LOVE
DESIGN
STUDIO

April 2023

The White Hart

Energy and Sustainability Statement

Contents

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Section Zero

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Executive Summary

Executive Summary

An assessment of the site's energy and sustainability credentials has been carried out for the proposed development at The White Hart, St Albans Road, South Mimms, EN6 3PJ. The proposed development consists of the conversion and extension of the former public house into six apartments, conversion of outbuilding into a two-bedroom apartment and construction of a detached infill dwelling, along with associated landscaping, bin store, cycle storage and vehicle parking.

The new-build element of the proposed development, consisting of two no. apartments and one detached infill dwelling, has incorporated energy efficiency measures through a well-insulated building fabric shell to reduce the demand for space heating. Additionally, the detached infill dwelling energy strategy will make use of high efficiency air source heat pumps (ASHPs) to maximise on-site CO2 reductions. The two no. apartments will utilise direct electric panels for space heating, electric immersion heaters for hot water, and photovoltaic solar panels on the roof to generate renewable energy on-site. The new build provides a **regulated CO_2 reduction of 55%** against the Part L (2021) Building Regulations, exceeding Hertmere's target of 30-40% set out within the Draft Carbon Offsetting SPD (2022).

The conversion element of the proposed development, consisting of five apartments, will benefit from an improved thermal performance via internal insulation and upgrade of existing windows and doors. The four no. apartments within the main building proposes to retain the existing gas boiler system assumed on-site. The apartment within the outbuilding will utilise an ASHP to provide space heating and domestic hot water. The conversion provides a **regulated CO_2 reduction of 58%** against the existing building.

The scheme will also integrate core sustainability principles within its design, including sustainable construction, waste, health, and wellbeing elements.

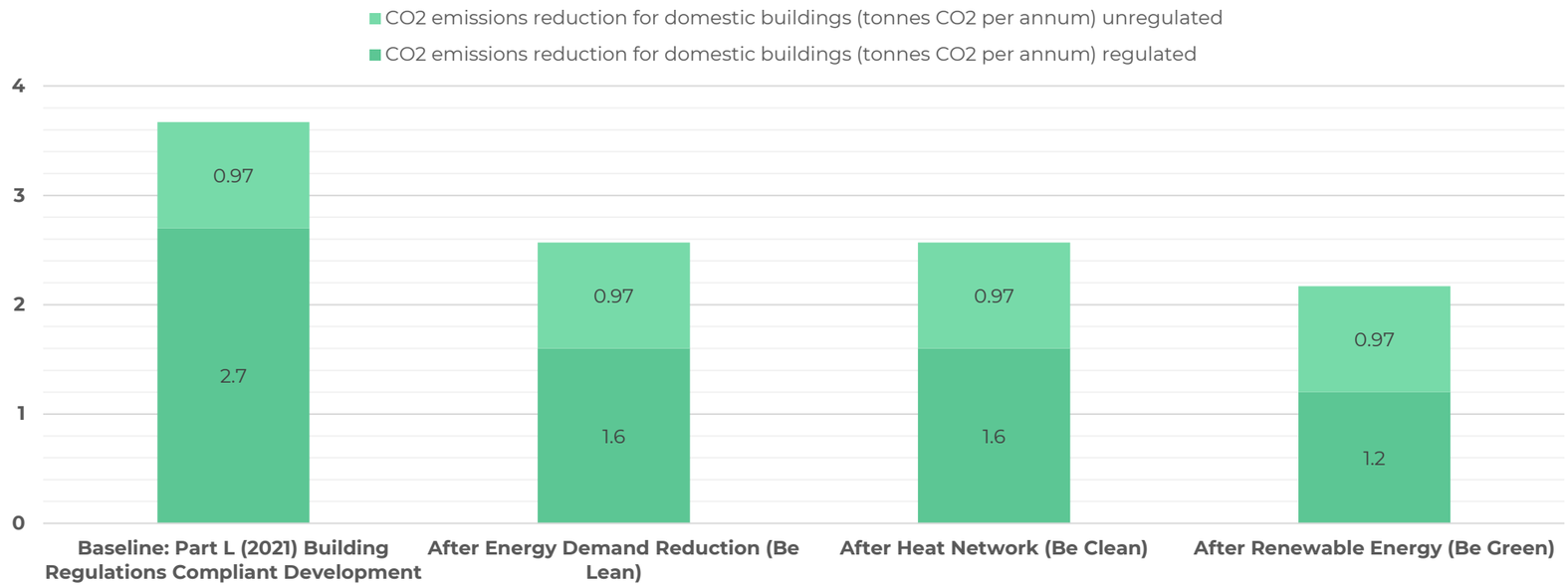

Figure 1: New Build CO2 savings at each stage of the energy hierarchy

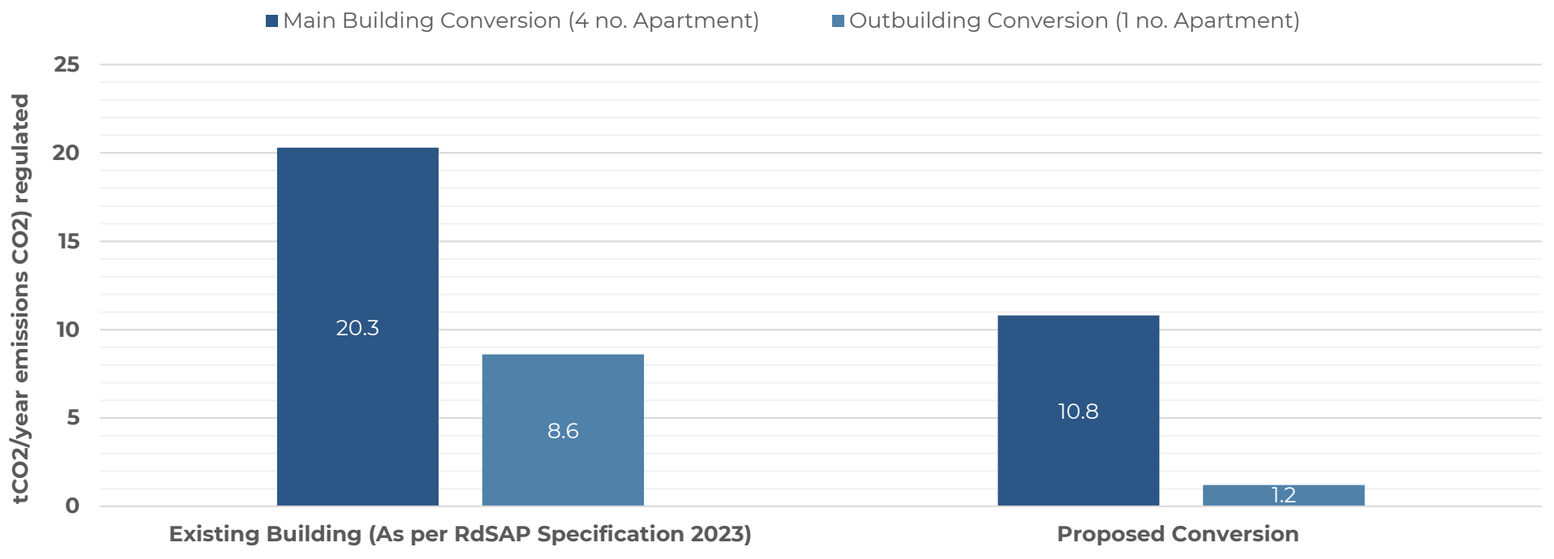

Figure 2: Conversion CO2 savings as compared to the existing building

Section One

1 Introduction

Site Overview

An assessment of the site's energy and sustainability credentials has been carried out for the proposed development at The White Hart, St Albans Road, South Mimms, EN6 3PJ.

The site is located within the jurisdiction of Hertsmere Borough council.

The proposed development consists of the conversion and extension of the former public house into six apartments, conversion of outbuilding into a two-bedroom apartment and construction of a detached infill dwelling, along with associated landscaping, bin store, cycle storage and vehicle parking.

The public house, which closed down in 2021, is a Grade II listed building. Furthermore, the site is located within the Green Belt.

The purpose of this statement is to highlight the sustainability credentials of the scheme and demonstrate the energy strategy and carbon reductions that will be achieved through the proposed development.

Figure 3: Aerial view of the proposed site (red).

National Planning Policy

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

Planning law requires that applications for planning permission be determined in accordance with the development plan unless material considerations indicate otherwise. The National Planning Policy Framework must be considered in preparing the development plan and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

The purpose of the planning system is to contribute to the achievement of sustainable development. In summary the framework advises:

"Plans should take a proactive approach to mitigating and adapting to climate change, considering the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

New development should be planned for in ways that:

- *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*
- *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:*
- *Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);*
- *Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and*
- *Identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers."*

- - Section 14, paragraphs 153-155 of the National Planning Policy Framework

- *"Achieving sustainable development means that the planning system has 3 overarching objectives, which are interdependent and need to be pursued in mutually supportive ways:*

- *an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure*
- *a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided*
- *to meet the needs of present and future generations; and by fostering well-designed beautiful and safe places, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and*
- *an environmental objective – to protect and enhance our natural, built and historic environment; including making effective use of land, improving biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*- Section 14, paragraphs 153-155 of the National Planning Policy Framework"

- Section 2, paragraphs 7-14 of the National Planning Policy Framework

Local Planning Policy

Local Development Framework

The Local Planning Authority, Hertsmere Borough Council, have a statutory guide to development within the borough and use policies and guides to do so. The current development framework within Hertsmere is determined by the local plan, consisting of the Core Strategy (2013), Site Allocations and Development Management Policies Plan (2016), and other development plan documents. The Local Plan has full weight in the determination of planning applications.

Core Strategy (2012-2027) (Adopted 2013)

The Core Strategy contains policies that the Council will use to determine planning applications and forms part of the Local Development Framework for the borough.

Policy extracts that are deemed relevant to Energy have been set out below for reference and have been considered and complied with in the scheme's current design:

POLICY CS17 – ENERGY AND CO2 REDUCTIONS

Encourages all new development or major refurbishments to incorporate energy from decentralised or low carbon sources, subject to meeting high standards of sustainable design and construction, preserving and enhancing local designated environmental assets and minimising any detriment to neighbouring amenities and land uses.
All new residential developments are required to achieve Code level 5 of the now defunct Code for Sustainable Homes (Code) and CO2 reduction targets in line with Part L (2021) Building Regulations requirements.

Policy extracts that are deemed relevant to Sustainability have been set out below for reference:

- *POLICY SP1 - CREATING SUSTAINABLE DEVELOPMENT*
- *POLICY SP2 - PRESUMPTION IN FAVOUR OF SUSTAINABLE DEVELOPMENT*
- *POLICY CS12 - THE ENHANCEMENT OF THE NATURAL ENVIRONMENT*
- *POLICY CS16 - ENVIRONMENTAL IMPACT OF DEVELOPMENT*
- *POLICY CS17 - ENERGY AND CO2 REDUCTIONS*
- *POLICY CS18 - ACCESS TO SERVICES*
- *POLICY CS26 - PROMOTING ALTERNATIVES TO THE CAR*

Site Allocations & Management Policies Plan (2016)

The Site Allocations and Development Management Policies Plan sets out detailed proposals and policies by which the Council sees the aims and objectives of the Core Strategy being best achieved.

The Site Allocations and Development Management Policies Plan should therefore be consistent with the strategic direction and policies of the Core Strategy. In turn, the consultation and technical appraisal which underpin the Core Strategy are relevant to the Site Allocations and Development Management Policies Plan itself.

Policy extracts that are deemed relevant to Energy and/or Sustainability have been set out below for reference:

- *POLICY SADM10 - BIODIVERSITY AND HABITATS*
- *POLICY SADM11 - LANDSCAPE CHARACTER*
- *POLICY SADM13 - THE WATER ENVIRONMENT*
- *POLICY SADM15 SUSTAINABLE DRAINAGE SYSTEMS*
- *POLICY SADM20 - ENVIRONMENTAL POLLUTION AND DEVELOPMENT*
- *POLICY SADM30 - DESIGN PRINCIPLES*

Local Planning Policy

Interim Planning Policy Position Statement (2020)

The Interim Planning Policy Position Statement sets out the requirements which Hertsmere, as Local Planning Authority, will seek on relevant applications for planning permission in order to deliver on the requirements set out in the adopted Core Strategy (2013) and the Site Allocations and Development Management Policies (2016), the NPPF (2019), Climate Change and Sustainability Strategy (Hertsmere Borough Council) and the Government's emerging priorities on climate change.

Its contents will be kept under review with any necessary amendments and clarifications made after the new Local Plan is published.

To comply with existing policies and the clarifications included in the Climate Change and Sustainability Interim Planning Policy Position Statement (draft) paper, all applications which exceed the following thresholds will be expected to be accompanied by a Climate Change and Energy Statement:

i. the development of five or more residential units,
ii. the creation of 500 square metres or above of additional floor-space for non-residential development; or
iii. change of use and refurbishment projects of 1,000 square metres or above.

Clarifications made to policies CS16 and 17 as part of this document encourage applicants to consider how schemes can strive for a target for new development of net zero carbon on site. Unless it can be demonstrated otherwise, new development above the thresholds included above will be expected to set a target for net zero carbon on site.

All new development should make the fullest contribution to minimising carbon dioxide emissions, through a range of design, technological, landscape and ecological measures, in accordance with the following energy hierarchy:

- Be lean: use less existing energy
- Be clean: supply and use energy efficiently
- Be green: use renewable energy

The Council acknowledge that there may be circumstances where net zero carbon cannot be reasonably achieved on site, and any residual carbon shortfall would need to be offset. In such cases, the Council will work with applicants in order to review whether any residual carbon shortfall can be monetised and ring fenced to be used for local carbon offset projects to secure carbon reductions in the vicinity of the application site, or where that is not possible, elsewhere in the Borough.

Draft Carbon Offsetting SPD (2022)

The Draft Carbon Offsetting Supplementary Planning Document (SPD) was published in September 2022, laying out the council's proposed plan to collect payments for offsets of residual carbon for development which exceeds the threshold set out in the Interim Planning Policy Statement on Climate Change (IPPSCC) document. This document has not yet been formally adopted, but is approved as interim guidance in the determination of planning applications made after 15th September 2022.

This SPD requests developments above the thresholds set out in the IPPSCC to achieve carbon reductions in line with the hierarchy, and to achieve:

- at least a 10-15% reduction in carbon emissions over and above Part L of the Building Regulations to be achieved through improvements to building fabric and the design and layout of development
- around 30-40% reduction on Part L achieved though renewable energy

Section Two

2 Energy

Methodology and Assumptions

New Build

The proposed development includes the new-build construction of two apartments as part of an extension from the main building of the former White Hart and one detached infill dwelling. The new build will look to meet operational energy targets, in reference to Hertsmere's Interim Planning Policy Position Statement (2020) by following the energy hierarchy:

1. **Be Lean** - use less existing energy
2. **Be Clean** – supply and use energy efficiently
3. **Be Green** – use renewable energy

To demonstrate the carbon dioxide emissions associated with the new build, the following assumptions, definitions, and methodology have been applied:

- SAP software has been used to calculate the carbon dioxide emissions for the scheme using SAP 10.2 Carbon Factors
- The latest version of SAP 10 software version has been used following recent updates
- Building fabric will be selected based on the U-values agreed by the design team to achieve a high level of building efficiency.
- Renewable technology, for the purpose of the report, includes for the provision of low carbon technologies, including heat-pump technology
- Drawings used to model the proposed development are based on the drawing set received 26th September 2023 from Griggs.

Conversion

The proposed development includes the conversion of a former public house building into four apartments and the outbuilding into one apartment. However, as the conversion is regarding a Grade II listed building, Part L (2021) states that the building "*does not need to comply fully with the energy efficiency requirements where to do so would unacceptably alter the dwelling's character or appearance.*"

Therefore, to demonstrate the CO2 savings of the proposed conversion, the existing building was used as a baseline for comparison. As limited construction details of the existing building are currently available, assumptions were extracted from the 'Reduced Data SAP Specification v.10 for Existing Dwellings' based on the building being of pre-1900s construction.

Updates to SAP software

On the 15th June 2022, Part L (2013) Building Regulations were replaced by Part L (2021). The aim of this update is to improve the energy efficiency of new buildings. Some of the changes are listed below:

- 31% lower CO_2 emissions required under part L (2021) in comparison to its 2013 counterpart for new build developments
- Air tightness testing now mandatory
- Improvements to thermal bridging and building fabric targets

There are several other differences that are included in the update, which means that the software used to validate the scheme's emissions and energy performance also required updating. Under Part L 2013, SAP 2012 was the default software used; however, to accommodate changes this has now been updated to SAP 10.2.

Therefore, in line with industry progression, SAP 10.2 has been utilised throughout.

