JS LEWIS LTD

Newmarket Ale House, 17 York Way, N7 9QG

Energy and Sustainability Assessment

Revision A

July 2023

Mendoza Ltd

Applicant:	Mendoza Ltd
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2 EXECUTIVE SUMMARY

This document has been prepared on behalf of Mendoza Ltd Ltd to help assess the energy and sustainability aspects of the proposed development of the Newmarket Ale House, 17 York Way, Camden, N7 9QG. The proposals are for the refurbishment and extension of the existing building, currently a public house and hotel, refurbishing the public house and creating 7 apartments through change of use. The building is within the Camden Square conservation area, and as a change of use refurbishment and extension is substantially constrained.

As part of the design process, the scheme seeks to address energy and sustainability matters from the outset, and this document sets out the proposed strategy. *It should be recognised that as schemes are developed post-planning, some of the details may change as the detailed design considerations are resolved in more depth. Accordingly, any related planning conditions should be worded to allow flexibility in how the details are resolved.*

The first section of this report sets out the purpose and scope of the Energy and Sustainability Strategy, the context within which it sits, and the description of development. An accommodation schedule is provided to inform the energy/CO2 assessment.

The second section sets out the planning policy and regulatory framework against which the development will be assessed. This covers national policy, local policy, emerging local policy, national building regulation and emerging national guidance that relates to property developments and policymaking. Major refurbishment schemes are required to address the GLA's Energy Guidance, which expects them to seek to do their best to meet the carbon standards set for new developments, noting that the limitations faced by such projects may make this impractical. This particular scheme is not defined as major under the GLA parameters. As a change of use scheme, the residential apartments are subject to Part L1B.

Section 3 considers the energy hierarchy, the heating hierarchy, the cooling hierarchy, the energy demand assessment and the CO2 strategy. The projected carbon performance is set out below:

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	25.7		
Be lean	25.7	0.0	0%
Be clean	25.7	0.0	0%
Be green	9.5	16.2	63%
Total Savings	-	16.2	63%

Figure 1 – CO2 Emissions Estimate (GLA Document, SAP 10)

The fourth section considers the sustainability strategy for the development. Flood, water conservation, sustainable transport, materials and resource efficiency, waste and ecology are all considered.

The final section sets out the conclusions for the scheme. The applicant is aiming to deliver a sustainable development that addresses the environmental, social and economic issues in the round. Through the provision of this strategy, the proposed development is considered to address fully the planning policy framework.

3 INTRODUCTION

3.1 Context

This document has been prepared on behalf of Mendoza Ltd Ltd to help assess the energy and sustainability aspects of the proposed development of the Newmarket Ale House, 17 York Way, Camden, N7 9QG. The proposals are for the refurbishment and extension of the existing building, currently a public house and hotel, refurbishing the public house and creating 7 apartments through change of use. The building is within the Camden Square conservation area, and as a change of use refurbishment and extension is substantially constrained. This document, a combined energy and sustainability strategy, forms one of a suite of documents that form a planning application to be submitted to the London Borough of Camden.

The scheme has addressed national, regional and the Council's policy on energy and sustainability. It also has to address the regulatory framework at the post-planning detailed design stage. This document sets out the energy strategy and the sustainability strategy. The strategy puts in place an approach to addressing both policy and regulatory expectations. However, it should be recognised that as schemes are developed post-planning, some of the details may change as the detailed design considerations are resolved in more depth.

3.2 Location and Scheme Details

The site is located at 17 York Way on the corner of the junction of York Way and Agar Grove with main facades facing North and East. It sits within the Camden Square conservation area, and is currently an active public house with a hotel above. The pub is located in the basement and ground floors, whilst the hotel is on floors 1, 2 and 3 above.

The application seeks to refurbish the building, retaining the majority of the external envelope, and to extend it by 1 floor vertically. The pub use will be retained, but the upper floors will be converted to 7 residential apartments. Floor 1 has a 1B2P flat and a 3B5P flat, whilst floors 2 and 3 replicate with 2 no. 2B3P flats. The 4th floor is a single apartment within a set-back mansard roof.

There are opportunities to integrate internal hot water heat pumps for the residential units, and some solar PV to the roof.

The client has appointed a design team to develop the proposals that address local, regional and national policy, and to submit the planning application.

4 POLICY AND REGULATORY CONTEXT

4.1 National Policy

National Planning Policy Framework (2021)

The National Planning Policy Framework sets out a framework for positive growth, making progress in environmental, social and economic areas, and enhancing existing areas. It is a material consideration in planning decisions and reinforces the need for decisions to be determined in accordance with the local plan, unless material considerations indicate otherwise.

The policies throughout the NPPF constitute the government's view of what sustainable development is, and requires the planning process to perform a number of roles:

1. An economic role – building a strong economy, supporting growth and innovation;
2. A social role – supporting communities through providing housing supply, a high-quality built environment, and accessible local services;
3. An environmental role – contributing to natural and built environments, improving biodiversity, using resources prudently, minimizing waste and addressing climate change, including moving to a low carbon economy.

The 2021 National Planning Policy Framework retains a presumption in favour of sustainable development. Section 14 concerns itself with climate change:

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

Planning for climate change

153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating 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.

154. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

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

a) provide a positive strategy for energy from these sources, that maximizes the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

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

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

156. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

157. In determining planning applications, local planning authorities should expect new development to:

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

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

158. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognize that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

The NPPF sets out the importance of dealing with climate change, and the use of energy efficiency and renewable energy. Development should be in sustainable locations to reduce CO2 emissions. It notes the need to align local policies with the national timeline for low carbon buildings. Further, the document makes it clear that the delivery of local standards should be balanced with viability considerations.

4.2 London Policy

The London Plan (2021)

Policy SI2 reflects the current adopted position on energy and CO2 savings:

A. *Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:*

1. *Be lean: use less energy and manage demand during construction and operation.*

2. *Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.*

3. *Be green: generate, store and use renewable energy on-site.*

B. *Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.*

C. *In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:*

1. *through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or*

2. *off-site provided that an alternative proposal is identified and delivery is certain.*

D. *Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver greenhouse gas reductions. The operation of offset funds should be monitored and reported on annually.*

Guidance on Preparation of Energy Strategies (2022)

Refurbishment schemes are to use Appendix D to determine the baseline performance when a change of use is proposed. Appendix D sets out the following standards:

Table 12: *Residential notional specification for existing buildings*

Element	Unit	Specification[3]
External Wall – cavity insulation	W/m²K	0.55
External Wall – internal or external insulation	W/m²K	0.30
Roof	W/m²K	0.16
Floor	W/m²K	0.25
Glazing	W/m²K	1.60
Vision element	g-value	0.63
Air permeability	(m^3/h m^2 @ 50 Pa)	Default - determined by fabric element types
Thermal Bridging	W/m²K	Default
HVAC type	-	As per final building specification
Heating and Hot Water	Per cent	Efficiencies to match the applicable notional values for existing dwellings (see section 6 of Approved Document L1)
Cooling (air-condition)	SEER	None
Lighting	Per cent	100 per cent low energy lighting with a minimum luminous efficacy of 75 light source lumens per circuit-watt.

Key extracts from the body text within the GLA guidance on major refurbishments is as follows:

Where an existing building or group of buildings is refurbished and the development qualifies as a major refurbishment, applicants are required to provide an energy assessment demonstrating how the individual elements of the energy hierarchy have been implemented and how reductions in regulated CO2 emissions have been achieved.

Major refurbishments are those which comprise of 10 or more units and, for other uses, those with have a floorspace of 1000m2 or more.

Once the baseline has been established, applicants will be expected to demonstrate that they have incorporated improvement measures that maximise performance at each stage of the energy hierarchy.

It is acknowledged that the Approved Documents allow for flexibility in meeting the recommended standards due to potential restrictions to building work upgrades, for instance listed building status or heritage projects. Therefore, any limitations in meeting these recommended standards should be stated.

It is generally acknowledged that the level of carbon savings that can be achieved through a refurbishment can vary considerably, however every effort should be made to improve the energy performance of the building in line with London Plan carbon targets and to follow the energy hierarchy.

For the proposals, the scheme is not a major refurbishment as it does not meet either threshold. As a result the requirements to seek to achieve the carbon standards in the London Plan do not apply. Nevertheless, the process outlined above is employed to seek to address the CO2 emissions from the development.

4.3 Local Policy

Policy CC2 of the Local Plan sets out the following expectations:

Policy CC2 Adapting to climate change
The Council will require development to be resilient to climate change.
All development should adopt appropriate climate change adaptation measures such as:

a. *the protection of existing green spaces and promoting new appropriate green infrastructure;*
b. *not increasing, and wherever possible reducing, surface water run- off through increasing permeable surfaces and use of Sustainable Drainage Systems;*
c. *incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
d. *measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.*

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures
The Council will promote and measure sustainable design and construction by:

a. *ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;*
b. *encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;*
c. *encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and*
d. *expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.*

The Camden Planning Guidance note summarises the expectations for new developments with regard to overheating:

Efficient ventilation and cooling

3.14 Local Plan Policy CC2 discourages active cooling (air conditioning). Air conditioning will only be permitted where thermal modelling demonstrates a clear need for it after all preferred measures are incorporated in line with the London Plan cooling hierarchy (please see Chapter 10 for further information on overheating and the cooling hierarchy). The following passive measures should be considered first. If active cooling is unavoidable, applicants need to identify the cooling requirement and provide details of the efficiency of the system.

• Water based cooling systems reduce the need for air conditioning by running cold water through pipes in the floor and/or ceiling to cool the air.
• Evaporation cooling could also be investigated, this cools air through the simple evaporation of water.
• Ground source cooling. Ground source cooling is provided by a 'ground source heat pump' in the summer the ground stays cooler than the air and the difference in temperature can be harnessed for cooling.
• Exposed concrete slabs can provide natural cooling. This leaves internal thermal mass (concrete slabs, stone or masonry which form part of the construction) inside a building exposed so that it can absorb excess heat in the day and slowly release it at night.
• Developments could adopt a natural 'stack effect' which draws cool air from lower levels whilst releasing hot air.

Other energy efficient technology

• High efficiency lighting with controlled sensors, e.g. timers, movement sensors and photo sensors, which adjust the brightness of the light depending on the natural light level.
• Zoned lighting, heating and cooling with individual control.
• Specifying appliances which are A+ rated.
• Efficient mechanical services system or a building management system – computer systems which control and monitor a building's mechanical and electrical equipment. Their main aim is to control the internal environment, but in doing so can also reduce the energy consumption of a building.
• Using heat recovery systems. Mechanical Ventilation with Heat Recovery (MVHR) conserves energy by recovering heat from stale warm air leaving a building and transferring the heat to the cooler incoming air.
• Energy monitoring, metering and controls should be used to inform and facilitate changes in user behaviour.

Cooling hierarchy

All developments should follow the cooling hierarchy outlined below, to reduce the risk of overheating and subsequent reliance on active cooling:

1. Minimise internal heat generation through energy efficient design, considering the following:

- *Layout and uses: locate any spaces that need to be kept cool or that generate heat on cooler sides of developments.*
- *Reducing heat gains e.g. including low energy lighting.*
- *Seal/insulate heat generating processes.*
- *Reduce the distance heat needs to travel and insulate pipework.*
- *Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.*
- *Consider evaporation cooling which cools air through the evaporation of water.*
- *Consider 'free cooling' or 'night cooling', which uses the cooling capacity of ambient air to directly cool the space.*

2. Reduce the amount of heat entering a building in summer:

- *Consider the angle of the sun and optimum daylight and solar gain balance.*
- *Orientate and recess windows and openings to avoid excessive solar gain.*
- *Consider low g-values and the proportion, size and location of windows.*
- *Make use of shadowing from other buildings.*
- *Include adequate insulation.*
- *Design in shading: e.g. include internal courtyards, large shade-providing trees and vegetation, balconies, louvers, internal or external blinds, and shutters.*
- *Make use of the albedo effect (use light coloured or reflective materials to reflect the sun's rays).*
- *Include green infrastructure e.g. green wall, green/blue roofs and landscaping, to regulate temperatures.*
- *Reduce the amount of heat entering a building in summer.*

3. Manage the heat within the building through exposed internal thermal mass and high ceilings, (see 'Thermal performance' Chapter 3 of this CPG).

4. Passive ventilation:

- *Natural ventilation, openable windows, the 'stack effect' system (see Chapter 3 of this guidance).*
- *Design layouts to promote natural ventilation e.g. shallow floor plans and high floor to ceiling heights.*
- *Consider evaporation cooling which cools air through the evaporation of water.*
- *Consider 'free cooling' or 'night cooling' which uses the cooling capacity of ambient air to directly cool the space*

5. Mechanical ventilation:

- *Ensuring the most efficient system possible.*
- *Consider mechanical ventilation with heat recovery*

6. Active cooling:

- *Ensuring they are the lowest carbon options.*
- *Ground Source Heat Pumps and Air Source Heat Pumps can be used in reverse to provide cooling to buildings.*
- *Water based cooling systems also reduce the need for air conditioning by running cold water through pipes in the floor and/or ceiling to cool the air.*

The Guidance note also covers the following points:

- The reuse of existing buildings is the most sustainable form of development;
- Opportunities to improve the carbon performance of the existing stock should be taken;
- The implications of conservation areas should be taken into account where applicable.

4.4 Policy Analysis and Discussion

The public house will be retained and refurbished as a minor refurbishment with internal alterations to layout. The 7 apartments created by the change of use refurbishment and extension on the upper floors do not constitute a major development in terms of the GLA policy thresholds. The residential element is marginally over the local policy threshold which encourages but does not require BREEAM Refurbishment. In this case, with the conservation area constraints, substantial focus from the heritage team within the Council on the aesthetic treatment of the scheme, and the limitations superimposed by the retention of the façade, BREEAM Refurbishment would be an impractical and costly imposition on the project. Nevertheless, the scheme is looking to address sustainable development and the next sections set out how this can be achieved.

5 ENERGY APPRAISAL

5.1 Part L 2022

At the point of drafting this report, it is anticipated that the residential element will be subject to Part L1B as units that are created through a change of use, and that the pub use may be subject to Part L2B albeit constrained by the heritage considerations in this regard.

5.2 Siting and Orientation and Passive Design

The proposals look to retain the extant building, which in itself is recognised as a sustainable form of development, as driven by the adopted GLA policies on the circular economy and life cycle carbon assessments.

As a form of building, it is inherently sustainable from a thermal efficiency perspective. There are many shared party floors and walls, reducing heat loss areas. In terms of orientation, the site is as it is presented - the two main facades facing North and East. This is a good approach to managing excessive solar gain and summertime overheating. The higher risk facades (South and West) have limited apertures which are shaded by the building form. In addition to this, low g-glass can be used to the South and West facades to further reduce unwanted solar gain.

There may be limits on what is achievable in terms of internal efficiency and insulation measures due to the conservation aspects of the scheme. At this stage, an assumption has had to be made that the expectations of Part L1B can be met, although this will have to be carefully reconsidered at the Building Control stage. This includes the reprovision of all glazing as double-glazed, and the insulating of walls internally to achieve a U-value of 0.30W/m2K.

5.3 Efficient Services

The proposals will incorporate the following measures to maximise energy efficiency:

- Building fabric in line with Part L regulations where the design permits and conservation area requirements do not limit the potential;
- Low energy lighting using LEDs throughout;
- Smart heating and hot water controls;
- Low energy appliances where provided;
- Clothes drying facilities.

5.4 Renewable Energy Appraisal

5.4.1 Communal Renewable Heat

All renewable heating technology that requires communal heating is not recommended at this stage due to the small scale of the development and the lack of space for communal plant. This discounts the following:

- Biomass
- Biogas
- Communal heat pumps

5.4.2 Individual Heat Pumps

Individual heat pumps could be incorporated in a number of ways to help provide low carbon heating and/or hot water for the residential units. External condenser units to the balconies of each unit to the rear were considered but would have acoustic issues. Therefore, the use of internal hot water heat pumps are proposed in lieu. It is assumed at this stage that the pub can utilise heat pumps for its own energy requirements.

5.4.3 Solar Photo-Voltaics

Solar PV is to be integrated - the roof plan sets out how the panels might be arranged.

5.4.4 Wind Energy

The urban profile for wind power is very poor. This is technically not a practical solution for the urban environment.

5.5 CO2 Modelling

The scheme was modelled using SAP 10. As noted previously, when the analysis was done, the software was newly published and subject to numerous bugs and issues. As a result, all outputs should be read with caution.

The proposed system integrates heat pumps and solar PV to achieve substantial onsite savings. The outputs from SAP 10 provided the following:

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	25.7		
Be lean	25.7	0.0	0%
Be clean	25.7	0.0	0%
Be green	9.5	16.2	63%
Total Savings	-	16.2	63%

Figure 2 – Emissions Summary Table

The figures above demonstrate that if individual hot water heat pumps and solar PV were used, the scheme could achieve savings in the region of 63%. The exact figures would vary depending upon the final specification to be determined at the Building Control stage.

6 SUSTAINABILITY APPRAISAL

6.1 Climate Change

Energy in building use is a key contributor to the UK's carbon emissions. The energy hierarchy sets out the order of importance for the adoption of different carbon saving measures:

- Reduce energy use;
- Use renewable energy;
- Use low carbon energy sources.

