172,6992	168.3899	152.8401	151.8653	157.4227	158.5791	175.4531	184.7953	204 6057	(64)
Efficiency of (217)m	206.6045 water heat 84.5000		84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	84.5000	204.6057 89.5000 84.5000	(216)
Fuel for water			230.2799	204.3777	199.2780	180.8759	179.7222	186.2990	187.6675	207.6367	218.6927	242.1369	
Space cooling (221)m			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Pumps and Fa Lighting	7.3041 20.0399	6.5973 16.0767	7.3041 14.4753	7.0685	7.3041 8.1918	7.0685 6.6928	7.3041 7.4728	7.3041 9.7135	7.0685 12.6168	7.3041 16.5540	7.0685 18.6977	7.3041 20.5969	
Electricity ge (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 ge (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 ge (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)
	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000	(235c)
Electricity ge (233b)m Electricity ge	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
(234b)m Electricity ge	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)
(235b)m Electricity us	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	(235b)
(235d)m Annual totals	0.0000 kWh/year	0.0000							0.0000	0.0000	0.0000	0.0000	
Space heating Space heating	fuel - main	n system 2										2570.2449 0.0000	(213)
Space heating Efficiency of	water heat											0.0000 89.5000	
Water heating Space cooling												2497.7091 0.0000	
Electricity fo central hea		d fans:										41.0000	(220-)
main heatin Total electric	ng flue fan city for the	e above, kW		iv I)								45.0000 86.0000	(230e) (231)
Electricity fo Energy saving/					1.01							161.7334	(232)
PV generation Wind generation Hydro-electric	n			oco n , w dire	* ¥1							0.0000 0.0000 0.0000	(234)
Electricity ge Appendix Q - s	enerated - 1	Micro CHP										0.0000	
Energy saved o Energy used	or generate	d	_									-0.0000	(237)
Total delivere	a energy f	or all uses	3									5315.6874	(238)
12a. Carbon di	loxide emis	sions - Ind	dividual hea	ting systems	including	g micro-CHP							

Energy	Emis
kWh/year	

Emission factor kg CO2/kWh Emissions kg CO2/year



Space heating -								2570.2449		0.2100		539.7514	
Total CO2 associ Water heating (c	ther fuel		systems					2497.7091		0.2100		0.0000 524.5189	(264)
Space and water Pumps, fans and	electric 1	keep-hot						86.0000		0.1387		1064.2703 11.9293	(267)
Energy for light Total CO2, kg/ye	ar							161.7334		0.1443		23.3431 1099.5427	(272)
EPC Dwelling Car	bon Dioxi	de Emission	Rate (DER)									15.2100	(273)
13a. Primary ene	rgy - Ind	ividual hea	ting system	s including	micro-CHP								
									Primary ene			ary energy kWh/year	
Space heating - Total CO2 associ			systems					2570.2449		1.1300		2904.3767 0.0000	(275)
Water heating (c Space and water	ther fuel		-1					2497.7091		1.1300		2822.4113 5726.7881	(278)
Pumps, fans and Energy for light	electric 1	keep-hot						86.0000 161.7334		1.5128 1.5338		130.1008 248.0720	(281)
Total Primary en Dwelling Primary	ergy kWh/y	year ate (DPER)										6104.9609 84.4400	(286)
SAD 10 HODVEHEET	FOD Nove I	Puild (Ac D		(Versier 10	2 February	. 2022)							
SAP 10 WORKSHEET CALCULATION OF 1			esignea)	(version 10	.2, repruary	y 2022)							
1. Overall dwell													
								Area		rey height		Volume	
Ground floor								(m2) 72.3000	(lb) x	(m) 3.0000	(2b) =	(m3) 216.9000	(1b) - (3b)
Total floor area Dwelling volume	TFA = (1a)	a)+(1b)+(1c)+(1d)+(1e)	(ln)	1	72.3000		(3a)+(3b)+(3c	+(3d)+(3e)	(3n) =	216.9000	(4) (5)
2. Ventilation r	ate												
												3 per hour	
Number of open of Number of open f	lues										0 * 80 = 0 * 20 =	0.0000	(6b)
Number of chimne Number of flues				ire							0 * 10 = 0 * 20 =	0.0000	(6c) (6d)
Number of flues Number of blocke	d chimneys	5	ater								0 * 35 = 0 * 20 =	0.0000	(6f)
Number of intern Number of passiv		tract fans									3 * 10 = 0 * 10 =	30.0000 0.0000 0.0000	(7a) (7b)
Number of fluele	ss gas fi	res											(7c)
Infiltration due	to chimne	eys, flues	and fans	= (6a)+(6b)	+(6c)+(6d)+	(6e)+(6f)+(6g) + (7a) + (7b)+(7c) =		30.0000	Air change / (5) =	0.1383	(8)
Pressure test Pressure Test Me											В	Yes lower Door	(17)
Measured/design Infiltration rat	e											5.0000	(18)
Number of sides Shelter factor	sneitered								(20) = 1	10 075 W	(10)1 -	1.0000	(19)
Infiltration rat	e adjuste	d to includ	e shelter f	actor						(10.075 x) = (18)		0.3883	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed Wind factor	5.1000 1.2750	5.0000 1.2500	4.9000	4.4000 1.1000	4.3000 1.0750	3.8000 0.9500	3.8000		4.0000	4.3000	4.5000	4.7000	
Adj infilt rate			0.4757	0.4271	0.4174	0.3689	0.3689			0.4174	0.4369		
Effective ac	0.6226		0.6131	0.5912	0.5871	0.5680	0.5680	0.5645	0.5754	0.5871	0.5954		
2 Host logger													
 Heat losses a Element 				Gross	Openings	Net	Area	U-value	λ	U K	-value	АхК	
TER Opening Type	(IIst = 1.)	20)		m2	Openings m2		m2 0700	0-Value W/m2K 1.1450	W	K I	-value kJ/m2K	AXK kJ/K	
Heatloss Floor 1 External Wall 1		207	,	11 6200	18.0700	72.	3000	0.1300	9.39	90			(28a) (29a)
External Roof 1		lolomonto		72.3000	10.0700	72.	3000	0.1100					(30)
Total net area o Fabric heat loss			Aum(A, M∠)			250.	(26) (30) + (32)	= 54.883	36			(31) (33)
Thermal mass par List of Thermal		MP = Cm / T	FA) in kJ/m	2K								229.7607	(35)
K1 Eleme		normal)							Length 1 7.2100	si-value 0.1600	Tot 5.95		
	er (normal	1)	ated using	Appendix K)					2.0000	0.0900	1.08		(36)
Point Thermal br Total fabric hea	idges		uoing	() and the second second					c	33) + (36) -	(36a) = + (36a) =	0.0000	
Ventilation heat		culated mon	thly (38)m	= 0.33 x (2	5)m x (5)				, , , , , , , , , , , , , , , , , , ,	, , , , , , , , , , , , , , , , , , , ,	,		
(38)m	Jan 44.5611	Feb 44.2204	Mar	Apr	May	Jun 40.6588	Jul 40.6588	Aug 40.4058	Sep 41.1849	Oct 42.0247	Nov 42.6184	Dec 43.2389	(38)