New Build: Passive Design Measures

Passive Design Measures Summary

Table 1 sets out the passive design measures of the new build dwellings used for the SAP calculations to generate carbon emission reduction findings.

In summary, the scheme will benefit from:

- An orientation that suits daylight and sunlight access.
- Being airtight, reducing draughts and heat loss.
- Mechanical Ventilation with Heat Recovery (2 no. extension apartments only)
- A well-insulated building fabric shell.
- 100% efficient lighting.

As per Part L 2021, the **Dwelling Fabric Energy Efficiency (DFEE)** for newly constructed dwellings must be shown to be no higher than the Target Fabric Energy Efficiency (TFEE). Furthermore, the **Dwelling Primary Energy Rate (DPER)** must also be shown to be no higher than the Target Primary Energy Rate (TPER).

The **DFEE** provides a **19% improvement** upon the notional dwelling (see Table 2) and the **DPER** provides a **7% improvement** upon the notional dwelling (see Table 3).

The improvements demonstrate that the proposed scheme has maximised opportunities to increase energy efficiency and reduce energy demand.

Table 1: SAP Model inputs

Proposed Technical Information			
Building Fabric (New Build)	**Input**	**Unit**	**Comment**
External Wall U-value	0.14	W/m²K	Include unheated areas
Roof U-value	0.12	W/m²K	-
Ground Floor U-value	0.12	W/m²K	-
Windows U-value	1.2	W/m²K	Double glazing
Door U-value	1.0	W/m²K	-
Other Technical Information	**Input**	**Unit**	**Comment**
Windows g-value	0.63	-	-
Frame-Factor	0.7	-	-
Thermal Bridge Y-value	0.05	-	Thermal Bridging calculations to be carried out Post-Planning.
Ventilation Method	Nuaire MRXBOXAB-ECO3		Mechanical Ventilation with Heat Recovery
Air permeability	3.0 @50Pa (m³/(h.m²))		-

Table 2: Area-weighted Fabric Energy Efficiency ratings for the proposed new build

	TFEE (kWh/m²/yr)	**DFEE (kWh/m²/yr)**	**Improvement (%)**
New Build Total	38.6	31.4	19%

Table 3: Dwelling Primary Energy Rate improvements for the proposed new build

	TPER (kgCO2/m²/yr)	**DPER (kgCO2/m²/yr)**	**Improvement (%)**
New Build Total	63.7	59.3	7%

New Build: Heat Networks

Heating Infrastructure

Once demand for energy has been minimised, planning applications should demonstrate how their energy systems will exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly to reduce CO_2 emissions.

As well as carbon dioxide emissions, all combustion processes can emit oxides of nitrogen (NO_x) and solid or liquid fuelled appliances (such as those using biomass or biodiesel) can also emit particulate matter. These pollutants contribute to poor air quality and can have negative impacts on the health of residents and occupants of the development. It is important that these impacts are considered in determining the heating strategy of a development.

Existing Networks, Planned Networks, and Supplying Heat Beyond the Site Boundary

Where a heat network exists in the vicinity of the proposed development, the applicant should look to prioritise connection and provide evidence of active two-way correspondence with the network operator.

Applicants should investigate the potential for connecting the development to an existing heat network system by contacting the local borough, local heat network operators and nearby developments.

If there is not an existing network, the applicant must investigate whether a network is being planned for the area. Applicants should also investigate opportunities for expanding their heat network to supply heat to local developments and buildings outside the boundaries of their site, particularly if this has the potential to facilitate an area-wide heat network.

The Heat Networks Planning Database has been interrogated and the scheme is located at too great a distance from any existing or proposed heat networks.

There are no CO_2 savings at this stage of the energy hierarchy

New Build: Low-Carbon Energy Strategy

Air Source Heat Pumps (ASHP)

Energy assessments should explain how the opportunities for producing, storing, and using low-carbon and renewable energy on-site will be maximised.

It was decided that an individual ASHP system was the most feasible and applicable low-carbon energy strategy for the detached infill dwelling . This all-electric option also assists in maximising the scheme's CO2 reduction.

The details of the ASHPs will be provided at the detailed design stage; therefore, conservative efficiencies have been used for the purpose of this report based on default SAP figures for residential uses.

Direct Electric Heating

Regarding the 2 no. new-build apartments that form the extension, space heating is proposed to be provided by direct electric panels with 100% efficiency. It is also proposed that domestic hot water will be provided by electric immersion heaters to provide an all-electric scheme.

ASHPs were not deemed feasible for the apartments due to space constraints for the equipment. Therefore, photovoltaic solar panels were deemed the most feasible and applicable renewable technology to incorporate within the new-build apartments.

Photovoltaic Solar Panels

Photovoltaic solar panels (PV panels) are the preferred on-site renewable generation technology as electricity is off-set on-site and can be utilised either by the tenants themselves or within the landlord areas.

The scheme proposes a minimum 2kWp PV system to provide energy for the 2 no. new-build apartments that form part of the extension to the main building.

Table 4: Summary of Low Carbon measures proposed

Technical Information		
Detached Infill Dwelling - Low Carbon Energy Strategy		
Space Heating System	Individual ASHPs	175.1% default efficiency, MCS certified
Heating Emitter	Radiators	-
Domestic Hot Water System	Same as space heating	-
Storage	Yes	~180 litres, 100mm foam insulation
Space Cooling System	No	-
Low/Zero Carbon Technologies used	ASHPs	175.1% default efficiency, MCS certified
2 no. Apartments (Extension) - Low Carbon Energy Strategy		
Space Heating System	Direct electric panels	100% efficiency
Heating Emitter	Panels	-
Domestic Hot Water System	Electric Immersion Heater	-
Storage	Yes	~180 litres, 100mm foam insulation
Space Cooling System	No	-
Low/Zero Carbon Technologies used	Photovoltaic Panels	>2kWp System

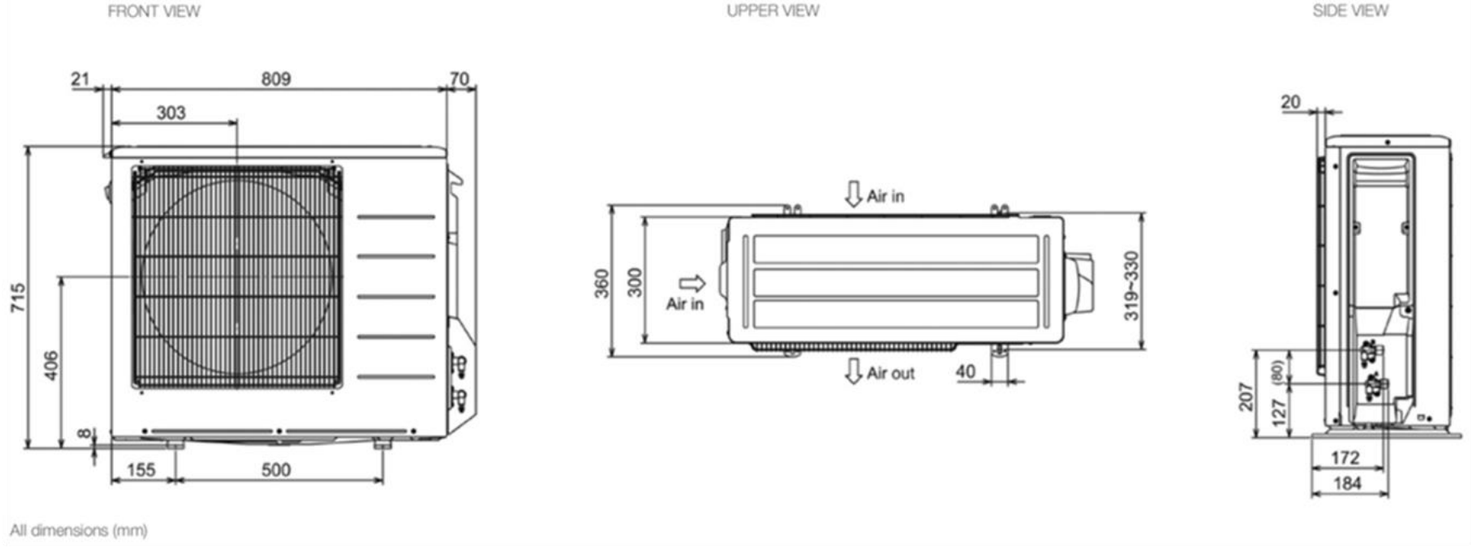

Figure 4: ©Mitsubishi QUHZ-W40VA Air Source Heat Pump external condenser example dimensions

New Build: Carbon Emission Results Summary

The new build element of the proposed development will incorporate energy efficiency measures through a well-insulated building fabric shell to reduce the demand for heating.

Furthermore, the energy strategy will make use of high efficiency air source heat pumps for space heating and domestic hot water to maximise on-site CO2 savings.

This combination of energy efficiency measures and a low carbon energy strategy provides a **regulated CO2 reduction of 55%** against Part L (2021) Building Regulations.

Overall, the new build achieves the CO2 reduction targets set out within the Draft Carbon Offsetting SPD (2022) through a minimum 30-40% reduction against the Part L (2021) Building Regulations.

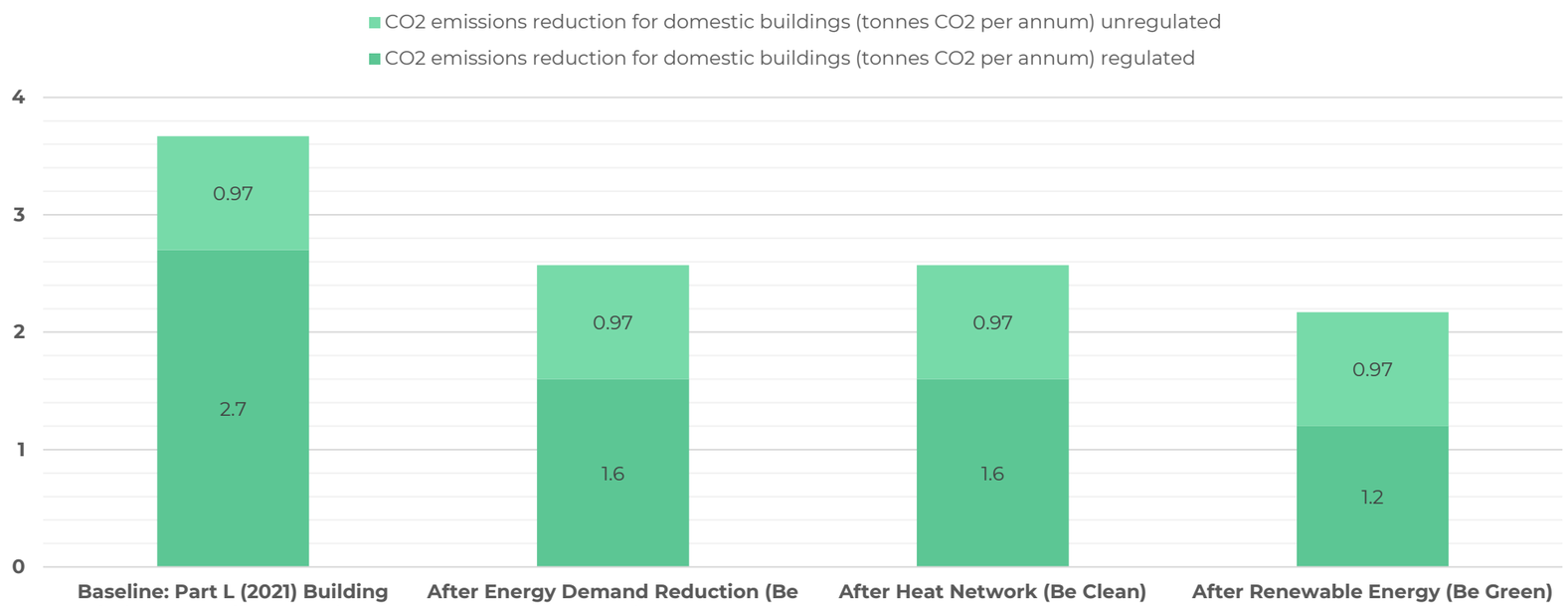

Figure 5: New Build CO2 savings at each stage of the energy hierarchy

Table 5: New Build CO2 savings at each stage of the energy hierarchy.

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)***
Savings from energy demand reduction	1.2	43%
Savings from heat network / CHP	0.0	0%
Savings from renewable energy	0.3	13%
Cumulative onsite savings	**1.5**	**55%**

Conversion: Energy Strategy

As the proposed development includes the conversion of a Grade II listed building, Part L (2021) states that the building "*does not need to comply fully with the energy efficiency requirements where to do so would unacceptably alter the dwelling's character or appearance.*"

Therefore, the conversion element of the proposed development will benefit from the following measures that were deemed to not impact the building's appearance:

- Improved thermal performance via internal insulation to existing parameter walls, roof, and floors to meet the minimum U-Values for existing buildings as per **Table 4.3** of the Part L (2021) Building Regulations.
- Replacement of existing windows to double glazed windows (1.4W/m²K)
- 100% efficient lighting.

A gas boiler system is assumed to be present within the existing main building and retained in order to provide space heating and domestic hot water to the dwellings within the conversion.

The proposed conversion of the outbuilding to create one apartment will incorporate an ASHP to provide space heating and domestic hot water. This all-electric option also assists in maximising the scheme's CO2 reduction.

The external condenser required for the ASHP is proposed to be located on the external wall to the rear of the building.

Table 6: Energy strategy summary for the conversion

Proposed Technical Information				
Building Fabric Conversion	**Existing (assumed)**	**Proposed**	**Unit**	**Comment**
External Wall U-value	2.5	0.3	W/m²K	Existing based on uninsulated solid brick wall, Pre-1900s construction
Roof U-value	2.3	0.16	W/m²K	Existing based on uninsulated pitched roof, Pre-1900s construction
Ground Floor U-value	0.45	0.25	W/m²K	Existing based on suspended timber floor, Pre-1900s construction
Windows U-value	4.8	1.4	W/m²K	Existing based on single glazed, wood frame windows
Rooflight U-Value	5.3	5.3	W/m²K	Based on single glazed, wood frame rooflights; existing conservation rooflights to be retained
Door U-value	3	1.4	W/m²K	Existing based on timber doors, Pre-1900s construction
Other Technical Information				**Comment**
Space Heating & Domestic Hot Water	• Retained Gas Boiler System (Main Building only) • Individual ASHP (Outbuilding only)			- -

Conversion: Carbon Emission Results Summary

The proposed conversion will incorporate energy efficiency measures through a well-insulated building fabric shell to reduce the demand for heating.

The walls, roofs, floors, windows, and doors will be improved to meet the minimum U-Value requirements, as set out in Table 4.3 of the Part L (2021) Building Regulations, where feasible.

The main building conversion (total 4 apartments) will utilise the existing gas boiler system that is assumed on-site. The outbuilding conversion will utilise an individual ASHP to provide space heating and domestic hot water.

The proposed development provides a **regulated CO2 reduction of 58%** compared to the existing building.

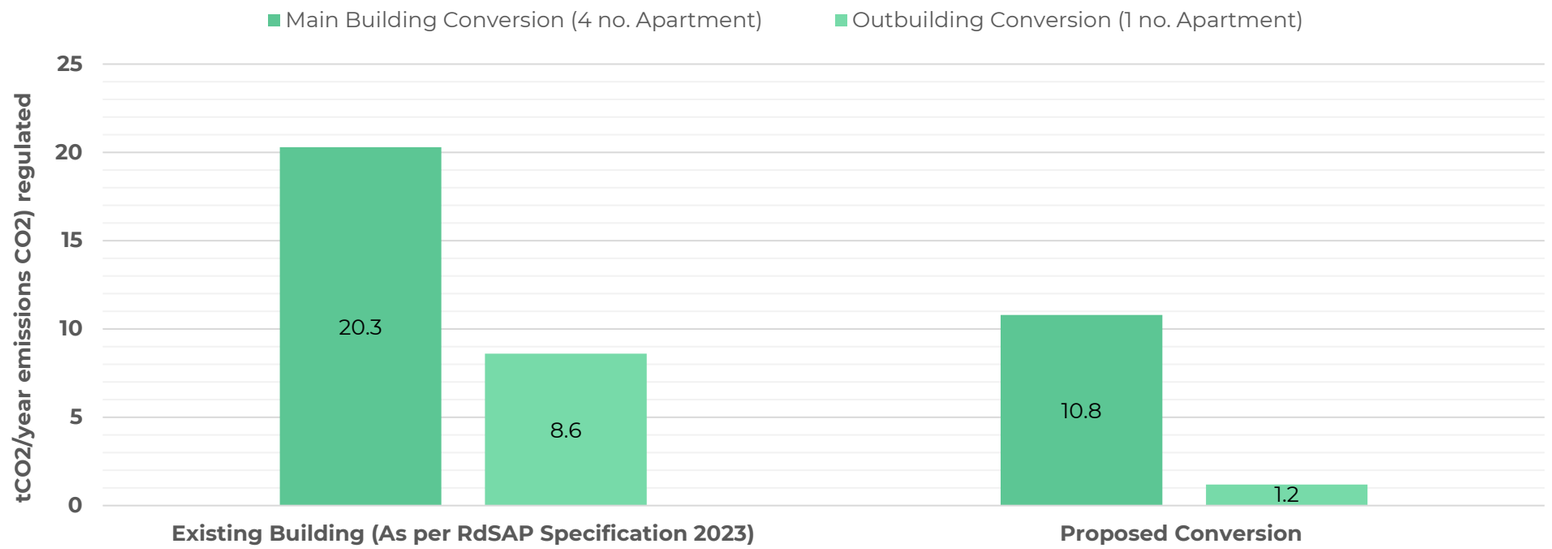

Figure 6: Conversion CO2 savings as compared to the existing building

Table 7: Conversion CO2 savings as compared to the existing building.