The scheme will also strive to utilise low CO2 impact materials in its construction including:

- Using low climate change impact building materials;
- Sourcing sustainable timber;
- Using low or zero global warming impact insulation materials.

6.2 Water

The internal specification will be designed to manage water use and to achieve the 105 litres per person per day target. Whilst the exact specification will be determined at the Building Control stage, an indicative specification is set out below:

Installation Type	Average Capacity/Flow Rate	Litres/Person/Day
Single Flush WC's	0	0
Dual Flush WC's	3.06	13.53
All WC's	3.06	13.53
Kitchen/Utility Room Taps	4	12.12
Other Taps	4	7.9
Baths	140	15.4
Showers	9	39.33
Dishwashers	1.25	4.5
Washing Machines	8.17	17.16
Water Softener		
Waste Disposal Unit	Not Present	0
Total Water Use	109.94 Litres/Person/Day	
Contribution from Rain Water	0 Litres/Person/Day	
Contribution from Grey Water	0 Litres/Person/Day	
Normalisation Factor	0.91 Litres/Person/Day	

Code for Sustainable Homes - Consumptions & Credits	
Water Consumption (Code for Sustainable Homes)	100 Litres/Person/Day
Credits Scored	3

Building Regulations 2000 AD Part G (2010 Ed) - Consumption	
External Water Use	5 Litres/Person/Day
Water Consumption (Building Regulation 17 K)	105 Litres/Person/Day

6.3 Sustainable Transport

The site has good bus and rail links and incorporates secure cycle storage spaces for residents. The apartments will incorporate facilities for home office working. This will include appropriate services including phone line connections, broadband and power sockets.

6.4 Materials and Resource Efficiency

Materials resource efficiency will be achieved through the scale of development, which by its very nature should achieve high materials efficiencies and low waste volumes. Certified timber such as FSC and PEFC is widely available and commonly used throughout major development schemes. There will be a preference for using materials that score good ratings in the Green Guide to Specification.

6.5 Waste Strategy

A waste management plan will be put in place to reduce site waste generation typically using some or all of the following:

1. Identification of pre-requisites for waste contractors and sub-contractors;
2. Identification of key parties and individuals responsible for waste monitoring and management (main contractor, waste sub-contractors);
3. Identification of appropriate benchmarks for waste generation/recycling including the use of appropriate tools for generating suitable benchmarks for the development such as;
    a. WRAP Net Waste Tool;
    b. BRE SMART Waste;
4. Identification of processes for dealing with different waste streams;
5. Processes for monitoring total waste arisings, proportion reused onsite, proportion recycled offsite, proportion sent to landfill;
6. Reporting mechanisms to capture the waste management data.

During occupation, all units will be required to provide waste segregation and recycling both internally and externally to the local authority standards. This will incorporate:

- Internal waste segregation into the waste streams collected locally;
- External segregation providing bin stores for the streams as above.

Residents will be provided with information on the local recycling collections.

6.6 Urban Heat Island

The scheme will mitigate its impacts upon the urban heat island effect through the following measures:

- Use of heat pumps to extract heat from the local air to provide heating and hot water;
- Use of high albedo finishes where appropriate .

6.7 Pollution

The approach is to use electrically driven solutions including air-source heat pumps, resulting in zero localised emissions of NOx and PM10.

6.8 Land Use and Ecology

The opportunities for habitat creation will be limited due to the size of the development. However, niche habitats such as bat and bird boxes will be included where appropriate.

6.9 Socio-Economic

The scheme will provide employment during construction but will also deliver new high-performance dwellings in a well-connected area.

7 CONCLUSION

7.1 Proposals

This document has been prepared to help inform and assess the energy and sustainability aspects of the proposed development of 7 new apartments and a refurbished public house at 17 York Way, N7 9QG. The applicant has taken a pro-active approach to addressing both energy and sustainability during the design stage of the development.

For the proposals, the scheme is not a major refurbishment as it does not meet either threshold. As a result the requirements to seek to achieve the carbon standards in the London Plan do not apply. Nevertheless, the process outlined above is employed to seek to address the CO2 emissions from the development.

7.2 Sustainable Development

The proposed development addresses the Local Plan policies. The strategy identified in this report sets out the following:

- Energy efficiency measures:
  - LED lighting throughout;
  - Demanding U-values where heritage concerns allow;
  - Addressing air tightness;
- Renewable energy through heat pumps for hot water provision;
- Sustainable materials;
- Inclusion of niche habitats;
- Cycle parking;
- Waste segregation;
- Low water usage.

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	25.7		
Be lean	25.7	0.0	0%
Be clean	25.7	0.0	0%
Be green	9.5	16.2	63%
Total Savings	-	16.2	63%

Figure 3 – Emissions Summary Table

7.3 Policy Compliance

The proposed development aims to achieve a wide range of sustainable benefits – economic, social and environmental. Further, the scheme has addressed the policies within the Local Plan. As a change of use project, it has followed the GLA guidance and has show to be addressing CO2 emissions effectively.

Through the NPPF's definition of sustainable development the proposal can be considered sustainable.

APPENDIX

DER and TER Calculations

Full SAP Calculation Printout

Property Reference	York Way	Issued on Date	30/06/2023
Assessment Reference	2.01 Actual	Prop Type Ref	York Way
Property	York Way, -		

SAP Rating	66 D	DER	9.63	TER	12.64
Environmental	93 A	% DER < TER			23.81
CO_2 Emissions (t/year)	0.49	DFEE	56.52	TFEE	28.63
Compliance Check	See BREL	% DFEE < TFEE			-97.42
% DPER < TPER	-48.08	DPER	99.27	TPER	67.04

Assessor Details	Mr. Jonathan Lewis	Assessor ID	AZ32-0001
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	61.0000 (1b)	x	2.6000 (2b)	=	158.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1261	(8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.8761	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7447	(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	0.9495	0.9309	0.9122	0.8192	0.8005	0.7075	0.7075	0.6888	0.7447	0.8005	0.8378	0.8750	(22b)
Effective ac	0.9508	0.9333	0.9161	0.8355	0.8204	0.7502	0.7502	0.7372	0.7773	0.8204	0.8509	0.8828	(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	
Windows (Uw = 1.60)			18.0000	1.5038	27.0677			(27)
External Wall 1	60.8000	18.0000	42.8000	0.3000	12.8400			(29a)
Total net area of external elements Aum(A, m2)			60.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.9077			(33)
Party Floor 1			61.0000					(32d)
Party Ceiling 1			61.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

Thermal bridges (Default value 0.200 * total exposed area) 12.1600 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.0677 (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	49.7605	48.8444	47.9465	43.7289	42.9398	39.2663	39.2663	38.5861	40.6813	42.9398	44.5361	46.2050	(38)
Heat transfer coeff	101.8282	100.9121	100.0142	95.7965	95.0074	91.3340	91.3340	90.6537	92.7490	95.0074	96.6038	98.2727	(39)

Average = Sum(39)m / 12 = 95.7928

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6693	1.6543	1.6396	1.5704	1.5575	1.4973	1.4973	1.4861	1.5205	1.5575	1.5837	1.6110	(40)
HLP (average)												1.5704	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

66.7466	65.7553	64.3594	61.7855	59.8583	57.7212	56.5669	57.9531	59.4624	61.7491	64.3759	66.5210	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 93.8955 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9586	99.6869	97.0105	93.1562	89.9485	86.5311	85.3767	88.0433	90.8331	94.4002	98.3075	101.7329	(44)
Energy conte	161.4775	141.9528	149.1015	127.5262	121.0880	106.4000	103.2558	109.0160	112.0062	128.1002	140.0570	159.2892	(45)

Energy content (annual) Total = Sum(45)m = 1559.2704

Distribution loss (46)m = 0.15 x (45)m												
24.2216	21.2929	22.3652	19.1289	18.1632	15.9600	15.4884	16.3524	16.8009	19.2150	21.0086	23.8934	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)
Total storage loss

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)

If cylinder contains dedicated solar storage

32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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

193.6183	170.9832	181.2423	158.6302	153.2288	137.5040	135.3966	141.1568	143.1102	160.2410	171.1610	191.4300	(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												
193.6183	170.9832	181.2423	158.6302	153.2288	137.5040	135.3966	141.1568	143.1102	160.2410	171.1610	191.4300	(64)

Total per year (kWh/year) = Sum(64)m = 1937.7024 (64)
12Total per year (kWh/year) 1938 (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

53.6913	47.1993	49.5763	42.4025	40.2618	35.3780	34.3325	36.2478	37.2421	42.5933	46.5690	52.9637	(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	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5003	97.9825	88.5003	91.4503	88.5003	91.4503	88.5003	88.5003	91.4503	88.5003	91.4503	88.5003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
Pumps, fans	9.5160	9.5160	9.5160	9.5160	9.5160	0.0000	0.0000	0.0000	0.0000	9.5160	9.5160	9.5160	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	72.1657	70.2370	66.6348	58.8923	54.1153	49.1361	46.1459	48.7202	51.7251	57.2491	64.6791	71.1877	(72)
Total internal gains	398.7901	408.1644	390.4918	375.9316	355.8744	332.7408	319.0587	319.8123	330.3554	352.2131	374.9232	390.0703	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

					W/m2	or Table 6b		or Table 6c		Table 6d			
North					11.9000	10.6334		0.6300		0.7000		0.7700	38.6715 (74)
East					1.7000	19.6403		0.6300		0.7000		0.7700	10.2039 (76)
South					4.4000	46.7521		0.6300		0.7000		0.7700	62.8674 (78)
Solar gains	111.7428	196.8248	289.6060	397.8882	484.9490	499.6914	474.0897	405.7063	326.2253	222.7102	134.9486	94.9529	(83)
Total gains	510.5329	604.9892	680.0978	773.8197	840.8234	832.4322	793.1485	725.5185	656.5807	574.9233	509.8719	485.0232	(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	16.6402	16.7913	16.9420	17.6880	17.8349	18.5522	18.5522	18.6914	18.2691	17.8349	17.5401	17.2423	
alpha	2.1093	2.1194	2.1295	2.1792	2.1890	2.2368	2.2368	2.2461	2.2179	2.1890	2.1693	2.1495	
util living area	0.9434	0.9189	0.8832	0.8095	0.7033	0.5631	0.4452	0.4903	0.6804	0.8446	0.9204	0.9482	(86)
MIT	17.5466	17.9586	18.5719	19.4455	20.1439	20.6544	20.8546	20.8165	20.4275	19.5279	18.4613	17.5666	(87)
Th2 (88a)m	19.5629	19.5738	19.5844	19.6351	19.6447	19.6895	19.6895	19.6979	19.6722	19.6447	19.6253	19.6053	(88a)
ni2,m (89a)m	0.9338	0.9055	0.8632	0.7762	0.6487	0.4795	0.3322	0.3770	0.6037	0.8099	0.9051	0.9395	(89a)
MIT2 (90a)m	15.6648	16.1821	16.9487	18.0372	18.8592	19.4381	19.6181	19.6003	19.2148	18.1679	16.8412	15.7038	(90a)
Th2 (88b)m	19.5629	19.5738	19.5844	19.6351	19.6447	19.6895	19.6895	19.6979	19.6722	19.6447	19.6253	19.6053	(88b)
ni2,m (89b)m	0.9338	0.9055	0.8632	0.7762	0.6487	0.4795	0.3322	0.3770	0.6037	0.8099	0.9051	0.9395	(89b)
MIT2 (90b)m	15.6648	16.1821	16.9487	18.0372	18.8592	19.4381	19.6181	19.6003	19.2148	18.1679	16.8412	15.7038	(90b)
MIT 2	15.6648	16.1821	16.9487	18.0372	18.8592	19.4381	19.6181	19.6003	19.2148	18.1679	16.8412	15.7038	(90)
Living area fraction										fLA = Living area / (4) =		0.3279	(91)
MIT	16.2818	16.7646	17.4809	18.4989	19.2804	19.8369	20.0235	19.9991	19.6124	18.6138	17.3724	16.3146	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.2818	16.7646	17.4809	18.4989	19.2804	19.8369	20.0235	19.9991	19.6124	18.6138	17.3724	16.3146	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9008	0.8679	0.8233	0.7423	0.6319	0.4897	0.3629	0.4053	0.5997	0.7762	0.8695	0.9086	(94)
Useful gains	459.8981	525.0475	559.9584	574.3930	531.3013	407.6296	287.8485	294.0333	393.7631	446.2625	443.3465	440.6890	(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	1220.0821	1197.2801	1098.2408	919.5437	720.1939	478.3050	312.6839	326.2688	511.2709	761.3719	992.3530	1190.5314	(97)
Space heating kWh	565.5769	451.7403	400.4821	248.5085	140.5361	0.0000	0.0000	0.0000	0.0000	234.4413	395.2847	557.8828	(98a)
Space heating requirement - total per year (kWh/year)												2994.4526	
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	565.5769	451.7403	400.4821	248.5085	140.5361	0.0000	0.0000	0.0000	0.0000	234.4413	395.2847	557.8828	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2994.4526	
Space heating per m2											(98c) / (4) =	49.0894	(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)
Fraction of main heating from main system 2	0.0001 (203)
Fraction of total heating from main system 1	0.9999 (204)
Fraction of total heating from main system 2	0.0001 (205)
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	565.5769	451.7403	400.4821	248.5085	140.5361	0.0000	0.0000	0.0000	0.0000	234.4413	395.2847	557.8828	(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)	565.5203	451.6951	400.4421	248.4836	140.5221	0.0000	0.0000	0.0000	0.0000	234.4179	395.2451	557.8270	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	193.6183	170.9832	181.2423	158.6302	153.2288	137.5040	135.3966	141.1568	143.1102	160.2410	171.1610	191.4300	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	63.9099	56.4385	59.8248	52.3610	50.5781	45.3876	44.6920	46.5933	47.2381	52.8927	56.4972	63.1876	(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	8.0821	7.2999	8.0821	7.8214	8.0821	7.8214	8.0821	8.0821	7.8214	8.0821	7.8214	8.0821 (231)
Lighting	18.8146	15.0938	13.5903	9.9568	7.6909	6.2835	7.0159	9.1196	11.8454	15.5418	17.5544	19.3375 (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	2994.1532 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	302.9550
Water heating fuel used	639.6007 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
warm air heating system fans	95.1600 (230b)
Total electricity for the above, kWh/year	95.1600 (231)
Electricity for lighting (calculated in Appendix L)	151.8444 (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	3880.7584 (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	2994.1532	0.1544	462.2894	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	639.6007	0.1410	90.1775	(264)
Space and water heating			552.4669	(265)
Pumps, fans and electric keep-hot	95.1600	0.1387	13.1999	(267)
Energy for lighting	151.8444	0.1443	21.9158	(268)
Total CO2, kg/year			587.5826	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.6300	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2994.1532	1.5716	4705.6542	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	639.6007	1.5213	973.0471	(278)
Space and water heating			5678.7013	(279)
Pumps, fans and electric keep-hot	95.1600	1.5128	143.9580	(281)
Energy for lighting	151.8444	1.5338	232.9041	(282)
Total Primary energy kWh/year			6055.5634	(286)
Dwelling Primary energy Rate (DPER)			99.2700	(287)

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

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1. Overall dwelling characteristics

	Area	Storey height	Volume

	(m2)		(m)		(m3)	
Ground floor	61.0000 (1b)	x	2.6000 (2b)	=	158.6000 (1b) -	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		158.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3197	(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	0.4076	0.3996	0.3916	0.3517	0.3437	0.3037	0.3037	0.2957	0.3197	0.3437	0.3596	0.3756	(22b)
Effective ac	0.5831	0.5798	0.5767	0.5618	0.5591	0.5461	0.5461	0.5437	0.5511	0.5591	0.5647	0.5706	(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 Opening Type (Uw = 1.20)			15.2500	1.1450	17.4618			(27)
External Wall 1	60.8000	15.2500	45.5500	0.1800	8.1990			(29a)
Total net area of external elements Aum(A, m2)			60.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.6608			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							3.0400	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		28.7008	(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	30.5167	30.3479	30.1824	29.4051	29.2597	28.5827	28.5827	28.4574	28.8435	29.2597	29.5539	29.8615	(38)
Heat transfer coeff	59.2175	59.0487	58.8832	58.1060	57.9605	57.2836	57.2836	57.1582	57.5443	57.9605	58.2547	58.5623	(39)
Average = Sum(39)m / 12 =												58.1053	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9708	0.9680	0.9653	0.9526	0.9502	0.9391	0.9391	0.9370	0.9433	0.9502	0.9550	0.9600	(40)
HLP (average)												0.9525	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0098	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	66.7466	65.7553	64.3594	61.7855	59.8583	57.7212	56.5669	57.9531	59.4624	61.7491	64.3759	66.5210	(42b)
Hot water usage for other uses	35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)
Average daily hot water use (litres/day)												93.8955	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9586	99.6869	97.0105	93.1562	89.9485	86.5311	85.3767	88.0433	90.8331	94.4002	98.3075	101.7329	(44)
Energy conte	161.4775	141.9528	149.1015	127.5262	121.0880	106.4000	103.2558	109.0160	112.0062	128.1002	140.0570	159.2892	(45)
Energy content (annual)										Total = Sum(45)m =		1559.2704	
Distribution loss (46)m = 0.15 x (45)m	24.2216	21.2929	22.3652	19.1289	18.1632	15.9600	15.4884	16.3524	16.8009	19.2150	21.0086	23.8934	(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)
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)
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)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

