EAL CONSULT BUILDING SUSTAINABILITY SINCE 2008

ENERGY & SUSTAINABILITY ASSESSMENT

123 STATION ROAD

PROPERTY ADDRESS
123 STATION ROAD
HAMPTON
TW12 2AL

DATE
September 2024

PREPARED BY
EAL Consult

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1. EXECUTIVE SUMMARY

Site description

This Assessment has been prepared to support the planning application for the division of an existing maisonette into 2no. flats, facilitated by extensions to the building.

Strategy

The strategy highlights how the proposed development will promote sustainability throught both design and operation and responds to the UK Planning and regulatory framework, National Planning Policy Framework 2023, the London Plan 2021 and Richmond Local Plan, summarising how the relevant targets will be addressed and achieved.

Energy Hierarchy

In accordance with the Energy Hierarchy detailed within The London Plan 2021, this statement outlines an overall commitment to reducing energy consumption under occupancy through the adoption of a 'Fabric First' principle, which will seek to enhance insulation standards and improved heating and lighting efficiencies in comparison to the standard requirements of Approved Document Part L 2021. The viability of district heating will be explored. Further carbon emission reduction will be achieved by using renewable technologies.

- ***Be 'Lean':*** Passive design principles including a high level of insulation and reduced air permeabilty to deliver Part L compliant Building in absence of renewable technologies. It will achieve **17.5%** reduction in carbon emissions over Part L 2021 baseline.
- ***Be 'Clean':*** district heating was deemed not viable for this project
- ***Be 'Green':*** Air Source Heat Pumps and Photovoltaic panels (PV) have been proposed for the specific scheme and will deliver a further **18.7%** reduction in regulated carbon emissions over Part L 2021 baseline

Energy Effcicency & Carbon Reduction

- This report demonstrates that the proposed development by incorporating the measures above can achieve an **overall** carbon emission reduction of **36.2%**

Sustainable Design

- Natural lighting is incorporated to prevent excessive demand for artificial lighting
- Will minimise adverse impacts on the urban heat island through design, layout, orientation and materials.
- The development will not increase the air pollution of the area
- Total internal water consumption will not exceed 105 litres/person/day
- All contractors should sign up to the nationally recognised Considerate Constructors Scheme
- Low Flood Risk area

Reducing Waste and Supporting the Circular Economy:

- Minimising the use of virgin materials during construction by recycling and reusing where feasible.
- Promote a more circular economy that improves resource efficiency and innovation to keep products and materials at their highest use for as long as possible
- Encourage waste minimisation and waste prevention through the reuse of materials and using fewer resources in the production and distribution of products
- Low waste benchmark levels will be targeted during construction with requirements identifying that the diversion of waste from landfill is to be achieved by the contractor.

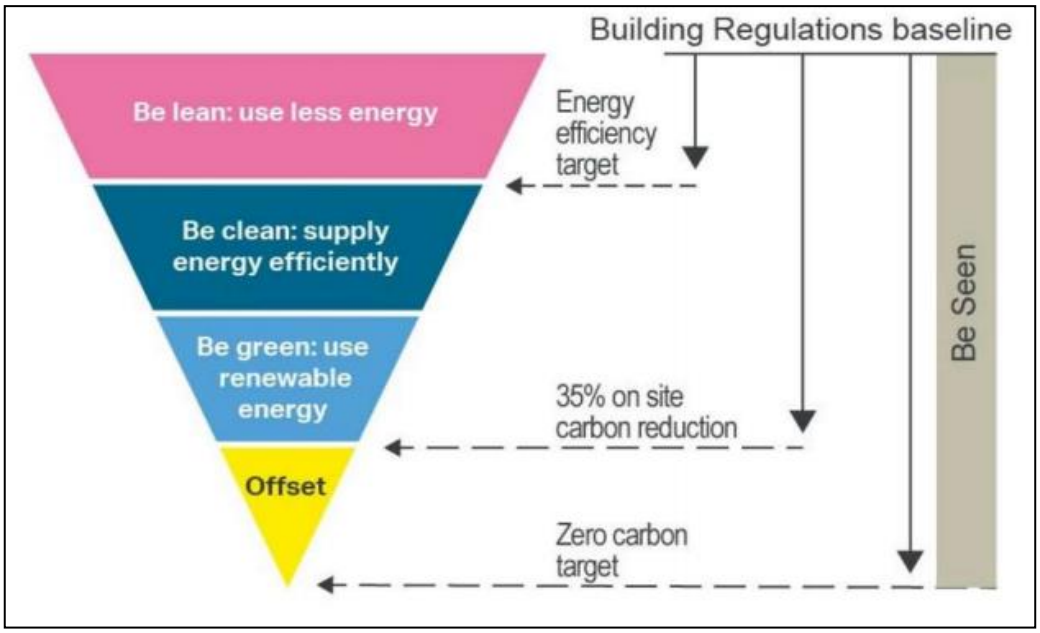
2. METHODOLOGY

This energy assessment outlines the energy demand from the development together with the associated CO_2 emissions, using Building Regulations Part L 2013 as a baseline. It demonstrates how the emissions from energy use in the development will be reduced through energy efficiency measures.

The proposed scheme is required to achieve carbon emission reduction principles in accordance with the UK Planning and regulatory framework.

The methodology employed to determine the potential CO_2 savings is in accordance with the three-step Energy Hierarchy.

Figure 1: The London Plan Energy Hierarchy



- ***Be 'Lean'*** **-** Improve the energy efficiency of the scheme;
- ***Be 'Clean'*** **-** Supply as much of the remaining energy requirement with low carbon; technologies such as district heating if available or combined heat and power (CHP); and
- ***Be 'Green'*** **-** Offset a proportion of the remaining carbon dioxide emissions by using renewable technologies.
- ***Be 'Seen'*** - monitor, verify and report on post-construction energy performance

The government approved Standard Assessment Procedure (SAP) methodology software (2021) has been used to determine the CO_2 emissions and energy requirements. It compares CO_2 emissions from regulated energy use (DER) with those of an equivalent dwelling built to Part L 2021 (TER), a notional dwelling of the same size and shape.

Where an existing building is being assessed the dwelling emission rates (DER) of the notional and proposed are compared to determine the level of improvement. This is in line with Building Regulations L for Existing Buildings SAP methodology.

Opportunities for incorporating features into the development that contribute to the objectives of sustainable development were explored during the design process, to ensure that where possible, the proposals achieve best practice.

3. PLANNING POLICY CONTEXT

National Planning Policy Framework 2021

Emphasises the concept of sustainable development by encouraging local authorities to adopt proactive strategies to mitigate and adapt to climate change. It recommends the move to a low carbon future by:

- Avoiding 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
- Contributing to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.
- To help increase the use and supply of renewable and low carbon energy and heat, plans should:
    - provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
    - consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
    - identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for colocating potential heat customers and suppliers.

The London Plan 2021

Provides the strategic framework for an integrated socio-economic, transportation and environmental development plan across the capital to 2050. The Plan seeks to ensure new developments are designed to enable the efficient use of energy and support the development of sustainable energy infrastructure to produce energy more efficiently. It sets out a range of policies that apply to new developments.

Policy SI 2 Minimising Greenhouse Gas Emissions:

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy: a) Be lean: use less energy and manage demand during operation, b) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly, c) Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site.

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should 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, in agreement with the borough, either: 1) through a cash in lieu contribution to the borough's carbon offset fund, 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 carbon reductions. The operation of offset funds should be monitored and reported on annually.

E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
F. Development proposals referable to the Mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

9.2.1 The Mayor is committed to London becoming a zero-carbon city. This will require reduction of all greenhouse gases, of which carbon dioxide is the most prominent. London's homes and workplaces are responsible for producing approximately 78 per cent of its greenhouse gas emissions. If London is to achieve its objective of becoming a zero-carbon city by 2050, new development needs to meet the requirements of this policy. Development involving major refurbishment should also aim to meet this policy.

9.2.2 The energy hierarchy should inform the design, construction, and operation of new buildings. The priority is to minimise energy demand, and then address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.

Richmond Local Plan 2018

Policy LP 22 Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:
    1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
    2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:
    2. All other new residential buildings should achieve a 35% reduction.
C. This should be achieved by following the Energy Hierarchy:
    1. Be lean: use less energy
    2. Be clean: supply energy efficiently
    3. Be green: use renewable energy Decentralised Energy Networks

B. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:
    1. All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.

6.3.1 This policy seeks to ensure that all new development and refurbishment is as sustainable as possible in order to mitigate the impact of development on the environment. All new buildings should be built to a standard which minimises the consumption of resources during construction and occupation and the use of recycled or secondary aggregates in construction is encouraged

where suitable. The policy takes forward the Council's commitment to sustainable construction and design. Where the policy exceeds national standards, this is based on local evidence and justification.

Water efficiency

6.3.3 London is classified as 'seriously' water stressed, meaning that more water is taken from the environment than the environment can sustain in the long term. London's water supply and demand is finely balanced and climate change as well as population growth will increase the risk of drought and impacts on the environment. Predicted higher temperatures due to climate change and a growing population mean that the borough's estimated water supply availability (in a dry year) is shown to be in significant deficit. Therefore, high standards of water efficiency will be required in new developments in order to address the fact that drinking water is becoming an increasingly limited resource in this borough. New developments, in their design, landscaping, construction and operation, should incorporate measures to avoid water wastage.