	Regulated domestic CO2 emissions	**Regulated domestic CO2 savings**
	(Tonnes CO_2 per annum)	**(%)**
Existing Building (As per RdSAP Specification 2023)	28.8	-
Proposed Conversion	**12.0**	**58%**

Section Three

3 Embodied Carbon

Embodied Carbon

Although the scheme is not located within London, guidance by the Greater London Authority (GLA) has been used to understand embodied carbon within the scheme in absence of benchmarks set by Hertsmere Borough Council. The GLA have published benchmarks in their Whole Life Cycle Assessment Guidance document that sets out the average embodied carbon footprint per building element in new constructions, as displayed to the right.

The proposed development has great opportunity to reduce embodied carbon across the Substructure, Superstructure, Façade, and Services building elements, which make up ~**85%** of the expected embodied carbon emission of an average new residential construction, as highlighted in yellow within Figure 7.

As the conversion involves a change of use to residential apartments, the embodied carbon emissions associated with the development are expected to largely emerge from the Internal Finishes, Fittings, Furnishes, and Equipment, and External Works.

The majority of the existing substructure, superstructure, and façade is to be retained as part of the conversion and no major demolition works are proposed. Additionally, a gas boiler system is assumed to be present within the existing building and retained in order to provide space heating and domestic hot water to the dwellings within the conversion.

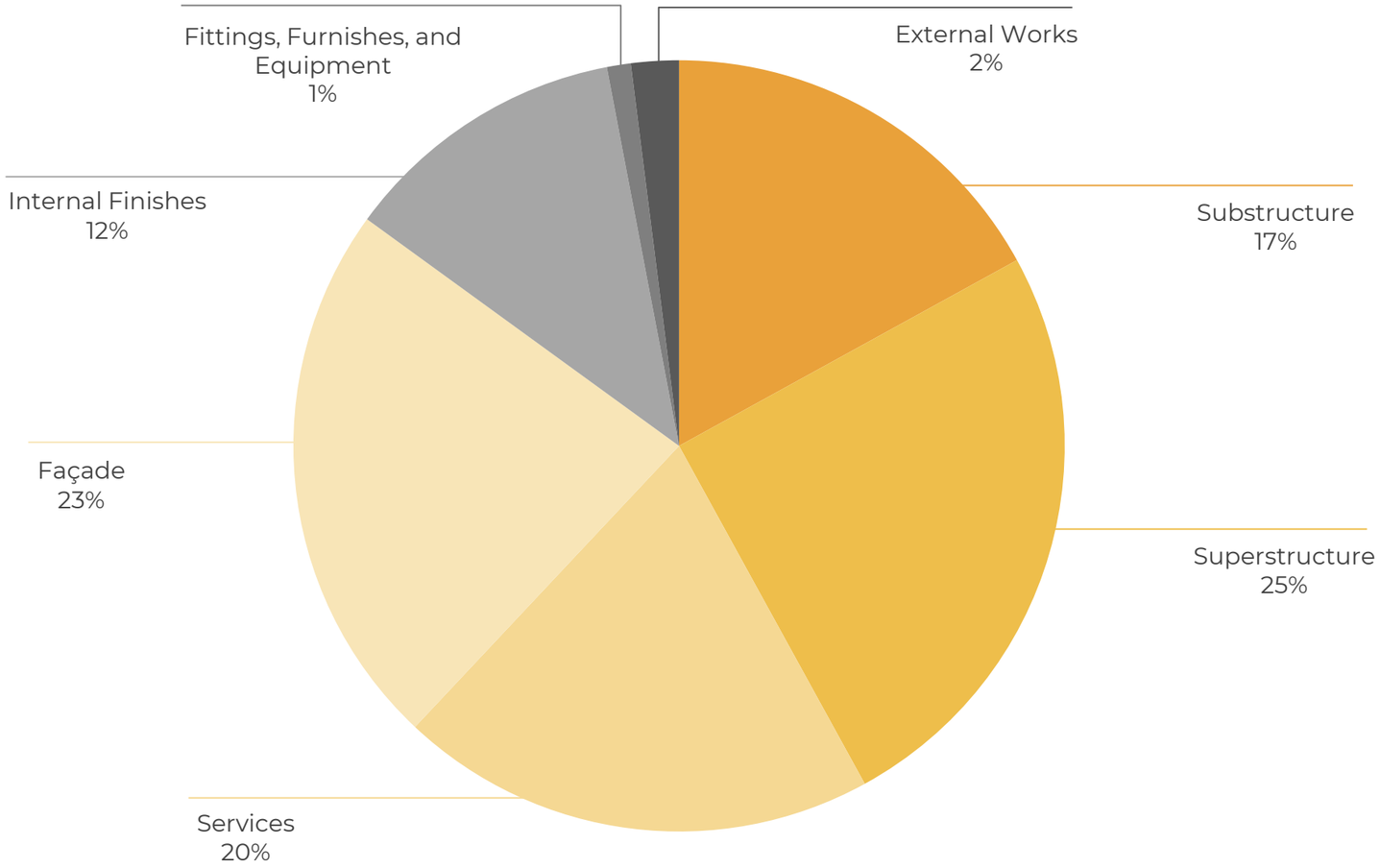

Figure 7: Residential embodied carbon benchmarks by building element, as set out by the GLA's Whole Life Cycle Carbon Assessment

Section Four

4 Sustainability

Sustainability and Climate Change Appraisal

To meet the Local Authority's sustainability requirements, we have set out the sustainability credentials of the scheme in similar format to that of the, now defunct, Code for Sustainable Homes.

In a statement made on 25 March 2015, the Secretary of State for Communities and Local Government, Eric Pickles, confirmed that from 27 March 2015, changes to the 2008 Climate Change Act would mean local authorities in England could no longer require code level 3, 4, 5 or 6 as part of the conditions imposed on planning permissions. Applicants should work towards to the relevant Building Regulations standard; however, energy requirements for dwellings in the UK are now typically set by the Building Regulations equivalent to code level 4.

For the purpose of this assessment, we have used the categories from the Code as a method for assessing and demonstrating the scheme's sustainability credentials.

Energy Display Devices

The scheme will be provided with the ability to display energy consumption data and record energy use; this is to promote the specification of equipment to display energy consumption data, thus empowering dwelling occupants to reduce energy use.

Sustainable Transport

The proposed scheme is closely located to the local bus network on St. Albans road, providing access to local transport services. This promotes sustainable uses of transport for occupants, via public transport, rather than relying on cars for travel.

Energy Labelled White Goods

Where white goods will be provided, the scheme will look to have them classified as energy efficient with at least an A-rating, where feasible. This is to promote the provision or purchase of energy efficient white goods, thus reducing the CO_2 emissions from appliance use in the dwelling.

External Lighting

All external space lighting, including lighting in common areas, will be provided by dedicated energy efficient fittings with appropriate control systems in-line with Building Regulations standards; this is to promote the provision of energy efficient external lighting, thus reducing CO_2 emissions associated with the dwelling.

Indoor Water Use

To reduce the consumption of potable water in the home, the scheme should consider water efficient fittings, appliances, and water recycling systems. Rainwater harvesting in the form of rainwater butts should be used for landscape maintenance. The scheme will aim to reduce water consumption to 110 litres/person/day, as per Policy SADM17 of the Hertsmere SADM Policies Plan.

External Water Use

Space should be made available for the provision of water butts on the roof area; this is to promote the recycling of rainwater and reduce the number of mains potable water used for external water uses.

Flood Risk

The site is situated within Flood zone 1 and therefore has a low probability of flooding.

Sustainability and Climate Change Appraisal

Environmental Impact of Materials

To specify materials with lower environmental impacts over their life cycle; where feasible, key elements of the building Envelope should achieve an equivalent rating of A+ to D in the 2008 version of The Green Guide:

- Roof
- External walls
- Internal walls (including separating walls)
- Upper and ground floors (including separating floors)
- Windows.

Responsible Sourcing of Materials - Basic Building Elements

To promote the specification of responsibly sourced materials for the basic building elements; materials in the following Building Elements will look to be responsibly sourced:

a) Frame
b) Ground floor
c) Upper floors (including separating floors)
d) Roof
e) External walls
f) Internal walls (including separating walls)
g) Foundation/substructure (excluding sub-base materials)
h) Staircase

Additionally, timber in these elements will be legally sourced

Responsible Sourcing of Materials - Finishing Elements

To promote the specification of responsibly sourced materials for the finishing elements; materials in the following Finishing Elements will look to be responsibly sourced:

a) Staircase
b) Windows
c) External & internal doors
d) Skirting
e) Panelling
f) Furniture
g) Fascias
h) Any other significant use

Additionally, timber in these elements will be legally sourced

Storage of Non-recyclable Waste and Recyclable Household Waste

Refuse space will be provided for each dwelling. Space for recycling containers will:

- Be located in an adequate external space
- Be sized according to the frequency of collection
- Store recyclable waste in identifiably different bins

Construction Site Waste Management

A compliant Site Waste Management Plan (SWMP) should be carried out setting out target benchmarks for waste, procedures for minimising hazardous waste and monitoring/measuring/reporting of hazardous and non-hazardous waste groups; this is to promote resource efficiency via the effective and appropriate management of construction site waste.

The SWMP should look to include procedures to sort and divert waste from landfill, through either:

a. Re-use on site (in situ or for new applications)
b. Re-use on other sites
c. Salvage/reclaim for re-use
d. Return to the supplier via a ‘take-back’ scheme
e. Recovery and recycling using an approved waste management contractor
f. Compost

according to the defined waste groups (in line with the waste streams generated by the scope of the works).

Sustainability and Climate Change Appraisal

Global Warming Potential (GWP) of Insulants

To promote the reduction of emissions of gases with high GWP associated with the manufacture, installation, use and disposal of foamed thermal and acoustic insulating materials; where feasible, insulating materials in the elements of the dwelling listed below will have a low GWP (in manufacture AND installation):

- Roofs: including loft access
- Walls: internal and external including lintels and all acoustic insulation
- Floors: including ground and upper floors
- Hot water cylinder: pipe insulation and other thermal stores
- Cold water storage tanks: where provided
- External doors

Daylight

All habitable spaces will aim to maximise daylight within the proposed dwellings to promote good daylighting, especially in living rooms, thereby improving quality of life and reducing the need for energy to light the home.

Sound Insulation

The average noise level at the site is considered medium regarding rail and traffic noise. Increased insulation and general improvements to the building fabric to minimize noise levels and reduce the likelihood of noise complaints from occupants.

Home User Guide

The scheme will look to provide a Home User Guide to the owner/tenants prior to handover to promote the provision of guidance enabling occupants to understand and operate their home efficiently and make the best use of local facilities.

Considerate Constructors Scheme

There is a commitment to meet best practice under a nationally or locally recognised certification scheme such as the Considerate Constructors Scheme; this is to promote the environmentally and socially considerate, and accountable management of construction sites.

Construction Site Impacts

To promote construction sites managed in a manner that mitigates environmental impacts; where feasible, there will be procedures that will typically cover one or more of the following items:

- Monitor, report and set targets for CO_2 production or energy use arising from site activities
- Monitor and report CO_2 or energy use arising from commercial transport to and from site
- Monitor, report and set targets for water consumption from site activities
- Adopt best practice policies in respect of air (dust) pollution arising from site activities
- Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site

Where feasible, 80% of site timber should be reclaimed, re-used or responsibly sourced

Sustainability and Climate Change Appraisal

Security

The principles of Secure by Design will be carried out for the scheme, to promote the design of developments where people feel safe and secure- where crime and disorder, or the fear of crime, does not undermine quality of life or community cohesion.

Ecology

To minimise reductions and promote an improvement in ecological value and enhance the ecological value of the site, the scheme will look to promote:

- development on land that already has a limited value to wildlife and discourage the development of ecologically valuable sites.
- the protection of existing ecological features from substantial damage during the clearing of the site and the completion of construction works.
- the most efficient use of a building's footprint by ensuring that land and material use is optimised across the development.

The scheme proposes the following ecological benefits to the site:

- Provision of new bat roosting and bird nesting opportunities within new buildings and retained mature trees
- Incorporation of native plants and those of wildlife importance into a landscaping scheme to provide foraging opportunities for birds, invertebrates and birds
- Provision of hedgehog gaps (13x13cm) in new fencing to promote habitat connectivity for small mammals across and within the Site

Section Five

5 Conclusion

Conclusion

An assessment of the site's energy and sustainability credentials has been carried out for the proposed development at The White Hart, St Albans Road, South Mimms, EN6 3PJ. The proposed development consists of the conversion and extension of the former public house into six apartments, conversion of outbuilding into a two-bedroom apartment and construction of a detached infill dwelling, along with associated landscaping, bin store, cycle storage and vehicle parking.

The new-build element of the proposed development, consisting of two no. apartments and one detached infill dwelling, has incorporated energy efficiency measures through a well-insulated building fabric shell to reduce the demand for space heating. Additionally, the detached infill dwelling energy strategy will make use of high efficiency air source heat pumps (ASHPs) to maximise on-site CO2 reductions. The two no. apartments will utilise direct electric panels for space heating, electric immersion heaters for hot water, and photovoltaic solar panels on the roof to generate renewable energy on-site. The new build provides a **regulated CO_2 reduction of 55%** against the Part L (2021) Building Regulations, exceeding Hertmere's target of 30-40% set out within the Draft Carbon Offsetting SPD (2022).

The conversion element of the proposed development, consisting of five apartments, will benefit from an improved thermal performance via internal insulation and upgrade of existing windows and doors. The four no. apartments within the main building proposes to retain the existing gas boiler system assumed on-site. The apartment within the outbuilding will utilise an ASHP to provide space heating and domestic hot water. The conversion provides a **regulated CO_2 reduction of 58%** against the existing building.

The scheme will also integrate core sustainability principles within its design, including sustainable construction, waste, health, and wellbeing elements.