Heat transfer		106.1377	105.8038	104.2354	103.9420	102.5760	102.5760	102.3231	103,1022	103.9420	104.5356	105.1562	(39)
Average = Sum	(39)m / 12 = Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	104.2340 Dec	
HLP HLP (average) Davs in mont	1.4727 31	1.4680 28	1.4634	1.4417 30	1.4376	1.4188	1.4188 31	1.4153	1.4260	1.4376 31	1.4459 30	1.4544	(40)
Days in mont	51	20	31	30	31	30	51	31	30	31	- 30	31	
4. Water heat	ing energy r	equirement	s (kWh/year))									
Assumed occupa Hot water usag	ge for mixer											2.3006	
Hot water usag		l l	60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533	
Hot water usag	27.1267 ge for other 38.1909	26.7238 uses 36.8021	26.1565 35.4134	25.1104 34.0246	24.3272 32.6359	23.4586 31.2471	22.9895 31.2471	23.5529 32.6359	24.1663 34.0246	25.0956 35.4134	26.1632 36.8021	27.0349 38.1909	
Average daily												117.7635	
Daily hot wate		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content		125.3761 178.5339	122.0449 187.5785	116.9791 160.1385	112.8654 151.9386	108.4429 133.3432	106.7430 129.0964	110.0598 136.2770	113.5579 140.0283	118.2009 160.3975 Total = Su	123.3448 175.7273 um(45)m =		
Distribution 1	30.4346		45)m 28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107	(46)
Water storage Store volume a) If manufac		ured loss fo	actor is kno	own (kWh/d	lav):							200.0000	
Temperature Enter (49) or Total storage	factor from (54) in (55	ı Table 2b										0.5400 0.8924	(49)
If cylinder co	27.6637 ontains dedi	24.9865 cated sola	27.6637 r storage	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
Primary loss	27.6637 23.2624	24.9865 21.0112	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	26.7713 22.5120	27.6637 23.2624	(59)
Combi loss Total heat rec						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
WWHRS PV diverter		224.5317 -25.3885 -0.0000	238.5046 -26.5854 -0.0000	209.4218 -22.0137 -0.0000	202.8647 -20.5160 -0.0000	182.6265 -17.5557 -0.0000	180.0225 -16.4557 -0.0000	187.2031 -17.4989 -0.0000	189.3116 -18.1638 -0.0000	211.3236 -21.4131 -0.0000	225.0106 -24.2584 -0.0000	250.9973 -28.1751 -0.0000	(63a)
Solar input FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w	/h 225.1165		211.9192	187.4081	182.3487	165.0708	163.5668	169.7042	171.1478	189.9105	200.7521	222.8222	(64)
12Total per ye Electric showe		ır)						Total pe	er year (kW1	n/year) = Su	um (64) m =	2288.9101 2289	
Electric showe	0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy us	0.0000 ed by insta	0.0000 antaneous el	0.0000 lectric show	0.0000 wer(s) (kWh	0.0000 (year) = Sur	0.0000 n(64a)m =	0.0000	
Heat gains fro	om water hea 108.2042		month 103.1107	92.6727	91.2604	83.7632	83.6654	86.0530	85.9860	94.0730	97.8560	107.2645	(65)
5. Internal ga	ains (see Ta	ble 5 and	5a)										
Metabolic gair	ns (Table 5)	, Watts							6-m	0	New	Dee	
(66)m Lighting gains	115.0322				May 115.0322 L9a), also s		Jul 115.0322	Aug 115.0322	Sep 115.0322	Oct 115.0322	Nov 115.0322	Dec 115.0322	
Appliances gai	102.1907	113.1397	102.1907	105.5970	102.1907	105.5970	102.1907	102.1907	105.5970				(66)
Cooking gains	202.6045					so see lab.	le 5	102.1907	105.5970	102.1907	105.5970	102.1907	
Pumps, fans		204.7069 l in Append	199.4089 ix L, equat:	188.1301 ion L15 or	173.8927 L15a), also	160.5115 see Table !	151.5721 5	149.4697	154.7676	166.0464	180.2839	193.6650	(67) (68)
T	34.5032 3.0000	204.7069 l in Append 34.5032 3.0000	199.4089 ix L, equat: 34.5032 3.0000	188.1301 ion L15 or 34.5032 3.0000	173.8927 L15a), also 34.5032	160.5115 see Table !	151.5721 5 34.5032		154.7676 34.5032	166.0464 34.5032	180.2839 34.5032	193.6650 34.5032	(67) (68) (69)
Losses e.g. ev	34.5032 3.0000 vaporation -92.0257	204.7069 l in Append 34.5032 3.0000 negative v -92.0257	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab:	188.1301 ion L15 or 34.5032 3.0000 le 5)	173.8927 L15a), also 34.5032	160.5115 see Table ! 34.5032 0.0000	151.5721 5 34.5032 0.0000	149.4697 34.5032 0.0000	154.7676 34.5032 0.0000	166.0464 34.5032 3.0000	180.2839 34.5032 3.0000	193.6650 34.5032 3.0000	(67) (68) (69) (70)
Water heating	34.5032 3.0000 vaporation (-92.0257 gains (Tabl 145.4357	204.7069 l in Append 34.5032 3.0000 (negative v -92.0257 .e 5)	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab -92.0257	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257	173.8927 L15a), also 34.5032 3.0000	160.5115 see Table 3 34.5032 0.0000 -92.0257	151.5721 5 34.5032 0.0000	149.4697 34.5032 0.0000 -92.0257	154.7676 34.5032 0.0000	166.0464 34.5032 3.0000 -92.0257	180.2839 34.5032 3.0000 -92.0257	193.6650 34.5032 3.0000 -92.0257	(67) (68) (69) (70) (71)
-	34.5032 3.0000 vaporation (-92.0257 gains (Tabl 145.4357 l gains	204.7069 1 in Append 34.5032 3.0000 (negative v. -92.0257 e 5) 143.0963	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab: -92.0257 138.5897	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121	173.8927 L15a), also 34.5032 3.0000 -92.0257	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378	151.5721 34.5032 0.0000 -92.0257 112.4535	149.4697 34.5032 0.0000 -92.0257 115.6626	154.7676 34.5032 0.0000 -92.0257	166.0464 34.5032 3.0000 -92.0257 126.4422	180.2839 34.5032 3.0000 -92.0257 135.9110	193.6650 34.5032 3.0000 -92.0257 144.1728	(67) (68) (69) (70) (71) (72)
Water heating Total internal	34.5032 3.0000 vaporation -92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 l in Append 34.5032 3.0000 (negative v. -92.0257 .e 5) 143.0963 521.4525	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab) -92.0257 138.5897 500.6989	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489	173.8927 L15a), also 34.5032 3.0000 -92.0257 122.6619 459.2549	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378 439.9560	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326	154.7676 34.5032 0.0000 -92.0257 119.4251	166.0464 34.5032 3.0000 -92.0257 126.4422	180.2839 34.5032 3.0000 -92.0257 135.9110	193.6650 34.5032 3.0000 -92.0257 144.1728	(67) (68) (69) (70) (71) (72)
Water heating Total internal	34.5032 3.0000 vaporation -92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 l in Append 34.5032 3.0000 (negative v. -92.0257 .e 5) 143.0963 521.4525	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab) -92.0257 138.5897 500.6989	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489	173.8927 L15a), also 34.5032 3.0000 -92.0257 122.6619 459.2549	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378 439.9560	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326	154.7676 34.5032 0.0000 -92.0257 119.4251	166.0464 34.5032 3.0000 -92.0257 126.4422	180.2839 34.5032 3.0000 -92.0257 135.9110	193.6650 34.5032 3.0000 -92.0257 144.1728	(67) (68) (69) (70) (71) (72)
Water heating Total internal	34.5032 3.0000 vaporation -92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 l in Append 34.5032 3.0000 (negative v. -92.0257 .e 5) 143.0963 521.4525	199,4089 ix L, equat: 34,5032 3.0000 alues) (Tabi -92.0257 138.5897 500.6989	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489	173.8927 LI5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci or	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 g fic data Table 6b	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tabi	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728	(67) (68) (70) (71) (72) (73)
Water heating Total internal 6. Solar gains [Jan] North	34.5032 3.0000 vaporation -92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 l in Append 34.5032 3.0000 (negative v. -92.0257 .e 5) 143.0963 521.4525	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab: -92.0257 138.5897 500.6989	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2	160.5115 see Table 3 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tabi	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data le 6c	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access facts Table 6	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105	 (67) (68) (69) (70) (71) (72) (73)