208.0724	184.0385	195.6964	172.6181	167.6829	151.4919	149.8507	155.6109	157.0981	174.6951	185.1489	205.8841	(62)
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)
-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)
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)
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)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

208.0724	184.0385	195.6964	172.6181	167.6829	151.4919	149.8507	155.6109	157.0981	174.6951	185.1489	205.8841	(64)

Total per year (kWh/year) = Sum(64)m = 2107.8878 (64)
12Total per year (kWh/year) 2108 (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

90.9672	80.8679	86.8522	78.4759	77.5377	71.4515	71.6085	73.5238	73.3155	79.8692	82.6424	90.2396	(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	
100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)m

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

88.5003	97.9825	88.5003	91.4503	88.5003	91.4503	88.5003	88.5003	91.4503	88.5003	91.4503	88.5003	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(69)
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)

Pumps, fans
Losses e.g. evaporation (negative values) (Table 5)

-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)

Water heating gains (Table 5)

122.2677	120.3391	116.7368	108.9944	104.2173	99.2382	96.2479	98.8223	101.8271	107.3511	114.7812	121.2898	(72)

Total internal gains

442.3762	451.7505	434.0778	419.5176	399.4605	382.8428	369.1608	369.9143	380.4575	395.7992	418.5093	433.6564	(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	10.0800	10.6334	0.6300	0.7000	0.7700	32.7570	(74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	3.7300	46.7521	0.6300	0.7000	0.7700	53.2944	(78)

94.6947	166.7910	245.4010	337.1338	410.8836	423.3674	401.6790	343.7513	276.4236	188.7228	114.3592	80.4670	(83)
537.0709	618.5415	679.4788	756.6514	810.3441	806.2102	770.8398	713.6657	656.8810	584.5220	532.8685	514.1234	(84)

Solar gains
Total gains

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	
28.6139	28.6957	28.7764	29.1613	29.2345	29.5799	29.5799	29.6448	29.4459	29.2345	29.0868	28.9341	
2.9076	2.9130	2.9184	2.9441	2.9490	2.9720	2.9720	2.9763	2.9631	2.9490	2.9391	2.9289	

tau
alpha
util living area

0.9147	0.8773	0.8227	0.7184	0.5815	0.4298	0.3189	0.3563	0.5422	0.7581	0.8762	0.9226	(86)

19.2262	19.5441	19.9471	20.4277	20.7565	20.9275	20.9777	20.9687	20.8527	20.4266	19.7709	19.1767	(87)
20.1078	20.1101	20.1124	20.1231	20.1251	20.1344	20.1344	20.1361	20.1308	20.1251	20.1210	20.1168	(88)

MIT
Th 2
util rest of house

0.9043	0.8632	0.8027	0.6886	0.5404	0.3780	0.2590	0.2934	0.4874	0.7251	0.8597	0.9131	(89)
18.0478	18.4425	18.9386	19.5195	19.8928	20.0774	20.1214	20.1169	20.0067	19.5339	18.7389	17.9922	(90)

MIT 2
Living area fraction fLA = Living area / (4) = 0.3279 (91)

18.4341	18.8037	19.2692	19.8173	20.1760	20.3562	20.4021	20.3962	20.2841	19.8266	19.0773	18.3806	(92)
											0.0000	
18.4341	18.8037	19.2692	19.8173	20.1760	20.3562	20.4021	20.3962	20.2841	19.8266	19.0773	18.3806	(93)

MIT
Temperature adjustment
adjusted MIT

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8802	0.8386	0.7812	0.6774	0.5429	0.3915	0.2778	0.3126	0.4975	0.7127	0.8364	0.8897	(94)
Useful gains	472.7342	518.7251	530.8073	512.5892	439.9418	315.6595	214.1226	223.1258	326.7758	416.5707	445.7158	457.4275	(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	836.9883	820.9936	751.8933	634.3576	491.2728	329.7334	217.7985	228.4140	355.8599	534.7804	697.7322	830.4477	(97)
Space heating kWh	271.0051	203.1245	164.4880	87.6733	38.1902	0.0000	0.0000	0.0000	0.0000	87.9480	181.4518	277.5270	(98a)
Space heating requirement - total per year (kWh/year)												1311.4079	
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	271.0051	203.1245	164.4880	87.6733	38.1902	0.0000	0.0000	0.0000	0.0000	87.9480	181.4518	277.5270	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1311.4079	
Space heating per m2											(98c) / (4) =	21.4985	(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	271.0051	203.1245	164.4880	87.6733	38.1902	0.0000	0.0000	0.0000	0.0000	87.9480	181.4518	277.5270	(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)	293.6133	220.0698	178.2102	94.9873	41.3762	0.0000	0.0000	0.0000	0.0000	95.2850	196.5892	300.6793	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	208.0724	184.0385	195.6964	172.6181	167.6829	151.4919	149.8507	155.6109	157.0981	174.6951	185.1489	205.8841	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.6534	84.2816	83.6728	82.6205	81.3291	79.8000	79.8000	79.8000	79.8000	82.6034	84.0146	84.7301	(217)
Fuel for water heating, kWh/month	245.7933	218.3615	233.8830	208.9289	206.1783	189.8394	187.7828	195.0012	196.8648	211.4865	220.3771	242.9881	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.3886	14.7520	13.2826	9.7314	7.5168	6.1413	6.8571	8.9131	11.5772	15.1899	17.1570	18.8997	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.4234	-24.3759	-36.8704	-43.7033	-49.1165	-46.5884	-46.0313	-42.4694	-36.5315	-28.8599	-18.4880	-14.0608	(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	-5.9056	-12.6976	-25.7521	-39.4401	-52.8960	-53.4109	-52.7717	-44.3302	-32.0414	-18.3949	-7.9609	-4.6491	(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	1420.8103	(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	2557.4849	(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)	148.4066	(232)

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

PV generation	-753.7695	(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	3458.9324	(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	1420.8103	0.2100	298.3702	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2557.4849	0.2100	537.0718	(264)
Space and water heating			835.4420	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.4066	0.1443	21.4197	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-403.5189	0.1335	-53.8733	
PV Unit electricity exported	-350.2506	0.1253	-43.8982	
Total			-97.7715	(269)
Total CO2, kg/year			771.0194	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6400	(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	1420.8103	1.1300	1605.5157	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2557.4849	1.1300	2889.9579	(278)
Space and water heating			4495.4736	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.4066	1.5338	227.6311	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-403.5189	1.4934	-602.6008	
PV Unit electricity exported	-350.2506	0.4600	-161.1272	
Total			-763.7280	(283)
Total Primary energy kWh/year			4089.4775	(286)
Target Primary Energy Rate (TPER)			67.0400	(287)

Full SAP Calculation Printout

Property Reference	York Way	Issued on Date	30/06/2023
Assessment Reference	2.01 BAU	Prop Type Ref	York Way
Property	York Way, -		

SAP Rating	81 B	DER	22.36	TER	12.90
Environmental	83 B	% DER < TER			-73.33
CO_2 Emissions (t/year)	1.18	DFEE	56.52	TFEE	28.63
Compliance Check	See BREL	% DFEE < TFEE			-97.42
% DPER < TPER	-79.34	DPER	122.74	TPER	68.44

Assessor Details	Mr. Jonathan Lewis	Assessor ID	AZ32-0001
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	61.0000 (1b)	x	2.6000 (2b)	=	158.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1261 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.8761 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7447 (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	0.9495	0.9309	0.9122	0.8192	0.8005	0.7075	0.7075	0.6888	0.7447	0.8005	0.8378	0.8750	(22b)
Effective ac	0.9508	0.9333	0.9161	0.8355	0.8204	0.7502	0.7502	0.7372	0.7773	0.8204	0.8509	0.8828	(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	
Windows (Uw = 1.60)			18.0000	1.5038	27.0677			(27)
External Wall 1	60.8000	18.0000	42.8000	0.3000	12.8400			(29a)
Total net area of external elements Aum(A, m2)			60.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.9077			(33)
Party Floor 1			61.0000					(32d)
Party Ceiling 1			61.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

Thermal bridges (Default value 0.200 * total exposed area) 12.1600 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.0677 (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	49.7605	48.8444	47.9465	43.7289	42.9398	39.2663	39.2663	38.5861	40.6813	42.9398	44.5361	46.2050	(38)
Heat transfer coeff	101.8282	100.9121	100.0142	95.7965	95.0074	91.3340	91.3340	90.6537	92.7490	95.0074	96.6038	98.2727	(39)

Average = Sum(39)m / 12 = 95.7928

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6693	1.6543	1.6396	1.5704	1.5575	1.4973	1.4973	1.4861	1.5205	1.5575	1.5837	1.6110	(40)
HLP (average)												1.5704	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0098 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

66.7466	65.7553	64.3594	61.7855	59.8583	57.7212	56.5669	57.9531	59.4624	61.7491	64.3759	66.5210	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day) 93.8955 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9586	99.6869	97.0105	93.1562	89.9485	86.5311	85.3767	88.0433	90.8331	94.4002	98.3075	101.7329	(44)
Energy conte	161.4775	141.9528	149.1015	127.5262	121.0880	106.4000	103.2558	109.0160	112.0062	128.1002	140.0570	159.2892	(45)

Energy content (annual) Total = Sum(45)m = 1559.2704

Distribution loss (46)m = 0.15 x (45)m

24.2216	21.2929	22.3652	19.1289	18.1632	15.9600	15.4884	16.3524	16.8009	19.2150	21.0086	23.8934	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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)
50.9589	45.8833	49.4355	45.9401	45.8368	42.6728	43.5070	44.8659	44.7944	48.1053	48.4804	50.9589	(61)

Total heat required for water heating calculated for each month

212.4364	187.8360	198.5370	173.4663	166.9248	149.0729	146.7628	153.8820	156.8006	176.2055	188.5374	210.2481	(62)
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)
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)
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)
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

212.4364	187.8360	198.5370	173.4663	166.9248	149.0729	146.7628	153.8820	156.8006	176.2055	188.5374	210.2481	(64)

Total per year (kWh/year) = Sum(64)m = 2120.7098 (64)

12Total per year (kWh/year) 2121 (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

66.4310	58.6701	61.9351	53.8875	51.7210	46.0462	45.2093	47.4643	48.4407	54.6196	58.6891	65.7034	(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	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.5003	97.9825	88.5003	91.4503	88.5003	91.4503	88.5003	88.5003	91.4503	88.5003	91.4503	88.5003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(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)	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)	89.2890	87.3067	83.2461	74.8437	69.5174	63.9531	60.7652	63.7961	67.2787	73.4135	81.5126	88.3110	(72)
Total internal gains	409.3974	418.7181	400.5871	385.3670	364.7606	347.5578	333.6780	334.8882	345.9090	361.8616	385.2407	400.6776	(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	11.9000	10.6334	0.6300	0.7000	0.7700	38.6715	(74)
East	1.7000	19.6403	0.6300	0.7000	0.7700	10.2039	(76)

South				4.4000		46.7521		0.6300		0.7000		0.7700	62.8674 (78)
Solar gains	111.7428	196.8248	289.6060	397.8882	484.9490	499.6914	474.0897	405.7063	326.2253	222.7102	134.9486	94.9529 (83)	
Total gains	521.1402	615.5429	690.1932	783.2552	849.7096	847.2492	807.7678	740.5945	672.1343	584.5717	520.1893	495.6305 (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	16.6402	16.7913	16.9420	17.6880	17.8349	18.5522	18.5522	18.6914	18.2691	17.8349	17.5401	17.2423	
alpha	2.1093	2.1194	2.1295	2.1792	2.1890	2.2368	2.2368	2.2461	2.2179	2.1890	2.1693	2.1495	
util living area													
	0.9413	0.9166	0.8805	0.8063	0.6997	0.5565	0.4389	0.4829	0.6722	0.8407	0.9176	0.9461 (86)	
MIT	17.5719	17.9821	18.5920	19.4604	20.1534	20.6628	20.8589	20.8223	20.4425	19.5452	18.4847	17.5927 (87)	
Th 2	19.5629	19.5738	19.5844	19.6351	19.6447	19.6895	19.6895	19.6979	19.6722	19.6447	19.6253	19.6053 (88)	
util rest of house													
	0.9314	0.9028	0.8601	0.7726	0.6449	0.4732	0.3270	0.3706	0.5951	0.8055	0.9019	0.9371 (89)	
MIT 2	16.5348	16.9413	17.5409	18.4002	19.0388	19.4987	19.6356	19.6245	19.3260	18.5068	17.4723	16.5802 (90)	
Living area fraction											fLA = Living area / (4) =	0.3279 (91)	
MIT	16.8748	17.2825	17.8855	18.7478	19.4043	19.8804	20.0367	20.0172	19.6921	18.8472	17.8042	16.9121 (92)	
Temperature adjustment												0.0000	
adjusted MIT	16.8748	17.2825	17.8855	18.7478	19.4043	19.8804	20.0367	20.0172	19.6921	18.8472	17.8042	16.9121 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9052	0.8729	0.8286	0.7465	0.6339	0.4863	0.3585	0.4002	0.5964	0.7797	0.8737	0.9125 (94)	
Useful gains	471.7231	537.3037	571.9008	584.7021	538.6556	412.0341	289.5795	296.3568	400.8558	455.8042	454.5143	452.2849 (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													
	1280.4685	1249.5481	1138.7112	943.3868	731.9631	482.2790	313.8865	327.9122	518.6601	783.5475	1034.0692	1249.2569 (97)	
Space heating kWh													
	601.7066	478.6282	421.7069	258.2530	143.8208	0.0000	0.0000	0.0000	0.0000	243.8410	417.2795	592.9472 (98a)	
Space heating requirement - total per year (kWh/year)												3158.1833	
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													
	601.7066	478.6282	421.7069	258.2530	143.8208	0.0000	0.0000	0.0000	0.0000	243.8410	417.2795	592.9472 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												3158.1833	
Space heating per m2											(98c) / (4) =	51.7735 (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 %)												81.0000 (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													
	601.7066	478.6282	421.7069	258.2530	143.8208	0.0000	0.0000	0.0000	0.0000	243.8410	417.2795	592.9472 (98)	
Space heating efficiency (main heating system 1)													
	81.0000	81.0000	81.0000	81.0000	81.0000	0.0000	0.0000	0.0000	0.0000	81.0000	81.0000	81.0000 (210)	
Space heating fuel (main heating system)													
	742.8476	590.8990	520.6258	318.8308	177.5565	0.0000	0.0000	0.0000	0.0000	301.0383	515.1599	732.0335 (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													
	212.4364	187.8360	198.5370	173.4663	166.9248	149.0729	146.7628	153.8820	156.8006	176.2055	188.5374	210.2481 (64)	
Efficiency of water heater												86.0000 (216)	
(217)m	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000 (217)	
Fuel for water heating, kWh/month													
	247.0190	218.4140	230.8570	201.7050	194.0986	173.3405	170.6544	178.9325	182.3263	204.8901	219.2296	244.4745 (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	3.4822	3.1452	3.4822	3.3699	3.4822	3.3699	3.4822	3.4822	3.3699	3.4822	3.3699	3.4822 (231)	
Lighting	18.8146	15.0938	13.5903	9.9568	7.6909	6.2835	7.0159	9.1196	11.8454	15.5418	17.5544	19.3375 (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	3898.9917 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	86.0000
Water heating fuel used	2465.9416 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
Total electricity for the above, kWh/year	41.0000 (231)
Electricity for lighting (calculated in Appendix L)	151.8444 (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	6557.7777 (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	3898.9917	0.2100	818.7883	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2465.9416	0.2100	517.8477	(264)
Space and water heating			1336.6360	(265)
Pumps, fans and electric keep-hot	41.0000	0.1387	5.6872	(267)
Energy for lighting	151.8444	0.1443	21.9158	(268)
Total CO2, kg/year			1364.2390	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			22.3600	(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	3898.9917	1.1300	4405.8606	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2465.9416	1.1300	2786.5140	(278)
Space and water heating			7192.3746	(279)
Pumps, fans and electric keep-hot	41.0000	1.5128	62.0248	(281)
Energy for lighting	151.8444	1.5338	232.9041	(282)
Total Primary energy kWh/year			7487.3035	(286)
Dwelling Primary energy Rate (DPER)			122.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET EMISSIONS

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		61.0000 (1b)	x	2.6000 (2b)	=	158.6000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	158.6000	(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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1261	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3761	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3197	(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	0.4076	0.3996	0.3916	0.3517	0.3437	0.3037	0.3037	0.2957	0.3197	0.3437	0.3596	0.3756	(22b)
Effective ac	0.5831	0.5798	0.5767	0.5618	0.5591	0.5461	0.5461	0.5437	0.5511	0.5591	0.5647	0.5706	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.20)			15.2500	1.1450	17.4618			(27)
External Wall 1	60.8000	15.2500	45.5500	0.1800	8.1990			(29a)
Total net area of external elements Aum(A, m2)			60.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		25.6608			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	3.0400	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 28.7008	(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	30.5167	30.3479	30.1824	29.4051	29.2597	28.5827	28.5827	28.4574	28.8435	29.2597	29.5539	29.8615	(38)
Heat transfer coeff	59.2175	59.0487	58.8832	58.1060	57.9605	57.2836	57.2836	57.1582	57.5443	57.9605	58.2547	58.5623	(39)
Average = Sum(39)m / 12 =												58.1053	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9708	0.9680	0.9653	0.9526	0.9502	0.9391	0.9391	0.9370	0.9433	0.9502	0.9550	0.9600	(40)
HLP (average)												0.9525	
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	2.0098	(42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