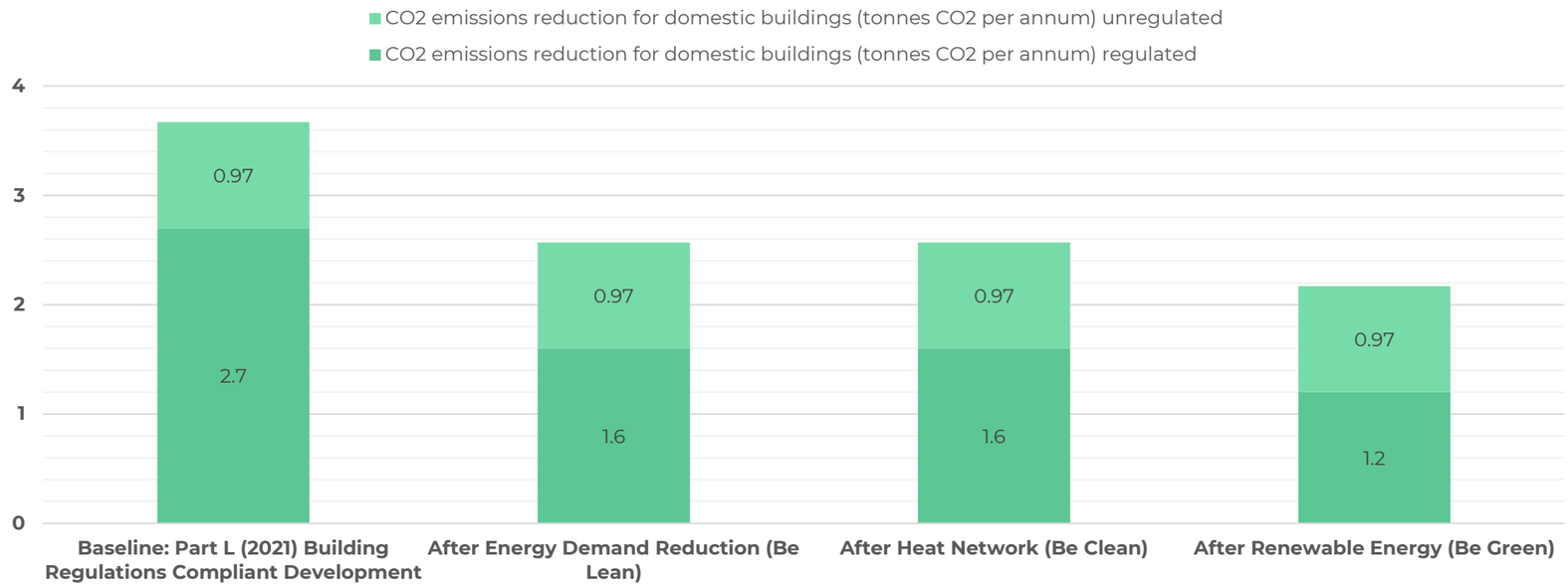

Figure 8: New Build CO2 savings at each stage of the energy hierarchy

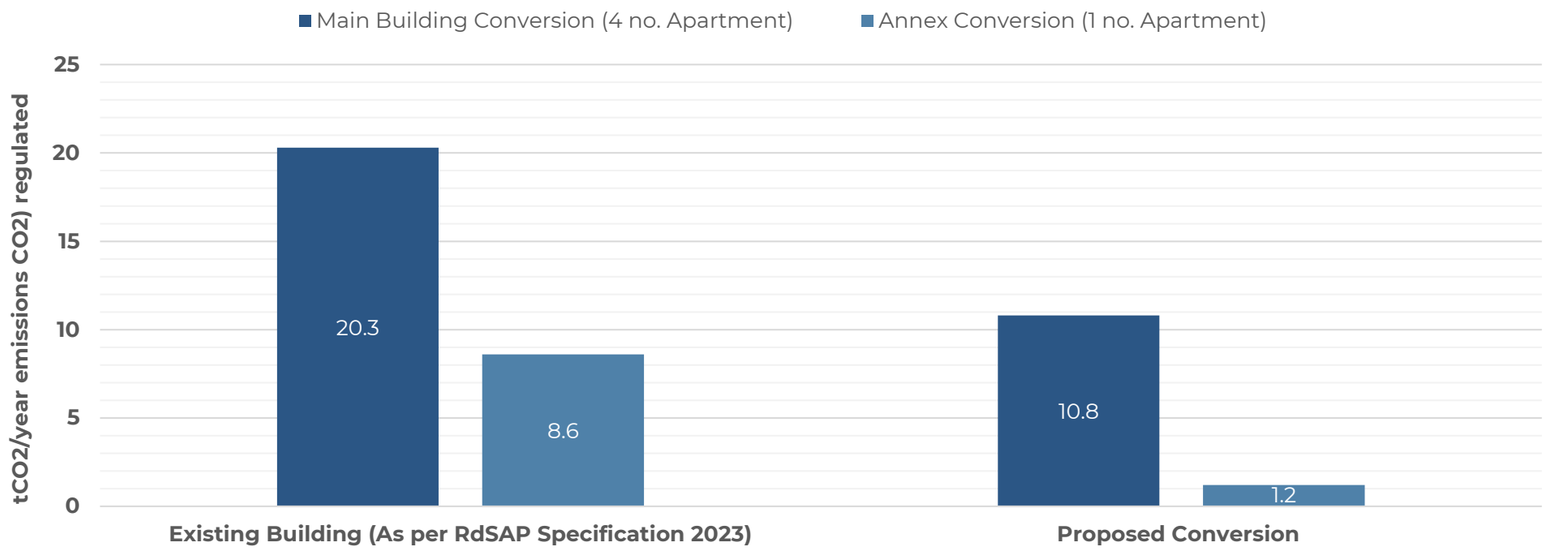

Figure 9: Conversion CO2 savings as compared to the existing building

Section Six

6 Appendices

Appendix A: DER/TER SAP Worksheets

Full SAP Calculation Printout

Property Reference	1_Extension_Be_Lean_Copy	**Issued on Date**	10/11/2023
Assessment Reference	1_Extension_Be_Green_MVHR	**Prop Type Ref**	
Property			

SAP Rating	78 C	**DER**	5.37	**TER**	11.92
Environmental	96 A	**% DER < TER**			54.95
CO_2 Emissions (t/year)	0.33	**DFEE**	29.09	**TFEE**	36.57
Compliance Check	See BREL	**% DFEE < TFEE**			20.45
% DPER < TPER	4.41	**DPER**	59.72	**TPER**	62.48

Assessor Details	Mr. Andy Love	**Assessor ID**	U860-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.7000	(1b)	x 2.7000	(2b) =	196.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.2900	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		80.1000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2907	0.2870	0.2833	0.2645	0.2607	0.2420	0.2420	0.2382	0.2495	0.2607	0.2682	0.2757	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			7.5500	1.1450	8.6450			(27)
Front Door			1.8900	1.0000	1.8900			(26)
Heatloss Floor 1			72.7000	0.1000	7.2700			(28a)
GF	51.6800	9.4400	42.2400	0.1400	5.9136			(29a)
External Wall 2	20.0000		20.0000	0.1200	2.4000			(29a)
Total net area of external elements Aum(A, m2)			144.3800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		26.1186			(33)
Party Wall 1			24.3300	0.0000	0.0000			(32)
Party Ceiling 1			72.7000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	7.2190	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	33.3376	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	18.8335	18.5906	18.3477	17.1332	16.8903	15.6757	15.6757	15.4328	16.1615	16.8903	17.3761	17.8619	(38)
Heat transfer coeff	52.1712	51.9283	51.6854	50.4708	50.2279	49.0134	49.0134	48.7704	49.4992	50.2279	50.7137	51.1995	(39)
Average = Sum(39)m / 12 =												50.4101	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.7176	0.7143	0.7109	0.6942	0.6909	0.6742	0.6742	0.6708	0.6809	0.6909	0.6976	0.7043	(40)
HLP (average)												0.6934	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3098 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
62.9483	62.0023	60.6238	57.9863	56.0399	53.8693	52.6355	54.0035	55.5032	57.8338	60.5279	62.7071	(42a)

Hot water usage for baths

27.1930	26.7892	26.2205	25.1719	24.3867	23.5160	23.0458	23.6105	24.2254	25.1570	26.2272	27.1011	(42b)

Hot water usage for other uses

38.2852	36.8930	35.5008	34.1086	32.7164	31.3242	31.3242	32.7164	34.1086	35.5008	36.8930	38.2852	(42c)

Average daily hot water use (litres/day) 118.0531 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.4265	125.6844	122.3450	117.2667	113.1430	108.7095	107.0055	110.3305	113.8372	118.4916	123.6481	128.0933	(44)
Energy conte	203.3961	178.9729	188.0398	160.5323	152.3122	133.6710	129.4138	136.6121	140.3726	160.7919	176.1594	200.5632	(45)
Energy content (annual)										Total = Sum(45)m =		1960.8375	
Distribution loss (46)m = 0.15 x (45)m	30.5094	26.8459	28.2060	24.0798	22.8468	20.0507	19.4121	20.4918	21.0559	24.1188	26.4239	30.0845	(46)

Water storage loss:

Store volume 150.0000 (47)

b) If manufacturer declared loss factor is not known :

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.0103 (51)

Volume factor from Table 2a 0.9283 (52)

Temperature factor from Table 2b 0.6000 (53)

Enter (49) or (54) in (55) 0.8596 (55)

Total storage loss

26.6472	24.0684	26.6472	25.7876	26.6472	25.7876	26.6472	26.6472	25.7876	26.6472	25.7876	26.6472	(56)

If cylinder contains dedicated solar storage

26.6472	24.0684	26.6472	25.7876	26.6472	25.7876	26.6472	26.6472	25.7876	26.6472	25.7876	26.6472	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

230.0433	203.0414	214.6869	186.3199	178.9594	159.4586	156.0610	163.2593	166.1602	187.4391	201.9470	227.2104	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
230.0433	203.0414	214.6869	186.3199	178.9594	159.4586	156.0610	163.2593	166.1602	187.4391	201.9470	227.2104	(64)
									Total per year (kWh/year) = Sum(64)m =		2274.5866	(64)
12Total per year (kWh/year)											2275	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

88.9470	78.7632	83.8410	74.0071	71.9615	65.0757	64.3478	66.7413	67.3040	74.7811	79.2031	88.0050	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	114.2153	126.4526	114.2153	118.0225	114.2153	118.0225	114.2153	114.2153	118.0225	114.2153	118.0225	114.2153	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.5149	205.6267	200.3049	188.9755	174.6741	161.2328	152.2532	150.1413	155.4631	166.7926	181.0940	194.5353	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	(71)
Water heating gains (Table 5)	119.5524	117.2072	112.6895	102.7876	96.7225	90.3829	86.4890	89.7060	93.4777	100.5122	110.0043	118.2863	(72)
Total internal gains	494.9303	506.9343	484.8575	467.4333	443.2596	427.2859	410.6052	411.7104	424.6111	439.1678	466.7684	484.6846	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	5.0300	19.6403	0.7000	0.8000	0.7700	38.3386	(76)
Southwest	2.5200	36.7938	0.7000	0.8000	0.7700	35.9830	(79)

Solar gains 74.3216	136.2908	207.3746	284.0447	337.1497	341.5352	326.5496	286.9011	234.4550	156.7331	90.9030	62.3217	(83)
Total gains 569.2519	643.2251	692.2321	751.4780	780.4093	768.8211	737.1549	698.6115	659.0661	595.9008	557.6715	547.0064	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	96.7701	97.2228	97.6797	100.0303	100.5141	103.0048	103.0048	103.5178	101.9938	100.5141	99.5512	98.6066
alpha	7.4513	7.4815	7.5120	7.6687	7.7009	7.8670	7.8670	7.9012	7.7996	7.7009	7.6367	7.5738

util living area												
	0.9851	0.9636	0.9144	0.7755	0.5939	0.4078	0.2925	0.3211	0.5167	0.8191	0.9598	0.9879 (86)
MIT	20.5030	20.6537	20.8134	20.9551	20.9941	20.9997	21.0000	21.0000	20.9984	20.9448	20.7273	20.4869 (87)
Th 2	20.3253	20.3282	20.3312	20.3459	20.3489	20.3637	20.3637	20.3667	20.3578	20.3489	20.3430	20.3371 (88)
util rest of house												
	0.9811	0.9549	0.8962	0.7424	0.5539	0.3674	0.2502	0.2769	0.4693	0.7823	0.9487	0.9847 (89)
MIT 2	19.7552	19.9440	20.1369	20.3051	20.3445	20.3636	20.3637	20.3666	20.3568	20.3004	20.0490	19.7449 (90)
Living area fraction										fLA = Living area / (4) =		0.3569 (91)
MIT	20.0221	20.1973	20.3784	20.5371	20.5764	20.5906	20.5908	20.5927	20.5858	20.5304	20.2912	20.0097 (92)
Temperature adjustment												0.0000
adjusted MIT	20.0221	20.1973	20.3784	20.5371	20.5764	20.5906	20.5908	20.5927	20.5858	20.5304	20.2912	20.0097 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9789	0.9529	0.8976	0.7523	0.5680	0.3818	0.2653	0.2927	0.4862	0.7930	0.9477	0.9827	(94)
Useful gains	557.2501	612.9331	621.3492	565.3560	443.2581	293.5278	195.5988	204.4715	320.4396	472.5474	528.4939	537.5624	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	820.2410	794.3624	717.3075	587.3332	445.8419	293.6212	195.6030	204.4803	321.0436	498.7836	668.9726	809.4505	(97)
Space heating kWh	195.6653	121.9205	71.3930	15.8236	1.9224	0.0000	0.0000	0.0000	0.0000	19.5197	101.1447	202.2847	(98a)
Space heating requirement - total per year (kWh/year)												729.6738	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	195.6653	121.9205	71.3930	15.8236	1.9224	0.0000	0.0000	0.0000	0.0000	19.5197	101.1447	202.2847	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												729.6738	
Space heating per m2											(98c) / (4) =	10.0368	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												100.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	195.6653	121.9205	71.3930	15.8236	1.9224	0.0000	0.0000	0.0000	0.0000	19.5197	101.1447	202.2847	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	195.6653	121.9205	71.3930	15.8236	1.9224	0.0000	0.0000	0.0000	0.0000	19.5197	101.1447	202.2847	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	230.0433	203.0414	214.6869	186.3199	178.9594	159.4586	156.0610	163.2593	166.1602	187.4391	201.9470	227.2104	(64)
Efficiency of water heater												100.0000	(216)
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)
Fuel for water heating, kWh/month	230.0433	203.0414	214.6869	186.3199	178.9594	159.4586	156.0610	163.2593	166.1602	187.4391	201.9470	227.2104	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	14.5423	13.1350	14.5423	14.0732	14.5423	14.0732	14.5423	14.5423	14.0732	14.5423	14.0732	14.5423	(231)
Lighting	30.8571	24.7547	22.2888	16.3298	12.6136	10.3054	11.5065	14.9566	19.4272	25.4895	28.7903	31.7147	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.5271	-29.3272	-47.1481	-58.2445	-67.6852	-64.9883	-64.0160	-57.9501	-47.5618	-35.1634	-21.2326	-15.6157	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-3.5137	-8.4572	-19.4374	-33.5268	-47.3667	-48.6826	-47.9271	-38.8386	-26.5487	-13.7888	-5.1194	-2.6822	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												729.6738	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												100.0000	
Water heating fuel used												2274.5866	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 0.7150)													
mechanical ventilation fans (SFP = 0.7150)												171.2238	(230a)
Total electricity for the above, kWh/year												171.2238	(231)
Electricity for lighting (calculated in Appendix L)												249.0341	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-823.3494	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2601.1689	(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	729.6738	0.1586	115.7403	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2274.5866	0.1412	321.1326	(264)
Space and water heating			436.8729	(265)
Pumps, fans and electric keep-hot	171.2238	0.1387	23.7508	(267)
Energy for lighting	249.0341	0.1443	35.9433	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-527.4600	0.1326	-69.9204	
PV Unit electricity exported	-295.8894	0.1228	-36.3354	
Total			-106.2558	(269)
Total CO2, kg/year			390.3112	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.3700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	729.6738	1.5871	1158.0937	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2274.5866	1.5221	3462.0503	(278)
Space and water heating			4620.1440	(279)
Pumps, fans and electric keep-hot	171.2238	1.5128	259.0273	(281)
Energy for lighting	249.0341	1.5338	381.9769	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-527.4600	1.4898	-785.8138	
PV Unit electricity exported	-295.8894	0.4506	-133.3395	
Total			-919.1533	(283)
Total Primary energy kWh/year			4341.9949	(286)
Dwelling Primary energy Rate (DPER)			59.7200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.7000	(1b)	x 2.7000	(2b) =	196.2900	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.2900	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1528	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4028	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4028	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.5136	0.5035	0.4935	0.4431	0.4330	0.3827	0.3827	0.3726	0.4028	0.4330	0.4532	0.4733	(22b)
Effective ac	0.6319	0.6268	0.6218	0.5982	0.5938	0.5732	0.5732	0.5694	0.5811	0.5938	0.6027	0.6120	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			7.5500	1.1450	8.6450			(27)

Heatloss Floor 1			72.7000	0.1300	9.4510		(28a)
GF	51.6800	9.4400	42.2400	0.1800	7.6032		(29a)
External Wall 2	20.0000		20.0000	0.1800	3.6000		(29a)
Total net area of external elements Aum(A, m2)			144.3800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		31.1892		(33)
Party Wall 1			24.3300	0.0000	0.0000		(32)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	6.3000	0.0500	0.3150
E3 Sill	4.5000	0.0500	0.2250
E4 Jamb	25.0000	0.0500	1.2500
E5 Ground floor (normal)	29.8600	0.1600	4.7776
E18 Party wall between dwellings	9.6000	0.0600	0.5760