Water heating Total internal 6. Solar gains [Jan]	34.5032 3.0000 vaporation -92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 l in Append 34.5032 3.0000 (negative v. -92.0257 .e 5) 143.0963 521.4525	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab: -92.0257 138.5897 500.6989	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2	160.5115 see Table 3 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tabi	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data le 6c	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access facts Table 6	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W	 (67) (68) (69) (70) (71) (72) (73)
Water heating Total internal 6. Solar gains [Jan] North East South West	34.5032 3.0000 vaporation (-92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 i in Append 34.5032 3.0000 (negative v. -92.0257 e. 5) 143.0963 521.4525	199,4089 ix L, equat: 34,5032 3.0000 -92.0257 138.5897 500.6989 	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2 10.6334 19.6403	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tab: 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data le 6c .7000 .7000 .7000 .7000	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access facto Table 6 0.770 0.770 0.770	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321	(67) (68) (69) (70) (71) (72) (73) (73)
Water heating Total internal 6. Solar gains [Jan] North East South West	34.5032 3.0000 vaporation (-92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 lin Append 34.5032 3.0000 negative v. -92.0257 e 5) 143.0963 521.4525	199.4089 ix L, equat: 34.5032 3.0000 -92.0257 138.5897 500.6989 A: A: 4: 341.0554	188.1301 ion L15 or 34.5032 3.0000 l= 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2 10.6334 19.6403 549.1495	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or 558.9776	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300 533.2169	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tab 0 0 0 0 0 0 0 0 0 0 0 0 0	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data 6c 7000 7000 7000 7000 382.5453	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access factor Table 6 0.777 0.777 0.777 0.777	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321 109.8055	(67) (68) (69) (70) (71) (72) (73) (73) (73) (78) (80) (83)
Water heating Total internal 6. Solar gains [Jan] North East South West Solar gains Total gains	34.5032 3.0000 vaporation (-92.0257 gains (Tabl 145.4357 1 gains 510.7405	204.7069 i in Append 34.5032 3.0000 negative v. -92.0257 e. 5) 143.0963 521.4525 	199.4089 ix L, equat: 34.5032 3.0000 eg2.0257 138.5897 500.6989 	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2 10.6334 19.6403 549.1495	160.5115 see Table 3 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or 558.9776 998.9337	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300 0.6300 0.6300 533.2169 956.9428	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tab: 0 0 0 0 0 465.7639 890.5965	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data 6c 7000 7000 7000 7000 382.5453	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access factor Table 6 0.777 0.777 0.777 0.777	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321 109.8055	(67) (68) (69) (70) (71) (72) (73) (73) (73) (78) (80) (83)
Water heating Total internal 6. Solar gains [Jan] North East South West Solar gains Total gains	34.5032 3.0000 vaporation (-92.0257 145.4357 1 gains (Tabl 150.7405 510.7405 3 129.7628 640.5033	204.7069 i in Append 34.5032 3.0000 -92.0257 e.5) 143.0963 521.4525 	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab: -92.0257 138.5897 500.6989 	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2 10.6334 19.6403 549.1495 1008.4044	160.5115 see Table 9 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or 558.9776 998.9337	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300 0.6300 533.2169 956.9428	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tab: 0 0 465.7639 890.5965	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data 6c 7000 7000 7000 7000 382.5453	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access factor Table 6 0.777 0.777 0.777 0.777	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321 109.8055 610.3436	(67) (68) (69) (70) (71) (72) (73) (73) (73) (73) (78) (78) (78) (78) (80) (83) (84)
Water heating Total internal 6. Solar gains [Jan] North East South West Solar gains Total gains 7. Mean intern	34.5032 3.0000 vaporation (-92.0257 145.4357 1 gains (Tabl 145.4357 1 gains (Tabl 1 gai	204.7069 i in Append 34.5032 3.0000 negative v. -92.0257 e. 5) 143.0963 521.4525 521.4525 231.1170 752.5696 	199.4089 ix L, equat: 34.5032 3.0000 alues) (Tab: -92.0257 138.5897 500.6989 	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.532 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2 10.6334 19.6403 549.1495 1008.4044 	160.5115 see Table 3 34.5032 0.0000 -92.0257 116.3378 439.9560 	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300 0.6300 533.2169 956.9428	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tab: 0 0 0 0 465.7639 890.5965	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data Le 6c .7000 .7000 .7000 .382.5453 819.8447	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access facts Table 6 0.770 0.770 0.770 0.770 262.3172 717.5062	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321 109.8055 610.3436 21.0000	(67) (68) (69) (70) (71) (72) (73) (73) (73) (73) (78) (78) (78) (78) (80) (83) (84)
Water heating Total internal 6. Solar gains [Jan] North East South West Solar gains Total gains 7. Mean intern Temperature di Utilisation fa tau	34.5032 3.0000 vaporation (-92.0257 145.4357 1 gains (Tabl 145.4357 1 gains 510.7405 5 129.7628 640.5033 129.7628 640.5033 al temperation (actor for ga Jan 43.3362	204.7069 i in Append 34.5032 3.0000 negative v. -92.0257 e. 5) 143.0963 521.4525 521.4525 231.1170 752.5696 231.1170 752.5696 urre (heating periods ins for lir Feb 43.4752	199.4089 ix L, equat: 34.5032 3.0000 -92.0257 138.5897 500.6989 	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a W/m2 10.6334 46.7521 19.6403 549.1495 1008.4044 	160.5115 see Table 3 34.5032 0.0000 -92.0257 116.3378 439.9560 	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300 0.6300 533.2169 956.9428 Jul 44.9848	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 Specific or Tab: 0. 0. 0. 0. 465.7639 890.5965 Aug 45.0960	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data le 6c .7000 .7000 .7000 .382.5453 819.8447 Sep 44.7552	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access facts Table 6 0.770 0.770 0.770 0.770 262.3172 717.5062	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016 482.3016 55 57 6d 50 00 00 00 157.3094 639.6110	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321 109.8055 610.3436 21.0000 Dec 43.8810	(67) (68) (69) (70) (71) (72) (73) (73) (73) (73) (78) (78) (78) (78) (80) (83) (84)
Water heating Total internal 6. Solar gains [Jan] North East South West Solar gains Total gains 7. Mean intern Temperature du Utilisation fa	34.5032 3.0000 vaporation (-92.0257 1 gains (Tabl 145.4357 1 gains 510.7405 	204.7069 1 in Append 34.5032 3.0000 negative v. -92.0257 e 5) 143.0963 521.4525 231.1170 752.5696 cure (heating periods in for life reb 43.4752 3.8983	199.4089 ix L, equat: 34.5032 3.0000 -92.0257 138.5897 500.6989 	188.1301 ion L15 or 34.5032 3.0000 le 5) -92.0257 128.7121 482.9489 	173.8927 Ll5a), also 34.5032 3.0000 -92.0257 122.6619 459.2549 Solar flux Table 6a 46.7521 19.6403 46.7521 19.6403 549.1495 1008.4044 m Table 9, T Table 9a, T Table 9a, May	160.5115 see Table 3 34.5032 0.0000 -92.0257 116.3378 439.9560 Speci: or 3 558.9776 998.9337 	151.5721 34.5032 0.0000 -92.0257 112.4535 423.7259 fic data Table 6b 0.6300 0.6300 0.6300 0.6300 0.6300 533.2169 956.9428 Jul 44.9848 3.9990	149.4697 34.5032 0.0000 -92.0257 115.6626 424.8326 	154.7676 34.5032 0.0000 -92.0257 119.4251 437.2994 FF data 66 .7000	166.0464 34.5032 3.0000 -92.0257 126.4422 455.1890 Access factor Table 6 0.777 0.777 0.777 0.777 0.777 0.777 262.3172 717.5062	180.2839 34.5032 3.0000 -92.0257 135.9110 482.3016 482.3016 482.3016 157.3094 639.6110	193.6650 34.5032 3.0000 -92.0257 144.1728 500.5381 Gains W 21.6105 8.5233 68.2968 31.3321 109.8055 610.3436 21.0000 Dec 43.8810 3.9254	(67) (68) (69) (70) (71) (72) (73) (73) (73) (73) (73) (78) (80) (83) (84) (85)