66.7466	65.7553	64.3594	61.7855	59.8583	57.7212	56.5669	57.9531	59.4624	61.7491	64.3759	66.5210	(42b)

Hot water usage for other uses

35.2120	33.9315	32.6511	31.3707	30.0902	28.8098	28.8098	30.0902	31.3707	32.6511	33.9315	35.2120	(42c)

Average daily hot water use (litres/day)	93.8955	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.9586	99.6869	97.0105	93.1562	89.9485	86.5311	85.3767	88.0433	90.8331	94.4002	98.3075	101.7329	(44)
Energy conte	161.4775	141.9528	149.1015	127.5262	121.0880	106.4000	103.2558	109.0160	112.0062	128.1002	140.0570	159.2892	(45)
Energy content (annual)										Total = Sum(45)m =		1559.2704	
Distribution loss (46)m = 0.15 x (45)m	24.2216	21.2929	22.3652	19.1289	18.1632	15.9600	15.4884	16.3524	16.8009	19.2150	21.0086	23.8934	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	45.8833	49.4355	45.9401	45.8368	42.6728	43.5070	44.8659	44.7944	48.1053	48.4804	50.9589	(61)
Total heat required for water heating calculated for each month	212.4364	187.8360	198.5370	173.4663	166.9248	149.0729	146.7628	153.8820	156.8006	176.2055	188.5374	210.2481	(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													

	212.4364	187.8360	198.5370	173.4663	166.9248	149.0729	146.7628	153.8820	156.8006	176.2055	188.5374	210.2481 (64)
											Total per year (kWh/year) = Sum(64)m =	2120.7098 (64)
12Total per year (kWh/year)												2121 (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												
	66.4310	58.6701	61.9351	53.8875	51.7210	46.0462	45.2093	47.4643	48.4407	54.6196	58.6891	65.7034 (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	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	100.4881	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.5003	97.9825	88.5003	91.4503	88.5003	91.4503	88.5003	88.5003	91.4503	88.5003	91.4503	88.5003	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.4617	177.2825	172.6943	162.9265	150.5964	139.0079	131.2661	129.4454	134.0336	143.8013	156.1314	167.7199	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	33.0488	(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)													
	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	-80.3905	(71)
Water heating gains (Table 5)													
	89.2890	87.3067	83.2461	74.8437	69.5174	63.9531	60.7652	63.7961	67.2787	73.4135	81.5126	88.3110	(72)
Total internal gains													
	409.3974	418.7181	400.5871	385.3670	364.7606	347.5578	333.6780	334.8882	345.9090	361.8616	385.2407	400.6776	(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	10.0800	10.6334	0.6300	0.7000	0.7700	32.7570	(74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	3.7300	46.7521	0.6300	0.7000	0.7700	53.2944	(78)

Solar gains	94.6947	166.7910	245.4010	337.1338	410.8836	423.3674	401.6790	343.7513	276.4236	188.7228	114.3592	80.4670	(83)
Total gains	504.0922	585.5091	645.9882	722.5007	775.6441	770.9251	735.3570	678.6396	622.3326	550.5844	499.5999	481.1446	(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	28.6139	28.6957	28.7764	29.1613	29.2345	29.5799	29.5799	29.6448	29.4459	29.2345	29.0868	28.9341	
alpha	2.9076	2.9130	2.9184	2.9441	2.9490	2.9720	2.9720	2.9763	2.9631	2.9490	2.9391	2.9289	
util living area													
	0.9255	0.8899	0.8378	0.7362	0.5999	0.4467	0.3333	0.3730	0.5647	0.7795	0.8911	0.9331	(86)
MIT	19.1381	19.4670	19.8835	20.3857	20.7351	20.9197	20.9749	20.9646	20.8357	20.3765	19.6930	19.0859	(87)
Th 2	20.1078	20.1101	20.1124	20.1231	20.1251	20.1344	20.1344	20.1361	20.1308	20.1251	20.1210	20.1168	(88)
util rest of house													
	0.9162	0.8768	0.8188	0.7070	0.5586	0.3935	0.2710	0.3077	0.5091	0.7478	0.8760	0.9247	(89)
MIT 2	17.9388	18.3485	18.8630	19.4725	19.8712	20.0710	20.1196	20.1142	19.9913	19.4782	18.6448	17.8794	(90)
Living area fraction										fLA = Living area / (4) =		0.3279	(91)
MIT	18.3320	18.7152	19.1976	19.7719	20.1545	20.3492	20.4000	20.3930	20.2682	19.7727	18.9885	18.2750	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3320	18.7152	19.1976	19.7719	20.1545	20.3492	20.4000	20.3930	20.2682	19.7727	18.9885	18.2750	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8928	0.8522	0.7964	0.6944	0.5600	0.4070	0.2904	0.3275	0.5183	0.7336	0.8526	0.9022	(94)
Useful gains	450.0666	498.9812	514.4855	501.7037	434.3705	313.7426	213.5336	222.2434	322.5577	403.8876	425.9505	434.0768	(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													
	830.9401	815.7723	747.6758	631.7220	490.0259	329.3361	217.6794	228.2347	354.9430	531.6551	692.5611	824.2640	(97)
Space heating kWh													
	283.3699	212.8836	173.4936	93.6132	41.4077	0.0000	0.0000	0.0000	0.0000	95.0590	191.9596	290.2993	(98a)
Space heating requirement - total per year (kWh/year)												1382.0859	
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													
	283.3699	212.8836	173.4936	93.6132	41.4077	0.0000	0.0000	0.0000	0.0000	95.0590	191.9596	290.2993	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1382.0859	
Space heating per m2											(98c) / (4) =	22.6571	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.4000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	283.3699	212.8836	173.4936	93.6132	41.4077	0.0000	0.0000	0.0000	0.0000	95.0590	191.9596	290.2993	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000		(210)
Space heating fuel (main heating system)													
	306.6774	230.3935	187.7637	101.3130	44.8135	0.0000	0.0000	0.0000	0.0000	102.8777	207.7485	314.1767	(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													
	212.4364	187.8360	198.5370	173.4663	166.9248	149.0729	146.7628	153.8820	156.8006	176.2055	188.5374	210.2481	(64)
Efficiency of water heater												80.3000	(216)
(217)m	84.9995	84.6504	84.0937	83.1183	81.8742	80.3000	80.3000	80.3000	80.3000	83.1177	84.4200	85.0730	(217)
Fuel for water heating, kWh/month													
	249.9265	221.8963	236.0902	208.6980	203.8795	185.6449	182.7681	191.6338	195.2685	211.9952	223.3326	247.1385	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	18.3886	14.7520	13.2826	9.7314	7.5168	6.1413	6.8571	8.9131	11.5772	15.1899	17.1570	18.8997	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.4234	-24.3759	-36.8704	-43.7033	-49.1165	-46.5884	-46.0313	-42.4694	-36.5315	-28.8599	-18.4880	-14.0608	(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	-5.9056	-12.6976	-25.7521	-39.4401	-52.8960	-53.4109	-52.7717	-44.3302	-32.0414	-18.3949	-7.9609	-4.6491	(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												1495.7640	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2558.2722	(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)												148.4066	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-753.7695	(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												3534.6733	(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	1495.7640	0.2100	314.1104	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2558.2722	0.2100	537.2372	(264)
Space and water heating			851.3476	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.4066	0.1443	21.4197	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-403.5189	0.1335	-53.8733	
PV Unit electricity exported	-350.2506	0.1253	-43.8982	
Total			-97.7715	(269)
Total CO2, kg/year			786.9250	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.9000	(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	1495.7640	1.1300	1690.2133	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2558.2722	1.1300	2890.8476	(278)
Space and water heating			4581.0608	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.4066	1.5338	227.6311	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-403.5189	1.4934	-602.6008	
PV Unit electricity exported	-350.2506	0.4600	-161.1272	
Total			-763.7280	(283)
Total Primary energy kWh/year			4175.0647	(286)
Target Primary Energy Rate (TPER)			68.4400	(287)

Full SAP Calculation Printout

Property Reference	York Way	Issued on Date	30/06/2023
Assessment Reference	2.02 Actual	Prop Type Ref	York Way
Property	York Way, -		

SAP Rating	66 D	DER	9.46	TER	12.29
Environmental	93 A	% DER < TER			23.03
CO_2 Emissions (t/year)	0.49	DFEE	54.82	TFEE	26.60
Compliance Check	See BREL	% DFEE < TFEE			-106.11
% DPER < TPER	-49.18	DPER	97.46	TPER	65.33

Assessor Details	Mr. Jonathan Lewis	Assessor ID	AZ32-0001
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	63.0000 (1b)	x	2.6000 (2b)	=	163.8000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.8000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1221 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.8721 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7413 (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	0.9451	0.9266	0.9081	0.8154	0.7969	0.7042	0.7042	0.6857	0.7413	0.7969	0.8339	0.8710	(22b)
Effective ac	0.9466	0.9293	0.9123	0.8324	0.8175	0.7480	0.7480	0.7351	0.7748	0.8175	0.8477	0.8793	(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	
Windows (Uw = 1.60)			7.3000	1.5038	10.9774			(27)
Solid Door			2.0000	1.6000	3.2000			(26)
External Wall 1	55.0000	7.3000	47.7000	0.3000	14.3100			(29a)
Communal	13.8000	2.0000	11.8000	0.3000	3.5400			(29a)
Total net area of external elements Aum(A, m2)			68.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0274			(33)
Party Floor 1			61.0000					(32d)
Party Ceiling 1			61.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area) 13.7600 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.7874 (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	51.1699	50.2324	49.3134	44.9972	44.1897	40.4304	40.4304	39.7343	41.8784	44.1897	45.8233	47.5313	(38)
Heat transfer coeff	96.9573	96.0198	95.1009	90.7847	89.9771	86.2179	86.2179	85.5217	87.6659	89.9771	91.6108	93.3187	(39)

Average = Sum(39)m / 12 = 90.7808

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5390	1.5241	1.5095	1.4410	1.4282	1.3685	1.3685	1.3575	1.3915	1.4282	1.4541	1.4812	(40)
HLP (average)												1.4410	
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 2.0651 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	67.8201	66.8129	65.3945	62.7793	60.8210	58.6496	57.4767	58.8852	60.4187	62.7422	65.4113	67.5908	(42b)
Hot water usage for other uses	35.7783	34.4773	33.1762	31.8752	30.5742	29.2732	29.2732	30.5742	31.8752	33.1762	34.4773	35.7783	(42c)

Average daily hot water use (litres/day) 95.4056 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.5984	101.2901	98.5707	94.6545	91.3952	87.9227	86.7499	89.4593	92.2939	95.9184	99.8886	103.3691	(44)
Energy conte	164.0745	144.2358	151.4995	129.5772	123.0355	108.1113	104.9164	110.7694	113.8076	130.1604	142.3096	161.8511	(45)

Energy content (annual) Total = Sum(45)m = 1584.3483

Distribution loss (46)m = 0.15 x (45)m	24.6112	21.6354	22.7249	19.4366	18.4553	16.2167	15.7375	16.6154	17.0711	19.5241	21.3464	24.2777	(46)

Water storage loss:
Store volume 173.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.9200 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 1.0368 (55)

Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	196.2153	173.2662	183.6403	160.6812	155.1763	139.2153	137.0572	142.9102	144.9116	162.3012	173.4136	193.9919	(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	196.2153	173.2662	183.6403	160.6812	155.1763	139.2153	137.0572	142.9102	144.9116	162.3012	173.4136	193.9919	(64)

Total per year (kWh/year) = Sum(64)m = 1962.7803 (64)
12Total per year (kWh/year) 1963 (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	54.5548	47.9584	50.3736	43.0844	40.9093	35.9470	34.8847	36.8308	37.8410	43.2783	47.3179	53.8155	(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	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8057	112.7135	101.8057	105.1993	101.8057	105.1993	101.8057	101.8057	105.1993	101.8057	105.1993	101.8057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.4447	182.3171	177.5986	167.5534	154.8732	142.9556	134.9939	133.1215	137.8400	147.8851	160.5654	172.4830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	(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)	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	(71)
Water heating gains (Table 5)	73.3263	71.3667	67.7064	59.8395	54.9856	49.9264	46.8881	49.5038	52.5570	58.1698	65.7193	72.3326	(72)
Total internal gains	409.5527	420.3732	401.0867	386.5681	365.6405	352.0572	337.6636	338.4069	349.5722	361.8366	385.4599	400.5973	(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	5.1000	19.6403	0.6300	0.7000	0.7700	30.6118 (76)
West	2.2000	19.6403	0.6300	0.7000	0.7700	13.2051 (80)

Solar gains	43.8169	85.7152	141.1608	205.8746	252.3070	258.2811	245.8941	211.2194	164.1758	101.7083	54.6346	36.0329 (83)
Total gains	453.3696	506.0884	542.2475	592.4427	617.9475	610.3383	583.5578	549.6263	513.7480	463.5449	440.0945	436.6302 (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	18.0492	18.2254	18.4015	19.2764	19.4494	20.2974	20.2974	20.4626	19.9622	19.4494	19.1026	18.7529	
alpha	2.2033	2.2150	2.2268	2.2851	2.2966	2.3532	2.3532	2.3642	2.3308	2.2966	2.2735	2.2502	
util living area	0.9557	0.9417	0.9201	0.8706	0.7937	0.6657	0.5420	0.5791	0.7546	0.8885	0.9397	0.9587	(86)
MIT	17.6173	17.9359	18.4671	19.2866	19.9776	20.5621	20.8102	20.7732	20.3511	19.4532	18.4822	17.6633	(87)
Th 2	19.6584	19.6695	19.6804	19.7320	19.7418	19.7875	19.7875	19.7961	19.7698	19.7418	19.7221	19.7016	(88)
util rest of house	0.9482	0.9319	0.9059	0.8460	0.7495	0.5873	0.4249	0.4660	0.6881	0.8623	0.9281	0.9519	(89)
MIT 2	15.7879	16.1939	16.8682	17.9131	18.7553	19.4446	19.6838	19.6630	19.2197	18.1401	16.9129	15.8629	(90)
Living area fraction										fLA = Living area / (4) =		0.3810	(91)
MIT	16.4848	16.8575	17.4773	18.4364	19.2210	19.8703	20.1129	20.0860	19.6507	18.6403	17.5107	16.5488	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.4848	16.8575	17.4773	18.4364	19.2210	19.8703	20.1129	20.0860	19.6507	18.6403	17.5107	16.5488	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9217	0.9018	0.8729	0.8138	0.7276	0.5933	0.4590	0.4959	0.6806	0.8320	0.8992	0.9269	(94)
Useful gains	417.8517	456.4158	473.3191	482.1060	449.6398	362.0916	267.8637	272.5351	349.6404	385.6828	395.7194	404.7292	(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	1181.4043	1148.1576	1043.9487	865.7545	676.7145	454.3961	302.8762	315.2299	486.6113	723.4475	953.7313	1152.3732	(97)
Space heating kWh	568.0832	464.8505	424.5485	276.2269	168.9436	0.0000	0.0000	0.0000	0.0000	251.2970	401.7685	556.2472	(98a)
Space heating requirement - total per year (kWh/year)												3111.9653	
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	568.0832	464.8505	424.5485	276.2269	168.9436	0.0000	0.0000	0.0000	0.0000	251.2970	401.7685	556.2472	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3111.9653	
Space heating per m2											(98c) / (4) =	49.3963	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
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	568.0832	464.8505	424.5485	276.2269	168.9436	0.0000	0.0000	0.0000	0.0000	251.2970	401.7685	556.2472	(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)	568.0832	464.8505	424.5485	276.2269	168.9436	0.0000	0.0000	0.0000	0.0000	251.2970	401.7685	556.2472	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	196.2153	173.2662	183.6403	160.6812	155.1763	139.2153	137.0572	142.9102	144.9116	162.3012	173.4136	193.9919	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	64.7672	57.1921	60.6164	53.0380	51.2209	45.9525	45.2401	47.1721	47.8327	53.5727	57.2407	64.0332	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	21.6432	17.3630	15.6335	11.4537	8.8472	7.2282	8.0707	10.4906	13.6263	17.8784	20.1936	22.2448 (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	3111.9653 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	302.9550
Water heating fuel used	647.8785 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	174.6733 (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	3934.5171 (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	3111.9653	0.1540	479.2423	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	647.8785	0.1410	91.3491	(264)
Space and water heating			570.5914	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	174.6733	0.1443	25.2108	(268)
Total CO2, kg/year			595.8022	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.4600	(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	3111.9653	1.5701	4886.2408	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	647.8785	1.5214	985.6575	(278)
Space and water heating			5871.8983	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	174.6733	1.5338	267.9197	(282)
Total Primary energy kWh/year			6139.8180	(286)
Dwelling Primary energy Rate (DPER)			97.4600	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		63.0000 (1b)	x	2.6000 (2b)	=	163.8000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0000						(4)

Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 163.8000 (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	2 * 10 =	20.0000	(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) =	20.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(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	0.4033	0.3954	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5782	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			7.3000	1.1450	8.3588			(27)
External Wall 1	55.0000	7.3000	47.7000	0.1800	8.5860			(29a)
Communal	13.8000	2.0000	11.8000	0.1800	2.1240			(29a)
Total net area of external elements Aum(A, m2)			68.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.0688			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		3.4400 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	24.5088 (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	31.4222	31.2515	31.0842	30.2985	30.1514	29.4671	29.4671	29.3403	29.7307	30.1514	30.4488	30.7598	(38)
Heat transfer coeff	55.9309	55.7603	55.5930	54.8072	54.6602	53.9758	53.9758	53.8491	54.2395	54.6602	54.9576	55.2685	(39)
Average = Sum(39)m / 12 =												54.8065	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8878	0.8851	0.8824	0.8700	0.8676	0.8568	0.8568	0.8547	0.8609	0.8676	0.8723	0.8773	(40)
HLP (average)												0.8699	
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		2.0651 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	67.8201	66.8129	65.3945	62.7793	60.8210	58.6496	57.4767	58.8852	60.4187	62.7422	65.4113	67.5908	(42b)
Hot water usage for other uses	35.7783	34.4773	33.1762	31.8752	30.5742	29.2732	29.2732	30.5742	31.8752	33.1762	34.4773	35.7783	(42c)
Average daily hot water use (litres/day)												95.4056	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.5984	101.2901	98.5707	94.6545	91.3952	87.9227	86.7499	89.4593	92.2939	95.9184	99.8886	103.3691	(44)
Energy conte	164.0745	144.2358	151.4995	129.5772	123.0355	108.1113	104.9164	110.7694	113.8076	130.1604	142.3096	161.8511	(45)
Energy content (annual)										Total = Sum(45)m =		1584.3483	
Distribution loss (46)m = 0.15 x (45)m	24.6112	21.6354	22.7249	19.4366	18.4553	16.2167	15.7375	16.6154	17.0711	19.5241	21.3464	24.2777	(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
210.6694 186.3215 198.0944 174.6691 169.6304 153.2031 151.5113 157.3643 158.8995 176.7553 187.4014 208.4460 (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
210.6694 186.3215 198.0944 174.6691 169.6304 153.2031 151.5113 157.3643 158.8995 176.7553 187.4014 208.4460 (64)
Total per year (kWh/year) = Sum(64)m = 2132.9657 (64)
12Total per year (kWh/year) 2133 (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
91.8307 81.6270 87.6495 79.1579 78.1852 72.0205 72.1606 74.1067 73.9145 80.5543 83.3914 91.0914 (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	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.8057	112.7135	101.8057	105.1993	101.8057	105.1993	101.8057	101.8057	105.1993	101.8057	105.1993	101.8057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.4447	182.3171	177.5986	167.5534	154.8732	142.9556	134.9939	133.1215	137.8400	147.8851	160.5654	172.4830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	(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)													
	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	(71)
Water heating gains (Table 5)													
	123.4284	121.4687	117.8085	109.9415	105.0877	100.0284	96.9901	99.6058	102.6590	108.2719	115.8214	122.4347	(72)
Total internal gains													
	462.6547	473.4753	454.1888	439.6702	418.7425	402.1592	387.7657	388.5090	399.6742	414.9387	438.5619	453.6993	(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	5.1000	19.6403	0.6300	0.7000	0.7700	30.6118	(76)
West	2.2000	19.6403	0.6300	0.7000	0.7700	13.2051	(80)

Solar gains	43.8169	85.7152	141.1608	205.8746	252.3070	258.2811	245.8941	211.2194	164.1758	101.7083	54.6346	36.0329	(83)
Total gains	506.4716	559.1905	595.3495	645.5447	671.0495	660.4403	633.6598	599.7284	563.8500	516.6470	493.1965	489.7322	(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	31.2886	31.3843	31.4788	31.9301	32.0160	32.4219	32.4219	32.4982	32.2643	32.0160	31.8427	31.6636	
alpha	3.0859	3.0923	3.0986	3.1287	3.1344	3.1615	3.1615	3.1665	3.1510	3.1344	3.1228	3.1109	
util living area													
	0.9246	0.8981	0.8563	0.7679	0.6449	0.4886	0.3641	0.3979	0.5887	0.7930	0.8918	0.9304	(86)
MIT	19.3417	19.5903	19.9429	20.3997	20.7287	20.9180	20.9756	20.9673	20.8478	20.4305	19.8394	19.3097	(87)
Th 2	20.1779	20.1802	20.1825	20.1931	20.1951	20.2044	20.2044	20.2061	20.2008	20.1951	20.1911	20.1869	(88)
util rest of house													
	0.9155	0.8862	0.8395	0.7416	0.6060	0.4362	0.3019	0.3342	0.5361	0.7638	0.8774	0.9220	(89)
MIT 2	18.2391	18.5501	18.9883	19.5482	19.9295	20.1376	20.1894	20.1851	20.0687	19.5972	18.8735	18.2052	(90)
Living area fraction									fLA = Living area / (4) =			0.3810	(91)
MIT	18.6591	18.9463	19.3519	19.8726	20.2340	20.4349	20.4889	20.4831	20.3655	19.9147	19.2414	18.6259	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6591	18.9463	19.3519	19.8726	20.2340	20.4349	20.4889	20.4831	20.3655	19.9147	19.2414	18.6259	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8950	0.8651	0.8200	0.7303	0.6080	0.4517	0.3245	0.3568	0.5474	0.7526	0.8575	0.9021	(94)

Useful gains	453.2910	483.7633	488.2115	471.4416	407.9725	298.3276	205.5933	213.9727	308.6382	388.8031	422.9308	441.7892 (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												
	803.1205	783.2270	714.4772	601.3783	466.4691	314.9430	209.9056	219.8689	339.8366	509.1411	667.2652	797.3002 (97)
Space heating kWh												
	260.2732	201.2397	168.3417	93.5545	43.5214	0.0000	0.0000	0.0000	0.0000	89.5315	175.9208	264.5002 (98a)
Space heating requirement - total per year (kWh/year)												1296.8829
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												
	260.2732	201.2397	168.3417	93.5545	43.5214	0.0000	0.0000	0.0000	0.0000	89.5315	175.9208	264.5002 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1296.8829
Space heating per m2											(98c) / (4) =	20.5854 (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													
	260.2732	201.2397	168.3417	93.5545	43.5214	0.0000	0.0000	0.0000	0.0000	89.5315	175.9208	264.5002	(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)													
	281.9861	218.0278	182.3854	101.3591	47.1521	0.0000	0.0000	0.0000	0.0000	97.0005	190.5967	286.5658	(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													
	210.6694	186.3215	198.0944	174.6691	169.6304	153.2031	151.5113	157.3643	158.8995	176.7553	187.4014	208.4460	(64)
Efficiency of water heater												79.8000	(216)
(217)m	84.5351	84.2329	83.6970	82.7244	81.4863	79.8000	79.8000	79.8000	79.8000	82.6152	83.9182	84.5950	(217)
Fuel for water heating, kWh/month													
	249.2095	221.1981	236.6804	211.1459	208.1705	191.9838	189.8638	197.1983	199.1222	213.9500	223.3143	246.4046	(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	21.1532	16.9699	15.2795	11.1944	8.6469	7.0646	7.8880	10.2531	13.3178	17.4736	19.7364	21.7411	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.9690	-25.1841	-38.0823	-45.1188	-50.6807	-48.0586	-47.4913	-43.8415	-37.7359	-29.8221	-19.1048	-14.5286	(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	-6.0921	-13.1049	-26.5933	-40.7507	-54.6765	-55.2194	-54.5512	-45.8041	-33.0853	-18.9821	-8.2113	-4.7948	(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	1405.0735 (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	2588.2414 (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)	170.7186 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-778.4832 (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	3471.5503 (238)

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

	Energy	Emission factor	Emissions

	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	1405.0735	0.2100	295.0654	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2588.2414	0.2100	543.5307	(264)
Space and water heating			838.5961	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.7186	0.1443	24.6400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-416.6176	0.1335	-55.6252	
PV Unit electricity exported	-361.8656	0.1253	-45.3489	
Total			-100.9741	(269)
Total CO2, kg/year			774.1913	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.2900	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1405.0735	1.1300	1587.7331	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2588.2414	1.1300	2924.7127	(278)
Space and water heating			4512.4459	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.7186	1.5338	261.8539	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-416.6176	1.4934	-622.1736	
PV Unit electricity exported	-361.8656	0.4600	-166.4517	
Total			-788.6253	(283)
Total Primary energy kWh/year			4115.7753	(286)
Target Primary Energy Rate (TPER)			65.3300	(287)

Full SAP Calculation Printout

Property Reference	York Way	Issued on Date	30/06/2023
Assessment Reference	2.02 BAU	Prop Type Ref	York Way
Property	York Way, -		

SAP Rating	81 B	DER	22.15	TER	12.60
Environmental	83 B	% DER < TER			-75.79
CO_2 Emissions (t/year)	1.21	DFEE	54.82	TFEE	26.60
Compliance Check	See BREL	% DFEE < TFEE			-106.11
% DPER < TPER	-81.76	DPER	121.76	TPER	66.99

Assessor Details	Mr. Jonathan Lewis	Assessor ID	AZ32-0001
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	63.0000 (1b)	x	2.6000 (2b)	=	163.8000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	63.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.8000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1221 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.8721 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7413 (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	0.9451	0.9266	0.9081	0.8154	0.7969	0.7042	0.7042	0.6857	0.7413	0.7969	0.8339	0.8710	(22b)
Effective ac	0.9466	0.9293	0.9123	0.8324	0.8175	0.7480	0.7480	0.7351	0.7748	0.8175	0.8477	0.8793	(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	
Windows (Uw = 1.60)			7.3000	1.5038	10.9774			(27)
Solid Door			2.0000	1.6000	3.2000			(26)
External Wall 1	55.0000	7.3000	47.7000	0.3000	14.3100			(29a)
Communal	13.8000	2.0000	11.8000	0.3000	3.5400			(29a)
Total net area of external elements Aum(A, m2)			68.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.0274			(33)
Party Floor 1			61.0000					(32d)
Party Ceiling 1			61.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area) 13.7600 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.7874 (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	51.1699	50.2324	49.3134	44.9972	44.1897	40.4304	40.4304	39.7343	41.8784	44.1897	45.8233	47.5313	(38)
Heat transfer coeff	96.9573	96.0198	95.1009	90.7847	89.9771	86.2179	86.2179	85.5217	87.6659	89.9771	91.6108	93.3187	(39)

Average = Sum(39)m / 12 = 90.7808

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5390	1.5241	1.5095	1.4410	1.4282	1.3685	1.3685	1.3575	1.3915	1.4282	1.4541	1.4812	(40)
HLP (average)												1.4410	
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 2.0651 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	67.8201	66.8129	65.3945	62.7793	60.8210	58.6496	57.4767	58.8852	60.4187	62.7422	65.4113	67.5908	(42b)
Hot water usage for other uses	35.7783	34.4773	33.1762	31.8752	30.5742	29.2732	29.2732	30.5742	31.8752	33.1762	34.4773	35.7783	(42c)

Average daily hot water use (litres/day) 95.4056 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.5984	101.2901	98.5707	94.6545	91.3952	87.9227	86.7499	89.4593	92.2939	95.9184	99.8886	103.3691	(44)
Energy conte	164.0745	144.2358	151.4995	129.5772	123.0355	108.1113	104.9164	110.7694	113.8076	130.1604	142.3096	161.8511	(45)

Energy content (annual) Total = Sum(45)m = 1584.3483

Distribution loss (46)m = 0.15 x (45)m	24.6112	21.6354	22.7249	19.4366	18.4553	16.2167	15.7375	16.6154	17.0711	19.5241	21.3464	24.2777	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.2306	46.6789	46.5740	43.3592	44.2068	45.5875	45.5148	48.8790	49.2601	50.9589	(61)
Total heat required for water heating calculated for each month	215.0334	190.2632	201.7301	176.2561	169.6094	151.4704	149.1232	156.3569	159.3225	179.0394	191.5697	212.8100	(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	215.0334	190.2632	201.7301	176.2561	169.6094	151.4704	149.1232	156.3569	159.3225	179.0394	191.5697	212.8100	(64)

Total per year (kWh/year) = Sum(64)m = 2152.5843 (64)

12Total per year (kWh/year) 2153 (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	67.2945	59.4653	62.9312	54.7542	52.5528	46.7868	45.9364	48.2277	49.2197	55.4981	59.6330	66.5552	(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	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.8057	112.7135	101.8057	105.1993	101.8057	105.1993	101.8057	101.8057	105.1993	101.8057	105.1993	101.8057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	180.4447	182.3171	177.5986	167.5534	154.8732	142.9556	134.9939	133.1215	137.8400	147.8851	160.5654	172.4830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	(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)	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	(71)
Water heating gains (Table 5)	90.4496	88.4900	84.5850	76.0474	70.6355	64.9816	61.7425	64.8222	68.3608	74.5942	82.8236	89.4559	(72)
Total internal gains	429.6759	440.4965	420.9653	405.7761	384.2904	367.1125	352.5181	353.7253	365.3759	381.2610	405.5641	420.7206	(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				5.1000		19.6403		0.6300		0.7000		0.7700	30.6118 (76)
West				2.2000		19.6403		0.6300		0.7000		0.7700	13.2051 (80)
Solar gains	43.8169	85.7152	141.1608	205.8746	252.3070	258.2811	245.8941	211.2194	164.1758	101.7083	54.6346	36.0329 (83)	
Total gains	473.4929	526.2117	562.1260	611.6506	636.5974	625.3936	598.4122	564.9447	529.5517	482.9693	460.1987	456.7535 (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	18.0492	18.2254	18.4015	19.2764	19.4494	20.2974	20.2974	20.4626	19.9622	19.4494	19.1026	18.7529	
alpha	2.2033	2.2150	2.2268	2.2851	2.2966	2.3532	2.3532	2.3642	2.3308	2.2966	2.2735	2.2502	
util living area	0.9519	0.9374	0.9150	0.8638	0.7851	0.6567	0.5326	0.5687	0.7448	0.8806	0.9345	0.9550	(86)
MIT	17.6671	17.9838	18.5114	19.3236	20.0050	20.5755	20.8174	20.7822	20.3713	19.4929	18.5305	17.7144	(87)
Th 2	19.6584	19.6695	19.6804	19.7320	19.7418	19.7875	19.7875	19.7961	19.7698	19.7418	19.7221	19.7016	(88)
util rest of house	0.9439	0.9270	0.9000	0.8383	0.7399	0.5781	0.4163	0.4561	0.6773	0.8531	0.9221	0.9476	(89)
MIT 2	16.6857	17.0036	17.5287	18.3482	18.9962	19.5295	19.7102	19.6971	19.3565	18.5297	17.5786	16.7581	(90)
Living area fraction										fLA = Living area / (4) =		0.3810	(91)
MIT	17.0596	17.3770	17.9030	18.7198	19.3805	19.9280	20.1320	20.1105	19.7431	18.8967	17.9412	17.1224	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.0596	17.3770	17.9030	18.7198	19.3805	19.9280	20.1320	20.1105	19.7431	18.8967	17.9412	17.1224	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9220	0.9024	0.8733	0.8131	0.7247	0.5882	0.4520	0.4882	0.6756	0.8296	0.8985	0.9270	(94)
Useful gains	436.5699	474.8692	490.9031	497.3051	461.3514	367.8357	270.4788	275.7938	357.7759	400.6616	413.4688	423.4028	(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	1237.1355	1198.0393	1084.4392	891.4836	691.0684	459.3688	304.5219	317.3282	494.7073	746.5105	993.1751	1205.9007	(97)
Space heating kWh	595.6209	485.9703	441.5908	283.8085	170.9094	0.0000	0.0000	0.0000	0.0000	257.3116	417.3885	582.1784	(98a)
Space heating requirement - total per year (kWh/year)												3234.7784	
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	595.6209	485.9703	441.5908	283.8085	170.9094	0.0000	0.0000	0.0000	0.0000	257.3116	417.3885	582.1784	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3234.7784	
Space heating per m2										(98c) / (4) =		51.3457	(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 %)	81.0000 (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	595.6209	485.9703	441.5908	283.8085	170.9094	0.0000	0.0000	0.0000	0.0000	257.3116	417.3885	582.1784	(98)
Space heating efficiency (main heating system 1)	81.0000	81.0000	81.0000	81.0000	81.0000	0.0000	0.0000	0.0000	0.0000	81.0000	81.0000	81.0000	(210)
Space heating fuel (main heating system)	735.3344	599.9633	545.1739	350.3809	210.9992	0.0000	0.0000	0.0000	0.0000	317.6686	515.2945	718.7388	(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	215.0334	190.2632	201.7301	176.2561	169.6094	151.4704	149.1232	156.3569	159.3225	179.0394	191.5697	212.8100	(64)
Efficiency of water heater												86.0000	(216)
(217)m	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	(217)
Fuel for water heating, kWh/month	250.0389	221.2363	234.5699	204.9490	197.2203	176.1284	173.3991	181.8103	185.2587	208.1853	222.7554	247.4534	(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	3.4822	3.1452	3.4822	3.3699	3.4822	3.3699	3.4822	3.4822	3.3699	3.4822	3.3699	3.4822	(231)
Lighting	21.6432	17.3630	15.6335	11.4537	8.8472	7.2282	8.0707	10.4906	13.6263	17.8784	20.1936	22.2448	(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	3993.5536	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	86.0000	
Water heating fuel used	2503.0050	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
central heating pump	41.0000	(230c)
Total electricity for the above, kWh/year	41.0000	(231)
Electricity for lighting (calculated in Appendix L)	174.6733	(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	6712.2319	(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	3993.5536	0.2100	838.6463	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2503.0050	0.2100	525.6311	(264)
Space and water heating			1364.2773	(265)
Pumps, fans and electric keep-hot	41.0000	0.1387	5.6872	(267)
Energy for lighting	174.6733	0.1443	25.2108	(268)
Total CO2, kg/year			1395.1753	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			22.1500	(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	3993.5536	1.1300	4512.7155	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2503.0050	1.1300	2828.3957	(278)
Space and water heating			7341.1112	(279)
Pumps, fans and electric keep-hot	41.0000	1.5128	62.0248	(281)
Energy for lighting	174.6733	1.5338	267.9197	(282)
Total Primary energy kWh/year			7671.0557	(286)
Dwelling Primary energy Rate (DPER)			121.7600	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.0000 (1b)	x	2.6000 (2b)	=	163.8000 (1b)	-
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 63.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	163.8000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1221	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3721	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3163	(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	0.4033	0.3954	0.3874	0.3479	0.3400	0.3005	0.3005	0.2926	0.3163	0.3400	0.3558	0.3716	(22b)
Effective ac	0.5813	0.5782	0.5751	0.5605	0.5578	0.5451	0.5451	0.5428	0.5500	0.5578	0.5633	0.5691	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			7.3000	1.1450	8.3588			(27)
External Wall 1	55.0000	7.3000	47.7000	0.1800	8.5860			(29a)
Communal	13.8000	2.0000	11.8000	0.1800	2.1240			(29a)
Total net area of external elements Aum(A, m2)			68.8000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		21.0688			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		3.4400 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	24.5088 (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	31.4222	31.2515	31.0842	30.2985	30.1514	29.4671	29.4671	29.3403	29.7307	30.1514	30.4488	30.7598	(38)
Heat transfer coeff	55.9309	55.7603	55.5930	54.8072	54.6602	53.9758	53.9758	53.8491	54.2395	54.6602	54.9576	55.2685	(39)
Average = Sum(39)m / 12 =												54.8065	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8878	0.8851	0.8824	0.8700	0.8676	0.8568	0.8568	0.8547	0.8609	0.8676	0.8723	0.8773	(40)
HLP (average)												0.8699	
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		2.0651 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