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		7.1436 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	38.3328 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.9318	40.6000	40.2748	38.7473	38.4616	37.1312	37.1312	36.8848	37.6436	38.4616	39.0397	39.6441	(38)
Heat transfer coeff	79.2646	78.9328	78.6076	77.0802	76.7944	75.4640	75.4640	75.2177	75.9765	76.7944	77.3725	77.9769	(39)
Average = Sum(39)m / 12 =												77.0788	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0903	1.0857	1.0813	1.0603	1.0563	1.0380	1.0380	1.0346	1.0451	1.0563	1.0643	1.0726	(40)
HLP (average)												1.0602	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3098 (42)
Hot water usage for mixer showers	62.9483	62.0023	60.6238	57.9863	56.0399	53.8693	52.6355	54.0035	55.5032	57.8338	60.5279	62.7071 (42a)
Hot water usage for baths	27.1930	26.7892	26.2205	25.1719	24.3867	23.5160	23.0458	23.6105	24.2254	25.1570	26.2272	27.1011 (42b)
Hot water usage for other uses	38.2852	36.8930	35.5008	34.1086	32.7164	31.3242	31.3242	32.7164	34.1086	35.5008	36.8930	38.2852 (42c)
Average daily hot water use (litres/day)												118.0531 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	128.4265	125.6844	122.3450	117.2667	113.1430	108.7095	107.0055	110.3305	113.8372	118.4916	123.6481	128.0933	(44)
Energy conte	203.3961	178.9729	188.0398	160.5323	152.3122	133.6710	129.4138	136.6121	140.3726	160.7919	176.1594	200.5632	(45)
Energy content (annual)										Total = Sum(45)m =		1960.8375	
Distribution loss (46)m = 0.15 x (45)m	30.5094	26.8459	28.2060	24.0798	22.8468	20.0507	19.4121	20.4918	21.0559	24.1188	26.4239	30.0845	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	249.9910	221.0587	234.6347	205.6242	198.9071	178.7629	176.0087	183.2070	185.4645	207.3868	221.2512	247.1581	(62)
WWHRS	-28.7773	-25.4509	-26.6507	-22.0678	-20.5664	-17.5988	-16.4961	-17.5420	-18.2084	-21.4657	-24.3181	-28.2444	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	221.2137	195.6078	207.9840	183.5563	178.3407	161.1640	159.5126	165.6651	167.2560	185.9211	196.9331	218.9137	(64)
									Total per year (kWh/year) = Sum(64)m =			2242.0682	(64)
12Total per year (kWh/year)												2242	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	104.9051	93.1771	99.7991	89.4505	87.9197	80.5191	80.3060	82.6995	82.7474	90.7392	94.6465	103.9632	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	115.4925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.5868	130.1854	117.5868	121.5064	117.5868	121.5064	117.5868	117.5868	121.5064	117.5868	121.5064	117.5868	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	203.5149	205.6267	200.3049	188.9755	174.6741	161.2328	152.2532	150.1413	155.4631	166.7926	181.0940	194.5353	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	34.5492	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	-92.3940	(71)
Water heating gains (Table 5)	141.0015	138.6564	134.1386	124.2368	118.1717	111.8321	107.9382	111.1552	114.9269	121.9613	131.4534	139.7355	(72)
Total internal gains	522.7509	535.1162	512.6781	495.3663	471.0803	452.2190	435.4259	436.5310	449.5441	466.9884	494.7015	512.5053	(73)

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6. Solar gains

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

East				5.0300		19.6403		0.6300		0.7000		0.7700	30.1917 (76)
Southwest				2.5200		36.7938		0.6300		0.7000		0.7700	28.3366 (79)
Solar gains	58.5282	107.3290	163.3075	223.6852	265.5054	268.9590	257.1578	225.9346	184.6333	123.4273	71.5862	49.0784 (83)	
Total gains	581.2792	642.4452	675.9856	719.0515	736.5857	721.1779	692.5837	662.4657	634.1774	590.4157	566.2876	561.5836 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.6931	63.9608	64.2255	65.4982	65.7419	66.9009	66.9009	67.1200	66.4497	65.7419	65.2507	64.7449	
alpha	5.2462	5.2641	5.2817	5.3665	5.3828	5.4601	5.4601	5.4747	5.4300	5.3828	5.3500	5.3163	
util living area	0.9925	0.9862	0.9732	0.9299	0.8300	0.6429	0.4749	0.5151	0.7544	0.9400	0.9844	0.9936	(86)
MIT	19.8867	20.0492	20.2804	20.6042	20.8458	20.9709	20.9953	20.9928	20.9312	20.6345	20.2241	19.8753	(87)
Th 2	20.0088	20.0125	20.0162	20.0334	20.0367	20.0518	20.0518	20.0546	20.0459	20.0367	20.0301	20.0233	(88)
util rest of house	0.9901	0.9819	0.9645	0.9071	0.7788	0.5587	0.3750	0.4130	0.6757	0.9157	0.9788	0.9916	(89)
MIT 2	18.7279	18.9364	19.2297	19.6374	19.9085	20.0354	20.0503	20.0520	20.0011	19.6824	19.1725	18.7241	(90)
Living area fraction										fLA = Living area / (4) =		0.3569	(91)
MIT	19.1415	19.3336	19.6047	19.9825	20.2431	20.3693	20.3876	20.3878	20.3331	20.0223	19.5479	19.1350	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1415	19.3336	19.6047	19.9825	20.2431	20.3693	20.3876	20.3878	20.3331	20.0223	19.5479	19.1350	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9780	0.9600	0.9057	0.7907	0.5879	0.4108	0.4495	0.7010	0.9153	0.9751	0.9892	(94)
Useful gains	573.9080	628.3227	648.9550	651.2759	582.4361	423.9704	284.4838	297.7986	444.5730	540.4010	552.1894	555.5033	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1176.4069	1139.2873	1030.1326	854.2414	656.0590	435.3772	285.8257	299.9560	473.5704	723.5762	963.1237	1164.5876	(97)
Space heating kWh	448.2592	343.3682	283.5961	146.1352	54.7755	0.0000	0.0000	0.0000	0.0000	136.2823	295.8727	453.1588	(98a)
Space heating requirement - total per year (kWh/year)												2161.4480	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	448.2592	343.3682	283.5961	146.1352	54.7755	0.0000	0.0000	0.0000	0.0000	136.2823	295.8727	453.1588	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2161.4480	
Space heating per m2											(98c) / (4) =	29.7311	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	448.2592	343.3682	283.5961	146.1352	54.7755	0.0000	0.0000	0.0000	0.0000	136.2823	295.8727	453.1588	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	485.6546	372.0132	307.2547	158.3263	59.3450	0.0000	0.0000	0.0000	0.0000	147.6515	320.5555	490.9629	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	221.2137	195.6078	207.9840	183.5563	178.3407	161.1640	159.5126	165.6651	167.2560	185.9211	196.9331	218.9137	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6096	85.3082	84.7557	83.5535	81.7468	79.8000	79.8000	79.8000	79.8000	83.3741	84.9704	85.6534	(217)
Fuel for water heating, kWh/month	258.3982	229.2953	245.3923	219.6871	218.1623	201.9600	199.8905	207.6004	209.5940	222.9961	231.7667	255.5809	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4322	19.6004	17.6480	12.9297	9.9873	8.1597	9.1107	11.8425	15.3822	20.1822	22.7958	25.1113	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.1462	-48.1953	-69.3435	-78.0387	-84.2088	-78.6295	-77.6889	-73.3487	-65.6448	-55.1926	-37.5736	-29.5174	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-19.0773	-40.1732	-79.9238	-120.1425	-158.9489	-159.7295	-157.8186	-133.5475	-97.8061	-57.4443	-25.4703	-15.0797	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2341.7638	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2700.3238	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	197.1820	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1796.6898	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3528.5797	(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	2341.7638	0.2100	491.7704	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2700.3238	0.2100	567.0680	(264)
Space and water heating			1058.8384	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.1820	0.1443	28.4594	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-731.5282	0.1346	-98.4356	
PV Unit electricity exported	-1065.1616	0.1259	-134.0766	
Total			-232.5123	(269)
Total CO2, kg/year			866.7148	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2341.7638	1.1300	2646.1931	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2700.3238	1.1300	3051.3659	(278)
Space and water heating			5697.5590	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.1820	1.5338	302.4443	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-731.5282	1.4973	-1095.3287	
PV Unit electricity exported	-1065.1616	0.4620	-492.1526	
Total			-1587.4813	(283)
Total Primary energy kWh/year			4542.6227	(286)
Target Primary Energy Rate (TPER)			62.4800	(287)

Full SAP Calculation Printout

Property Reference	7_Notional	**Issued on Date**	10/11/2023
Assessment Reference	7_Proposed	**Prop Type Ref**	
Property			

SAP Rating	60 D	**DER**	50.11	**TER**	14.24
Environmental	58 D	**% DER < TER**			-251.90
CO_2 Emissions (t/year)	3.45	**DFEE**	120.37	**TFEE**	61.87
Compliance Check	See BREL	**% DFEE < TFEE**			-94.56
% DPER < TPER	-258.08	**DPER**	275.04	**TPER**	76.81

Assessor Details	Mr. Andy Love	**Assessor ID**	U860-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	74.6000	(1b)	x 3.3000	(2b) =	246.1800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.1800	(5)

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2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		8.0000	(17)
Infiltration rate		0.4000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4718	0.4625	0.4533	0.4070	0.3978	0.3515	0.3515	0.3423	0.3700	0.3978	0.4163	0.4348	(22b)

Mechanical extract ventilation - centralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.7218	0.7125	0.7033	0.6570	0.6478	0.6015	0.6015	0.5923	0.6200	0.6478	0.6663	0.6848	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.40)			1.5300	1.3258	2.0284			(27)
TImber Door			11.9600	3.0000	35.8800			(26)
Opening			1.2500	4.3729	5.4662			(27a)
Heatloss Floor 1			74.6000	0.2500	18.6500			(28a)
GF	100.0000	13.4900	86.5100	0.3000	25.9530			(29a)
External Roof 1	104.0000	1.2500	102.7500	0.1600	16.4400			(30)
Total net area of external elements Aum(A, m2)			278.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		104.4176			(33)
Party Wall 1			8.7300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.150 * total exposed area)	41.7900	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	146.2076	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	58.6345	57.8831	57.1316	53.3743	52.6228	48.8655	48.8655	48.1140	50.3684	52.6228	54.1258	55.6287	(38)
Heat transfer coeff													
	204.8421	204.0907	203.3392	199.5819	198.8304	195.0731	195.0731	194.3216	196.5760	198.8304	200.3333	201.8363	(39)
Average = Sum(39)m / 12 =												199.3940	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.7459	2.7358	2.7257	2.6754	2.6653	2.6149	2.6149	2.6048	2.6351	2.6653	2.6854	2.7056	(40)
HLP (average)												2.6728	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3524	(42)
Hot water usage for mixer showers													
	63.6623	62.7056	61.3115	58.6440	56.6756	54.4803	53.2325	54.6161	56.1328	58.4898	61.2145	63.4184	(42a)
Hot water usage for baths													
	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	(42b)
Hot water usage for other uses													
	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	(42c)
Average daily hot water use (litres/day)												119.3926	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	129.8837	127.1105	123.7332	118.5973	114.4267	109.9430	108.2196	111.5823	115.1289	119.8361	125.0511	129.5468	(44)
Energy conte	205.7040	181.0037	190.1733	162.3538	154.0404	135.1877	130.8822	138.1623	141.9654	162.6164	178.1583	202.8390	(45)
Energy content (annual)										Total = Sum(45)m =		1983.0866	
Distribution loss (46)m = 0.15 x (45)m													
	30.8556	27.1506	28.5260	24.3531	23.1061	20.2782	19.6323	20.7243	21.2948	24.3925	26.7237	30.4259	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.1425	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												10.7151	(55)
Total storage loss													
	332.1683	300.0230	332.1683	321.4532	332.1683	321.4532	332.1683	332.1683	321.4532	332.1683	321.4532	332.1683	(56)
If cylinder contains dedicated solar storage													
	332.1683	300.0230	332.1683	321.4532	332.1683	321.4532	332.1683	332.1683	321.4532	332.1683	321.4532	332.1683	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	561.1348	502.0379	545.6041	506.3190	509.4711	479.1529	486.3130	493.5930	485.9307	518.0472	522.1235	558.2698	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	561.1348	502.0379	545.6041	506.3190	509.4711	479.1529	486.3130	493.5930	485.9307	518.0472	522.1235	558.2698	(64)
										Total per year (kWh/year) = Sum(64)m =		6167.9969	(64)
12Total per year (kWh/year)												6168	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	352.7412	317.0111	347.5772	329.1548	335.5630	320.1221	327.8629	330.2835	322.3757	338.4146	334.4098	351.7886	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	136.4531	151.0731	136.4531	141.0015	136.4531	141.0015	136.4531	136.4531	141.0015	136.4531	141.0015	136.4531	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	(69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	0.0000	0.0000	0.0000	0.0000	10.0000	10.0000	10.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	(71)
Water heating gains (Table 5)													
	474.1145	471.7427	467.1737	457.1595	451.0256	444.6140	440.6760	443.9295	447.7440	454.8583	464.4581	472.8341	(72)
Total internal gains													
	886.6410	901.0454	876.4229	859.3898	834.1059	808.5193	790.8647	791.9621	805.7585	829.8916	858.6414	876.1925	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.6300	0.8000	0.7700	5.6823	(74)
South	1.2500	47.0123	0.8500	0.8000	1.0000	35.9644	(82)

Solar gains	41.6468	75.0417	112.3371	153.3707	183.2720	186.6086	177.9992	155.2364	126.6113	85.6613	50.6601	35.1220	(83)
Total gains	928.2878	976.0871	988.7600	1012.7606	1017.3778	995.1279	968.8639	947.1985	932.3698	915.5529	909.3015	911.3145	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	25.2905	25.3836	25.4774	25.9570	26.0551	26.5570	26.5570	26.6597	26.3540	26.0551	25.8597	25.6671	
alpha	2.6860	2.6922	2.6985	2.7305	2.7370	2.7705	2.7705	2.7773	2.7569	2.7370	2.7240	2.7111	
util living area													

	0.9779	0.9729	0.9645	0.9437	0.9018	0.8117	0.6888	0.7136	0.8528	0.9371	0.9676	0.9791	(86)
MIT	18.2021	18.3953	18.7729	19.3591	19.9508	20.5000	20.7834	20.7524	20.3652	19.6375	18.8610	18.2023	(87)
Th 2	18.8824	18.8879	18.8934	18.9211	18.9267	18.9549	18.9549	18.9606	18.9436	18.9267	18.9155	18.9044	(88)
util rest of house	0.9697	0.9627	0.9498	0.9164	0.8434	0.6743	0.4406	0.4796	0.7415	0.9008	0.9532	0.9714	(89)
MIT 2	15.9010	16.1480	16.6283	17.3743	18.0903	18.6951	18.9076	18.8974	18.5651	17.7261	16.7537	15.9122	(90)
Living area fraction										fLA = Living area / (4) =		0.4133	(91)
MIT	16.8520	17.0768	17.5146	18.1946	18.8592	19.4410	19.6828	19.6640	19.3090	18.5160	17.6246	16.8586	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.8520	17.0768	17.5146	18.1946	18.8592	19.4410	19.6828	19.6640	19.3090	18.5160	17.6246	16.8586	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9576	0.9493	0.9354	0.9029	0.8409	0.7153	0.5454	0.5765	0.7672	0.8906	0.9398	0.9598	(94)
Useful gains	888.9321	926.6380	924.8538	914.3828	855.4809	711.7704	528.4381	546.0908	715.3122	815.4059	854.5934	874.6841	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2571.1763	2485.1627	2239.7008	1855.0241	1423.4660	944.3529	601.3738	634.2753	1023.9636	1573.9419	2108.4331	2554.9663	(97)
Space heating kWh	1251.5897	1047.3286	978.2462	677.2618	422.5809	0.0000	0.0000	0.0000	0.0000	564.3508	902.7645	1250.1299	(98a)
Space heating requirement - total per year (kWh/year)												7094.2525	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	1251.5897	1047.3286	978.2462	677.2618	422.5809	0.0000	0.0000	0.0000	0.0000	564.3508	902.7645	1250.1299	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7094.2525	
Space heating per m2											(98c) / (4) =	95.0972	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	79.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1251.5897	1047.3286	978.2462	677.2618	422.5809	0.0000	0.0000	0.0000	0.0000	564.3508	902.7645	1250.1299	(98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000	(210)
Space heating fuel (main heating system)	1584.2907	1325.7324	1238.2864	857.2934	534.9126	0.0000	0.0000	0.0000	0.0000	714.3681	1142.7399	1582.4429	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	561.1348	502.0379	545.6041	506.3190	509.4711	479.1529	486.3130	493.5930	485.9307	518.0472	522.1235	558.2698	(64)
Efficiency of water heater												74.0000	(216)
(217)m	75.6272	75.4761	75.1233	74.4094	73.2220	69.0000	69.0000	69.0000	69.0000	73.8972	75.0368	75.6361	(217)
Fuel for water heating, kWh/month	741.9744	665.1610	726.2781	680.4501	695.7896	694.4246	704.8014	715.3522	704.2473	701.0380	695.8236	738.0999	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	19.6510	17.7493	19.6510	19.0171	19.6510	19.0171	19.6510	19.6510	19.0171	19.6510	19.0171	19.6510	(231)
Lighting	36.9121	29.6122	26.6625	19.5341	15.0887	12.3276	13.7644	17.8915	23.2393	30.4913	34.4398	37.9380	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	8980.0664	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	74.0000	
Water heating fuel used	8463.4403	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2210)		
mechanical ventilation fans (SFP = 0.2210)	66.3751	(230a)
central heating pump	165.0000	(230c)
Total electricity for the above, kWh/year	231.3751	(231)
Electricity for lighting (calculated in Appendix L)	297.9017	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	17972.7834	(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	8980.0664	0.2100	1885.8139	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	8463.4403	0.2100	1777.3225	(264)
Space and water heating			3663.1364	(265)
Pumps, fans and electric keep-hot	231.3751	0.1387	32.0946	(267)
Energy for lighting	297.9017	0.1443	42.9964	(268)
Total CO2, kg/year			3738.2274	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			50.1100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	8980.0664	1.1300	10147.4750	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	8463.4403	1.1300	9563.6875	(278)
Space and water heating			19711.1625	(279)
Pumps, fans and electric keep-hot	231.3751	1.5128	350.0242	(281)
Energy for lighting	297.9017	1.5338	456.9315	(282)
Total Primary energy kWh/year			20518.1182	(286)
Dwelling Primary energy Rate (DPER)			275.0400	(287)