6.3.4 The Council has adopted the 'optional' higher national technical standard for water consumption of 110 litres per person per day (including an allowance of 5 litres or less per person per day for external water consumption) in line with the national technical standard set out in Part G of the Building Regulations 2013. All new residential developments including conversions, reversions, change of use and extensions that create one or more new dwellings must meet this target.

Retrofitting

E. High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting. Householder extensions and other development proposals that do not meet the thresholds set out in this policy are encouraged to complete and submit the Sustainable Construction Checklist SPD as far as possible, and opportunities for micro-generation of renewable energy will be supported in line with other policies in this Plan.

Policy LP 20 Climate Change Adaption

C. The Council will promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.
D. New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:
    - 1. minimise internal heat generation through energy efficient design
    - 2. reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls
    - 3. manage the heat within the building through exposed internal thermal mass and high ceilings
    - 4. passive ventilation
    - 5. mechanical ventilation
    - 6. active cooling systems (ensuring they are the lowest carbon options).
E. Opportunities to adapt existing buildings, places and spaces to the likely effects of climate change should be maximised and will be supported.

4. ENERGY STRATEGY

The Energy strategy for the proposed dwelling is based on the Building Regulations Part L; it adopts a set of principles to guide design and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. It seeks to incorporate energy efficiency through the approach detailed below.

The following tables and graph demonstrate the carbon emissions and savings.

Table 1. Average Carbon Dioxide emissions after each stage of the Energy Hierarchy

	Regulated Carbon dioxide emissions (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L Building Regulations Compliant Development	0.79	
After Energy Demand Reduction (Be Lean)	0.65	
After Heat Network Connection (Be Clean)	0.00	
After Renewables (Be Green)	0.50	

Table 2. Average Carbon Dioxide Savings from each stage of the Energy Hierarchy

	Regulated Carbon dioxide savings	
	Tonnes CO_2 per annum	**%**
Be Lean: Savings from Energy Demand Reduction	0.14	17.5
Be Clean: Savings from Heat Network	0	0
Be Green: Savings from Renewable Energy	0.15	18.7
Cumulative on-site savings	0.29	36.2

a. Notional Model

A notional model is run to calculate the performance of the existing building, which is then used in the Energy Strategy process in comparison to the Be 'Lean', Be 'Clean' and Be 'Green' scenarios of the Energy Hierarchy, to establish the regulated CO^2 emissions from the development.

b. Be 'Lean' - Demand Reduction

In accordance with London Plan Policy SI 2 the development must achieve at least a 10% improvement in fabric efficiency on Building Regulations Part L 2021 baseline scenario.

The building fabric performance and engineering systems have been optimised in order to use less energy prior to the inclusion or consideration of Low and Zero Carbon (LZC) Technology.

Through passive design measures, efficient building fabric and engineering systems the building is estimated to achieve **17.5%** reduction in annual regulated CO_2 emissions over Part L benchmark, therefore demonstrating compliance with Building Regulations Through passive means alone without the utilisation of renewable technologies.

Passive Design Measures

Fabric Performance - The fabric performance values aim to reduce unwanted heat loss and heat gains, whilst maintaining a comfortable internal environment.

Efficient Lighting and Controls - Throughout the development natural lighting will be optimised. The development will also incorporate low energy light fittings throughout. All light fittings will be specified as low energy lighting and will accommodate LED luminaries only.

Ventilation - The use of natural ventilation is proposed for the dwellings.

Space Heating & Cooling - Space heating will be provided by air source heat pumps

Domestic Hot Water (DHW) system – domestic hot water is supplied for the dwellings via a built in cylinder

Table 3. Energy Efficient Design Specification

Element	Building Regulations 2021 Standard	Specification
Proposed Wall	0.18 W/m²k	0.18 W/m²k
Existing Wall	0.30 W/m²k	0.25 W/m²k
Roofs	0.15 W/m²k	0.13 W/m²k
Windows	1.4 W/m²k	1.4 W/m²k

c. Be 'Clean' - Supply Energy Efficiently

The Be Clean step of the energy hierarchy refers to the use of 'Clean energy supply'. This includes, but is not limited to, the use of Combined Heat and Power (CHP) and District Heat Networks. Policy SI 3 seeks for new development to promote the use of CHP and district heating.

Policy SI 1 Improving Air Quality

A. Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.
B. To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:
    1. Development proposals should not:
        a. lead to further deterioration of existing poor air quality
        b. create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits
        c. create unacceptable risk of high levels of exposure to poor air quality.
    2. In order to meet the requirements in Part 1, as a minimum:
        a. development proposals must be at least Air Quality Neutral
        b. development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

d. development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

E. Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.

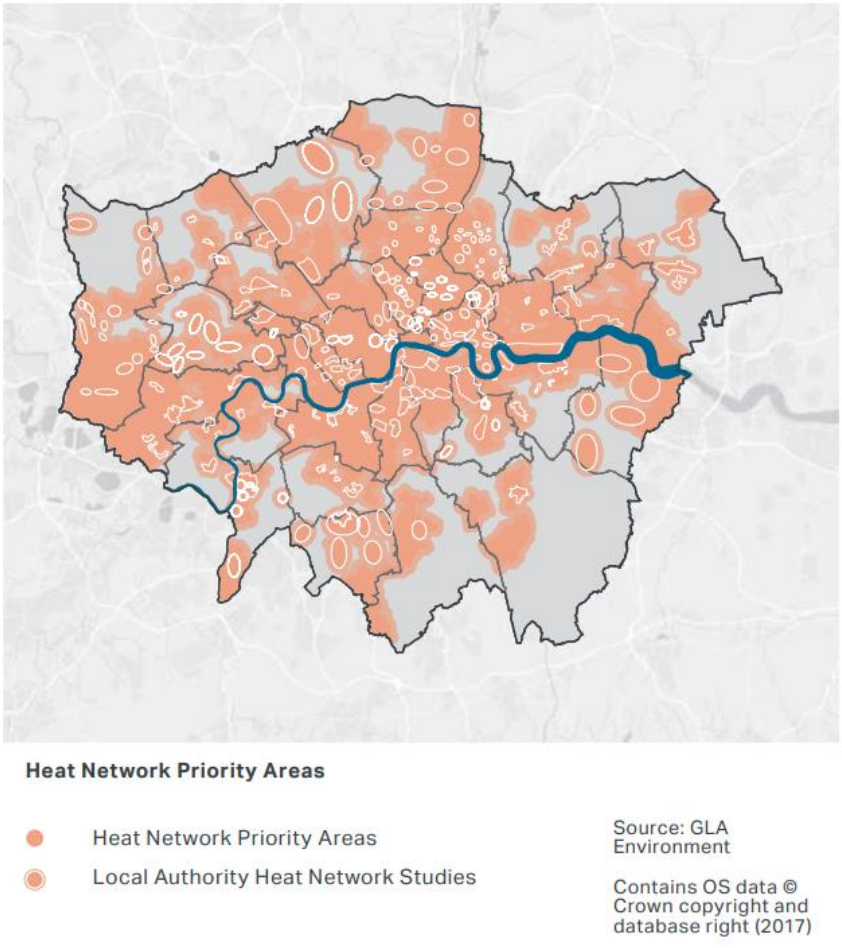
Policy SI 3 Energy Infrastructure

A. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

C. Development Plans should:

1. identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure
2. identify existing heating and cooling networks, identify proposed locations for future heating and cooling networks and identify opportunities for expanding and inter-connecting existing networks as well as establishing new networks.

Figure 2: Heat Network Priority Areas



District Heating and Cooling

There is no existing or planned heat and energy network in the vicinity and the site does not fall into an opportunity area with decentralised energy potential as identified in the London Plan.

Community heating and Combined Heat and Power (CHP system)

CHP systems are usually needed where there is a large heat demand (schemes with more than 100-150 dwellings), usually resulting from the building(s) being in continuous use, or through specific heating requirements such as a swimming pool. Community (or district) heating involves using a central boiler plant (or other heat sources) to heat a number of buildings through a network of well-insulated underground pipes. This system is not considered appropriate for this development

In light of the small scale of the proposed development, it is apparent that the use of CHP is also technically and financially unviable in this instance.

Site-wide communal system/network and design for district network connection

In light of the small scale of the proposed development and it is location; it is apparent that the use a heatpump fed site-wide network is technically and financially unviable.

Air Quality

In line with London Plan Policy SI 1 all developments are required to demonstrate compliance with the Building Emission Benchmarks (BEB) set out in the Air Quality Neutral LPG. The BEB demonstrates the emissions from equipment used to supply heat and energy to the buildings.

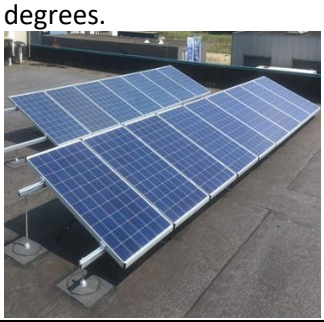
d. Be 'Green' - Renewable Energy

In accordance with Local Plan Policy residential development must achieve be able to target 35% reduction in CO2 emissions below Part L. The use of on-site renewable energy generation can aid in reaching this target.

Once energy demand reduction measures have been applied, methods for generating low and zero carbon energy can be assessed. The following renewable technologies can be considered for the project: Biomass, Water source heat pump, air source heat pump, Wind energy and solar photovoltaic panels.