MIT 19.2927 Th 2 19.7080 util rest of house		19.9089 19.7151	20.3757 19.7315	20.7316 19.7346	20.9279 19.7490	20.9818 19.7490	20.9729 19.7517	20.8414 19.7434	20.3726 19.7346	19.7601 19.7284	19.2616 19.7218	
0.9841 MIT 2 17.7758 Living area fraction		0.9403 18.5527	0.8626	0.7171 19.5190	0.5084	0.3346	0.3799 19.7427		0.8927 19.1398 Living area		0.9867 17.7454 0.1757	(90) (91)
MIT 18.0423 Temperature adjustment adjusted MIT 18.0423		18.7909 18.7909	19.3455 19.3455	19.7320 19.7320	19.9237 19.9237	19.9611 19.9611	19.9588 19.9588	19.8526 19.8526	19.3564 19.3564	18.6249 18.6249	18.0117 0.0000 18.0117	
aujusteu mii 10.0423								19.0320	19.3304	10.0245	10.0117	(53)
8. Space heating requirem	lent											
Jan Utilisation 0.9770 Useful gains 625.7533 Ext temp. 4.3000 Heat loss rate W	Feb 0.9593 721.9306 7 4.9000	Mar 0.9269 80.2149 6.5000	Apr 0.8507 802.9902 8.9000	May 0.7170 723.0044 11.7000	Jun 0.5234 522.8291 14.6000	Jul 0.3564 341.0245 16.6000	Aug 0.4021 358.0939 16.4000	Sep 0.6546 536.7047 14.1000	Oct 0.8808 631.9955 10.6000	Nov 0.9596 613.7649 7.1000	Dec 0.9804 598.4038 4.2000	(95)
Space heating kWh	1427.9342 13			834.8650	546.0886	344.7671	364.1445	593.1084		1204.7629		
Space heating requirement Solar heating kWh	_	year (kWh	n/year)	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626 3041.4053	
0.0000 Solar heating contributio Space heating kWh	-			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
623.1011 Space heating requirement Space heating per m2	474.4344 3 after solar			83.2243 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	206.9511 (98c)	425.5186	635.3626 3041.4053 42.0665	
9a. Energy requirements -					O-CHP							
Fraction of space heat fr Fraction of space heat fr Efficiency of main space	com secondary/ com main system heating system	supplemer m(s) m l (in %	ntary system)						0.0000 1.0000 92.3000	(202) (206)
Efficiency of main space Efficiency of secondary/s											0.0000 0.0000	
Jan Space heating requirement	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	474.4344 3		205.7774	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626	(98)
92.3000 Space heating fuel (main	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
	514.0134 4	19.3237		90.1672	0.0000	0.0000	0.0000	0.0000	224.2157	461.0169	688.3669	(211)
0.0000 Space heating fuel (main	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
0.0000 Space heating fuel (secon	0.0000 dary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
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		11.9192	187.4081	102 2407	165.0708	163.5668	169.7042	171 1470	189.9105	200.7521	222.8222	(64)
225.1165 Efficiency of water heate (217)m 86.2193	r	85.3925	84.2699	182.3487 82.4177	79.8000	79.8000	79.8000	171.1478 79.8000	84.2529	85.7017	79.8000 86.2736	(216)
Fuel for water heating, k	Wh/month	48.1708	222.3902	221.2494	206.8556	204.9710	212.6619	214.4709	225.4053	234.2453	258.2738	
Space cooling fuel requir (221)m 0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Pumps and Fa 7.3041 Lighting 21.2332	6.5973 17.0341	7.3041 15.3373	7.0685 11.2368	7.3041 8.6796	7.0685 7.0913	7.3041 7.9178	7.3041 10.2919	7.0685 13.3681	7.3041 17.5397	7.0685 19.8111	7.3041 21.8233	
Electricity generated by	PVs (Appendix -73.7992 -				-97.3270	-96.1129	-93.4647	-88.1264	-80.6535	-59.7353	-49.1057	(233a)
Electricity generated by (234a)m 0.0000	wind turbines 0.0000	(Appendi 0.0000	ix M) (negat: 0.0000	ive quanti 0.0000	ty) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by (235a)m 0.0000	hydro-electri 0.0000	c generat 0.0000	ors (Append: 0.0000	ix M) (neg 0.0000	ative quanti 0.0000	(1ty) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net e (235c)m 0.0000	0.0000	0.0000	0.0000	0.0000		7e if net ge 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
	-101.9654 -1	97.7208	-290.1200	-377.2605		-372.3107	-318.0510	-236.9766	-143.3808	-65.6587	-39.5977	(233b)
Electricity generated by (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 (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 e (235d)m 0.0000	electricity ge 0.0000	nerated h 0.0000	oy micro-CHP 0.0000	(Appendix 0.0000	N) (negativ: 0.0000	ve if net ge 0.0000	eneration) 0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - main											3295.1303	
Space heating fuel - main Space heating fuel - seco	ondary										0.0000	
Efficiency of water heate Water heating fuel used Space cooling fuel	r										79.8000 2741.5299 0.0000	
Electricity for pumps and Total electricity for the Electricity for lighting	above, kWh/y		v I.)								86.0000 171.3641	(231)
Energy saving/generation				Q)								
PV generation Wind generation											-3573.6086	(234)
Hydro-electric generation Electricity generated - M	licro CHP (App	endix N)									0.0000 0.0000	
Appendix Q - special feat Energy saved or generated											-0.0000	
Energy used Total delivered energy fo	or all uses										0.0000 2720.4157	