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

1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		74.6000	(1b) x	3.3000	(2b) =	246.1800	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	74.6000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		246.1800	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1219	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3719	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3440	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4386	0.4300	0.4214	0.3784	0.3698	0.3268	0.3268	0.3182	0.3440	0.3698	0.3870	0.4042	(22b)
Effective ac	0.5962	0.5924	0.5888	0.5716	0.5684	0.5534	0.5534	0.5506	0.5592	0.5684	0.5749	0.5817	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			11.9600	1.0000	11.9600			(26)
TER Opening Type (Uw = 1.20)			1.5300	1.1450	1.7519			(27)
Opening			1.2500	1.4151	1.7689			(27a)
Heatloss Floor 1			74.6000	0.1300	9.6980			(28a)
GF	100.0000	13.4900	86.5100	0.1800	15.5718			(29a)
External Roof 1	104.0000	1.2500	102.7500	0.1100	11.3025			(30)
Total net area of external elements Aum(A, m2)			278.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.0531			(33)
Party Wall 1			8.7300	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E1 Steel lintel with perforated steel base plate	7.0000	0.0500	0.3500	
E3 Sill	1.8000	0.0500	0.0900	
E4 Jamb	21.8000	0.0500	1.0900	
E5 Ground floor (normal)	43.2200	0.1600	6.9152	
E16 Corner (normal)	6.6000	0.0900	0.5940	
E18 Party wall between dwellings	6.6000	0.0600	0.3960	
R1 Head of roof window	2.5000	0.0800	0.2000	
R2 Sill of roof window	2.5000	0.0600	0.1500	
R3 Jamb of roof window	5.0000	0.0800	0.4000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			10.1852	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	62.2383	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.4325	48.1291	47.8317	46.4350	46.1736	44.9571	44.9571	44.7318	45.4257	46.1736	46.7023	47.2550	(38)
Heat transfer coeff	110.6707	110.3674	110.0700	108.6732	108.4119	107.1954	107.1954	106.9701	107.6640	108.4119	108.9406	109.4933	(39)
Average = Sum(39)m / 12 =												108.6720	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4835	1.4795	1.4755	1.4567	1.4532	1.4369	1.4369	1.4339	1.4432	1.4532	1.4603	1.4677	(40)
HLP (average)												1.4567	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3524	(42)
Hot water usage for mixer showers	63.6623	62.7056	61.3115	58.6440	56.6756	54.4803	53.2325	54.6161	56.1328	58.4898	61.2145	63.4184	(42a)
Hot water usage for baths	27.5001	27.0917	26.5166	25.4561	24.6621	23.7816	23.3060	23.8771	24.4989	25.4411	26.5234	27.4071	(42b)
Hot water usage for other uses	38.7213	37.3133	35.9052	34.4972	33.0891	31.6811	31.6811	33.0891	34.4972	35.9052	37.3133	38.7213	(42c)
Average daily hot water use (litres/day)												119.3926	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	129.8837	127.1105	123.7332	118.5973	114.4267	109.9430	108.2196	111.5823	115.1289	119.8361	125.0511	129.5468	(44)
Energy conte	205.7040	181.0037	190.1733	162.3538	154.0404	135.1877	130.8822	138.1623	141.9654	162.6164	178.1583	202.8390	(45)
Energy content (annual)											Total = Sum(45)m =	1983.0866	
Distribution loss (46)m = 0.15 x (45)m	30.8556	27.1506	28.5260	24.3531	23.1061	20.2782	19.6323	20.7243	21.2948	24.3925	26.7237	30.4259	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	252.2989	223.0894	236.7682	207.4456	200.6353	180.2795	177.4771	184.7572	187.0573	209.2113	223.2501	249.4339	(62)
WWHRS	-29.1037	-25.7396	-26.9530	-22.3182	-20.7997	-17.7985	-16.6832	-17.7409	-18.4150	-21.7092	-24.5939	-28.5648	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	223.1952	197.3498	209.8152	185.1275	179.8355	162.4811	160.7939	167.0162	168.6423	187.5021	198.6562	220.8691	(64)
										Total per year (kWh/year) = Sum(64)m =		2261.2841	(64)
12Total per year (kWh/year)												2261	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	105.6725	93.8523	100.5086	90.0561	88.4943	81.0234	80.7943	83.2149	83.2770	91.3459	95.3111	104.7199	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	117.6218	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	139.6200	154.5793	139.6200	144.2740	139.6200	144.2740	139.6200	139.6200	144.2740	139.6200	144.2740	139.6200	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	207.7869	209.9431	204.5096	192.9423	178.3407	164.6172	155.4491	153.2929	158.7264	170.2937	184.8953	198.6188	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	34.7622	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	-94.0975	(71)
Water heating gains (Table 5)	142.0330	139.6612	135.0921	125.0779	118.9440	112.5325	108.5944	111.8479	115.6625	122.7767	132.3765	140.7525	(72)
Total internal gains	550.7264	565.4701	540.5083	523.5808	498.1912	479.7103	461.9501	463.0474	476.9495	493.9770	522.8324	540.2779	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.5300	10.6334	0.6300	0.7000	0.7700	4.9720	(74)
South	1.2500	47.0123	0.6300	0.7000	1.0000	23.3240	(82)

Solar gains	28.2960	51.1260	77.0329	106.1779	127.8996	130.7012	124.4753	107.8456	87.1356	58.4813	34.4421	23.8505	(83)

Total gains	579.0224	616.5961	617.5411	629.7587	626.0908	610.4115	586.4254	570.8930	564.0851	552.4583	557.2745	564.1284	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.8105	46.9392	47.0660	47.6709	47.7859	48.3282	48.3282	48.4299	48.1178	47.7859	47.5540	47.3139	
alpha	4.1207	4.1293	4.1377	4.1781	4.1857	4.2219	4.2219	4.2287	4.2079	4.1857	4.1703	4.1543	
util living area													
	0.9942	0.9917	0.9879	0.9754	0.9437	0.8526	0.7119	0.7444	0.9008	0.9736	0.9902	0.9949	(86)
MIT	19.2762	19.4201	19.6625	20.0464	20.4316	20.7738	20.9260	20.9083	20.6798	20.1971	19.6909	19.2637	(87)
Th 2	19.6999	19.7029	19.7059	19.7201	19.7228	19.7351	19.7351	19.7374	19.7304	19.7228	19.7174	19.7118	(88)
util rest of house													
	0.9922	0.9888	0.9831	0.9644	0.9135	0.7646	0.5484	0.5901	0.8359	0.9595	0.9861	0.9931	(89)
MIT 2	17.7360	17.9216	18.2325	18.7273	19.2023	19.5883	19.7098	19.7022	19.4946	18.9208	18.2775	17.7279	(90)
Living area fraction										fLA = Living area / (4) =		0.4133	(91)
MIT	18.3725	18.5409	18.8235	19.2725	19.7103	20.0783	20.2124	20.2006	19.9844	19.4482	18.8617	18.3626	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3725	18.5409	18.8235	19.2725	19.7103	20.0783	20.2124	20.2006	19.9844	19.4482	18.8617	18.3626	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9850	0.9786	0.9592	0.9131	0.7925	0.6164	0.6534	0.8518	0.9553	0.9822	0.9904	(94)
Useful gains	572.8159	607.3744	604.3426	604.0884	571.7043	483.7758	361.4769	373.0208	480.4797	527.7823	547.3625	558.7208	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1557.4141	1505.5069	1356.4467	1127.2087	868.4172	587.2446	387.2339	406.5559	633.5390	959.2551	1281.3213	1550.7097	(97)
Space heating kWh													
	732.5411	603.5451	559.5654	376.6466	220.7544	0.0000	0.0000	0.0000	0.0000	321.0157	528.4504	738.0397	(98a)
Space heating requirement - total per year (kWh/year)												4080.5584	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	732.5411	603.5451	559.5654	376.6466	220.7544	0.0000	0.0000	0.0000	0.0000	321.0157	528.4504	738.0397	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4080.5584	
Space heating per m2											(98c) / (4) =	54.6992	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	732.5411	603.5451	559.5654	376.6466	220.7544	0.0000	0.0000	0.0000	0.0000	321.0157	528.4504	738.0397	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	793.6523	653.8950	606.2464	408.0678	239.1705	0.0000	0.0000	0.0000	0.0000	347.7960	572.5356	799.6097	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	223.1952	197.3498	209.8152	185.1275	179.8355	162.4811	160.7939	167.0162	168.6423	187.5021	198.6562	220.8691	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.5212	86.3989	86.1503	85.6179	84.5206	79.8000	79.8000	79.8000	79.8000	85.2547	86.1455	86.5516	(217)
Fuel for water heating, kWh/month													
	257.9660	228.4170	243.5455	216.2252	212.7711	203.6104	201.4961	209.2935	211.3312	219.9318	230.6053	255.1878	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	29.0103	23.2731	20.9549	15.3524	11.8587	9.6886	10.8179	14.0615	18.2645	23.9640	27.0672	29.8166	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-58.1773	-76.6548	-102.9804	-107.9269	-110.1422	-100.6792	-99.5353	-97.0537	-91.7345	-83.9680	-62.0870	-50.9653	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-51.0518	-104.7012	-203.3563	-298.7946	-388.8829	-388.4978	-383.7898	-327.5532	-243.7107	-147.1932	-67.2960	-40.5599	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4420.9733	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2690.3808	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												234.1296	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3687.2919	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3744.1918	(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	4420.9733	0.2100	928.4044	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2690.3808	0.2100	564.9800	(264)
Space and water heating			1493.3844	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	234.1296	0.1443	33.7921	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1041.9045	0.1361	-141.7696	
PV Unit electricity exported	-2645.3874	0.1266	-334.8042	
Total			-476.5739	(269)
Total CO2, kg/year			1062.5319	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.2400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4420.9733	1.1300	4995.6998	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2690.3808	1.1300	3040.1303	(278)
Space and water heating			8035.8302	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	234.1296	1.5338	359.1158	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1041.9045	1.5030	-1565.9453	
PV Unit electricity exported	-2645.3874	0.4646	-1229.0407	
Total			-2794.9860	(283)
Total Primary energy kWh/year			5730.0608	(286)
Target Primary Energy Rate (TPER)			76.8100	(287)

Full SAP Calculation Printout

Property Reference	8_New_Build_Be_Green	**Issued on Date**	10/11/2023
Assessment Reference	8_New_Build_Be_Green_MEV	**Prop Type Ref**	
Property			

SAP Rating	78 C	**DER**	5.57	**TER**	12.57
Environmental	95 A	**% DER < TER**			55.69
CO_2 Emissions (t/year)	0.4	**DFEE**	35.59	**TFEE**	42.41
Compliance Check	See BREL	**% DFEE < TFEE**			16.07
% DPER < TPER	11.20	**DPER**	58.42	**TPER**	65.78

Assessor Details	Mr. Andy Love	**Assessor ID**	U860-0001
Client			

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.0000 (1b)	x	2.6000 (2b)	=	104.0000	(1b) - (3b)
First floor	40.0000 (1c)	x	2.8000 (2c)	=	112.0000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.0000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		3.0000	(17)
Infiltration rate		0.1500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)

Mechanical extract ventilation - centralised

If mechanical ventilation		(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			14.4400	1.1450	16.5344			(27)
Front Door			1.8900	1.0000	1.8900			(26)
Heatloss Floor 1			40.0000	0.1200	4.8000			(28a)
GF	75.0000	11.3500	63.6500	0.1400	8.9110			(29a)
L1	66.0000	4.9800	61.0200	0.1300	7.9326			(29a)
External Roof 1	40.0000		40.0000	0.1200	4.8000			(30)
Total net area of external elements Aum(A, m2)			221.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.8680			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	11.0500	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 55.9180	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	35.6400	(38)
Heat transfer coeff													
	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	91.5580	(39)
Average = Sum(39)m / 12 =												91.5580	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	1.1445	(40)
HLP (average)												1.1445	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4629	(42)
Hot water usage for mixer showers													
	65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)
Hot water usage for baths													
	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses													
	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												122.8659	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7768	
Distribution loss (46)m = 0.15 x (45)m													
	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.7736	(55)
Total storage loss													
	23.9825	21.6616	23.9825	23.2088	23.9825	23.2088	23.9825	23.9825	23.2088	23.9825	23.2088	23.9825	(56)
If cylinder contains dedicated solar storage													
	23.9825	21.6616	23.9825	23.2088	23.9825	23.2088	23.9825	23.9825	23.2088	23.9825	23.2088	23.9825	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	258.9332	228.9421	242.9504	212.7976	205.7663	184.8411	181.9345	189.4264	191.8163	214.5921	229.0620	255.9848	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	258.9332	228.9421	242.9504	212.7976	205.7663	184.8411	181.9345	189.4264	191.8163	214.5921	229.0620	255.9848	(64)
										Total per year (kWh/year) = Sum(64)m =		2597.0470	(64)
12Total per year (kWh/year)												2597	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	108.1823	96.0728	102.8680	92.1297	90.5043	82.8342	82.5802	85.0713	85.1534	93.4389	97.5376	107.2019	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	111.1384	123.0461	111.1384	114.8430	111.1384	114.8430	111.1384	111.1384	114.8430	111.1384	114.8430	111.1384	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)													
	145.4063	142.9654	138.2634	127.9579	121.6455	115.0475	110.9949	114.3431	118.2686	125.5899	135.4689	144.0886	(72)
Total internal gains													
	538.9281	550.6720	528.3241	509.5072	484.0697	463.6831	446.2436	447.3147	460.6831	479.5157	508.5199	527.9282	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6400	10.6334	0.7000	0.8000	0.7700	2.6410	(74)
East	1.9200	19.6403	0.7000	0.8000	0.7700	14.6342	(76)
South	2.1600	46.7521	0.7000	0.8000	0.7700	39.1900	(78)
Southwest	9.7200	36.7938	0.7000	0.8000	0.7700	138.7914	(79)