67.8201	66.8129	65.3945	62.7793	60.8210	58.6496	57.4767	58.8852	60.4187	62.7422	65.4113	67.5908	(42b)

Hot water usage for other uses

35.7783	34.4773	33.1762	31.8752	30.5742	29.2732	29.2732	30.5742	31.8752	33.1762	34.4773	35.7783	(42c)

Average daily hot water use (litres/day)	95.4056 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	103.5984	101.2901	98.5707	94.6545	91.3952	87.9227	86.7499	89.4593	92.2939	95.9184	99.8886	103.3691	(44)
Energy conte	164.0745	144.2358	151.4995	129.5772	123.0355	108.1113	104.9164	110.7694	113.8076	130.1604	142.3096	161.8511	(45)
Energy content (annual)										Total = Sum(45)m =		1584.3483	
Distribution loss (46)m = 0.15 x (45)m	24.6112	21.6354	22.7249	19.4366	18.4553	16.2167	15.7375	16.6154	17.0711	19.5241	21.3464	24.2777	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 50.9589	46.0274	50.2306	46.6789	46.5740	43.3592	44.2068	45.5875	45.5148	48.8790	49.2601	50.9589	(61)

Total heat required for water heating calculated for each month

215.0334	190.2632	201.7301	176.2561	169.6094	151.4704	149.1232	156.3569	159.3225	179.0394	191.5697	212.8100	(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													
	215.0334	190.2632	201.7301	176.2561	169.6094	151.4704	149.1232	156.3569	159.3225	179.0394	191.5697	212.8100	(64)
											Total per year (kWh/year) = Sum(64)m =	2152.5843	(64)
12Total per year (kWh/year)												2153	(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													
	67.2945	59.4653	62.9312	54.7542	52.5528	46.7868	45.9364	48.2277	49.2197	55.4981	59.6330	66.5552	(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	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	103.2531	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.8057	112.7135	101.8057	105.1993	101.8057	105.1993	101.8057	101.8057	105.1993	101.8057	105.1993	101.8057	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	180.4447	182.3171	177.5986	167.5534	154.8732	142.9556	134.9939	133.1215	137.8400	147.8851	160.5654	172.4830	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	33.3253	(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)													
	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	-82.6025	(71)
Water heating gains (Table 5)													
	90.4496	88.4900	84.5850	76.0474	70.6355	64.9816	61.7425	64.8222	68.3608	74.5942	82.8236	89.4559	(72)
Total internal gains													
	429.6759	440.4965	420.9653	405.7761	384.2904	367.1125	352.5181	353.7253	365.3759	381.2610	405.5641	420.7206	(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	5.1000	19.6403	0.6300	0.7000	0.7700	30.6118	(76)
West	2.2000	19.6403	0.6300	0.7000	0.7700	13.2051	(80)

Solar gains	43.8169	85.7152	141.1608	205.8746	252.3070	258.2811	245.8941	211.2194	164.1758	101.7083	54.6346	36.0329	(83)
Total gains	473.4929	526.2117	562.1260	611.6506	636.5974	625.3936	598.4122	564.9447	529.5517	482.9693	460.1987	456.7535	(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	31.2886	31.3843	31.4788	31.9301	32.0160	32.4219	32.4219	32.4982	32.2643	32.0160	31.8427	31.6636	
alpha	3.0859	3.0923	3.0986	3.1287	3.1344	3.1615	3.1615	3.1665	3.1510	3.1344	3.1228	3.1109	
util living area													
	0.9354	0.9106	0.8717	0.7875	0.6673	0.5110	0.3837	0.4198	0.6158	0.8159	0.9068	0.9409	(86)
MIT	19.2514	19.5083	19.8722	20.3494	20.7002	20.9068	20.9716	20.9619	20.8267	20.3743	19.7587	19.2171	(87)
Th 2	20.1779	20.1802	20.1825	20.1931	20.1951	20.2044	20.2044	20.2061	20.2008	20.1951	20.1911	20.1869	(88)
util rest of house													
	0.9274	0.8999	0.8561	0.7623	0.6287	0.4573	0.3188	0.3533	0.5628	0.7884	0.8939	0.9336	(89)
MIT 2	18.1269	18.4493	18.9033	19.4907	19.8998	20.1280	20.1868	20.1814	20.0490	19.5335	18.7753	18.0899	(90)
Living area fraction											fLA = Living area / (4) =	0.3810	(91)
MIT	18.5552	18.8527	19.2724	19.8178	20.2047	20.4247	20.4858	20.4787	20.3453	19.8538	19.1499	18.5193	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5552	18.8527	19.2724	19.8178	20.2047	20.4247	20.4858	20.4787	20.3453	19.8538	19.1499	18.5193	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9077	0.8790	0.8361	0.7494	0.6292	0.4726	0.3421	0.3766	0.5728	0.7754	0.8740	0.9146	(94)
Useful gains	429.7814	462.5321	469.9687	458.3795	400.5156	295.5403	204.7235	212.7624	303.3364	374.4703	402.2121	417.7478	(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													
	797.3092	778.0063	710.0579	598.3758	464.8704	314.3930	209.7395	219.6367	338.7421	505.8167	662.2340	791.4081	(97)
Space heating kWh													
	273.4407	211.9987	178.6263	100.7974	47.8800	0.0000	0.0000	0.0000	0.0000	97.7218	187.2158	278.0032	(98a)
Space heating requirement - total per year (kWh/year)												1375.6838	
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													
	273.4407	211.9987	178.6263	100.7974	47.8800	0.0000	0.0000	0.0000	0.0000	97.7218	187.2158	278.0032	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1375.6838	

Space heating per m2 (98c) / (4) = 21.8363 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.4000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	273.4407	211.9987	178.6263	100.7974	47.8800	0.0000	0.0000	0.0000	0.0000	97.7218	187.2158	278.0032	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	295.9315	229.4358	193.3185	109.0880	51.8181	0.0000	0.0000	0.0000	0.0000	105.7595	202.6145	300.8693	(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													
	215.0334	190.2632	201.7301	176.2561	169.6094	151.4704	149.1232	156.3569	159.3225	179.0394	191.5697	212.8100	(64)
Efficiency of water heater												80.3000	(216)
(217)m	84.8974	84.6138	84.1217	83.2293	82.0473	80.3000	80.3000	80.3000	80.3000	83.1398	84.3322	84.9550	(217)
Fuel for water heating, kWh/month													
	253.2862	224.8607	239.8074	211.7718	206.7214	188.6307	185.7076	194.7159	198.4090	215.3473	227.1608	250.4973	(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	21.1532	16.9699	15.2795	11.1944	8.6469	7.0646	7.8880	10.2531	13.3178	17.4736	19.7364	21.7411	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.9690	-25.1841	-38.0823	-45.1188	-50.6807	-48.0586	-47.4913	-43.8415	-37.7359	-29.8221	-19.1048	-14.5286	(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	-6.0921	-13.1049	-26.5933	-40.7507	-54.6765	-55.2194	-54.5512	-45.8041	-33.0853	-18.9821	-8.2113	-4.7948	(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 1488.8352 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 80.3000
Water heating fuel used 2596.9162 (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) 170.7186 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -778.4832 (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 3563.9869 (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	1488.8352	0.2100	312.6554	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2596.9162	0.2100	545.3524	(264)
Space and water heating			858.0078	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.7186	0.1443	24.6400	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-416.6176	0.1335	-55.6252	
PV Unit electricity exported	-361.8656	0.1253	-45.3489	
Total			-100.9741	(269)
Total CO2, kg/year			793.6030	(272)

EPC Target Carbon Dioxide Emission Rate (TER) 12.6000 (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	1488.8352	1.1300	1682.3838	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2596.9162	1.1300	2934.5153	(278)
Space and water heating			4616.8991	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.7186	1.5338	261.8539	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-416.6176	1.4934	-622.1736	
PV Unit electricity exported	-361.8656	0.4600	-166.4517	
Total			-788.6253	(283)
Total Primary energy kWh/year			4220.2285	(286)
Target Primary Energy Rate (TPER)			66.9900	(287)

Full SAP Calculation Printout

Property Reference	York Way	Issued on Date	30/06/2023
Assessment Reference	4.01 Actual	Prop Type Ref	York Way
Property	York Way, -		

SAP Rating	50 E	DER	12.75	TER	14.39
Environmental	89 B	% DER < TER			11.40
CO_2 Emissions (t/year)	0.83	DFEE	80.96	TFEE	41.30
Compliance Check	See BREL	% DFEE < TFEE			-96.03
% DPER < TPER	-71.84	DPER	131.17	TPER	76.33

Assessor Details	Mr. Jonathan Lewis	Assessor ID	AZ32-0001
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	76.0000 (1b)	x	2.6000 (2b)	=	197.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.6000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1012 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.8512 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7235 (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	0.9225	0.9044	0.8863	0.7959	0.7778	0.6874	0.6874	0.6693	0.7235	0.7778	0.8140	0.8502	(22b)
Effective ac	0.9255	0.9090	0.8928	0.8167	0.8025	0.7362	0.7362	0.7240	0.7617	0.8025	0.8313	0.8614	(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	
Windows (Uw = 1.60)			13.0000	1.5038	19.5489			(27)
Solid Door			2.0000	1.6000	3.2000			(26)
External Wall 1	100.4000	13.0000	87.4000	0.3000	26.2200			(29a)
Communal	13.8000	2.0000	11.8000	0.3000	3.5400			(29a)
Roof	76.0000		76.0000	0.1600	12.1600			(30)
Total net area of external elements Aum(A, m2)			190.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.6689			(33)
Party Floor 1			61.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												100.0000	(35)
Thermal bridges (Default value 0.200 * total exposed area)												38.0400	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	102.7089	(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	60.3504	59.2730	58.2169	53.2565	52.3284	48.0080	48.0080	47.2079	49.6722	52.3284	54.2059	56.1687	(38)
Heat transfer coeff	163.0593	161.9819	160.9258	155.9654	155.0373	150.7169	150.7169	149.9168	152.3810	155.0373	156.9148	158.8776	(39)
Average = Sum(39)m / 12 =												155.9609	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.1455	2.1313	2.1174	2.0522	2.0400	1.9831	1.9831	1.9726	2.0050	2.0400	2.0647	2.0905	(40)
HLP (average)												2.0521	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3826	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	73.9840	72.8853	71.3380	68.4851	66.3488	63.9801	62.7006	64.2370	65.9100	68.4446	71.3563	73.7339	(42b)
Hot water usage for other uses	39.0301	37.6108	36.1915	34.7722	33.3530	31.9337	31.9337	33.3530	34.7722	36.1915	37.6108	39.0301	(42c)
Average daily hot water use (litres/day)												104.0768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.0141	110.4961	107.5295	103.2573	99.7018	95.9137	94.6343	97.5900	100.6822	104.6361	108.9671	112.7640	(44)
Energy conte	178.9867	157.3449	165.2688	141.3541	134.2178	117.9371	114.4519	120.8368	124.1513	141.9903	155.2436	176.5612	(45)
Energy content (annual)										Total = Sum(45)m =		1728.3446	
Distribution loss (46)m = 0.15 x (45)m	26.8480	23.6017	24.7903	21.2031	20.1327	17.6906	17.1678	18.1255	18.6227	21.2985	23.2865	26.4842	(46)
Water storage loss:													
Store volume												173.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0368	(55)
Total storage loss	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(56)
If cylinder contains dedicated solar storage	32.1408	29.0304	32.1408	31.1040	32.1408	31.1040	32.1408	32.1408	31.1040	32.1408	31.1040	32.1408	(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	211.1275	186.3753	197.4096	172.4581	166.3586	149.0411	146.5927	152.9776	155.2553	174.1311	186.3476	208.7020	(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	211.1275	186.3753	197.4096	172.4581	166.3586	149.0411	146.5927	152.9776	155.2553	174.1311	186.3476	208.7020	(64)
										Total per year (kWh/year) = Sum(64)m =		2106.7766	(64)
12Total per year (kWh/year)												2107	(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	59.5131	52.3172	54.9519	47.0002	44.6274	39.2141	38.0553	40.1782	41.2803	47.2118	51.6185	58.7066	(65)

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	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.5785	121.3190	109.5785	113.2311	109.5785	113.2311	109.5785	109.5785	113.2311	109.5785	113.2311	109.5785	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.8782	213.0665	207.5522	195.8128	180.9940	167.0663	157.7618	155.5736	161.0879	172.8273	187.6461	201.5737	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	(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)	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	(71)
Water heating gains (Table 5)	79.9907	77.8530	73.8601	65.2781	59.9831	54.4640	51.1496	54.0030	57.3337	63.4567	71.6924	78.9067	(72)
Total internal gains	459.1862	470.9773	449.7295	433.0608	409.2943	393.5003	377.2287	377.8939	390.3915	404.6012	431.3084	448.7977	(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	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982 (74)
East	4.0000	19.6403	0.6300	0.7000	0.7700	24.0093 (76)
South	3.0000	46.7521	0.6300	0.7000	0.7700	42.8641 (78)