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



	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3295.1303	0.2100	691.9774 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2741.5299	0.2100	575.7213 (264)
Space and water heating			1267.6986 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	171.3641	0.1443	24.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.9951	0.1361	-136.6018
PV Unit electricity exported	-2569.6135	0.1266	-325.3107
Total			-461.9126 (269)
Total CO2, kg/year			842.4485 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.6500 (273)

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

	Energy F kWh/year	rimary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3295.1303	1.1300	3723.4973 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	2741.5299	1.1300	3097.9288 (278)	
Space and water heating			6821.4261 (279)	
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)	
Energy for lighting	171.3641	1.5338	262.8440 (282)	
Energy saving/generation technologies PV Unit electricity used in dwelling PV Unit electricity exported Total Total Primary energy KWh/year Target Primary Energy Rate (TPER)	-1003.9951 -2569.6135	1.5029 0.4647	-1508.9325 -1194.1945 -2703.1269 (283) 4511.2440 (286) 62.4000 (287)	



Property Reference	:e	Tv	pe C_Green						ls	sued on Da	ite	23/10/2024	
Assessment Refer			001					Prop Type Re					
Property													
SAP Rating					102 A		DER	-0.7	6	TER		11.65	
Environmental					102 A		% DER < TER		•			11.05	
CO ₂ Emissions (t/)	year)				-0.12		DFEE	39.3	32	TFEE		50.66	
Compliance Check					See BREL		% DFEE < TFI		-			22.37	
% DPER < TPER					99.84		DPER	0.10)	TPER	1	62.40	
A											ID		
Assessor Details Client		Mr. Olive	er Eggenton							Asses	ssor ID	AQ01-00	זנ
SAP 10 WORKSHEET CALCULATION OF D						2022)							
1. Overall dwell	ing charac	teristics											
Ground floor Total floor area Dwelling volume	TFA = (la	a)+(lb)+(lc)+(ld)+(le)	(ln)	7	2.3000		Area (m2) 72.3000 (3	-		(2b) = (3n) =	Volume (m3) 216.9000 216.9000	(1b) - (3b) (4) (5)
2. Ventilation r	ate												
Number of open c Number of open f Number of chimne Number of flues Number of flues Number of blocke Number of passiv Number of fluele	lues ys / flues attached t attached t d chimneys ittent ext e vents	to solid fu to other he s tract fans	el boiler	ire							0 * 80 = 0 * 20 = 0 * 10 =		(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design	thod AP50	eys, flues	and fans :	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+(6g) + (7a) + ('	7b)+(7c) =			/ (5) =	Yes lower Door 3.0000	(17)
Infiltration rat Number of sides Shelter factor									(20) = 1 -	[0.075 x	(19)1 =	0.2422 0	(19)
Infiltration rat	e adjusted	d to includ	e shelter f	actor							x (20) =	0.2422	
Wind speed Wind factor	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250		Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Adj infilt rate Effective ac	0.3088 0.5477		0.2967 0.5440		0.2604 0.5339	0.2301 0.5265		0.2240 0.5251			0.2725 0.5371		
2													
 Heat losses a 													
Element				Gross m2	Openings m2		Area m2	U-value W/m2K	A x U W/K]	-value kJ/m2K	AxK kJ/K	
Window (Uw = 0.8 Heatloss Floor 1 External Wall 1 External Roof 1 Total net area o Fabric heat loss	of external			11.6300 72.3000	24.2000	72. 87. 72.	3000 4300 3000 2300	0.7752 0.0800 0.1300 0.1000 30) + (32)	5.7840 11.3659 7.2300	(19(0.0000 0.0000 0.0000	0.0000 16611.7000 0.0000	(29a)
Heat capacity Cm Thermal mass par Thermal bridges Point Thermal br Total fabric hea	ameter (TM (User defi idges	1P = Cm / T			area)			(28).	(30) + (32) (33)		(32e) = (36a) = + (36a) =	16611.7000 229.7607 12.8115 0.0000 55.9511	(35) (36)
	Jan 39.2015		thly (38)m - Mar 38.9391		5)m x (5) May 38.2148	Jun 37.6833	Jul 37.6833	Aug 37.5849	Sep 37.8880	Oct 38.2148	Nov 38.4457	Dec 38.6872	(38)
Heat transfer co Average = Sum(39	95.1526		94.8902	94.2800	94.1659	93.6344	93.6344	93.5360	93.8391	94.1659	94.3968	94.6383 94.2795	(39)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP HLP (average) Days in mont	1.3161 31	1.3142 28	1.3125	1.3040	1.3024	1.2951	1.2951	1.2937	1.2979 30	1.3024	1.3056 30	1.3090 (40 1.3040 31
Juyo In Mone	51	20	51	30	51	50	51	51	30	51	50	51
4. Water heati												
Assumed occupa Hot water usag	e for mixer											2.3006 (42
Hot water usag			60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919 25.0956	60.3795	62.5533 (42 27.0349 (42
Hot water usag Average daily	38.1909	36.8021	26.1565 35.4134 /day)	25.1104 34.0246	24.3272 32.6359	23.4586 31.2471	22.9895 31.2471	23.5529 32.6359	24.1663 34.0246	35.4134	26.1632 36.8021	38.1909 (42 117.7635 (43
Daily hot wate	Jan	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec
- Energy conte Energy content	128.1114 202.8972 (annual)	178.5339	122.0449 187.5785	116.9791 160.1385	112.8654 151.9386	108.4429 133.3432	106.7430 129.0964	110.0598 136.2770	113.5579 140.0283	118.2009 160.3975 Total = St	123.3448 175.7273 um(45)m =	127.7791 (44 200.0712 (45 1956.0277
Distribution 1	30.4346	= 0.15 x (4 26.7801	45)m 28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107 (46
Water storage Store volume a) If manufac Temperature	turer decla factor from	Table 2b	actor is kno	own (kWh/o	day):							200.0000 (47 1.5000 (48 0.5400 (49
Enter (49) or Total storage		22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	0.8100 (55 25.1100 (56
If cylinder co				24.3000		24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (50
Primary loss Combi loss Total heat req	23.2624 0.0000 uired for w	21.0112 0.0000 ater heatin	23.2624 0.0000 ng calculate	22.5120 0.0000 ed for each	23.2624 0.0000 h month	22.5120 0.0000	23.2624 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 0.0000	22.5120 0.0000	23.2624 (59 0.0000 (61
WWHRS PV diverter Solar input FGHRS	251.2696 -44.6651 -51.5661 0.0000 0.0000	222.2251 -39.5022 -106.2995 0.0000 0.0000	235.9509 -41.3644 -207.9867 0.0000 0.0000	206.9505 -34.2514 -308.6339 0.0000 0.0000	200.3110 -31.9210 -403.5261 0.0000 0.0000	180.1552 -27.3151 -404.0458 0.0000 0.0000	177.4688 -25.6035 -398.6197 0.0000 0.0000	184.6494 -27.2268 -337.8726 0.0000 0.0000	186.8403 -28.2612 -249.4957 0.0000 0.0000	208.7699 -33.3169 -149.5722 0.0000 0.0000	222.5393 -37.7440 -67.9701 0.0000 0.0000	248.4436 (62 -43.8380 (63 -40.8391 (63 0.0000 (63 0.0000 (63
Output from w/	h 155.0383	76.4234	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		116.8252	163.7666 (64 537.9344 (64 538 (64
Electric showe		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64
Heat gains fro	m water hea 106.1612		nonth 101.0678	Tot 90.6957	tal Energy u: 89.2175	sed by inst 81.7862	antaneous e 81.6225	lectric sho 84.0100	wer(s) (kWh 84.0090	/year) = Sur 92.0301	m(64a)m = 95.8789	0.0000 (64
5. Internal ga Metabolic gain												
(66)m Lighting gains	(calculate	d in Append	dix L, equat	tion L9 or	May 115.0322 L9a), also: 102.1907	see Table 5		Aug 115.0322 102.1907	Sep 115.0322	Oct 115.0322	Nov 115.0322 105.5970	Dec 115.0322 (66 102.1907 (67
Appliances gai	ns (calcula	ted in Appe	endix L, equ	ation L13		lso see Tab	le 5	149.4697	105.5970 154.7676	102.1907 166.0464	180.2839	193.6650 (68
Cooking gains	(calculated 34.5032	in Appendi 34.5032	ix L, equati 34.5032	ion L15 or		see Table	5 34.5032	34.5032	34.5032	34.5032	34.5032	34.5032 (69
Pumps, fans Losses e.g. ev		negative va	alues) (Tabl		3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70
Water heating		e 5)		-92.0257	-92.0257 119.9160	-92.0257	-92.0257 109.7076	-92.0257	-92.0257 116.6792	-92.0257	-92.0257 133.1652	-92.0257 (71 141.4269 (72
Total internal	gains											497.7923 (73
6. Solar gains												
[Jan]				rea m2	Solar flux Table 6a W/m2	Speci or	g fic data Table 6b	Specific or Tab	FF data le 6c	Acces facto Table (ss or 6d	Gains W
North East South			8.90 1.90 6.40)00)00)00	10.6334 19.6403 46.7521 19.6403		0.6800 0.6800 0.6800	0 0 0	.7000 .7000 .7000	0.77(0.77(0.77(0.77)		31.2178 (74 12.3095 (76 98.7009 (78
West												45.3509 (80
Solar gains Total gains												
7. Mean intern	al temperat	ure (heatin	ng season)									
Temperature du Utilisation fa	ring heatin ctor for ga	g periods i ins for liv	in the livin ving area, n	ng area fro nil,m (see	om Table 9, 1 Table 9a)	Thl (C)						21.0000 (85
tau alpha util living ar	48.4943 4.2330	48.5619	48.6284	48.9431	May 49.0025 4.2668		Jul 49.2806 4.2854	49.3325		Oct 49.0025 4.2668	Nov 48.8826 4.2588	Dec 48.7579 4.2505
-	0.9827	0.9610	0.9153	0.8079		0.4701	0.3433		0.6141	0.8699	0.9655	0.9862 (86
MIT Th 2	19.6106 19.8283	19.9097 19.8297		20.6703 19.8377		20.9787 19.8447	20.9956 19.8447		20.9368 19.8425	20.6064 19.8389		19.5519 (87 19.8338 (88
util rest of h		0.9504	0.8935	0.7647	0.5811	0.3899	0.2544	0.2931	0.5263	0.8279	0.9543	0.9822 (89