Table 4. Renewable Technologies Feasibility Table

Technology	Pros	Cons
Biomass Heating A biomass system designed for wood pellets, which have a high-energy content, would fuel this development. 	• Less volume of storage • Less maintenance and produce considerably less ash residue	• Nox Emissions which may impacts • High Costs • Not suitable for the project

Ground Source Heat Pump It circulates a mixture of water and antifreeze around a loop of pipe, called a ground loop, which is buried in the garden. Heat from the ground is absorbed into the fluid and passes through a heat exchanger into the heat pump 	• Use all through the year	• High Costs • Not suitable for this project
Air Source Heat Pump They are an efficient and environmentally-friendly way of heating using air drawn freely from the atmosphere. They operate rather like a refrigerator in reverse, absorbing heat from the air into a working fluid which is passed into a compressor where its temperature is increased before it is transferred into the heating and hot water circuits of the building	• Can generate less CO_2 than conventional heating systems. • Cheaper • Provides heating and hot water • Less maintenance • Can be used as air-conditioning in the summer	• Needs electricity • Can be noisy
Wind Turbines Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings. 	• Cheaper • Less CO_2	• Local wind speeds in the area is likely to be below the level generally required for investment in large wind turbines. • Noise and signal interference. • Detrimental aesthetic impact
Solar Photovoltaic Panels (PV) Photovoltaic panels extract the energy of the sun to generate electricity. They operate most efficiently when oriented to the south and are inclined to about 35 degrees. 	• Cheaper • Less CO_2 • No input power in order to generate electricity.	

Renewable Technologies Feasibility Review Conclusion

The renewable energy sources that have been reviewed for this project are Biomass Heating, Ground Source Heat Pump, Air Source Heat Pump, Domestic Wind Turbine and Solar Photovoltaic Panels (PV).

On review of the above technologies, it has been concluded that the use of air source heat pumps and PV panels are to be incorporated in the design because together they achieve a CO_2 percentage reduction of **18.7%** contributing to an overall reduction of **36.2%** in carbon emissions.

Table 5. Photovoltaic Panels (Flat 1)

System size	Orientation	Pitch	Connection
0.5 kWp	South	Horizontal	Direct connection to flat

e. Be 'Seen' - Monitoring Performance

In accordance with London Plan Policy Guidance 'Be Seen' Energy Monitoring 1.2, the following is suggested:

1.2.1 To truly achieve net zero-carbon buildings we need to have a better understanding of their actual operational energy performance. Although Part L calculations and Energy Performance Certificates (EPCs) give an indication of the theoretical performance of buildings, it is well established that there is a 'performance gap' between design theory and measured reality.

1.2.2 To address this gap the London Plan Policy SI 2 'Minimising greenhouse gas emissions' introduces a fourth stage to the energy hierarchy; the 'be seen' stage, which requires monitoring and reporting of the actual operational energy performance of major developments for at least five years via the Mayor's 'be seen' monitoring portal.

1.2.3 The 'be seen' policy establishes post-construction monitoring as good practice, enabling developers and building owners to better understand their buildings and identify methods for improving energy performance from the project inception stage and throughout the building's lifetime.

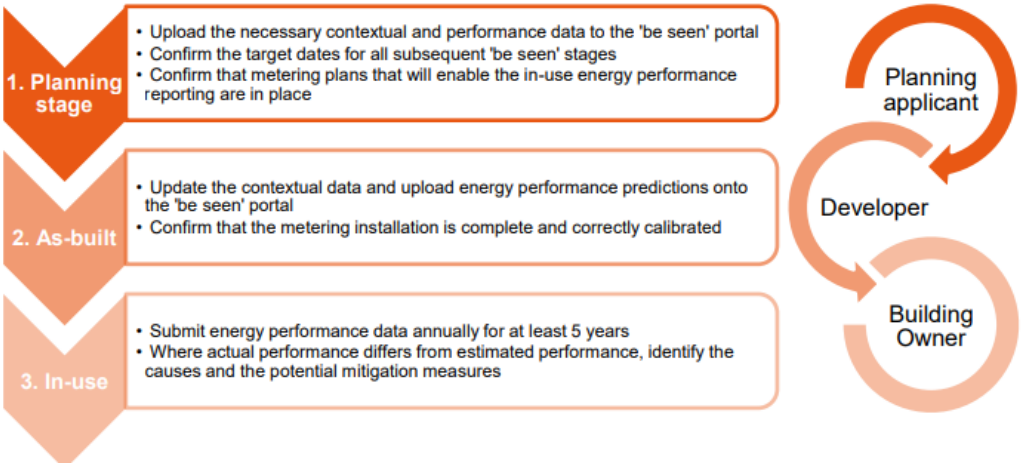
1.2.4 Ensuring that the actual energy and carbon performance of buildings is aligned with the estimated energy and carbon performance will also be a key factor in achieving a zero-carbon London.

1.2.5 The energy performance data that will be collected will provide an evidence base which could help inform future industry-wide benchmarks or performance ratings for major building typologies based on in-use performance

1.2.6 An effectively implemented post-construction monitoring regime can have a number of benefits including environmental (for example, carbon emissions reduction) and socio-economic (for example, reduced occupants' bills, raised awareness around energy usage).

Figure 3 below outlines the 'be seen' process through the reporting stages of a development.

Figure 3. 'Be seen' process and responsibilities



Smart metering equipment will be installed with display of energy usage and generation to raise awareness of occupants. This can help occupants to reduce demand and subsequent running costs. An on-site operational manual will be provided for the occupants on completion of the build to assist residents better understanding of appliances and cost management. With an average EPC rating of C the operational running costs will be low due to the high performance. As the development includes renewable technologies it is less reliant on the main grid and will protect the consumer from high prices

5. SUSTAINABILITY STRATEGY

a. Sustainable Design

London Plan Policy 5.3 Sustainable Design and Construction and Sustainable Design and Construction SPG (2014) to consider the following principles:

a. Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
b. Avoiding internal overheating and contributing to the urban heat island effect
c. Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
d. Minimising pollution (including noise, air and urban runoff)
e. Minimising the generation of waste and maximising reuse or recycling
f. Avoiding impacts from natural hazards (including flooding)
g. Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
h. Securing sustainable procurement of materials, using local supplies where feasible, and
i. Promoting and protecting biodiversity and green infrastructure.

The proposed project incorporates sustainable design and construction measures capable of mitigating and adapting to climate change to meet future needs. This section details site-specific initiatives which demonstrate how the conversion helps to meet the sustainability objectives set out in the National Planning Framework 2023.

Materials Efficiency

Materials can have a significant impact on environmental performance, both in construction but also ongoing use. Materials used for the building will have lower environmental impacts over their lifecycle. This applies to the materials used in the external walls, roof and glazing. This extends to elements of the materials category such as the basic building materials (internal walls) and the finishing elements (fascia, skirting, and furniture).

b. Overheating Strategy

Policy SI 4 Managing Heat Risk

Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.

Minimise Heat Generation Through Energy Efficient Design

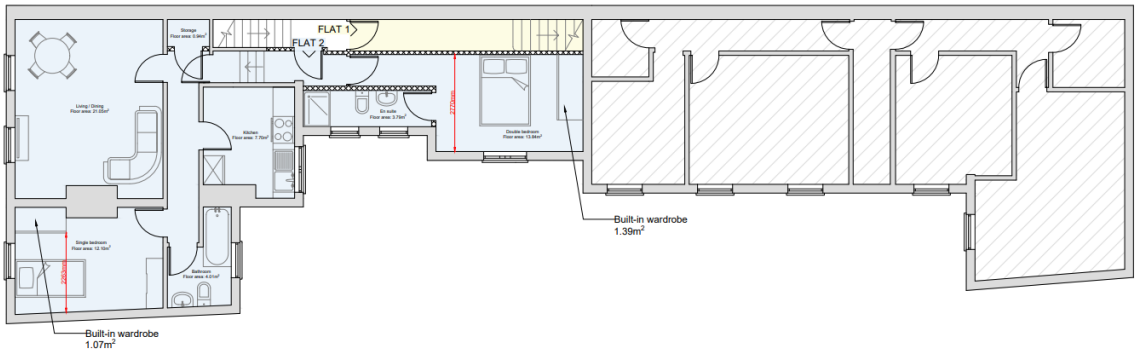
Through the use of passive and active design measures, the design team have enabled the development to require less energy through the use of optimised fabric efficiency, cross ventilation, air tightness and reduced cold bridging.

Daylight

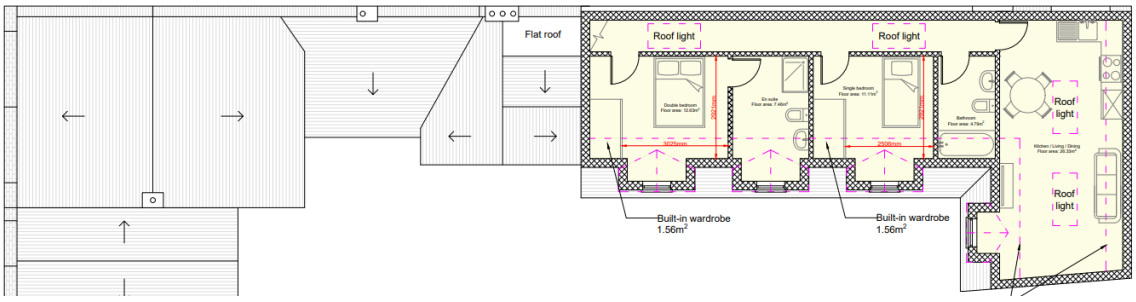
The design of the development has taken into consideration day lighting to habitable spaces to improve the wellbeing of occupants. Good levels of daylight will offer occupants a pleasant and highly valued connection to the outdoors and plenty of natural light. It will also reduce the use of artificial lighting and therefore energy use. All light fittings will be specified as low energy lighting.
No external lighting is required. The location and orientation of windows help to create a design that avoids overheating in the summer.