Solar gains	195.2567	334.2711	460.9507	575.7351	648.0400	644.4737	620.8955	566.9627	500.8002	370.4915	234.1989	166.8765	(83)
Total gains	734.1848	884.9431	989.2749	1085.2423	1132.1096	1108.1568	1067.1391	1014.2774	961.4833	850.0073	742.7188	694.8047	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	60.6780	

alpha	5.0452	5.0452	5.0452	5.0452	5.0452	5.0452	5.0452	5.0452	5.0452	5.0452	5.0452		
util living area	0.9870	0.9681	0.9305	0.8431	0.6982	0.5186	0.3758	0.4123	0.6277	0.8781	0.9714	0.9900	(86)
MIT	19.9211	20.1719	20.4540	20.7412	20.9181	20.9848	20.9975	20.9961	20.9621	20.7240	20.2607	19.8594	(87)
Th 2	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	19.9647	(88)
util rest of house	0.9831	0.9590	0.9115	0.8046	0.6366	0.4391	0.2883	0.3211	0.5450	0.8382	0.9616	0.9869	(89)
MIT 2	18.7384	19.0514	19.3949	19.7239	19.9027	19.9569	19.9640	19.9634	19.9424	19.7152	19.1666	18.6606	(90)
Living area fraction									fLA = Living area / (4) =			0.1905	(91)
MIT	18.9637	19.2648	19.5966	19.9177	20.0961	20.1527	20.1609	20.1601	20.1367	19.9074	19.3750	18.8889	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9637	19.2648	19.5966	19.9177	20.0961	20.1527	20.1609	20.1601	20.1367	19.9074	19.3750	18.8889	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9779	0.9512	0.9035	0.8027	0.6448	0.4539	0.3050	0.3385	0.5593	0.8356	0.9543	0.9824	(94)
Useful gains	717.9300	841.7932	893.8546	871.0756	729.9996	502.9447	325.4530	343.2939	537.7950	710.2955	708.7836	682.5824	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1342.5779	1315.2159	1199.1024	1008.7590	768.7308	508.3922	326.0247	344.2711	552.7055	852.1628	1123.8754	1344.8899	(97)
Space heating kWh	464.7380	318.1401	227.1044	99.1320	28.8160	0.0000	0.0000	0.0000	0.0000	105.5493	298.8661	492.7568	(98a)
Space heating requirement - total per year (kWh/year)												2035.1026	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	464.7380	318.1401	227.1044	99.1320	28.8160	0.0000	0.0000	0.0000	0.0000	105.5493	298.8661	492.7568	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2035.1026	
Space heating per m2											(98c) / (4) =	25.4388	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	170.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	464.7380	318.1401	227.1044	99.1320	28.8160	0.0000	0.0000	0.0000	0.0000	105.5493	298.8661	492.7568	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	273.3753	187.1412	133.5908	58.3129	16.9506	0.0000	0.0000	0.0000	0.0000	62.0878	175.8036	289.8569	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	258.9332	228.9421	242.9504	212.7976	205.7663	184.8411	181.9345	189.4264	191.8163	214.5921	229.0620	255.9848	(64)
Efficiency of water heater												170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month	152.3136	134.6718	142.9120	125.1750	121.0390	108.7301	107.0203	111.4273	112.8331	126.2307	134.7424	150.5793	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	4.7000	4.2452	4.7000	4.5484	4.7000	4.5484	4.7000	4.7000	4.5484	4.7000	4.5484	4.7000	(231)
Lighting	30.1633	24.1981	21.7877	15.9626	12.3300	10.0737	11.2478	14.6204	18.9904	24.9164	28.1431	31.0017	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1197.1192	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	170.0000	
Water heating fuel used	1527.6747	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVCentralised, Database: in-use factor = 1.0000, SFP = 0.2100)		
mechanical ventilation fans (SFP = 0.2100)	55.3392	(230a)
Total electricity for the above, kWh/year	55.3392	(231)
Electricity for lighting (calculated in Appendix L)	243.4354	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3023.5684	(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	1197.1192	0.1568	187.7554	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1527.6747	0.1410	215.3476	(264)
Space and water heating			403.1029	(265)
Pumps, fans and electric keep-hot	55.3392	0.1387	7.6762	(267)
Energy for lighting	243.4354	0.1443	35.1352	(268)
Total CO2, kg/year			445.9144	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.5700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1197.1192	1.5806	1892.1705	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1527.6747	1.5212	2323.9569	(278)
Space and water heating			4216.1274	(279)
Pumps, fans and electric keep-hot	55.3392	1.5128	83.7171	(281)
Energy for lighting	243.4354	1.5338	373.3893	(282)
Total Primary energy kWh/year			4673.2338	(286)
Dwelling Primary energy Rate (DPER)			58.4200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	40.0000 (1b)	x	2.6000 (2b)	=	104.0000 (1b) - (3b)	
First floor	40.0000 (1c)	x	2.8000 (2c)	=	112.0000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	80.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.0000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1389	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3889	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3889	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4958	0.4861	0.4764	0.4278	0.4181	0.3694	0.3694	0.3597	0.3889	0.4181	0.4375	0.4569	(22b)
Effective ac	0.6229	0.6182	0.6135	0.5915	0.5874	0.5682	0.5682	0.5647	0.5756	0.5874	0.5957	0.6044	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			14.4400	1.1450	16.5344			(27)
Heatloss Floor 1			40.0000	0.1300	5.2000			(28a)
GF	75.0000	11.3500	63.6500	0.1800	11.4570			(29a)
L1	66.0000	4.9800	61.0200	0.1800	10.9836			(29a)
External Roof 1	40.0000		40.0000	0.1100	4.4000			(30)
Total net area of external elements Aum(A, m2)			221.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.4650			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E1 Steel lintel with perforated steel base plate	11.4000	0.0500	0.5700	
E3 Sill	10.5000	0.0500	0.5250	
E4 Jamb	34.6000	0.0500	1.7300	
E5 Ground floor (normal)	26.7900	0.1600	4.2864	
E6 Intermediate floor within a dwelling	27.6800	0.0000	0.0000	
E16 Corner (normal)	21.6000	0.0900	1.9440	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			9.0554	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	59.5204	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.4021	44.0619	43.7284	42.1619	41.8688	40.5045	40.5045	40.2518	41.0300	41.8688	42.4617	43.0816	(38)
Heat transfer coeff	103.9225	103.5822	103.2487	101.6823	101.3892	100.0248	100.0248	99.7722	100.5504	101.3892	101.9821	102.6019	(39)
Average = Sum(39)m / 12 =												101.6808	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2990	1.2948	1.2906	1.2710	1.2674	1.2503	1.2503	1.2472	1.2569	1.2674	1.2748	1.2825	(40)
HLP (average)												1.2710	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.4629	(42)
Hot water usage for mixer showers	65.5138	64.5292	63.0946	60.3496	58.3238	56.0648	54.7807	56.2045	57.7653	60.1909	62.9948	65.2628	(42a)
Hot water usage for baths	28.2963	27.8761	27.2843	26.1931	25.3761	24.4701	23.9808	24.5684	25.2083	26.1777	27.2913	28.2006	(42b)
Hot water usage for other uses	39.8522	38.4030	36.9538	35.5047	34.0555	32.6063	32.6063	34.0555	35.5047	36.9538	38.4030	39.8522	(42c)
Average daily hot water use (litres/day)												122.8659	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.6623	130.8083	127.3327	122.0474	117.7554	113.1412	111.3678	114.8284	118.4782	123.3223	128.6891	133.3156	(44)
Energy conte	211.6883	186.2693	195.7056	167.0767	158.5214	139.1203	134.6897	142.1816	146.0955	167.3473	183.3412	208.7400	(45)
Energy content (annual)										Total = Sum(45)m =		2040.7768	
Distribution loss (46)m = 0.15 x (45)m	31.7533	27.9404	29.3558	25.0615	23.7782	20.8680	20.2035	21.3272	21.9143	25.1021	27.5012	31.3110	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	258.2832	228.3550	242.3005	212.1686	205.1163	184.2121	181.2846	188.7765	191.1873	213.9422	228.4330	255.3349	(62)
WWHRS	-29.9502	-26.4882	-27.7369	-22.9672	-21.4046	-18.3161	-17.1684	-18.2569	-18.9505	-22.3406	-25.3092	-29.3955	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	228.3331	201.8668	214.5636	189.2013	183.7117	165.8960	164.1162	170.5196	172.2368	191.6015	203.1238	225.9393	(64)
										Total per year (kWh/year) = Sum(64)m =		2311.1097	(64)
12Total per year (kWh/year)												2311	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	107.6623	95.6031	102.3480	91.6265	89.9843	82.3310	82.0602	84.5513	84.6502	92.9189	97.0344	106.6820	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	123.1431	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.9964	125.1032	112.9964	116.7630	112.9964	116.7630	112.9964	112.9964	116.7630	112.9964	116.7630	112.9964	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	219.4405	221.7177	215.9794	203.7634	188.3429	173.8497	164.1674	161.8903	167.6286	179.8446	195.2651	209.7582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	35.3143	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	-98.5144	(71)
Water heating gains (Table 5)	144.7074	142.2665	137.5645	127.2590	120.9466	114.3486	110.2960	113.6442	117.5697	124.8910	134.7700	143.3897	(72)
Total internal gains	540.0873	552.0303	529.4833	510.7283	485.2288	464.9042	447.4028	448.4739	461.9042	480.6749	509.7410	529.0873	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6400	10.6334	0.6300	0.7000	0.7700	2.0798	(74)
East	1.9200	19.6403	0.6300	0.7000	0.7700	11.5245	(76)
South	2.1600	46.7521	0.6300	0.7000	0.7700	30.8622	(78)
Southwest	9.7200	36.7938	0.6300	0.7000	0.7700	109.2982	(79)

Solar gains	153.7647	263.2385	362.9987	453.3914	510.3315	507.5230	488.9552	446.4831	394.3801	291.7621	184.4316	131.4152	(83)

Total gains	693.8519	815.2688	892.4820	964.1197	995.5603	972.4272	936.3580	894.9570	856.2843	772.4370	694.1726	660.5026	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.4587	53.6343	53.8075	54.6364	54.7944	55.5418	55.5418	55.6824	55.2515	54.7944	54.4758	54.1467	
alpha	4.5639	4.5756	4.5872	4.6424	4.6530	4.7028	4.7028	4.7122	4.6834	4.6530	4.6317	4.6098	
util living area													
	0.9908	0.9803	0.9601	0.9067	0.8000	0.6236	0.4628	0.5018	0.7280	0.9241	0.9810	0.9926	(86)
MIT	19.6328	19.8662	20.1636	20.5330	20.8079	20.9556	20.9911	20.9871	20.9074	20.5531	20.0349	19.6025	(87)
Th 2	19.8416	19.8449	19.8482	19.8636	19.8665	19.8800	19.8800	19.8825	19.8748	19.8665	19.8606	19.8545	(88)
util rest of house													
	0.9878	0.9741	0.9473	0.8768	0.7399	0.5286	0.3487	0.3855	0.6383	0.8932	0.9738	0.9901	(89)
MIT 2	18.2853	18.5820	18.9551	19.4103	19.7127	19.8561	19.8774	19.8783	19.8173	19.4463	18.8093	18.2559	(90)
Living area fraction										fLA = Living area / (4) =		0.1905	(91)
MIT	18.5420	18.8266	19.1853	19.6242	19.9213	20.0656	20.0895	20.0895	20.0250	19.6572	19.0428	18.5124	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5420	18.8266	19.1853	19.6242	19.9213	20.0656	20.0895	20.0895	20.0250	19.6572	19.0428	18.5124	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9830	0.9667	0.9379	0.8694	0.7432	0.5452	0.3705	0.4076	0.6514	0.8861	0.9668	0.9860	(94)
Useful gains	682.0649	788.1001	837.0398	838.1979	739.8657	530.1228	346.9185	364.7949	557.7813	684.4948	671.1156	651.2603	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1480.0602	1442.5520	1309.7442	1090.4615	833.5551	546.6952	349.0388	368.1102	595.7605	918.2978	1217.9506	1468.4828	(97)
Space heating kWh													
	593.7085	439.7917	351.6921	181.6298	69.7049	0.0000	0.0000	0.0000	0.0000	173.9494	393.7212	608.0135	(98a)
Space heating requirement - total per year (kWh/year)												2812.2112	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	593.7085	439.7917	351.6921	181.6298	69.7049	0.0000	0.0000	0.0000	0.0000	173.9494	393.7212	608.0135	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2812.2112	
Space heating per m2											(98c) / (4) =	35.1526	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	593.7085	439.7917	351.6921	181.6298	69.7049	0.0000	0.0000	0.0000	0.0000	173.9494	393.7212	608.0135	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	643.2379	476.4807	381.0315	196.7820	75.5200	0.0000	0.0000	0.0000	0.0000	188.4609	426.5668	658.7362	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	228.3331	201.8668	214.5636	189.2013	183.7117	165.8960	164.1162	170.5196	172.2368	191.6015	203.1238	225.9393	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1027	85.7572	85.1607	83.9683	82.0884	79.8000	79.8000	79.8000	79.8000	83.8437	85.5176	86.1671	(217)
Fuel for water heating, kWh/month													
	265.1869	235.3934	251.9515	225.3248	223.7973	207.8898	205.6593	213.6837	215.8355	228.5224	237.5229	262.2106	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	23.4784	18.8353	16.9591	12.4249	9.5974	7.8411	8.7551	11.3801	14.7817	19.3944	21.9059	24.1310	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.2720	-52.4694	-75.3142	-84.5614	-91.0850	-84.9801	-83.9208	-79.2655	-71.0455	-59.9291	-40.9451	-32.2322	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.2958	-44.7724	-88.9414	-133.5198	-176.4887	-177.3132	-175.2347	-148.4058	-108.8179	-64.0180	-28.4292	-16.8430	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3046.8160	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2772.9781	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												189.4843	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1977.1002	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4118.1782	(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	3046.8160	0.2100	639.8314	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2772.9781	0.2100	582.3254	(264)
Space and water heating			1222.1568	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	189.4843	0.1443	27.3484	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-793.0203	0.1346	-106.7540	
PV Unit electricity exported	-1184.0799	0.1259	-149.0866	
Total			-255.8407	(269)
Total CO2, kg/year			1005.5938	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5700	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3046.8160	1.1300	3442.9021	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2772.9781	1.1300	3133.4653	(278)
Space and water heating			6576.3674	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	189.4843	1.5338	290.6374	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-793.0203	1.4975	-1187.5665	
PV Unit electricity exported	-1184.0799	0.4622	-547.2512	
Total			-1734.8177	(283)
Total Primary energy kWh/year			5262.2879	(286)
Target Primary Energy Rate (TPER)			65.7800	(287)

Full SAP Calculation Printout

Property Reference	3_Notional	**Issued on Date**	10/11/2023
Assessment Reference	2_Proposed	**Prop Type Ref**	
Property			

SAP Rating	71 C	**DER**	33.41	**TER**	10.74
Environmental	72 C	**% DER < TER**			-211.08
CO_2 Emissions (t/year)	2.5	**DFEE**	59.42	**TFEE**	33.57
Compliance Check	See BREL	**% DFEE < TFEE**			-76.98
% DPER < TPER	-228.85	**DPER**	184.32	**TPER**	56.05

Assessor Details	Mr. Andy Love	**Assessor ID**	U860-0001
Client			

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	81.0000	(1b)	x 2.4000	(2b) =	194.4000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	194.4000	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		8.0000	(17)
Infiltration rate		0.4000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4718	0.4625	0.4533	0.4070	0.3978	0.3515	0.3515	0.3423	0.3700	0.3978	0.4163	0.4348	(22b)

Mechanical extract ventilation - centralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

Effective ac	0.7218	0.7125	0.7033	0.6570	0.6478	0.6015	0.6015	0.5923	0.6200	0.6478	0.6663	0.6848	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			9.7200	1.1450	11.1298			(27)
Door			1.8900	1.0000	1.8900			(26)
Heatloss Floor 1			81.0000	0.2500	20.2500			(28a)
GF	62.5000	11.6100	50.8900	0.3000	15.2670			(29a)
External Wall 2	18.1800		18.1800	0.2400	4.3632			(29a)
Total net area of external elements Aum(A, m2)			161.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.9000			(33)
Party Wall 1			22.0000	0.0000	0.0000			(32)
Party Ceiling 1			81.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.150 * total exposed area)	24.2520	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	77.1520	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	46.3017	45.7083	45.1149	42.1479	41.5545	38.5874	38.5874	37.9940	39.7742	41.5545	42.7413	43.9281	(38)
Heat transfer coeff													
	123.4537	122.8603	122.2669	119.2998	118.7064	115.7394	115.7394	115.1460	116.9262	118.7064	119.8932	121.0801	(39)
Average = Sum(39)m / 12 =												119.1515	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5241	1.5168	1.5095	1.4728	1.4655	1.4289	1.4289	1.4216	1.4435	1.4655	1.4802	1.4948	(40)
HLP (average)												1.4710	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4816	(42)
Hot water usage for mixer showers													
	65.8273	64.8381	63.3965	60.6384	58.6030	56.3331	55.0429	56.4735	58.0417	60.4789	63.2963	65.5751	(42a)
Hot water usage for baths													
	28.4311	28.0089	27.4143	26.3179	25.4970	24.5867	24.0950	24.6855	25.3284	26.3024	27.4213	28.3350	(42b)
Hot water usage for other uses													
	40.0437	38.5875	37.1314	35.6753	34.2191	32.7630	32.7630	34.2191	35.6753	37.1314	38.5875	40.0437	(42c)
Average daily hot water use (litres/day)												123.4541	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	134.3021	131.4345	127.9422	122.6316	118.3191	113.6828	111.9009	115.3781	119.0454	123.9127	129.3052	133.9538	(44)
Energy conte	212.7018	187.1610	196.6424	167.8766	159.2803	139.7863	135.3345	142.8622	146.7949	168.1484	184.2189	209.7393	(45)
Energy content (annual)										Total = Sum(45)m =		2050.5464	
Distribution loss (46)m = 0.15 x (45)m													
	31.9053	28.0741	29.4964	25.1815	23.8920	20.9679	20.3002	21.4293	22.0192	25.2223	27.6328	31.4609	(46)
Water storage loss:													
Store volume												150.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.1425	(51)
Volume factor from Table 2a												0.9283	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												10.7151	(55)
Total storage loss													
	332.1683	300.0230	332.1683	321.4532	332.1683	321.4532	332.1683	332.1683	321.4532	332.1683	321.4532	332.1683	(56)
If cylinder contains dedicated solar storage													
	332.1683	300.0230	332.1683	321.4532	332.1683	321.4532	332.1683	332.1683	321.4532	332.1683	321.4532	332.1683	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	568.1325	508.1952	552.0732	511.8418	514.7110	483.7515	490.7652	498.2930	490.7601	523.5791	528.1841	565.1700	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	568.1325	508.1952	552.0732	511.8418	514.7110	483.7515	490.7652	498.2930	490.7601	523.5791	528.1841	565.1700	(64)
										Total per year (kWh/year) = Sum(64)m =		6235.4568	(64)
12Total per year (kWh/year)												6235	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	355.0679	319.0584	349.7282	330.9911	337.3053	321.6511	329.3433	331.8463	323.9815	340.2539	336.4250	354.0829	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.4069	133.3077	120.4069	124.4205	120.4069	124.4205	120.4069	120.4069	124.4205	120.4069	124.4205	120.4069	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	10.0000	10.0000	10.0000	10.0000	10.0000	0.0000	0.0000	0.0000	0.0000	10.0000	10.0000	10.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)													
	477.2418	474.7893	470.0648	459.7099	453.3673	446.7377	442.6657	446.0300	449.9743	457.3306	467.2569	475.9179	(72)
Total internal gains													
	889.3900	902.1368	878.7191	860.0461	834.1234	806.8770	789.0176	790.0831	803.8336	829.5079	859.0144	878.2921	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2400	10.6334	0.7000	0.8000	0.7700	13.3702	(74)
East	5.4000	19.6403	0.7000	0.8000	0.7700	41.1588	(76)
South	1.0800	46.7521	0.7000	0.8000	0.7700	19.5950	(78)