Solar gains	86.3716	154.4297	230.0886	315.5792	380.5733	389.5459	370.6989	320.5468	259.5001	175.8039	104.7989	73.0373 (83)
Total gains	545.5579	625.4070	679.8181	748.6400	789.8676	783.0461	747.9275	698.4407	649.8916	580.4052	536.1073	521.8350 (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	12.9469	13.0330	13.1185	13.5358	13.6168	14.0071	14.0071	14.0819	13.8542	13.6168	13.4539	13.2877	
alpha	1.8631	1.8689	1.8746	1.9024	1.9078	1.9338	1.9338	1.9388	1.9236	1.9078	1.8969	1.8858	
util living area	0.9596	0.9464	0.9277	0.8885	0.8264	0.7252	0.6189	0.6555	0.7995	0.9040	0.9464	0.9626	(86)
MIT	16.6344	16.9829	17.5939	18.5103	19.3868	20.1757	20.5839	20.5170	19.9019	18.7763	17.6021	16.6328	(87)
Th 2	19.2381	19.2472	19.2562	19.2988	19.3068	19.3446	19.3446	19.3517	19.3300	19.3068	19.2906	19.2737	(88)
util rest of house	0.9516	0.9356	0.9121	0.8616	0.7767	0.6288	0.4577	0.5038	0.7225	0.8754	0.9339	0.9553	(89)
MIT 2	14.4564	14.8899	15.6503	16.7894	17.8475	18.7599	19.1572	19.1129	18.4763	17.1359	15.6769	14.4604	(90)
Living area fraction									fLA = Living area / (4) =			0.3947	(91)
MIT	15.3161	15.7161	16.4175	17.4687	18.4551	19.3188	19.7204	19.6671	19.0391	17.7834	16.4368	15.3179	(92)
Temperature adjustment												0.0000	
adjusted MIT	15.3161	15.7161	16.4175	17.4687	18.4551	19.3188	19.7204	19.6671	19.0391	17.7834	16.4368	15.3179	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9218	0.9011	0.8732	0.8206	0.7436	0.6270	0.5008	0.5387	0.7050	0.8375	0.9004	0.9272	(94)
Useful gains	502.9036	563.5290	593.5959	614.3148	587.3519	490.9717	374.5772	376.2397	458.1636	486.0648	482.7194	483.8275	(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	1796.2796	1752.0087	1595.9795	1336.4205	1047.2902	711.2006	470.2912	489.8007	752.6182	1113.6974	1465.0875	1766.3907	(97)
Space heating kWh	962.2717	798.6584	745.7734	519.9161	342.1941	0.0000	0.0000	0.0000	0.0000	466.9586	707.3050	954.2271	(98a)
Space heating requirement - total per year (kWh/year)												5497.3044	
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	962.2717	798.6584	745.7734	519.9161	342.1941	0.0000	0.0000	0.0000	0.0000	466.9586	707.3050	954.2271	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5497.3044	
Space heating per m2										(98c) / (4) =		72.3330	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
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	962.2717	798.6584	745.7734	519.9161	342.1941	0.0000	0.0000	0.0000	0.0000	466.9586	707.3050	954.2271	(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)	962.2717	798.6584	745.7734	519.9161	342.1941	0.0000	0.0000	0.0000	0.0000	466.9586	707.3050	954.2271	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	211.1275	186.3753	197.4096	172.4581	166.3586	149.0411	146.5927	152.9776	155.2553	174.1311	186.3476	208.7020	(64)
Efficiency of water heater												302.9550	(216)
(217)m	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	302.9550	(217)
Fuel for water heating, kWh/month	69.6894	61.5191	65.1614	56.9253	54.9120	49.1958	48.3876	50.4952	51.2470	57.4775	61.5100	68.8888	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	23.2957	18.6886	16.8271	12.3282	9.5227	7.7801	8.6869	11.2916	14.6666	19.2434	21.7354	23.9431 (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	5497.3044 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	302.9550
Water heating fuel used	695.4091 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	188.0094 (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	6380.7229 (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	5497.3044	0.1535	844.1050	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	695.4091	0.1410	98.0768	(264)
Space and water heating			942.1818	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	188.0094	0.1443	27.1356	(268)
Total CO2, kg/year			969.3174	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.7500	(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	5497.3044	1.5685	8622.3763	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	695.4091	1.5215	1058.0659	(278)
Space and water heating			9680.4422	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	188.0094	1.5338	288.3751	(282)
Total Primary energy kWh/year			9968.8172	(286)
Dwelling Primary energy Rate (DPER)			131.1700	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	76.0000 (1b)	x	2.6000 (2b)	=	197.6000 (1b)	-

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 76.0000 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 197.6000 (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	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) =	0.1518	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4018	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415	(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	0.4355	0.4269	0.4184	0.3757	0.3672	0.3245	0.3245	0.3159	0.3415	0.3672	0.3842	0.4013	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			13.0000	1.1450	14.8855			(27)
External Wall 1	100.4000	13.0000	87.4000	0.1800	15.7320			(29a)
Communal	13.8000	2.0000	11.8000	0.1800	2.1240			(29a)
Roof	76.0000		76.0000	0.1100	8.3600			(30)
Total net area of external elements Aum(A, m2)			190.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1015			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	9.5100	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	52.6115	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.7870	38.5469	38.3115	37.2062	36.9993	36.0366	36.0366	35.8583	36.4074	36.9993	37.4177	37.8551	(38)
Heat transfer coeff	91.3985	91.1584	90.9230	89.8177	89.6108	88.6481	88.6481	88.4698	89.0189	89.6108	90.0292	90.4666	(39)
Average = Sum(39)m / 12 =												89.8167	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2026	1.1995	1.1964	1.1818	1.1791	1.1664	1.1664	1.1641	1.1713	1.1791	1.1846	1.1904	(40)
HLP (average)												1.1818	
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	2.3826 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

73.9840	72.8853	71.3380	68.4851	66.3488	63.9801	62.7006	64.2370	65.9100	68.4446	71.3563	73.7339	(42b)

Hot water usage for other uses

39.0301	37.6108	36.1915	34.7722	33.3530	31.9337	31.9337	33.3530	34.7722	36.1915	37.6108	39.0301	(42c)

Average daily hot water use (litres/day)	104.0768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.0141	110.4961	107.5295	103.2573	99.7018	95.9137	94.6343	97.5900	100.6822	104.6361	108.9671	112.7640	(44)
Energy conte	178.9867	157.3449	165.2688	141.3541	134.2178	117.9371	114.4519	120.8368	124.1513	141.9903	155.2436	176.5612	(45)
Energy content (annual)										Total = Sum(45)m =		1728.3446	

Distribution loss (46)m = 0.15 x (45)m

26.8480	23.6017	24.7903	21.2031	20.1327	17.6906	17.1678	18.1255	18.6227	21.2985	23.2865	26.4842	(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													
	225.5816	199.4307	211.8637	186.4459	180.8127	163.0290	161.0468	167.4317	169.2431	188.5852	200.3355	223.1561	(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													
	225.5816	199.4307	211.8637	186.4459	180.8127	163.0290	161.0468	167.4317	169.2431	188.5852	200.3355	223.1561	(64)
									Total per year (kWh/year) = Sum(64)m =			2276.9620	(64)
12Total per year (kWh/year)												2277	(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													
	96.7890	85.9858	92.2278	83.0737	81.9033	75.2876	75.3312	77.4542	77.3538	84.4877	87.6920	95.9825	(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	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.5785	121.3190	109.5785	113.2311	109.5785	113.2311	109.5785	109.5785	113.2311	109.5785	113.2311	109.5785	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.8782	213.0665	207.5522	195.8128	180.9940	167.0663	157.7618	155.5736	161.0879	172.8273	187.6461	201.5737	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	(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)													
	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	(71)
Water heating gains (Table 5)													
	130.0928	127.9550	123.9621	115.3801	110.0851	104.5661	101.2516	104.1051	107.4358	113.5587	121.7944	129.0088	(72)
Total internal gains													
	512.2883	524.0793	502.8316	486.1628	462.3964	443.6023	427.3307	427.9959	440.4936	457.7033	484.4104	501.8998	(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	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982	(74)
East	4.0000	19.6403	0.6300	0.7000	0.7700	24.0093	(76)
South	3.0000	46.7521	0.6300	0.7000	0.7700	42.8641	(78)

Solar gains	86.3716	154.4297	230.0886	315.5792	380.5733	389.5459	370.6989	320.5468	259.5001	175.8039	104.7989	73.0373	(83)
Total gains	598.6599	678.5091	732.9202	801.7420	842.9696	833.1482	798.0296	748.5427	699.9937	633.5072	589.2093	574.9371	(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	23.0979	23.1587	23.2187	23.5044	23.5587	23.8145	23.8145	23.8625	23.7153	23.5587	23.4492	23.3358	
alpha	2.5399	2.5439	2.5479	2.5670	2.5706	2.5876	2.5876	2.5908	2.5810	2.5706	2.5633	2.5557	
util living area													
	0.9415	0.9192	0.8864	0.8186	0.7158	0.5735	0.4463	0.4861	0.6722	0.8413	0.9176	0.9465	(86)
MIT	18.4630	18.7737	19.2340	19.8574	20.3891	20.7611	20.9096	20.8848	20.6173	19.9401	19.1156	18.4182	(87)
Th 2	19.9179	19.9204	19.9229	19.9346	19.9368	19.9470	19.9470	19.9488	19.9430	19.9368	19.9323	19.9277	(88)
util rest of house													
	0.9330	0.9078	0.8697	0.7911	0.6706	0.5033	0.3532	0.3926	0.6076	0.8113	0.9041	0.9388	(89)
MIT 2	16.9799	17.3705	17.9473	18.7192	19.3478	19.7596	19.8962	19.8801	19.6189	18.8368	17.8141	16.9291	(90)
Living area fraction										fLA = Living area / (4) =		0.3947	(91)
MIT	17.5653	17.9244	18.4552	19.1685	19.7589	20.1550	20.2962	20.2767	20.0130	19.2723	18.3278	17.5169	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5653	17.9244	18.4552	19.1685	19.7589	20.1550	20.2962	20.2767	20.0130	19.2723	18.3278	17.5169	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9081	0.8803	0.8415	0.7680	0.6623	0.5180	0.3854	0.4232	0.6123	0.7890	0.8775	0.9149	(94)
Useful gains	543.6557	597.2850	616.7760	615.7468	558.2982	431.5584	307.5406	316.7818	428.5802	499.8123	517.0547	526.0348	(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	1212.4305	1187.2821	1087.0024	922.2956	722.1604	492.4381	327.6630	342.9689	526.3679	777.1350	1010.8335	1204.7331	(97)
Space heating kWh	497.5684	396.4780	349.8485	220.7152	121.9134	0.0000	0.0000	0.0000	0.0000	206.3281	355.5207	504.9515	(98a)
Space heating requirement - total per year (kWh/year)												2653.3238	
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	497.5684	396.4780	349.8485	220.7152	121.9134	0.0000	0.0000	0.0000	0.0000	206.3281	355.5207	504.9515	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2653.3238	
Space heating per m2											(98c) / (4) =	34.9122	(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	497.5684	396.4780	349.8485	220.7152	121.9134	0.0000	0.0000	0.0000	0.0000	206.3281	355.5207	504.9515	(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)	539.0774	429.5537	379.0341	239.1280	132.0839	0.0000	0.0000	0.0000	0.0000	223.5407	385.1795	547.0764	(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	225.5816	199.4307	211.8637	186.4459	180.8127	163.0290	161.0468	167.4317	169.2431	188.5852	200.3355	223.1561	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7821	85.5702	85.1767	84.4392	83.1957	79.8000	79.8000	79.8000	79.8000	84.2619	85.3315	85.8331	(217)
Fuel for water heating, kWh/month	262.9707	233.0608	248.7344	220.8050	217.3341	204.2970	201.8131	209.8142	212.0841	223.8084	234.7732	259.9885	(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	22.7682	18.2655	16.4461	12.0491	9.3071	7.6040	8.4902	11.0359	14.3346	18.8077	21.2433	23.4010	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.3082	-30.0571	-45.3294	-53.5538	-60.0156	-56.8454	-56.1502	-51.8827	-44.7519	-35.4989	-22.8271	-17.3951	(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	-7.5116	-16.1328	-32.6920	-50.0347	-67.0819	-67.7439	-66.9487	-56.2612	-40.6832	-23.3760	-10.1256	-5.9157	(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	2874.6737	(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	2729.4834	(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)	183.7528	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-939.1226	(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	4934.7873	(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	2874.6737	0.2100	603.6815	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2729.4834	0.2100	573.1915	(264)
Space and water heating			1176.8730	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	183.7528	0.1443	26.5212	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-494.6153	0.1336	-66.0699	
PV Unit electricity exported	-444.5073	0.1253	-55.7176	
Total			-121.7874	(269)
Total CO2, kg/year			1093.5360	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.3900	(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	2874.6737	1.1300	3248.3813	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2729.4834	1.1300	3084.3163	(278)
Space and water heating			6332.6976	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	183.7528	1.5338	281.8462	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-494.6153	1.4936	-738.7701	
PV Unit electricity exported	-444.5073	0.4601	-204.5100	
Total			-943.2801	(283)
Total Primary energy kWh/year			5801.3645	(286)
Target Primary Energy Rate (TPER)			76.3300	(287)

Full SAP Calculation Printout

Property Reference	York Way	Issued on Date	30/06/2023
Assessment Reference	4.01 BAU	Prop Type Ref	York Way
Property	York Way, -		

SAP Rating	77 C	DER	27.71	TER	14.74
Environmental	77 C	% DER < TER			-87.99
CO_2 Emissions (t/year)	1.85	DFEE	80.96	TFEE	41.30
Compliance Check	See BREL	% DFEE < TFEE			-96.03
% DPER < TPER	-93.52	DPER	151.41	TPER	78.24

Assessor Details	Mr. Jonathan Lewis	Assessor ID	AZ32-0001
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	76.0000 (1b)	x	2.6000 (2b)	=	197.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.6000	(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	2 * 10 =	20.0000 (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) =	20.0000 / (5) =	0.1012 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.8512 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7235 (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	0.9225	0.9044	0.8863	0.7959	0.7778	0.6874	0.6874	0.6693	0.7235	0.7778	0.8140	0.8502	(22b)
Effective ac	0.9255	0.9090	0.8928	0.8167	0.8025	0.7362	0.7362	0.7240	0.7617	0.8025	0.8313	0.8614	(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	
Windows (Uw = 1.60)			13.0000	1.5038	19.5489			(27)
Solid Door			2.0000	1.6000	3.2000			(26)
External Wall 1	100.4000	13.0000	87.4000	0.3000	26.2200			(29a)
Communal	13.8000	2.0000	11.8000	0.3000	3.5400			(29a)
Roof	76.0000		76.0000	0.1600	12.1600			(30)
Total net area of external elements Aum(A, m2)			190.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.6689			(33)
Party Floor 1			61.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)
Thermal bridges (Default value 0.200 * total exposed area) 38.4000 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 102.7089 (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	60.3504	59.2730	58.2169	53.2565	52.3284	48.0080	48.0080	47.2079	49.6722	52.3284	54.2059	56.1687	(38)
Heat transfer coeff	163.0593	161.9819	160.9258	155.9654	155.0373	150.7169	150.7169	149.9168	152.3810	155.0373	156.9148	158.8776	(39)

Average = Sum(39)m / 12 = 155.9609

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.1455	2.1313	2.1174	2.0522	2.0400	1.9831	1.9831	1.9726	2.0050	2.0400	2.0647	2.0905	(40)
HLP (average)												2.0521	
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 2.3826 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

73.9840	72.8853	71.3380	68.4851	66.3488	63.9801	62.7006	64.2370	65.9100	68.4446	71.3563	73.7339	(42b)

Hot water usage for other uses

39.0301	37.6108	36.1915	34.7722	33.3530	31.9337	31.9337	33.3530	34.7722	36.1915	37.6108	39.0301	(42c)

Average daily hot water use (litres/day) 104.0768 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.0141	110.4961	107.5295	103.2573	99.7018	95.9137	94.6343	97.5900	100.6822	104.6361	108.9671	112.7640	(44)
Energy conte	178.9867	157.3449	165.2688	141.3541	134.2178	117.9371	114.4519	120.8368	124.1513	141.9903	155.2436	176.5612	(45)

Energy content (annual) Total = Sum(45)m = 1728.3446

Distribution loss (46)m = 0.15 x (45)m												
26.8480	23.6017	24.7903	21.2031	20.1327	17.6906	17.1678	18.1255	18.6227	21.2985	23.2865	26.4842	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.8069	47.2999	48.2246	49.7308	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
229.9456	203.3723	216.2277	190.6691	185.0247	165.2371	162.6765	170.5676	173.4663	192.9492	204.5587	227.5201	(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													
229.9456	203.3723	216.2277	190.6691	185.0247	165.2371	162.6765	170.5676	173.4663	192.9492	204.5587	227.5201	(64)

Total per year (kWh/year) = Sum(64)m = 2322.2150 (64)
12Total per year (kWh/year) 2322 (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												
72.2528	63.8240	67.6916	59.3290	57.3291	51.0391	50.1114	52.6109	53.6091	59.9515	63.9473	71.4463	(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	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
109.5785	121.3190	109.5785	113.2311	109.5785	113.2311	109.5785	109.5785	113.2311	109.5785	113.2311	109.5785	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
210.8782	213.0665	207.5522	195.8128	180.9940	167.0663	157.7618	155.5736	161.0879	172.8273	187.6461	201.5737	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	(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)													
-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	(71)
Water heating gains (Table 5)													
97.1140	94.9762	90.9834	82.4014	77.0553	70.8876	67.3541	70.7136	74.4570	80.5800	88.8157	96.0300	(72)
Total internal gains													
479.3095	491.1006	469.8528	453.1841	429.3665	409.9239	393.4332	394.6045	407.5148	424.7245	451.4317	468.9210	(73)