Figure 4. Internal layout

FIRST FLOOR



SECOND FLOOR



c. Water Efficiency

Water: Water Efficiency

In domestic and non-domestic buildings, the demand for water can be reduced as much as 50% using a variety of simple and innovative strategies that are integrated into the plumbing and mechanical systems. In order to reduce water consumption the proposed development will include efficient fixtures with low flow rates. Total internal water consumption will not exceed 105 litres/person/day.

Table 6. Water Fittings Standards

Schedule Appliance Water Consumption		
Appliance	**Flow rate or Capacity**	**Total Litres**
WC	Dual flush WC 4/2.6 litre	14.72
Basin	1.7 litres/min	5.98
Shower	8 litres/minute flow	24.00
Bath	160 litres	25.60
Sink	4 litres/min	14.13
W/machine	Default used	16.66
Dish Washer	Default used	3.90
		104.99

d. Pollution: Light, Air and Noise

Light

Light pollution can best be described as artificial light that is allowed to illuminate or intrude upon areas not intended to be lit. Light in the wrong place at the wrong time can be intrusive.
Intrusive light is over bright or poorly directed lights shining onto neighbouring property which affect the neighbours' right to enjoy their property. Therefore, the proposal will incorporate lighting measures in order to avoid causing a nuisance.

Air and Noise

The layout of the development can provide good internal air quality for habitable areas but not too much so as to waste heat.

The use of openable windows will create horizontal airflow. By achieving a good naturally ventilated building the energy demand for air conditioning and mechanical ventilation will thereby be eliminated within the development.

The development will not increase the air pollution of the area by reducing as a start, its energy use, which in turn will reduce emissions that lead to air pollution.
Other measures will include:

a. Use of eco-friendly building materials
b. Non-toxic paints
c. Installation of energy efficient appliances and devices
d. Use of renewable technologies

e. Waste Management

Considerate Construction

All contractors would be required to sign up to the nationally recognised Considerate Constructors Scheme which requires, amongst other things that dust emissions, potential noise pollution, impacts on water quality and the potential for ground contamination are minimised during demolition and construction. The Contractor would also be obliged to adhere to a site-specific Code of Construction Practice to reduce potential nuisance effects.

Diversion of waste from landfill

- Where possible, segregation of recyclable and non-recyclable material will be employed for all waste generated throughout the construction process. Furthermore, material will be re-used on-site where feasible;
- Pre-fabrication of materials/elements such as bathroom pods, pipework and riser materials will be considered;
- Reusable packing solutions with key product manufacturers will be explored at the earliest opportunity. Solutions may include flat pallets, bulk bags, steel stillages and returnable cable drums;
- Construction waste – minimum 80% diversion from landfill rate;
- Demolition waste – minimum 90% diversion from landfill rate;

Operational Waste

A space for reuse and recycling has been included for the residents exclusive use.

f. Flood Risk

The development site is located in a Low Flood Risk Area on the Environment Agency Flood Risk Map.

g. Sustainable Procurement

It is expected that all timber used in the development will come from a legal Source (FSC Scheme). At least 80% of the building materials will be responsibly sourced and will use suppliers who can provide an EMS certificate or equivalent. Materials rated with an A or B in the BRE Green Guide to Specification will be preferred.

Other measures will be implemented:

- The reuse of existing materials from the demolition of existing buildings
- At least 20% of the total value of materials used should derive from recycled and reused content in the products and materials selected;
- Steel will have a high recycled content;
- Concrete will have a Ground Granulated Blast Furnace Slag (GGBS) value of 50%.

h. Biodiversity and Green Infrastructure

As the project relates to a conversion of an existing building with no external works, there is little scope for greening or biodiversity measures. Within the scope of the project, the only biodiversity methods could be to include window box planters for the residents own use.

i. Transport

In order to reduce further emissions it is important to ensure the residents will be participating in sustainable behaviours through encouraging sustainable modes of transport.

The site is conveniently located a short walk from multiple bus stops along Station Road and only a 1 minute walk to Hampton Rail station.

6. CONCLUSION

The development has been designed to exceed Part L building regulations requirements. In line with the national and local policies, regulated CO_2 emissions from the development will be reduced by **36.7%** from the notional emissions once energy efficiency measures and lean measures are taken into account.

The use of air source heat pumps and solar photovoltaic panels can be incorporated in the design because together they achieve an average CO2 percentage reduction of **18.7%** contributing to the overall average reduction of **36.2%** in carbon emissions. The remainder is made up from a fabric first approach with U-values outlined in the specification column of Table 3 on Page 9 of this report.

An appraisal of the proposed development has been undertaken against key sustainability objectives identified from relevant policy guidance. The framework for the appraisal was guided by the National Plan. This process has ensured that the development responds to the sustainable development objectives that are relevant to the area. Key sustainability initiatives in ecology, waste management, water, health and wellbeing, materials, pollution and Surface water management have been incorporated in the design of the proposed development.

7. APPENDIX

A. SAP Calculations

i. Baseline

Full SAP Calculation Printout

Property Reference	123 Station Road - 2 Flats	**Issued on Date**	06/09/2024
Assessment Reference	Option 1 - Flat 1	**Prop Type Ref**	123 Station Road - 2 Flats
Property	123, Station Road, LONDON, TW12 2AL		

SAP Rating	63 D	**DER**	9.15	**TER**	12.63
Environmental	92 A	**% DER < TER**			27.55
CO_2 Emissions (t/year)	0.6	**DFEE**	77.40	**TFEE**	35.86
Compliance Check	See BREL	**% DFEE < TFEE**			-115.83
% DPER < TPER	-44.16	**DPER**	96.08	**TPER**	66.65

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
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	75.8400 (1b)	x	2.5500 (2b)	=	193.3920	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.8400					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	193.3920	(5)

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2. Ventilation rate

---

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	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) =	0.1551 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9051 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.9051 (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	1.1540	1.1314	1.1088	0.9956	0.9730	0.8599	0.8599	0.8372	0.9051	0.9730	1.0183	1.0635	(22b)
Effective ac	1.1540	1.1314	1.1088	0.9956	0.9734	0.8697	0.8697	0.8505	0.9096	0.9734	1.0183	1.0635	(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)			2.7600	1.5038	4.1504			(27)
Roof			4.2000	1.5038	6.3158			(27a)
External Wall	76.0900		76.0900	0.2800	21.3052	70.0000	5326.3000	(29a)
Dromer	15.7600	2.7600	13.0000	0.2800	3.6400	18.0000	234.0000	(29a)
External Roof	13.2800		13.2800	0.1600	2.1248	9.0000	119.5200	(30)
Flat Roof	62.5600	4.2000	58.3600	0.1800	10.5048	9.0000	525.2400	(30)
Total net area of external elements Aum(A, m2)			167.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.0410			(33)
Party Floor			75.8400			40.0000	3033.6000	(32d)
Internal Wall			120.0000			9.0000	1080.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10318.6600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.0583 (35)
Thermal bridges (Default value 0.200 * total exposed area)		33.5380 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	81.5790 (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	73.6498	72.2057	70.7615	63.5416	62.1201	55.5029	55.5029	54.2775	58.0517	62.1201	64.9851	67.8733	(38)

Heat transfer coeff

	155.2287	153.7846	152.3405	145.1205	143.6991	137.0819	137.0819	135.8565	139.6307	143.6991	146.5641	149.4523 (39)
Average = Sum(39)m / 12 =												144.9616

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0468	2.0278	2.0087	1.9135	1.8948	1.8075	1.8075	1.7914	1.8411	1.8948	1.9325	1.9706	(40)
HLP (average)												1.9114	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3792 (42)

Hot water usage for mixer showers

	72.1248	71.0409	69.4615	66.4395	64.2093	61.7223	60.3087	61.8761	63.5944	66.2647	69.3516	71.8485 (42a)

Hot water usage for baths

	29.1506	28.7176	28.1080	26.9839	26.1422	25.2089	24.7047	25.3101	25.9693	26.9680	28.1152	29.0520 (42b)

Hot water usage for other uses

	41.0477	39.5551	38.0624	36.5698	35.0771	33.5845	33.5845	35.0771	36.5698	38.0624	39.5551	41.0477 (42c)

Average daily hot water use (litres/day) 130.8399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	142.3231	139.3136	135.6319	129.9932	125.4287	120.5157	118.5979	122.2634	126.1335	131.2951	137.0219	141.9482	(44)
Energy conte	225.4050	198.3808	208.4612	177.9541	168.8511	148.1881	143.4339	151.3876	155.5352	178.1663	195.2128	222.2566	(45)
Energy content (annual)										Total = Sum(45)m =		2173.2326	
Distribution loss (46)m = 0.15 x (45)m													
	33.8107	29.7571	31.2692	26.6931	25.3277	22.2282	21.5151	22.7081	23.3303	26.7249	29.2819	33.3385	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8802 (55)