Solar gains	74.1240	138.1580	216.8938	309.3271	379.0922	389.5179	370.1443	316.8649	249.1210	160.5673	91.0408	61.9249	(83)
Total gains	963.5140	1040.2949	1095.6129	1169.3732	1213.2156	1196.3949	1159.1619	1106.9480	1052.9546	990.0752	950.0552	940.2170	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.5636	45.7837	46.0059	47.1501	47.3858	48.6006	48.6006	48.8510	48.1073	47.3858	46.9167	46.4569	
alpha	4.0376	4.0522	4.0671	4.1433	4.1591	4.2400	4.2400	4.2567	4.2072	4.1591	4.1278	4.0971	

util living area													
	0.9748	0.9635	0.9409	0.8800	0.7664	0.5855	0.4317	0.4674	0.6883	0.8836	0.9552	0.9768	(86)
MIT	19.6093	19.7896	20.0783	20.4820	20.7820	20.9494	20.9889	20.9846	20.8970	20.5499	20.0525	19.6106	(87)
Th 2	19.6695	19.6749	19.6804	19.7079	19.7135	19.7413	19.7413	19.7468	19.7301	19.7135	19.7024	19.6914	(88)
util rest of house													
	0.9670	0.9524	0.9224	0.8428	0.6980	0.4841	0.3121	0.3456	0.5896	0.8401	0.9397	0.9697	(89)
MIT 2	18.1341	18.3625	18.7226	19.2206	19.5457	19.7156	19.7383	19.7423	19.6698	19.3119	18.7122	18.1511	(90)
Living area fraction										fLA = Living area / (4) =		0.3074	(91)
MIT	18.5876	18.8012	19.1393	19.6084	19.9257	20.0949	20.1227	20.1242	20.0470	19.6925	19.1242	18.5997	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5876	18.8012	19.1393	19.6084	19.9257	20.0949	20.1227	20.1242	20.0470	19.6925	19.1242	18.5997	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9585	0.9429	0.9129	0.8395	0.7103	0.5138	0.3490	0.3832	0.6161	0.8393	0.9309	0.9617	(94)
Useful gains	923.5622	980.8997	1000.1921	981.6410	861.7954	614.7590	404.5572	424.1527	648.7755	830.9675	884.3824	904.1674	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1763.8576	1707.9059	1545.3718	1277.5062	976.4491	635.9715	407.7185	428.8226	695.3607	1079.3366	1441.6245	1743.5211	(97)
Space heating kWh	625.1798	488.5482	405.6137	213.0229	85.3023	0.0000	0.0000	0.0000	0.0000	184.7866	401.2143	624.4792	(98a)
Space heating requirement - total per year (kWh/year)												3028.1470	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	625.1798	488.5482	405.6137	213.0229	85.3023	0.0000	0.0000	0.0000	0.0000	184.7866	401.2143	624.4792	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3028.1470	
Space heating per m2											(98c) / (4) =	37.3845	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												79.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	625.1798	488.5482	405.6137	213.0229	85.3023	0.0000	0.0000	0.0000	0.0000	184.7866	401.2143	624.4792	(98)
Space heating efficiency (main heating system 1)	79.0000	79.0000	79.0000	79.0000	79.0000	0.0000	0.0000	0.0000	0.0000	79.0000	79.0000	79.0000	(210)
Space heating fuel (main heating system)	791.3669	618.4154	513.4350	269.6493	107.9776	0.0000	0.0000	0.0000	0.0000	233.9071	507.8662	790.4800	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	568.1325	508.1952	552.0732	511.8418	514.7110	483.7515	490.7652	498.2930	490.7601	523.5791	528.1841	565.1700	(64)
Efficiency of water heater												74.0000	(216)
(217)m	73.9223	73.5855	72.9293	71.6828	70.2740	69.0000	69.0000	69.0000	69.0000	71.3717	73.0090	73.9326	(217)
Fuel for water heating, kWh/month	768.5532	690.6186	756.9982	714.0371	732.4346	701.0892	711.2539	722.1637	711.2465	733.5945	723.4504	764.4395	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	18.4653	16.6783	18.4653	17.8697	18.4653	17.8697	18.4653	18.4653	17.8697	18.4653	17.8697	18.4653	(231)
Lighting	32.6972	26.2309	23.6180	17.3036	13.3658	10.9199	12.1927	15.8485	20.5857	27.0095	30.5072	33.6059	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3833.0975	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												74.0000	
Water heating fuel used												8729.8795	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.3000, SFP = 0.2210)													
mechanical ventilation fans (SFP = 0.2210)												52.4141	(230a)
central heating pump												165.0000	(230c)
Total electricity for the above, kWh/year												217.4141	(231)
Electricity for lighting (calculated in Appendix L)												263.8849	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												13044.2760	(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	3833.0975	0.2100	804.9505	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	8729.8795	0.2100	1833.2747	(264)
Space and water heating			2638.2252	(265)
Pumps, fans and electric keep-hot	217.4141	0.1387	30.1580	(267)
Energy for lighting	263.8849	0.1443	38.0867	(268)
Total CO2, kg/year			2706.4699	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			33.4100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3833.0975	1.1300	4331.4002	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	8729.8795	1.1300	9864.7638	(278)
Space and water heating			14196.1640	(279)
Pumps, fans and electric keep-hot	217.4141	1.5128	328.9041	(281)
Energy for lighting	263.8849	1.5338	404.7554	(282)
Total Primary energy kWh/year			14929.8236	(286)
Dwelling Primary energy Rate (DPER)			184.3200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	81.0000	(1b)	x 2.4000	(2b) =	194.4000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		194.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1543 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4043 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3740 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4768	0.4675	0.4581	0.4114	0.4020	0.3553	0.3553	0.3459	0.3740	0.4020	0.4207	0.4394	(22b)
Effective ac	0.6137	0.6093	0.6049	0.5846	0.5808	0.5631	0.5631	0.5598	0.5699	0.5808	0.5885	0.5966	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			9.7200	1.1450	11.1298			(27)
Heatloss Floor 1			81.0000	0.1300	10.5300			(28a)
GF	62.5000	11.6100	50.8900	0.1800	9.1602			(29a)
External Wall 2	18.1800		18.1800	0.1800	3.2724			(29a)
Total net area of external elements Aum(A, m2)			161.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.9824			(33)
Party Wall 1			22.0000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E1 Steel lintel with perforated steel base plate	9.3000	0.0500	0.4650	
E3 Sill	8.4000	0.0500	0.4200	
E4 Jamb	47.8000	0.0500	2.3900	
E5 Ground floor (normal)	17.3500	0.1600	2.7760	
E16 Corner (normal)	4.8000	0.0900	0.4320	
E18 Party wall between dwellings	4.8000	0.0600	0.2880	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.7710	(36)
Point Thermal bridges		(36a) =	0.0000	
Total fabric heat loss		(33) + (36) + (36a) =	42.7534	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	39.3695	39.0863	38.8087	37.5048	37.2608	36.1251	36.1251	35.9148	36.5626	37.2608	37.7543	38.2703	(38)
Heat transfer coeff	82.1229	81.8397	81.5621	80.2581	80.0142	78.8785	78.8785	78.6682	79.3160	80.0142	80.5077	81.0237	(39)
Average = Sum(39)m / 12 =												80.2570	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0139	1.0104	1.0069	0.9908	0.9878	0.9738	0.9738	0.9712	0.9792	0.9878	0.9939	1.0003	(40)
HLP (average)												0.9908	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4816	(42)
Hot water usage for mixer showers	65.8273	64.8381	63.3965	60.6384	58.6030	56.3331	55.0429	56.4735	58.0417	60.4789	63.2963	65.5751	(42a)
Hot water usage for baths	28.4311	28.0089	27.4143	26.3179	25.4970	24.5867	24.0950	24.6855	25.3284	26.3024	27.4213	28.3350	(42b)
Hot water usage for other uses	40.0437	38.5875	37.1314	35.6753	34.2191	32.7630	32.7630	34.2191	35.6753	37.1314	38.5875	40.0437	(42c)
Average daily hot water use (litres/day)												123.4541	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	134.3021	131.4345	127.9422	122.6316	118.3191	113.6828	111.9009	115.3781	119.0454	123.9127	129.3052	133.9538	(44)
Energy conte	212.7018	187.1610	196.6424	167.8766	159.2803	139.7863	135.3345	142.8622	146.7949	168.1484	184.2189	209.7393	(45)
Energy content (annual)										Total = Sum(45)m =		2050.5464	
Distribution loss (46)m = 0.15 x (45)m	31.9053	28.0741	29.4964	25.1815	23.8920	20.9679	20.3002	21.4293	22.0192	25.2223	27.6328	31.4609	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	259.2967	229.2467	243.2373	212.9684	205.8752	184.8781	181.9294	189.4571	191.8867	214.7433	229.3107	256.3342	(62)
WWHRS	-30.0935	-26.6149	-27.8696	-23.0772	-21.5071	-18.4038	-17.2506	-18.3443	-19.0412	-22.4475	-25.4303	-29.5362	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	229.2031	202.6318	215.3677	189.8912	184.3681	166.4744	164.6788	171.1128	172.8455	192.2958	203.8804	226.7980	(64)
									Total per year (kWh/year) = Sum(64)m =			2319.5475	(64)
12Total per year (kWh/year)												2320	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	107.9993	95.8996	102.6595	91.8924	90.2366	82.5524	82.2746	84.7776	84.8828	93.1853	97.3263	107.0142	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	124.0781	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	124.0166	137.3041	124.0166	128.1505	124.0166	128.1505	124.0166	124.0166	128.1505	124.0166	128.1505	124.0166	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	221.5178	223.8165	218.0239	205.6923	190.1258	175.4954	165.7215	163.4228	169.2154	181.5470	197.1135	211.7439	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	35.4078	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	-99.2624	(71)
Water heating gains (Table 5)	145.1603	142.7077	137.9832	127.6284	121.2858	114.6561	110.5842	113.9484	117.8927	125.2490	135.1754	143.8363	(72)
Total internal gains	553.9182	567.0518	543.2472	524.6946	498.6516	478.5255	460.5457	461.6113	475.4820	494.0361	523.6628	542.8203	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2400	10.6334	0.6300	0.7000	0.7700	10.5290	(74)
East	5.4000	19.6403	0.6300	0.7000	0.7700	32.4125	(76)
South	1.0800	46.7521	0.6300	0.7000	0.7700	15.4311	(78)

Solar gains	58.3726	108.7994	170.8039	243.5951	298.5351	306.7453	291.4886	249.5311	196.1828	126.4467	71.6946	48.7659	(83)
Total gains	612.2908	675.8512	714.0511	768.2897	797.1867	785.2708	752.0344	711.1424	671.6649	620.4828	595.3575	591.5861	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.4949	68.7320	68.9659	70.0863	70.3000	71.3122	71.3122	71.5028	70.9189	70.3000	69.8691	69.4242	
alpha	5.5663	5.5821	5.5977	5.6724	5.6867	5.7541	5.7541	5.7669	5.7279	5.6867	5.6579	5.6283	
util living area	0.9937	0.9881	0.9756	0.9301	0.8197	0.6238	0.4586	0.5037	0.7524	0.9442	0.9866	0.9948	(86)
MIT	19.9646	20.1176	20.3396	20.6503	20.8763	20.9796	20.9970	20.9950	20.9427	20.6642	20.2758	19.9487	(87)
Th 2	20.0718	20.0747	20.0776	20.0910	20.0935	20.1052	20.1052	20.1074	20.1007	20.0935	20.0884	20.0831	(88)
util rest of house	0.9918	0.9844	0.9678	0.9079	0.7691	0.5447	0.3669	0.4087	0.6768	0.9218	0.9818	0.9932	(89)
MIT 2	18.8738	19.0701	19.3515	19.7401	19.9911	20.0937	20.1042	20.1056	20.0632	19.7651	19.2824	18.8621	(90)
Living area fraction									fLA = Living area / (4) =			0.3074	(91)
MIT	19.2091	19.3921	19.6553	20.0199	20.2632	20.3661	20.3787	20.3790	20.3336	20.0415	19.5878	19.1962	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2091	19.3921	19.6553	20.0199	20.2632	20.3661	20.3787	20.3790	20.3336	20.0415	19.5878	19.1962	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9809	0.9633	0.9059	0.7793	0.5684	0.3952	0.4380	0.6976	0.9203	0.9783	0.9910	(94)
Useful gains	605.7560	662.9411	687.8233	695.9833	621.2570	446.3425	297.1798	311.4734	468.5685	571.0206	582.4367	586.2568	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1224.3795	1186.0271	1072.9713	892.4613	685.1791	454.8176	298.0571	313.0226	494.4219	755.4548	1005.3602	1215.0439	(97)
Space heating kWh	460.2559	351.5138	286.5501	141.4642	47.5580	0.0000	0.0000	0.0000	0.0000	137.2190	304.5050	467.8176	(98a)
Space heating requirement - total per year (kWh/year)												2196.8836	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	460.2559	351.5138	286.5501	141.4642	47.5580	0.0000	0.0000	0.0000	0.0000	137.2190	304.5050	467.8176	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2196.8836	
Space heating per m2											(98c) / (4) =	27.1220	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.2559	351.5138	286.5501	141.4642	47.5580	0.0000	0.0000	0.0000	0.0000	137.2190	304.5050	467.8176	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	498.6521	380.8384	310.4551	153.2656	51.5255	0.0000	0.0000	0.0000	0.0000	148.6663	329.9079	506.8446	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	229.2031	202.6318	215.3677	189.8912	184.3681	166.4744	164.6788	171.1128	172.8455	192.2958	203.8804	226.7980	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5909	85.2829	84.7010	83.4091	81.4937	79.8000	79.8000	79.8000	79.8000	83.3164	84.9574	85.6461	(217)
Fuel for water heating, kWh/month	267.7891	237.5995	254.2681	227.6626	226.2361	208.6145	206.3644	214.4271	216.5983	230.8018	239.9795	264.8082	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.7682	20.6722	18.6130	13.6367	10.5334	8.6059	9.6089	12.4900	16.2233	21.2858	24.0423	26.4844	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.7671	-53.1683	-76.3033	-85.6399	-92.2061	-86.0070	-84.9529	-80.2871	-72.0031	-60.7489	-41.4986	-32.6615	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.5329	-45.2890	-90.0055	-135.1673	-178.7124	-179.5650	-177.4420	-150.2301	-110.1086	-64.7475	-28.7429	-17.0271	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 2380.1556 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 79.8000

Water heating fuel used 2795.1492 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year 86.0000 (231)

Electricity for lighting (calculated in Appendix L) 207.9642 (232)

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

PV generation -2001.8140 (233)

Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3467.4550	(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	2380.1556	0.2100	499.8327	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2795.1492	0.2100	586.9813	(264)
Space and water heating			1086.8140	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	207.9642	0.1443	30.0157	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-803.2438	0.1346	-108.1342	
PV Unit electricity exported	-1198.5702	0.1259	-150.8998	
Total			-259.0339	(269)
Total CO2, kg/year			869.7250	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7400	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2380.1556	1.1300	2689.5758	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2795.1492	1.1300	3158.5186	(278)
Space and water heating			5848.0944	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	207.9642	1.5338	318.9824	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-803.2438	1.4975	-1202.8911	
PV Unit electricity exported	-1198.5702	0.4621	-553.9061	
Total			-1756.7971	(283)
Total Primary energy kWh/year			4540.3805	(286)
Target Primary Energy Rate (TPER)			56.0500	(287)

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