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6. Solar gains

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

North				6.0000		10.6334		0.6300		0.7000		0.7700	19.4982 (74)
East				4.0000		19.6403		0.6300		0.7000		0.7700	24.0093 (76)
South				3.0000		46.7521		0.6300		0.7000		0.7700	42.8641 (78)
Solar gains	86.3716	154.4297	230.0886	315.5792	380.5733	389.5459	370.6989	320.5468	259.5001	175.8039	104.7989	73.0373 (83)	
Total gains	565.6811	645.5303	699.9414	768.7633	809.9398	799.4697	764.1320	715.1513	667.0149	600.5285	556.2306	541.9583 (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	12.9469	13.0330	13.1185	13.5358	13.6168	14.0071	14.0071	14.0819	13.8542	13.6168	13.4539	13.2877
alpha	1.8631	1.8689	1.8746	1.9024	1.9078	1.9338	1.9338	1.9388	1.9236	1.9078	1.8969	1.8858
util living area	0.9571	0.9436	0.9244	0.8841	0.8206	0.7189	0.6116	0.6477	0.7929	0.8989	0.9431	0.9602 (86)
MIT	16.6700	17.0172	17.6266	18.5399	19.4111	20.1900	20.5931	20.5281	19.9211	18.8073	17.6370	16.6692 (87)
Th 2	19.2381	19.2472	19.2562	19.2988	19.3068	19.3446	19.3446	19.3517	19.3300	19.3068	19.2906	19.2737 (88)
util rest of house	0.9486	0.9324	0.9081	0.8564	0.7699	0.6218	0.4506	0.4957	0.7146	0.8692	0.9299	0.9524 (89)
MIT 2	15.4687	15.8157	16.4214	17.3359	18.1706	18.8918	19.2005	19.1683	18.6687	17.6143	16.4572	15.4872 (90)
Living area fraction										fLA = Living area / (4) =		0.3947 (91)
MIT	15.9429	16.2900	16.8971	17.8112	18.6603	19.4042	19.7502	19.7051	19.1631	18.0852	16.9229	15.9538 (92)
Temperature adjustment												0.0000
adjusted MIT	15.9429	16.2900	16.8971	17.8112	18.6603	19.4042	19.7502	19.7051	19.1631	18.0852	16.9229	15.9538 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9241	0.9039	0.8764	0.8235	0.7450	0.6261	0.4968	0.5345	0.7046	0.8390	0.9025	0.9292	(94)
Useful gains	522.7266	583.5211	613.3943	633.0719	603.4069	500.5104	379.5948	382.2580	469.9848	503.8350	501.9738	503.5631	(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	1898.4834	1844.9752	1673.1675	1389.8339	1079.1056	724.0811	474.7914	495.4909	771.5161	1160.4891	1541.3627	1867.4103	(97)
Space heating kWh	1023.5631	847.6971	788.4713	544.8686	353.9198	0.0000	0.0000	0.0000	0.0000	488.5507	748.3601	1014.7024	(98a)
Space heating requirement - total per year (kWh/year)												5810.1330	
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	1023.5631	847.6971	788.4713	544.8686	353.9198	0.0000	0.0000	0.0000	0.0000	488.5507	748.3601	1014.7024	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5810.1330	
Space heating per m2										(98c) / (4) =		76.4491	(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 %)												81.0000	(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	1023.5631	847.6971	788.4713	544.8686	353.9198	0.0000	0.0000	0.0000	0.0000	488.5507	748.3601	1014.7024	(98)
Space heating efficiency (main heating system 1)	81.0000	81.0000	81.0000	81.0000	81.0000	0.0000	0.0000	0.0000	0.0000	81.0000	81.0000	81.0000	(210)
Space heating fuel (main heating system)	1263.6581	1046.5397	973.4213	672.6773	436.9380	0.0000	0.0000	0.0000	0.0000	603.1490	923.9013	1252.7190	(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	229.9456	203.3723	216.2277	190.6691	185.0247	165.2371	162.6765	170.5676	173.4663	192.9492	204.5587	227.5201	(64)
Efficiency of water heater												86.0000	(216)
(217)m	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	86.0000	(217)
Fuel for water heating, kWh/month	267.3786	236.4795	251.4276	221.7083	215.1450	192.1361	189.1588	198.3344	201.7050	224.3595	237.8589	264.5582	(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	3.4822	3.1452	3.4822	3.3699	3.4822	3.3699	3.4822	3.4822	3.3699	3.4822	3.3699	3.4822	(231)
Lighting	23.2957	18.6886	16.8271	12.3282	9.5227	7.7801	8.6869	11.2916	14.6666	19.2434	21.7354	23.9431	(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	7173.0037 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	86.0000
Water heating fuel used	2700.2500 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
central heating pump	41.0000 (230c)
Total electricity for the above, kWh/year	41.0000 (231)
Electricity for lighting (calculated in Appendix L)	188.0094 (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	10102.2631 (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	7173.0037	0.2100	1506.3308	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2700.2500	0.2100	567.0525	(264)
Space and water heating			2073.3833	(265)
Pumps, fans and electric keep-hot	41.0000	0.1387	5.6872	(267)
Energy for lighting	188.0094	0.1443	27.1356	(268)
Total CO2, kg/year			2106.2060	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			27.7100	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	7173.0037	1.1300	8105.4941	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2700.2500	1.1300	3051.2826	(278)
Space and water heating			11156.7767	(279)
Pumps, fans and electric keep-hot	41.0000	1.5128	62.0248	(281)
Energy for lighting	188.0094	1.5338	288.3751	(282)
Total Primary energy kWh/year			11507.1766	(286)
Dwelling Primary energy Rate (DPER)			151.4100	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		76.0000 (1b)	x	2.6000 (2b)	=	197.6000	(1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.6000	(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	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) =	0.1518 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4018 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3415 (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	0.4355	0.4269	0.4184	0.3757	0.3672	0.3245	0.3245	0.3159	0.3415	0.3672	0.3842	0.4013	(22b)
Effective ac	0.5948	0.5911	0.5875	0.5706	0.5674	0.5526	0.5526	0.5499	0.5583	0.5674	0.5738	0.5805	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.20)			13.0000	1.1450	14.8855			(27)
External Wall 1	100.4000	13.0000	87.4000	0.1800	15.7320			(29a)
Communal	13.8000	2.0000	11.8000	0.1800	2.1240			(29a)
Roof	76.0000		76.0000	0.1100	8.3600			(30)
Total net area of external elements Aum(A, m2)			190.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		43.1015			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.5100	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		52.6115	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.7870	38.5469	38.3115	37.2062	36.9993	36.0366	36.0366	35.8583	36.4074	36.9993	37.4177	37.8551	(38)
Heat transfer coeff	91.3985	91.1584	90.9230	89.8177	89.6108	88.6481	88.6481	88.4698	89.0189	89.6108	90.0292	90.4666	(39)
Average = Sum(39)m / 12 =												89.8167	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2026	1.1995	1.1964	1.1818	1.1791	1.1664	1.1664	1.1641	1.1713	1.1791	1.1846	1.1904	(40)
HLP (average)												1.1818	
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												2.3826	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	73.9840	72.8853	71.3380	68.4851	66.3488	63.9801	62.7006	64.2370	65.9100	68.4446	71.3563	73.7339	(42b)
Hot water usage for other uses	39.0301	37.6108	36.1915	34.7722	33.3530	31.9337	31.9337	33.3530	34.7722	36.1915	37.6108	39.0301	(42c)
Average daily hot water use (litres/day)												104.0768	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.0141	110.4961	107.5295	103.2573	99.7018	95.9137	94.6343	97.5900	100.6822	104.6361	108.9671	112.7640	(44)
Energy conte	178.9867	157.3449	165.2688	141.3541	134.2178	117.9371	114.4519	120.8368	124.1513	141.9903	155.2436	176.5612	(45)
Energy content (annual)										Total = Sum(45)m =		1728.3446	
Distribution loss (46)m = 0.15 x (45)m	26.8480	23.6017	24.7903	21.2031	20.1327	17.6906	17.1678	18.1255	18.6227	21.2985	23.2865	26.4842	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.8069	47.2999	48.2246	49.7308	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	229.9456	203.3723	216.2277	190.6691	185.0247	165.2371	162.6765	170.5676	173.4663	192.9492	204.5587	227.5201	(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													
	229.9456	203.3723	216.2277	190.6691	185.0247	165.2371	162.6765	170.5676	173.4663	192.9492	204.5587	227.5201	(64)
										Total per year (kWh/year) = Sum(64)m =		2322.2150	(64)
12Total per year (kWh/year)												2322	(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													
	72.2528	63.8240	67.6916	59.3290	57.3291	51.0391	50.1114	52.6109	53.6091	59.9515	63.9473	71.4463	(65)

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	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	119.1293	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.5785	121.3190	109.5785	113.2311	109.5785	113.2311	109.5785	109.5785	113.2311	109.5785	113.2311	109.5785	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.8782	213.0665	207.5522	195.8128	180.9940	167.0663	157.7618	155.5736	161.0879	172.8273	187.6461	201.5737	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	34.9129	(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)													
	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	-95.3035	(71)
Water heating gains (Table 5)													
	97.1140	94.9762	90.9834	82.4014	77.0553	70.8876	67.3541	70.7136	74.4570	80.5800	88.8157	96.0300	(72)
Total internal gains													
	479.3095	491.1006	469.8528	453.1841	429.3665	409.9239	393.4332	394.6045	407.5148	424.7245	451.4317	468.9210	(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	6.0000	10.6334	0.6300	0.7000	0.7700	19.4982	(74)
East	4.0000	19.6403	0.6300	0.7000	0.7700	24.0093	(76)
South	3.0000	46.7521	0.6300	0.7000	0.7700	42.8641	(78)

Solar gains	86.3716	154.4297	230.0886	315.5792	380.5733	389.5459	370.6989	320.5468	259.5001	175.8039	104.7989	73.0373	(83)
Total gains	565.6811	645.5303	699.9414	768.7633	809.9398	799.4697	764.1320	715.1513	667.0149	600.5285	556.2306	541.9583	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	23.0979	23.1587	23.2187	23.5044	23.5587	23.8145	23.8145	23.8625	23.7153	23.5587	23.4492	23.3358	
alpha	2.5399	2.5439	2.5479	2.5670	2.5706	2.5876	2.5876	2.5908	2.5810	2.5706	2.5633	2.5557	
util living area													
	0.9479	0.9267	0.8955	0.8303	0.7301	0.5898	0.4623	0.5035	0.6904	0.8549	0.9264	0.9527	(86)
MIT	18.3908	18.7064	19.1736	19.8098	20.3571	20.7444	20.9018	20.8748	20.5906	19.8881	19.0483	18.3445	(87)
Th 2	19.9179	19.9204	19.9229	19.9346	19.9368	19.9470	19.9470	19.9488	19.9430	19.9368	19.9323	19.9277	(88)
util rest of house													
	0.9402	0.9161	0.8798	0.8039	0.6858	0.5192	0.3670	0.4082	0.6265	0.8266	0.9140	0.9457	(89)
MIT 2	16.8896	17.2874	17.8741	18.6640	19.3141	19.7452	19.8914	19.8734	19.5936	18.7769	17.7315	16.8368	(90)
Living area fraction										fLA = Living area / (4) =		0.3947	(91)
MIT	17.4822	17.8475	18.3871	19.1163	19.7258	20.1396	20.2902	20.2687	19.9872	19.2155	18.2513	17.4319	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4822	17.8475	18.3871	19.1163	19.7258	20.1396	20.2902	20.2687	19.9872	19.2155	18.2513	17.4319	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9165	0.8894	0.8518	0.7800	0.6760	0.5330	0.3995	0.4388	0.6295	0.8033	0.8882	0.9232	(94)
Useful gains	518.4488	574.1048	596.2022	599.6322	547.4908	426.0919	305.2610	313.7963	419.8762	482.4318	494.0485	500.3316	(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													
	1204.8286	1180.2748	1080.8109	917.6011	719.1964	491.0780	327.1304	342.2619	524.0703	772.0422	1003.9390	1197.0457	(97)
Space heating kWh													
	510.6665	407.3462	360.5489	228.9376	127.7490	0.0000	0.0000	0.0000	0.0000	215.4701	367.1212	518.3553	(98a)
Space heating requirement - total per year (kWh/year)												2736.1948	
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

510.6665	407.3462	360.5489	228.9376	127.7490	0.0000	0.0000	0.0000	0.0000	215.4701	367.1212	518.3553 (98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2736.1948

Space heating per m2 (98c) / (4) = 36.0026 (99)

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

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

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

Efficiency of main space heating system 1 (in %) 92.4000 (206)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	510.6665	407.3462	360.5489	228.9376	127.7490	0.0000	0.0000	0.0000	0.0000	215.4701	367.1212	518.3553	(98)
Space heating efficiency (main heating system 1)													
	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating fuel (main heating system)													
	552.6694	440.8509	390.2044	247.7680	138.2565	0.0000	0.0000	0.0000	0.0000	233.1928	397.3173	560.9905	(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													
	229.9456	203.3723	216.2277	190.6691	185.0247	165.2371	162.6765	170.5676	173.4663	192.9492	204.5587	227.5201	(64)
Efficiency of water heater												80.3000	(216)
(217)m	86.0390	85.8386	85.4684	84.7744	83.6033	80.3000	80.3000	80.3000	80.3000	84.6186	85.6189	86.0876	(217)
Fuel for water heating, kWh/month													
	267.2573	236.9240	252.9914	224.9136	221.3127	205.7747	202.5860	212.4130	216.0228	228.0222	238.9176	264.2890	(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	22.7682	18.2655	16.4461	12.0491	9.3071	7.6040	8.4902	11.0359	14.3346	18.8077	21.2433	23.4010	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-20.3082	-30.0571	-45.3294	-53.5538	-60.0156	-56.8454	-56.1502	-51.8827	-44.7519	-35.4989	-22.8271	-17.3951	(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	-7.5116	-16.1328	-32.6920	-50.0347	-67.0819	-67.7439	-66.9487	-56.2612	-40.6832	-23.3760	-10.1256	-5.9157	(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 2961.2498 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 80.3000

Water heating fuel used 2771.4242 (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) 183.7528 (232)

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

PV generation -939.1226 (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 5063.3042 (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	2961.2498	0.2100	621.8625	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2771.4242	0.2100	581.9991	(264)
Space and water heating			1203.8615	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	183.7528	0.1443	26.5212	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-494.6153	0.1336	-66.0699	

PV Unit electricity exported	-444.5073	0.1253	-55.7176	
Total			-121.7874	(269)
Total CO2, kg/year			1120.5246	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.7400	(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	2961.2498	1.1300	3346.2123	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2771.4242	1.1300	3131.7094	(278)
Space and water heating			6477.9216	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	183.7528	1.5338	281.8462	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-494.6153	1.4936	-738.7701	
PV Unit electricity exported	-444.5073	0.4601	-204.5100	
Total			-943.2801	(283)
Total Primary energy kWh/year			5946.5885	(286)
Target Primary Energy Rate (TPER)			78.2400	(287)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Newmarket Ale House

As designed

Date: Fri Jun 30 10:37:58 2023

Administrative information

Building Details

Address: 17 York Way, N7 9QG

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.4

BRUKL compliance check version: v6.1.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Foundation area [m^2]: 140.94

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	35.2	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	61.87	
Target primary energy rate (TPER), kWh/m^2.annum	202.29	
Building primary energy rate (BPER), kWh/m^2.annum	414.19	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.31	0.31	External Wall
Floors	0.18	0.26	0.26	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	-	-	No flat roofs in project
Windows** and roof windows	1.6	2.37	2.79	Door Lower
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	-	-	No personnel doors in project
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	25

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- New HVAC System (A345_EatDrink 1)

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.86	-	-	1.6	0.7
Standard value	0.93*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- New HWS Circuit

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	0.86	0
Standard value	0.91	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
A345_EatDrink 1	-	-	-	-	-	-	-	0.5	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
A345_EatDrink 1	-	95	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
A345_EatDrink 1	YES (+71%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	141	141
External area [m^2]	285	285
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	177	104
Average U-value [W/m^2K]	0.62	0.36
Alpha value* [%]	23.37	8.37

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
100	**Restaurants and Cafes/Drinking Establishments/Takeaways**
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	86.56	3.48
Cooling	7.84	11.93
Auxiliary	61.94	30.43
Lighting	39.82	9.6
Hot water	138.29	151.55
Equipment*	115.14	115.14
TOTAL**	**334.45**	**206.98**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	32.8
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*32.8*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	389.09	210.2
Primary energy [kWh/m^2]	414.19	202.29
Total emissions [kg/m^2]	61.87	35.2

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	281.9	107	91	8.3	65.2	0.86	3.6	0.86	3.6
	Notional	11.3	198.9	3.7	12.6	25.3	0.86	4.4	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Newmarket Ale House

As designed

Date: Fri Jun 30 10:47:40 2023

Administrative information

Building Details

Address: 17 York Way, N7 9QG

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.4

BRUKL compliance check version: v6.1.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Foundation area [m^2]: 140.94

The CO_2 emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	13.69	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	19.6	
Target primary energy rate (TPER), kWh/m^2.annum	150.42	
Building primary energy rate (BPER), kWh/m^2.annum	209.51	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.31	0.31	External Wall
Floors	0.18	0.26	0.26	Ground Floor
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	-	-	No flat roofs in project
Windows** and roof windows	1.6	2.37	2.79	Door Lower
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	-	-	No personnel doors in project
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)]

$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check.

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	25

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- New HVAC System (A345_EatDrink 1)

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	-	1.6	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- New HWS Circuit

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	3.2	0
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	**SFP [W/(l/s)]**									**HR efficiency**	
ID of system type	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
A345_EatDrink 1	-	-	-	-	-	-	-	0.5	-	-	N/A

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
A345_EatDrink 1	-	95	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	**Solar gain limit exceeded? (%)**	**Internal blinds used?**
A345_EatDrink 1	YES (+71%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	141	141
External area [m^2]	285	285
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	177	104
Average U-value [W/m^2K]	0.62	0.36
Alpha value* [%]	23.37	8.37

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
100	**Restaurants and Cafes/Drinking Establishments/Takeaways**
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	23.26	1.13
Cooling	5.65	11.93
Auxiliary	61.94	30.43
Lighting	39.82	9.6
Hot water	37.17	49.28
Equipment*	115.14	115.14
TOTAL**	**167.83**	**102.36**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	26.71	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*26.71*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	389.09	210.2
Primary energy [kWh/m^2]	209.51	150.42
Total emissions [kg/m^2]	19.6	13.69

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	281.9	107	24.5	5.9	65.2	3.2	5	3.2	5
	Notional	11.3	198.9	1.2	12.6	25.3	2.64	4.4	----	----

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