Total storage loss

	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)

If cylinder contains dedicated solar storage

	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(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

	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(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

	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(64)
										Total per year (kWh/year) = Sum(64)m =		2768.4016	(64)
12Total per year (kWh/year)												2768	(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

	115.3860	102.4870	109.7522	98.3042	96.5819	88.4069	88.1306	90.7753	90.8499	99.6792	104.0427	114.3392	(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	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	(66)

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

	121.8232	134.8757	121.8232	125.8840	121.8232	125.8840	121.8232	121.8232	125.8840	121.8232	125.8840	121.8232	(67)

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

	210.5274	212.7120	207.2068	195.4870	180.6928	166.7884	157.4993	155.3147	160.8199	172.5397	187.3339	201.2384	(68)

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

	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	(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)

	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	(71)

Water heating gains (Table 5)

	155.0888	152.5105	147.5164	136.5335	129.8143	122.7874	118.4552	122.0098	126.1804	133.9774	144.5037	153.6817	(72)

Total internal gains

	546.1273	558.7861	535.2344	516.5924	491.0183	474.1477	456.4656	457.8356	471.5721	487.0282	516.4095	535.4312	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6900	10.6334	0.6300	0.7000	0.7700	2.2423	(74)
West	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(80)
Horizontal	4.2000	26.0000	0.6300	0.7000	1.0000	43.3415	(82)

Solar gains	58.0086	118.6076	207.3394	320.1211	407.3603	423.5014	400.5326	334.1030	247.0114	143.9622	73.2688	47.0934	(83)
Total gains	604.1358	677.3937	742.5737	836.7135	898.3785	897.6490	856.9983	791.9387	718.5835	630.9904	589.6783	582.5246	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	18.4650	18.6384	18.8151	19.7511	19.9465	20.9094	20.9094	21.0980	20.5277	19.9465	19.5566	19.1787	
alpha	2.2310	2.2426	2.2543	2.3167	2.3298	2.3940	2.3940	2.4065	2.3685	2.3298	2.3038	2.2786	
util living area													
	0.9700	0.9597	0.9415	0.8972	0.8229	0.6972	0.5747	0.6192	0.7978	0.9178	0.9585	0.9723	(86)
Living	19.7073	19.7853	19.9241	20.1488	20.3349	20.5003	20.5658	20.5564	20.4332	20.1899	19.9378	19.7278	

Non living	18.7528	18.8387	18.9850	19.2492	19.4374	19.6309	19.6851	19.6870	19.5574	19.3002	19.0338	18.8075	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.9766	19.9861	19.9956	20.0432	20.0526	20.0962	20.0962	20.1043	20.0794	20.0526	20.0337	20.0147	(88)
util rest of house	0.9660	0.9544	0.9333	0.8819	0.7931	0.6415	0.4880	0.5366	0.7539	0.9027	0.9522	0.9687	(89)
MIT 2	19.9766	19.9861	19.9956	20.0432	20.0526	20.0962	20.0962	20.1043	20.0794	20.0526	20.0337	20.0147	(90)
Living area fraction										fLA = Living area / (4) =		0.3472	(91)
MIT	20.3319	20.3381	20.3443	20.3754	20.3815	20.4100	20.4100	20.4153	20.3990	20.3815	20.3692	20.3568	(92)
Temperature adjustment												0.3000	
adjusted MIT	20.6319	20.6381	20.6443	20.6754	20.6815	20.7100	20.7100	20.7153	20.6990	20.6815	20.6692	20.6568	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9686	0.9579	0.9387	0.8923	0.8135	0.6806	0.5487	0.5948	0.7846	0.9131	0.9565	0.9711	(94)
Useful gains	585.1894	648.8767	697.0732	746.6264	730.8431	610.9026	470.2567	471.0631	563.8246	576.1785	564.0064	565.6792	(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	2535.1808	2420.2808	2154.7552	1708.8539	1290.6372	837.5712	563.4075	586.2589	921.4283	1448.7062	1988.7565	2459.5012	(97)
Space heating kWh	1450.7936	1190.3835	1084.5154	692.8038	416.4868	0.0000	0.0000	0.0000	0.0000	649.1606	1025.8200	1409.0036	(98a)
Space heating requirement - total per year (kWh/year)												7918.9673	
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	1450.7936	1190.3835	1084.5154	692.8038	416.4868	0.0000	0.0000	0.0000	649.1606	1025.8200	1409.0036	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												7918.9673	
Space heating per m2											(98c) / (4) =	104.4168	(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 %)	371.0985	(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	1450.7936	1190.3835	1084.5154	692.8038	416.4868	0.0000	0.0000	0.0000	0.0000	649.1606	1025.8200	1409.0036	(98)
Space heating efficiency (main heating system 1)	371.0985	371.0985	371.0985	371.0985	371.0985	0.0000	0.0000	0.0000	0.0000	371.0985	371.0985	371.0985	(210)
Space heating fuel (main heating system)	390.9457	320.7730	292.2447	186.6900	112.2308	0.0000	0.0000	0.0000	0.0000	174.9295	276.4280	379.6846	(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	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(64)
Efficiency of water heater												116.0400	(216)
(217)m	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	(217)
Fuel for water heating, kWh/month	237.8090	210.3047	223.2073	195.5120	189.0725	169.8604	167.1686	174.0230	176.1920	197.1000	210.3851	235.0958	(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	24.7951	19.8915	17.9101	13.1217	10.1356	8.2809	9.2460	12.0183	15.6106	20.4820	23.1344	25.4842	(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	2133.9262	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	116.0400	
Water heating fuel used	2385.7304	(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)	200.1105	(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	4719.7671	(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	2133.9262	0.1540	328.6920	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2385.7304	0.1410	336.2975	(264)
Space and water heating			664.9895	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	200.1105	0.1443	28.8821	(268)
Total CO2, kg/year			693.8716	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.1500	(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	2133.9262	1.5703	3350.8317	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2385.7304	1.5212	3629.2440	(278)
Space and water heating			6980.0757	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	200.1105	1.5338	306.9362	(282)
Total Primary energy kWh/year			7287.0119	(286)
Dwelling Primary energy Rate (DPER)			96.0800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.8400	(1b)	x 2.5500	(2b) =	193.3920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		193.3920	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1551	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4051	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4051	(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	0.5165	0.5064	0.4963	0.4456	0.4355	0.3849	0.3849	0.3747	0.4051	0.4355	0.4558	0.4760	(22b)
Effective ac	0.6334	0.6282	0.6231	0.5993	0.5948	0.5741	0.5741	0.5702	0.5821	0.5948	0.6039	0.6133	(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)			2.7600	1.1450	3.1603			(27)
Roof			4.2000	1.5918	6.6854			(27a)
External Wall	76.0900		76.0900	0.1800	13.6962			(29a)
Dromer	15.7600	2.7600	13.0000	0.1800	2.3400			(29a)
External Roof	13.2800		13.2800	0.1100	1.4608			(30)
Flat Roof	62.5600	4.2000	58.3600	0.1100	6.4196			(30)
Total net area of external elements Aum(A, m2)			167.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7623			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							136.0583	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							8.3845	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		42.1468	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4234	40.0928	39.7688	38.2467	37.9619	36.6363	36.6363	36.3908	37.1469	37.9619	38.5380	39.1403	(38)
Heat transfer coeff	82.5702	82.2396	81.9156	80.3935	80.1087	78.7831	78.7831	78.5376	79.2937	80.1087	80.6848	81.2871	(39)
Average = Sum(39)m / 12 =												80.3922	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0887	1.0844	1.0801	1.0600	1.0563	1.0388	1.0388	1.0356	1.0455	1.0563	1.0639	1.0718	(40)
HLP (average)												1.0600	
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												2.3792	(42)
Hot water usage for mixer showers	64.1110	63.1475	61.7435	59.0573	57.0750	54.8643	53.6077	55.0010	56.5284	58.9020	61.6459	63.8653	(42a)
Hot water usage for baths	27.6930	27.2818	26.7026	25.6347	24.8351	23.9484	23.4695	24.0446	24.6708	25.6196	26.7094	27.5994	(42b)
Hot water usage for other uses	38.9953	37.5773	36.1593	34.7413	33.3233	31.9053	31.9053	33.3233	34.7413	36.1593	37.5773	38.9953	(42c)
Average daily hot water use (litres/day)												120.2343	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.7993	128.0066	124.6054	119.4333	115.2333	110.7180	108.9825	112.3689	115.9405	120.6809	125.9327	130.4601	(44)
Energy conte	207.1541	182.2796	191.5139	163.4982	155.1262	136.1406	131.8048	139.1362	142.9662	163.7628	179.4142	204.2689	(45)
Energy content (annual)										Total = Sum(45)m =		1997.0659	
Distribution loss (46)m = 0.15 x (45)m	31.0731	27.3419	28.7271	24.5247	23.2689	20.4211	19.7707	20.8704	21.4449	24.5644	26.9121	30.6403	(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	253.7490	224.3654	238.1088	208.5901	201.7211	181.2325	178.3998	185.7311	188.0580	210.3577	224.5060	250.8638	(62)
WWHRS	-29.3089	-25.9210	-27.1430	-22.4754	-20.9463	-17.9239	-16.8008	-17.8660	-18.5448	-21.8622	-24.7673	-28.7661	(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	224.4402	198.4444	210.9658	186.1146	180.7748	163.3086	161.5989	167.8651	169.5133	188.4955	199.7388	222.0977	(64)
										Total per year (kWh/year) = Sum(64)m =		2273.3577	(64)
12Total per year (kWh/year)												2273	(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	106.1547	94.2766	100.9543	90.4366	88.8554	81.3402	81.1010	83.5387	83.6097	91.7271	95.7287	105.1953	(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	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.8232	134.8757	121.8232	125.8840	121.8232	125.8840	121.8232	121.8232	125.8840	121.8232	125.8840	121.8232	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.5274	212.7120	207.2068	195.4870	180.6928	166.7884	157.4993	155.3147	160.8199	172.5397	187.3339	201.2384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	(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)	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	(71)
Water heating gains (Table 5)	142.6810	140.2925	135.6913	125.6064	119.4293	112.9726	109.0068	112.2832	116.1246	123.2890	132.9565	141.3916	(72)
Total internal gains	536.7195	549.5681	526.4092	508.6653	483.6332	464.3328	447.0172	448.1091	461.5164	479.3399	507.8623	526.1411	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6900	10.6334	0.6300	0.7000	0.7700	2.2423	(74)
West	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(80)
Horizontal	4.2000	26.0000	0.6300	0.7000	1.0000	43.3415	(82)