MIT 2 18.2581 Living area fraction	18.6319	19.0832	19.5331	19.7604	19.8337	19.8434	19.8434	19.8047	19.4807 Living area	18.7954	18.1880 0.1757	
MIT 18.4957 Temperature adjustment	18.8563	19.2934	19.7329	19.9599	20.0348	20.0458	20.0453	20.0036	19.6785	19.0127	18.4276	
adjusted MIT 18.4957	18.8563	19.2934	19.7329	19.9599	20.0348	20.0458	20.0453	20.0036	19.6785	19.0127	18.4276	(93)
 Space heating requir 	ement											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation 0.9698 Useful gains 674.5970			0.7604 871.9336	0.5883 735.5532	0.4034 502.3289	0.2700 321.7741	0.3098 339.3861	0.5392 532.4615	0.8211 682.8876	0.9437 667.1233	0.9752 640.2638	
Ext temp. 4.3000 Heat loss rate W	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
1350.7543 Space heating kWh	1326.1333	1213.9724	1021.3239	777.7960	508.8874	322.6454	340.9628	553.9844	854.8825	1124.5180	1346.4720	(97)
503.0610 Space heating requireme Solar heating kWh			107.5610 h/year)	31.4287	0.0000	0.0000	0.0000	0.0000	127.9642	329.3242	525.4189 2231.1240	(98a)
0.0000 Solar heating contribut			0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
	353.0378		107.5610	31.4287	0.0000	0.0000	0.0000	0.0000	127.9642	329.3242	525.4189	(98c)
Space heating requireme Space heating per m2	nt alter so	lar contribu	ulon - tota.	i per year	(kwn/year)				(98c) / (4) =	2231.1240 30.8593	(99)
9a. Energy requirements	- Individu	al heating s	ystems, inc	luding micr	ro-CHP							
Fraction of space heat Fraction of space heat			ntary system	m (Table 11	.)						0.0000 1.0000	
Efficiency of main space Efficiency of main space	e heating s	ystem 1 (in									219.3000 0.0000	(206)
Efficiency of secondary											0.0000	
Jan Space heating requireme	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
503.0610 Space heating efficience	353.0378		107.5610	31.4287	0.0000	0.0000	0.0000	0.0000	127.9642	329.3242	525.4189	(98)
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 (mai 229.3940	160.9840	115.5168	49.0474	14.3314	0.0000	0.0000	0.0000	0.0000	58.3512	150.1706	239.5891	(211)
Space heating efficience 0.0000	0.0000	0.0000	2) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (mai 0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (sec 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 requireme 155.0383		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	25.8808	116.8252	163.7666	(64)
Efficiency of water hea (217)m 190.4000	ter		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, 81.4277	kWh/month		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	13.5929	61.3578	86.0118	
Space cooling fuel requ (221)m 0.0000	irement		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Pumps and Fa 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting 20.0399 Electricity generated h	y PVs (Appe	ndix M) (neg			6.6928	7.4728	9.7135	12.6168	16.5540	18.6977	20.5969	
Electricity generated h	y wind turb		lix M) (negat	tive quanti		-96.2541	-95.8171		-108.7488	-93.3391	-78.5148	
(234a)m 0.0000 Electricity generated h			0.0000 tors (Append	0.0000 dix M) (neg	0.0000 pative quanti	0.0000 ty)	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
(235a)m 0.0000 Electricity used or net	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235a)
(235c)m 0.0000 Electricity generated h	0.0000	0.0000	0.0000	0.0000		0.0000		0.0000	0.0000	0.0000	0.0000	(235c)
(233b)m -3.4797 Electricity generated h	-16.8104	-54.8390	-99.6702	-143.2142	-148.5291	-146.7897	-128.0908	-98.0401	-45.5975	-9.3680	-1.8499	(233b)
(234b)m 0.0000 Electricity generated h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(235b)m 0.0000 Electricity used or net	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	(235b)
(235d)m 0.0000								0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year Space heating fuel - ma											1017.3844	
Space heating fuel - ma Space heating fuel - se	condary										0.0000	(215)
Efficiency of water hea Water heating fuel used											190.4000 282.5286	(219)
Space cooling fuel											0.0000	(221)
Electricity for pumps a Total electricity for t Electricity for lightin	he above, k		lix L)								0.0000 161.7334	
Energy saving/generation	n technolog	jies (Appendi	.ces M ,N and	d Q)								
PV generation Wind generation	-		-								-2152.3541 0.0000	
Hydro-electric generati Electricity generated -												(235a)
Appendix Q - special fe Energy saved or generat	atures										-0.0000	
Energy used Total delivered energy		3									0.0000	(237)
issui activereu energy	101 011 030	~									000.7070	(200)
12a. Carbon dioxide emi	ssions - In	dividual hea	ting system:	s including	g micro-CHP							
							Energy	Emiss	ion factor		Emissions	

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1017.3844	0.1567	159.3928 (261)
Total CO2 associated with community systems			0.0000 (373)



	-r	energy	
2.5286	0.1587	44.8284	(264)
2.5200	0.1307	204.2212	
0.0000	0.0000	0.0000	(267)
1.7334	0.1443	23.3431	(268)
6.0755 6.2786	0.1392 0.1198	-174.8003 -107.3827	
0.2700	0.1190	-282.1830	(269)
		-54.6186	(272)
		-0.7600	(273)
	energy factor	Primary energy	
h/year 7.3844	kg CO2/kWh 1.5800	kWh/year 1607.4471	
1.3044	1.5000	0.0000	
2.5286	1.5871	448.3897	(278)
0.0000	0.0000	2055.8368 0.0000	
1.7334	1.5338	248.0720	
			(,
6.0755	1.5146	-1902.4491	
6.2786	0.4397	-394.0646	
		-2296.5137	
		7.3952	
		012000	(201)
_			

1. Overall dwelling characteristics

		Area	Store	ey height		Volume
		(m2)		(m)		(m3)
Ground floor		72.3000 (1b)	х	3.0000 (2b)	=	216.9000 (1b) - (3b)
Total floor area $TFA = (la)+(lb)+(lc)+(ld)+(le)(ln)$	72.3000					(4)
Dwelling volume		(3a) + (3b)+(3c)+	+(3d)+(3e)(3n	ı) =	216.9000 (5)

2. Ventilation 1	rate												
											m3 j	per hour	
Number of open of Number of open i Number of chimme Number of flues Number of flues Number of blocke Number of intern Number of passiv Number of flues	flues attached t attached t attached t d chimneys mittent ext ve vents	o solid fue o other hea ract fans	el boiler	re							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 30.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 ce	ys, flues a	and fans =	= (6a)+(6b)+	(6c)+(6d)+	(6e)+(6f)+(6	6g) + (7a) + (7h	o)+(7c) =		30.0000 /	(-)	0.1383 Yes wer Door 5.0000 0.3883	(8)
Shelter factor Infiltration rat	te adjusted	l to include	e shelter fa	actor				((20) = 1 - (21)		(19)] = (20) =	1.0000 0.3883	
Wind speed Wind factor Adj infilt rate	Jan 5.1000 1.2750	Feb 5.0000 1.2500	Mar 4.9000 1.2250	Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500	Aug 3.7000 0.9250	Sep 4.0000 1.0000	Oct 4.3000 1.0750	Nov 4.5000 1.1250	Dec 4.7000 1.1750	
Effective ac	0.4951 0.6226	0.4854 0.6178	0.4757 0.6131	0.4271 0.5912	0.4174 0.5871	0.3689 0.5680	0.3689 0.5680	0.3592 0.5645	0.3883 0.5754	0.4174 0.5871	0.4369 0.5954	0.4563 0.6041	

ement	Gross	Openings	NetArea	U-value	A x U	K-value	АхК	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
R Opening Type (Uw = 1.20)			18.0700	1.1450	20.6908			(27
atloss Floor 1			72.3000	0.1300	9.3990			(28
ternal Wall 1	111.6300	18.0700	93.5600	0.1800	16.8408			(29
ternal Roof 1	72.3000		72.3000	0.1100	7.9530			(30
tal net area of external elements A	Aum (A, m2)		256.2300					(31
bric heat loss, W/K = Sum (A x U)			(26)	.(30) + (32) =	54.8836			(33
ermal mass parameter (TMP = Cm / TF	7A) in kT/m2K						229.7607	135