Solar gains	58.0086	118.6076	207.3394	320.1211	407.3603	423.5014	400.5326	334.1030	247.0114	143.9622	73.2688	47.0934	(83)
Total gains	594.7281	668.1757	733.7486	828.7864	890.9935	887.8342	847.5499	782.2121	708.5278	623.3021	581.1311	573.2345	(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	34.7134	34.8530	34.9908	35.6533	35.7800	36.3821	36.3821	36.4958	36.1478	35.7800	35.5246	35.2614	
alpha	3.3142	3.3235	3.3327	3.3769	3.3853	3.4255	3.4255	3.4331	3.4099	3.3853	3.3683	3.3508	

util living area													
	0.9640	0.9462	0.9124	0.8290	0.6987	0.5294	0.3975	0.4437	0.6651	0.8690	0.9442	0.9676	(86)
MIT	19.1884	19.4422	19.8314	20.3521	20.7219	20.9221	20.9777	20.9676	20.8272	20.3383	19.7025	19.1673	(87)
Th 2	20.0100	20.0136	20.0171	20.0336	20.0367	20.0511	20.0511	20.0538	20.0456	20.0367	20.0304	20.0239	(88)
util rest of house													
	0.9577	0.9369	0.8971	0.8003	0.6510	0.4621	0.3163	0.3593	0.5988	0.8401	0.9331	0.9619	(89)
MIT 2	17.9104	18.2312	18.7181	19.3590	19.7808	19.9949	20.0400	20.0366	19.9078	19.3599	18.5741	17.8929	(90)
Living area fraction										fLA = Living area / (4) =		0.3472	(91)
MIT	18.3541	18.6516	19.1047	19.7038	20.1075	20.3168	20.3656	20.3598	20.2270	19.6995	18.9659	18.3353	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3541	18.6516	19.1047	19.7038	20.1075	20.3168	20.3656	20.3598	20.2270	19.6995	18.9659	18.3353	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9437	0.9207	0.8800	0.7893	0.6547	0.4816	0.3437	0.3873	0.6123	0.8283	0.9176	0.9488	(94)
Useful gains	561.2208	615.1694	645.6939	654.1290	583.3304	427.5502	291.3224	302.9626	433.8011	516.2642	533.2220	543.8607	(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	1160.4496	1130.9288	1032.5183	868.5563	673.5175	450.3869	296.6641	310.9942	485.8305	728.9531	957.3972	1149.0213	(97)
Space heating kWh	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(98a)
Space heating requirement - total per year (kWh/year)												2215.5870	
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	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2215.5870	
Space heating per m2											(98c) / (4) =	29.2140	(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	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(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)	483.0186	375.5041	311.8065	167.2672	72.6969	0.0000	0.0000	0.0000	0.0000	171.4416	330.8843	487.8001	(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	224.4402	198.4444	210.9658	186.1146	180.7748	163.3086	161.5989	167.8651	169.5133	188.4955	199.7388	222.0977	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5685	85.2974	84.7567	83.6438	82.0511	79.8000	79.8000	79.8000	79.8000	83.6701	85.0090	85.6105	(217)
Fuel for water heating, kWh/month	262.2931	232.6499	248.9074	222.5087	220.3197	204.6473	202.5049	210.3573	212.4227	225.2842	234.9618	259.4282	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.3125	20.3066	18.2838	13.3955	10.3471	8.4537	9.4390	12.2691	15.9364	20.9094	23.6171	26.0160	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-25.7532	-37.4436	-55.4741	-64.3392	-71.0656	-66.9413	-66.1364	-61.6276	-53.9182	-43.7211	-28.7207	-22.1355	(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	-11.2617	-24.0132	-48.3354	-73.4881	-98.0410	-98.8281	-97.6499	-82.2606	-59.7555	-34.6134	-15.1238	-8.8800	(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												2400.4193	(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												2736.2853	(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)												204.2860	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1249.5273	(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												4177.4633	(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	2400.4193	0.2100	504.0881	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2736.2853	0.2100	574.6199	(264)
Space and water heating			1078.7080	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	204.2860	0.1443	29.4848	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-597.2766	0.1339	-80.0029	
PV Unit electricity exported	-652.2508	0.1255	-81.8843	
Total			-161.8872	(269)
Total CO2, kg/year			958.2349	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6300	(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	2400.4193	1.1300	2712.4738	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2736.2853	1.1300	3092.0024	(278)
Space and water heating			5804.4763	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	204.2860	1.5338	313.3407	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-597.2766	1.4950	-892.9321	
PV Unit electricity exported	-652.2508	0.4608	-300.5608	
Total			-1193.4929	(283)
Total Primary energy kWh/year			5054.4249	(286)
Target Primary Energy Rate (TPER)			66.6500	(287)

Full SAP Calculation Printout

Property Reference	123 Station Road - 2 Flats	**Issued on Date**	06/09/2024
Assessment Reference	Option 1 - Flat 2	**Prop Type Ref**	123 Station Road - 2 Flats
Property	123, Station Road, LONDON, TW12 2AL		

SAP Rating	52 E	**DER**	11.69	**TER**	13.13
Environmental	90 B	**% DER < TER**			10.97
CO_2 Emissions (t/year)	0.79	**DFEE**	133.04	**TFEE**	38.99
Compliance Check	See BREL	**% DFEE < TFEE**			-241.24
% DPER < TPER	-76.28	**DPER**	122.02	**TPER**	69.22

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
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	77.9600 (1b)	x	2.5100 (2b)	=	195.6796	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.6796	(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) =	0.1533	(8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.9033	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.9033	(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	1.1517	1.1291	1.1066	0.9936	0.9711	0.8581	0.8581	0.8356	0.9033	0.9711	1.0162	1.0614	(22b)
Effective ac	1.1517	1.1291	1.1066	0.9937	0.9715	0.8682	0.8682	0.8491	0.9080	0.9715	1.0162	1.0614	(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)			10.4300	1.5038	15.6842			(27)
Entrance Door			1.6900	1.6000	2.7040			(26)
External Wall	76.4300	10.4300	66.0000	1.5500	102.3000	135.0000	8910.0000	(29a)
Hallway	29.2900	1.6900	27.6000	0.2500	6.9000	18.0000	496.8000	(29a)
External Roof	77.9600		77.9600	0.1600	12.4736	9.0000	701.6400	(30)
Total net area of external elements Aum(A, m2)			183.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		140.0618			(33)
Party Wall			20.8800	0.0000	0.0000	180.0000	3758.4000	(32)
Party Floor			77.9600			40.0000	3118.4000	(32d)
Internal Wall			149.8500			9.0000	1348.6500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18333.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		235.1705 (35)
Thermal bridges (Default value 0.200 * total exposed area)		36.7360 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	176.7978 (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	74.3716	72.9134	71.4551	64.1651	62.7325	56.0639	56.0639	54.8289	58.6325	62.7325	65.6220	68.5386	(38)

Heat transfer coeff

	251.1695	249.7112	248.2529	240.9629	239.5304	232.8617	232.8617	231.6267	235.4304	239.5304	242.4198	245.3364 (39)
Average = Sum(39)m / 12 =												240.8078

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	3.2218	3.2031	3.1844	3.0909	3.0725	2.9869	2.9869	2.9711	3.0199	3.0725	3.1095	3.1470	(40)
HLP (average)												3.0889	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4230 (42)

Hot water usage for mixer showers

	72.9514	71.8551	70.2575	67.2009	64.9452	62.4296	60.9998	62.5853	64.3232	67.0241	70.1464	72.6719 (42a)

Hot water usage for baths

	29.4831	29.0453	28.4287	27.2918	26.4404	25.4965	24.9866	25.5989	26.2656	27.2756	28.4360	29.3835 (42b)

Hot water usage for other uses

	41.5201	40.0103	38.5004	36.9906	35.4808	33.9710	33.9710	35.4808	36.9906	38.5004	40.0103	41.5201 (42c)

Average daily hot water use (litres/day) 132.3398 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.9546	140.9106	137.1866	131.4833	126.8664	121.8971	119.9574	123.6650	127.5794	132.8002	138.5927	143.5754	(44)
Energy conte	227.9889	200.6548	210.8507	179.9940	170.7866	149.8867	145.0781	153.1230	157.3182	180.2087	197.4507	224.8044	(45)
Energy content (annual)										Total = Sum(45)m =		2198.1449	
Distribution loss (46)m = 0.15 x (45)m													
	34.1983	30.0982	31.6276	26.9991	25.6180	22.4830	21.7617	22.9685	23.5977	27.0313	29.6176	33.7207	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8802 (55)

Total storage loss

	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)

If cylinder contains dedicated solar storage

	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(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

	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(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

	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(64)
										Total per year (kWh/year) = Sum(64)m =		2793.3139	(64)
12Total per year (kWh/year)												2793	(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

	116.2452	103.2432	110.5468	98.9824	97.2254	88.9717	88.6773	91.3523	91.4427	100.3583	104.7867	115.1864	(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	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	117.5702	130.1670	117.5702	121.4892	117.5702	121.4892	117.5702	117.5702	121.4892	117.5702	121.4892	117.5702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(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)													
	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)													
	156.2435	153.6357	148.5843	137.4756	130.6793	123.5718	119.1900	122.7853	127.0037	134.8901	145.5371	154.8204	(72)
Total internal gains													
	548.2831	560.5044	537.2309	518.0654	492.2329	474.8364	457.0436	458.4067	472.1695	488.1126	517.7958	537.3681	(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	3.7200	10.6334	0.6300	0.7000	0.7700	12.0889	(74)
South	2.8500	46.7521	0.6300	0.7000	0.7700	40.7209	(78)
West	3.8600	19.6403	0.6300	0.7000	0.7700	23.1690	(80)

Solar gains	75.9788	135.1162	198.8496	267.9300	318.4068	323.7912	308.9971	270.4047	222.7522	153.2123	92.0703	64.3175	(83)
Total gains	624.2619	695.6206	736.0805	785.9954	810.6398	798.6275	766.0408	728.8114	694.9217	641.3249	609.8662	601.6856	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.2761	20.3945	20.5143	21.1350	21.2614	21.8703	21.8703	21.9869	21.6317	21.2614	21.0080	20.7582	
alpha	2.3517	2.3596	2.3676	2.4090	2.4174	2.4580	2.4580	2.4658	2.4421	2.4174	2.4005	2.3839	
util living area													
	0.9903	0.9868	0.9814	0.9686	0.9430	0.8867	0.8053	0.8307	0.9240	0.9718	0.9864	0.9913	(86)
Living	19.6866	19.7483	19.8659	20.0528	20.2350	20.4182	20.5182	20.5051	20.3636	20.1282	19.8920	19.6955	

Non living	17.1534	17.2394	17.3969	17.6721	17.9069	18.1585	18.2506	18.2506	18.0867	17.7768	17.4611	17.1945	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	18.6432	18.6519	18.6607	18.7053	18.7142	18.7565	18.7565	18.7645	18.7401	18.7142	18.6962	18.6783	(88)
util rest of house	0.9866	0.9815	0.9730	0.9518	0.9031	0.7755	0.5514	0.6046	0.8473	0.9530	0.9799	0.9879	(89)
MIT 2	18.6432	18.6519	18.6607	18.7053	18.7142	18.7565	18.7565	18.7645	18.7401	18.7142	18.6962	18.6783	(90)
Living area fraction										fLA = Living area / (4) =		0.2700	(91)
MIT	19.2796	19.2859	19.2923	19.3249	19.3314	19.3623	19.3623	19.3681	19.3503	19.3314	19.3183	19.3052	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2796	19.2859	19.2923	19.3249	19.3314	19.3623	19.3623	19.3681	19.3503	19.3314	19.3183	19.3052	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9878	0.9832	0.9757	0.9574	0.9169	0.8160	0.6465	0.6904	0.8756	0.9595	0.9820	0.9890	(94)
Useful gains	616.6229	683.9196	718.2019	752.4825	743.2668	651.6771	495.2390	503.1894	608.4679	615.3398	598.9130	595.0599	(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	3762.4101	3592.3234	3175.7256	2512.0054	1827.9492	1108.9574	643.2341	687.4967	1236.0773	2091.4326	2961.9514	3705.8552	(97)
Space heating kWh	2340.4657	1954.4473	1828.3977	1266.8565	807.0038	0.0000	0.0000	0.0000	0.0000	1098.2130	1701.3876	2314.4317	(98a)
Space heating requirement - total per year (kWh/year)												13311.2034	
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	2340.4657	1954.4473	1828.3977	1266.8565	807.0038	0.0000	0.0000	0.0000	0.0000	1098.2130	1701.3876	2314.4317	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												13311.2034	
Space heating per m2											(98c) / (4) =	170.7440	(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 %)	375.9677	(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	2340.4657	1954.4473	1828.3977	1266.8565	807.0038	0.0000	0.0000	0.0000	0.0000	1098.2130	1701.3876	2314.4317	(98)
Space heating efficiency (main heating system 1)	375.9677	375.9677	375.9677	375.9677	375.9677	0.0000	0.0000	0.0000	0.0000	375.9677	375.9677	375.9677	(210)
Space heating fuel (main heating system)	622.5178	519.8445	486.3178	336.9589	214.6471	0.0000	0.0000	0.0000	0.0000	292.1030	452.5356	615.5933	(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	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(64)
Efficiency of water heater												116.0400	(216)
(217)m	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	(217)
Fuel for water heating, kWh/month	240.0358	212.2644	225.2666	197.2699	190.7404	171.3243	168.5855	175.5185	177.7285	198.8601	212.3136	237.2915	(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	23.9294	19.1971	17.2849	12.6636	9.7817	7.9918	8.9232	11.5988	15.0656	19.7669	22.3267	24.5945	(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	3540.5180	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	116.0400	
Water heating fuel used	2407.1991	(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)	193.1244	(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	6140.8415	(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	3540.5180	0.1536	543.9713	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2407.1991	0.1410	339.3370	(264)
Space and water heating			883.3082	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	193.1244	0.1443	27.8738	(268)
Total CO2, kg/year			911.1820	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.6900	(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	3540.5180	1.5688	5554.4445	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2407.1991	1.5213	3661.9524	(278)
Space and water heating			9216.3969	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	193.1244	1.5338	296.2206	(282)
Total Primary energy kWh/year			9512.6175	(286)
Dwelling Primary energy Rate (DPER)			122.0200	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.9600 (1b)	x	2.5100 (2b)	=	195.6796	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.6796	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1533	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4033	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4033	(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	0.5142	0.5041	0.4941	0.4436	0.4336	0.3831	0.3831	0.3731	0.4033	0.4336	0.4537	0.4739	(22b)
Effective ac	0.6322	0.6271	0.6220	0.5984	0.5940	0.5734	0.5734	0.5696	0.5813	0.5940	0.6029	0.6123	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.6900	1.0000	1.6900			(26)
TER Opening Type (Uw = 1.20)			10.4300	1.1450	11.9427			(27)
External Wall	76.4300	10.4300	66.0000	0.1800	11.8800			(29a)
Hallway	29.2900	1.6900	27.6000	0.1800	4.9680			(29a)
External Roof	77.9600		77.9600	0.1100	8.5756			(30)
Total net area of external elements Aum(A, m2)			183.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0563			(33)
Party Wall			20.8800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							235.1705	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.1840	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		48.2403	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.8247	40.4931	40.1682	38.6419	38.3563	37.0269	37.0269	36.7807	37.5390	38.3563	38.9340	39.5380	(38)
Heat transfer coeff	89.0650	88.7335	88.4085	86.8822	86.5966	85.2673	85.2673	85.0211	85.7793	86.5966	87.1743	87.7783	(39)
Average = Sum(39)m / 12 =												86.8808	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1424	1.1382	1.1340	1.1144	1.1108	1.0937	1.0937	1.0906	1.1003	1.1108	1.1182	1.1259	(40)
HLP (average)												1.1144	
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												2.4230	(42)
Hot water usage for mixer showers	64.8457	63.8712	62.4511	59.7341	57.7290	55.4930	54.2220	55.6313	57.1762	59.5770	62.3524	64.5972	(42a)
Hot water usage for baths	28.0090	27.5930	27.0072	25.9272	25.1184	24.2217	23.7373	24.3190	24.9523	25.9119	27.0142	27.9143	(42b)
Hot water usage for other uses	39.4441	38.0098	36.5754	35.1411	33.7068	32.2724	32.2724	33.7068	35.1411	36.5754	38.0098	39.4441	(42c)
Average daily hot water use (litres/day)												121.6125	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.2987	129.4739	126.0338	120.8024	116.5542	111.9871	110.2317	113.6571	117.2696	122.0643	127.3763	131.9556	(44)
Energy conte	209.5289	184.3692	193.7092	165.3724	156.9044	137.7012	133.3157	140.7312	144.6051	165.6401	181.4709	206.6106	(45)
Energy content (annual)										Total = Sum(45)m =		2019.9589	
Distribution loss (46)m = 0.15 x (45)m	31.4293	27.6554	29.0564	24.8059	23.5357	20.6552	19.9974	21.1097	21.6908	24.8460	27.2206	30.9916	(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	256.1238	226.4549	240.3041	210.4643	203.4993	182.7930	179.9106	187.3261	189.6970	212.2350	226.5627	253.2055	(62)
WWHRS	-29.6447	-26.2180	-27.4540	-22.7330	-21.1864	-18.1293	-16.9933	-18.0707	-18.7573	-22.1128	-25.0511	-29.0958	(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	226.4790	200.2368	212.8501	187.7313	182.3130	164.6637	162.9173	169.2554	170.9397	190.1222	201.5116	224.1097	(64)
									Total per year (kWh/year) = Sum(64)m =			2293.1299	(64)
12Total per year (kWh/year)												2293	(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	106.9443	94.9713	101.6842	91.0598	89.4466	81.8591	81.6034	84.0690	84.1547	92.3513	96.4125	105.9739	(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	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.5702	130.1670	117.5702	121.4892	117.5702	121.4892	117.5702	117.5702	121.4892	117.5702	121.4892	117.5702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(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)	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)	143.7423	141.3264	136.6724	126.4720	120.2240	113.6932	109.6820	112.9960	116.8815	124.1280	133.9063	142.4381	(72)
Total internal gains	538.7819	551.1951	528.3189	510.0617	484.7775	464.9578	447.5357	448.6174	462.0472	480.3505	509.1650	527.9858	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.7200	10.6334	0.6300	0.7000	0.7700	12.0889	(74)
South	2.8500	46.7521	0.6300	0.7000	0.7700	40.7209	(78)
West	3.8600	19.6403	0.6300	0.7000	0.7700	23.1690	(80)