El6 Co Thermal bridge	orner (norma es (Sum(L x		lated using	Appendix K)			12	.0000	0.0900	1.08	00 7.0336	(36)
Point Thermal Total fabric b	bridges	ibi) calca	Lubcu ubing	Appendia A	,				(33) + (36) ·	(36a) = + (36a) =	0.0000 61.9172	/
Ventilation he	eat loss cal	culated mo	nthly (38)m	$= 0.33 \times 0$	25)m x (5)								
(38)m	Jan 44.5611	Feb 44.2204	Mar 43.8865	Apr 42.3182	May 42.0247	Jun 40.6588	Jul 40.6588	Aug 40.4058	Sep 41.1849	Oct 42.0247	Nov 42.6184	Dec 43.2389	(38)
Heat transfer Average = Sum	106.4783	106.1377	105.8038	104.2354	103.9420	102.5760	102.5760	102.3231	103.1022	103.9420	104.5356	105.1562 104.2340	(39)
HLP	Jan 1.4727	Feb 1.4680	Mar 1.4634	Apr 1.4417	May 1.4376	Jun 1.4188	Jul 1.4188	Aug 1.4153	Sep 1.4260	Oct 1.4376	Nov 1.4459	Dec 1.4544 1.4417	(40)
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.4417 31	
4. Water heati	ing energy 1	requirement											
Assumed occupa Hot water usad		showers										2.3006	(42)
Hot water usag	62.7939	61.8502	60.4751	57.8441	55.9024	53.7372	52.5064	53.8711	55.3671	57.6919	60.3795	62.5533	(42a)
Hot water usag	27.1267 ge for other	26.7238 uses	26.1565	25.1104	24.3272	23.4586	22.9895	23.5529	24.1663	25.0956	26.1632	27.0349	(42b)
Average daily	38.1909 hot water u	36.8021 use (litres	35.4134 /day)	34.0246	32.6359	31.2471	31.2471	32.6359	34.0246	35.4134	36.8021	38.1909 117.7635	
Daily hot wate	Jan er use	Feb	Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte Energy content	c (annual)	125.3761 178.5339	122.0449 187.5785	116.9791 160.1385	112.8654 151.9386	108.4429 133.3432	106.7430 129.0964	110.0598 136.2770	113.5579 140.0283	118.2009 160.3975 Total = S	123.3448 175.7273 um(45)m =	127.7791 200.0712 1956.0277	
Distribution 1 Water storage	30.4346	= 0.15 x (26.7801	45)m 28.1368	24.0208	22.7908	20.0015	19.3645	20.4416	21.0042	24.0596	26.3591	30.0107	(46)
Store volume a) If manufac		ared loss f	actor is kno	own (kWh/d	av):							200.0000	
Temperature Enter (49) or Total storage	factor from (54) in (55	n Table 2b										0.5400 0.8924	
-	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder co	ontains dedi 27.6637	icated sola 24.9865	r storage 27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(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	
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 red	<pre>uired for v 253.8233</pre>	vater heati 224.5317	ng calculate 238.5046	ed for each 209.4218	month 202.8647	182.6265	180.0225	187.2031	189.3116	211.3236	225.0106	250.9973	(62)
WWHRS	-28.7067	-25.3885	-26.5854	-22.0137	-20.5160	-17.5557	-16.4557	-17.4989	-18.1638	-21.4131	-24.2584	-28.1751	
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	
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	
FGHRS Output from w	0.0000 /b	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63Q)
output from w		199.1432	211.9192	187.4081	182.3487	165.0708	163.5668		171.1478		200.7521	222.8222	(64)
12Total per ye		ar)						Total p	er year (kW	h/year) = S	um (64) m =	2288.9101 2289	
Electric showe	er(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	
Heat gains fro	om water hea	ating, kWh/	month	100	ar Energy u	sed by INSU	ancaneous e.	Tectric sho	wer(s) (KMU	/year) = Su	m(04a)m =	0.0000	(044)
gaind it	108.2042		103.1107	92.6727	91.2604	83.7632	83.6654	86.0530	85.9860	94.0730	97.8560	107.2645	(65)
	–												

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

 Metabolic gains (Table 5), Watts
 Mar
 Apr
 May
 Jun
 Jun

 Jan
 Feb
 Mar
 Apr
 May
 Jun
 J Jul 115.0322 Sep Oct Nov Dec 115.0322 115.0322 115.0322 (66) Aug 115.0322 102,1907 102.1907 105.5970 102.1907 105.5970 102.1907 (67) 151.5721 149.4697 154.7676 166.0464 180.2839 193.6650 (68) 34.5032 0.0000 34.5032 (69) 3.0000 (70) 34.5032 34.5032 34.5032 34,5032 0.0000 0.0000 3.0000 3.0000 -92.0257 -92.0257 -92.0257 -92.0257 -92.0257 -92.0257 -92.0257 (71) Water heating gains (Table 5) 145.4357 143.0963 138.5897 128.7121 122.6619 116.3378 112.4535 115.6626 119.4251 126.4422 135.9110 144.1728 (72) Total internal gains 510.7405 521.4525 500.6989 482.9489 459.2549 439.9560 423.7259 424.8326 437.2994 455.1890 482.3016 500.5381 (73)

6. Solar gain	5												
[Jan]			A	m2	Solar flux Table 6a W/m2		g fic data Table 6b	Specific or Tab		Acces fact Table	or	Gains W	
North East South West			6.65 1.42 4.70 5.22	200	10.6334 19.6403 46.7521 19.6403		0.6300 0.6300 0.6300 0.6300	0	.7000 .7000 .7000 .7000	0.77	00 00	21.6105 8.5233 68.2968 31.3321	(76) (78)
Solar gains Total gains	129.7628 640.5033	231.1170 752.5696	341.0554 841.7543	461.0169 943.9658	549.1495 1008.4044	558.9776 998.9337	533.2169 956.9428	465.7639 890.5965	382.5453 819.8447	262.3172 717.5062	157.3094 639.6110	109.8055 610.3436	

7. Mean internal temperature (heating season)



												iergy	
Temperature dur Utilisation fac						Thl (C)						21.0000	(85)
OUTITSation Tac	Jan	Feb	Mar Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau alpha util liuing and	43.3362 3.8891	43.4752 3.8983	43.6125 3.9075	44.2686 3.9512	44.3936 3.9596	44.9848 3.9990	44.9848 3.9990	45.0960 4.0064	44.7552 3.9837	44.3936 3.9596	44.1415 3.9428	43.8810 3.9254	
util living are	0.9879	0.9767	0.9544	0.8949	0.7812	0.6093	0.4590	0.5083	0.7391	0.9236	0.9776	0.9899	(86)
MIT Th 2 util rest of ho	19.2927 19.7080	19.5474 19.7116	19.9089 19.7151	20.3757 19.7315	20.7316 19.7346	20.9279 19.7490	20.9818 19.7490	20.9729 19.7517	20.8414 19.7434	20.3726 19.7346	19.7601 19.7284	19.2616 19.7218	
MIT 2	0.9841 17.7758	0.9697 18.0992	0.9403 18.5527	0.8626	0.7171 19.5190	0.5084 19.7098	0.3346 19.7436	0.3799 19.7427	0.6455	0.8927	0.9695 18.3830	0.9867 17.7454	(90)
Living area fra MIT Temperature adj	18.0423	18.3536	18.7909	19.3455	19.7320	19.9237	19.9611	19.9588	fLA = 19.8526	Living area 19.3564	a / (4) = 18.6249	0.1757 18.0117 0.0000	
adjusted MIT	18.0423	18.3536	18.7909	19.3455	19.7320	19.9237	19.9611	19.9588	19.8526	19.3564	18.6249	18.0117	(93)
8. Space heatin	ng requirem	nent											
	Jan	Feb		Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext temp.	0.9770 625.7533 4.3000	0.9593 721.9306 4.9000	0.9269 780.2149 6.5000	0.8507 802.9902 8.9000	0.7170 723.0044 11.7000	0.5234 522.8291 14.6000	0.3564 341.0245 16.6000	0.4021 358.0939 16.4000	0.6546 536.7047 14.1000	0.8808 631.9955 10.6000	0.9596 613.7649 7.1000	0.9804 598.4038 4.2000	(95)
Heat loss rate 1 Space heating k	463.2548	1427.9342	1300.4243	1088.7921	834.8650	546.0886	344.7671	364.1445	593.1084	910.1555	1204.7629	1452.3858	(97)
	623.1011 equirement	474.4344 ; - total pe	387.0358 er year (kW	205.7774 h/year)	83.2243	0.0000	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626 3041.4053	(98a)
Solar heating c	0.0000 contributio	0.0000 on - total p	0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating k Space heating r Space heating p	623.1011 requirement	474.4344 after sola	387.0358 ar contribu	205.7774 tion - total	83.2243 per year	0.0000 (kWh/year)	0.0000	0.0000	0.0000	206.9511	425.5186	635.3626 3041.4053 42.0665	
Fraction of spa					luding micr								
Fraction of spa Efficiency of m Efficiency of m	ace heat fr Main space Main space	com seconda: com main sy: heating sy: heating sy:	ry/suppleme stem(s) stem 1 (in stem 2 (in	ntary system %) %)								0.0000 1.0000 92.3000 0.0000	(202) (206) (207)
Efficiency of m Efficiency of m	ace heat fr Main space Main space	com seconda: com main sy: heating sy: heating sy:	ry/suppleme stem(s) stem 1 (in stem 2 (in	ntary system %) %)			Jul	Aug	Sep	Oct	Nov	1.0000 92.3000	(202) (206) (207)
Efficiency of m Efficiency of m Efficiency of s Space heating r	ace heat fr main space main space secondary/s Jan requirement 623.1011	com seconda: com main sy: heating sy: heating sy: supplementa: Feb ; 474.4344	ry/supplements stem(s) stem 1 (in stem 2 (in ry heating Mar 387.0358	ntary system %) system, % Apr 205.7774	n (Table 11)	Jul 0.0000		Sep 0.0000	Oct 206.9511	Nov 425.5186	1.0000 92.3000 0.0000 0.0000	(202) (206) (207) (208)
Efficiency of m Efficiency of m Efficiency of s Space heating r Space heating e	ace heat fr main space main space secondary/s Jan requirement 623.1011 efficiency 92.3000	com seconda: com main syn heating syn heating syn supplementa: Feb 474.4344 (main heat: 92.3000	ry/suppleme stem(s) stem 1 (in stem 2 (in ry heating Mar 387.0358 ing system 92.3000	ntary system %) system, % Apr 205.7774	n (Table 11 May) Jun		Aug	-			1.0000 92.3000 0.0000 0.0000 Dec	(202) (206) (207) (208) (98)
Efficiency of m Efficiency of m Efficiency of s Space heating r Space heating e Space heating f	ace heat fr main space becondary/s Jan requirement 623.1011 efficiency 92.3000 tuel (main 675.0825	com seconda: com main sy: heating sy: heating sy: supplementa: Feb 474.4344 (main heat: 92.3000 heating sy: 514.0134	ry/suppleme stem(s) stem(s) stem 1 (in stem 2 (in ry heating Mar 387.0358 ing system 92.3000 stem) 419.3237	<pre>%) %) %) system, % Apr 205.7774 1) 92.3000 222.9441</pre>	May 83.2243	Jun 0.0000	0.0000	Aug 0.0000	0.0000	206.9511	425.5186	1.0000 92.3000 0.0000 0.0000 Dec 635.3626	(202) (206) (207) (208) (98) (210)
Efficiency of m Efficiency of m Efficiency of s Space heating r Space heating e Space heating e	the heat fr hain space secondary/s Jan requirement 623.1011 ffficiency 92.3000 fuel (main 675.0825 ffficiency 0.0000	com seconda: com main sy: heating sy: heating sy: supplementa: Feb 474.4344 (main heat: 92.3000 heating sy: 514.0134 (main heat: 0.0000	ry/suppleme stem (3) stem 1 (in stem 2 (in ry heating Mar 387.0358 ing system 92.3000 stem) 419.3237 ing system 0.0000	<pre>%) %) %) system, % Apr 205.7774 1) 92.3000 222.9441</pre>	May 83.2243 92.3000	Jun 0.0000 0.0000	0.0000	Aug 0.0000 0.0000	0.0000	206.9511 92.3000	425.5186 92.3000	1.0000 92.3000 0.0000 Dec 635.3626 92.3000	(202) (206) (207) (208) (98) (210) (211)
Efficiency of m Efficiency of m Efficiency of s Space heating r Space heating e Space heating f Space heating f	tee heat fr hain space secondary/s Jan requirement 623.1011 fficiency 92.3000 uuel (main 675.0825 fficiency 0.0000 tuel (main 0.0000 fuel (secon	com seconda: com main sy: heating sy: heating sy: supplementa: Feb 474.4344 (main heat: 92.3000 heating sy: 0.0000 heating sy: 0.0000 daty)	ry/suppleme stem(s) stem 1 (in stem 2 (in ry heating Mar 387.0358 ing system 92.3000 stem) 419.3237 ing system 0.0000 stem 2) 0.0000	ntary system %) system, % Apr 205.7774) 92.3000 222.9441 2) 0.0000 0.0000	May 83.2243 92.3000 90.1672 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000	206.9511 92.3000 224.2157 0.0000 0.0000	425.5186 92.3000 461.0169 0.0000 0.0000	1.0000 92.3000 0.0000 Dec 635.3626 92.3000 688.3669 0.0000 0.0000	(202) (206) (207) (208) (210) (211) (212) (213)
Efficiency of m Efficiency of m Efficiency of s Space heating r Space heating e Space heating f Space heating f Space heating f	the heat fr hain space secondary/s Jan requirement 623.1011 fficiency 92.3000 ruel (main 675.0825 fficiency 0.0000 fuel (main 0.0000	com seconda: com main sy: heating sy: heating sy: heating sy: supplementa: Feb 474.4344 (main heat: 0.0000 heating sy: 0.0000	ry/suppleme stem(s) stem 1 (in stem 2 (in ry heating Mar 387.0358 ing system 92.3000 stem) 419.3237 ing system 0.0000 stem 2)	<pre>ntary system %) %) %) % 205.7774 1) 92.3000 222.9441 2) 0.0000</pre>	May 83.2243 92.3000 90.1672 0.0000	Jun 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000	206.9511 92.3000 224.2157 0.0000	425.5186 92.3000 461.0169 0.0000	1.0000 92.3000 0.0000 Dec 635.3626 92.3000 688.3669 0.0000	(202) (206) (207) (208) (210) (211) (212) (213)
Efficiency of m Efficiency of s Space heating r Space heating e Space heating f Space heating f Space heating f Space heating f Mater heating r	to heat fr main space secondary/s Jan requirement 623.1011 efficiency 92.3000 uel (main 675.0825 efficiency 0.0000 uel (main 0.0000 uel (secor 0.0000 ecquirement 225.1165	com seconda: com main sy: heating sy: heating sy: heating sy: heating sy: sy: 474.4344 (main heat: 0.0000 heating sy: 0.0000 heating sy: 0.0000 heating sy: 0.0000 idary) 0.0000 idary) 199.1432	ry/suppleme stem(s) stem 1 (in stem 2 (in ry heating Mar 387.0358 ing system 92.3000 stem) 419.3237 ing system 0.0000 stem 2) 0.0000 0.0000	ntary system %) system, % Apr 205.7774) 92.3000 222.9441 2) 0.0000 0.0000	May 83.2243 92.3000 90.1672 0.0000 0.0000 0.0000	Jun 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	Aug 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	206.9511 92.3000 224.2157 0.0000 0.0000	425.5186 92.3000 461.0169 0.0000 0.0000 0.0000	1.0000 92.3000 0.0000 Dec 635.3626 92.3000 688.3669 0.0000 0.0000 0.0000	(202) (206) (207) (208) (210) (211) (212) (212) (213) (215) (64)
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 -197.7208
 -290.1200
 -377.2605
 -376.7681
 -372.3107
 -318.0510

 Electricity generated by wind turbines (Appendix M)
 (negative quantity)
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Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features Energy saved or generated

-0.0000 (236)

elmhurst energy

Energy used Total delivered energy for all uses

0.0000 (237) 2720.4157 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
	Energy kWh/year 3295.1303	Emission factor kg CO2/kWh 0.2100	Emissions kg CO2/year
Space heating - main system 1 Total CO2 associated with community systems	5295.1303	0.2100	691.9774 (261) 0.0000 (373)
Water heating (other fuel) Space and water heating	2741.5299	0.2100	575.7213 (264) 1267.6986 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	171.3641	0.1443	24.7331 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1003.9951	0.1361	-136.6018
PV Unit electricity exported Total Total CO2, kg/year EPC Target Carbon Dioxide Emission Rate (TER)	-2569.6135	0.1266	-325.3107 -461.9126 (269) 842.4485 (272) 11.6500 (273)

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

	Energy Prima kWh/year	ary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3295.1303	1.1300	3723.4973 (275)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	2741.5299	1.1300	3097.9288 (278)	
Space and water heating			6821.4261 (279)	
Pumps, fans and electric keep-hot	86.0000	1.5128	130,1008 (281)	
Energy for lighting	171.3641	1.5338	262.8440 (282)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1003,9951	1,5029	-1508,9325	
PV Unit electricity exported	-2569.6135	0.4647	-1194,1945	
Total	200310200	011017	-2703.1269 (283)	
Total Primary energy kWh/year			4511.2440 (286)	
Target Primary Energy Rate (TPER)			62.4000 (287)	
Targeo Tirmari Emergi nave (Trin)			02110000 (2017)	