Solar gains	75.9788	135.1162	198.8496	267.9300	318.4068	323.7912	308.9971	270.4047	222.7522	153.2123	92.0703	64.3175	(83)
Total gains	614.7606	686.3113	727.1685	777.9918	803.1844	788.7489	756.5328	719.0221	684.7994	633.5628	601.2353	592.3033	(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	57.1801	57.3937	57.6047	58.6167	58.8100	59.7269	59.7269	59.8998	59.3703	58.8100	58.4203	58.0183	
alpha	4.8120	4.8262	4.8403	4.9078	4.9207	4.9818	4.9818	4.9933	4.9580	4.9207	4.8947	4.8679	

util living area													
	0.9916	0.9847	0.9711	0.9286	0.8322	0.6536	0.4882	0.5318	0.7663	0.9400	0.9834	0.9929	(86)
MIT	19.7318	19.9115	20.1668	20.5224	20.8010	20.9560	20.9915	20.9872	20.9022	20.5566	20.0994	19.7151	(87)
Th 2	19.9663	19.9698	19.9731	19.9891	19.9920	20.0060	20.0060	20.0085	20.0006	19.9920	19.9860	19.9797	(88)
util rest of house													
	0.9891	0.9801	0.9621	0.9060	0.7814	0.5670	0.3819	0.4232	0.6875	0.9162	0.9776	0.9908	(89)
MIT 2	18.5068	18.7368	19.0605	19.5071	19.8233	19.9802	20.0031	20.0038	19.9346	19.5578	18.9885	18.4951	(90)
Living area fraction										fLA = Living area / (4) =		0.2700	(91)
MIT	18.8376	19.0540	19.3592	19.7812	20.0873	20.2437	20.2700	20.2694	20.1958	19.8275	19.2885	18.8245	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8376	19.0540	19.3592	19.7812	20.0873	20.2437	20.2700	20.2694	20.1958	19.8275	19.2885	18.8245	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9747	0.9553	0.9005	0.7867	0.5887	0.4106	0.4525	0.7043	0.9115	0.9723	0.9874	(94)
Useful gains	605.6793	668.9511	694.6457	700.5761	631.8982	464.3407	310.6599	325.3463	482.3038	577.4888	584.5759	584.8348	(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	1294.7870	1255.9319	1136.8633	945.3862	726.3128	481.2237	312.9293	328.9766	522.8964	799.0673	1062.5229	1283.7136	(97)
Space heating kWh	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(98a)
Space heating requirement - total per year (kWh/year)												2511.6069	
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	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2511.6069	
Space heating per m2											(98c) / (4) =	32.2166	(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	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(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)	555.4670	427.3576	356.4571	190.9678	76.1045	0.0000	0.0000	0.0000	0.0000	178.6072	372.8298	563.3433	(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	226.4790	200.2368	212.8501	187.7313	182.3130	164.6637	162.9173	169.2554	170.9397	190.1222	201.5116	224.1097	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8339	85.5512	85.0328	83.9187	82.1147	79.8000	79.8000	79.8000	79.8000	83.7416	85.2492	85.8826	(217)
Fuel for water heating, kWh/month	263.8572	234.0549	250.3152	223.7062	222.0222	206.3455	204.1570	212.0994	214.2101	227.0344	236.3796	260.9488	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4288	19.5977	17.6455	12.9279	9.9859	8.1585	9.1094	11.8408	15.3800	20.1794	22.7926	25.1077	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-26.4119	-38.3742	-56.8190	-65.8632	-72.7212	-68.4890	-67.6535	-63.0408	-55.1698	-44.7732	-29.4410	-22.7039	(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	-11.6377	-24.8006	-49.8924	-75.8169	-101.1126	-101.9142	-100.7112	-84.8696	-61.6814	-35.7511	-15.6292	-9.1786	(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												2721.1343	(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												2755.1306	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												197.1541	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1284.4561	(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												4474.9629	(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	2721.1343	0.2100	571.4382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2755.1306	0.2100	578.5774	(264)
Space and water heating			1150.0156	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.1541	0.1443	28.4554	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-611.4608	0.1340	-81.9110	
PV Unit electricity exported	-672.9953	0.1256	-84.4971	
Total			-166.4080	(269)
Total CO2, kg/year			1023.9923	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1300	(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	2721.1343	1.1300	3074.8817	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2755.1306	1.1300	3113.2976	(278)
Space and water heating			6188.1793	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.1541	1.5338	302.4015	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-611.4608	1.4951	-914.1683	
PV Unit electricity exported	-672.9953	0.4609	-310.1515	
Total			-1224.3198	(283)
Total Primary energy kWh/year			5396.3619	(286)
Target Primary Energy Rate (TPER)			69.2200	(287)

ii. Be Lean

Full SAP Calculation Printout

Property Reference	123 Station Road - 2 Flats	**Issued on Date**	06/09/2024
Assessment Reference	Option 2 - Flat 1	**Prop Type Ref**	123 Station Road - 2 Flats
Property	123, Station Road, LONDON, TW12 2AL		

SAP Rating	65 D	**DER**	8.63	**TER**	12.63
Environmental	93 A	**% DER < TER**			31.67
CO_2 Emissions (t/year)	0.57	**DFEE**	69.82	**TFEE**	35.86
Compliance Check	See BREL	**% DFEE < TFEE**			-94.67
% DPER < TPER	-36.22	**DPER**	90.79	**TPER**	66.65

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
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	75.8400 (1b)	x	2.5500 (2b)	=	193.3920	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.8400					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	193.3920	(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) =	0.1551 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9051 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.9051 (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	1.1540	1.1314	1.1088	0.9956	0.9730	0.8599	0.8599	0.8372	0.9051	0.9730	1.0183	1.0635	(22b)
Effective ac	1.1540	1.1314	1.1088	0.9956	0.9734	0.8697	0.8697	0.8505	0.9096	0.9734	1.0183	1.0635	(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 = 1.40)			2.7600	1.3258	3.6591			(27)
Roof			4.2000	1.3258	5.5682			(27a)
External Wall	76.0900		76.0900	0.1800	13.6962	70.0000	5326.3000	(29a)
Dromer	15.7600	2.7600	13.0000	0.1800	2.3400	18.0000	234.0000	(29a)
External Roof	13.2800		13.2800	0.1300	1.7264	9.0000	119.5200	(30)
Flat Roof	62.5600	4.2000	58.3600	0.1300	7.5868	9.0000	525.2400	(30)
Total net area of external elements Aum(A, m2)			167.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.5767			(33)
Party Floor			75.8400			40.0000	3033.6000	(32d)
Internal Wall			120.0000			9.0000	1080.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10318.6600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.0583 (35)
Thermal bridges (Default value 0.200 * total exposed area)		33.5380 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.1147 (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	73.6498	72.2057	70.7615	63.5416	62.1201	55.5029	55.5029	54.2775	58.0517	62.1201	64.9851	67.8733	(38)

Heat transfer coeff

	141.7644	140.3203	138.8762	131.6563	130.2348	123.6176	123.6176	122.3922	126.1664	130.2348	133.0998	135.9880 (39)
Average = Sum(39)m / 12 =												131.4974

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.8693	1.8502	1.8312	1.7360	1.7172	1.6300	1.6300	1.6138	1.6636	1.7172	1.7550	1.7931	(40)
HLP (average)												1.7339	
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 2.3792 (42)

Hot water usage for mixer showers

	72.1248	71.0409	69.4615	66.4395	64.2093	61.7223	60.3087	61.8761	63.5944	66.2647	69.3516	71.8485 (42a)

Hot water usage for baths

	29.1506	28.7176	28.1080	26.9839	26.1422	25.2089	24.7047	25.3101	25.9693	26.9680	28.1152	29.0520 (42b)

Hot water usage for other uses

	41.0477	39.5551	38.0624	36.5698	35.0771	33.5845	33.5845	35.0771	36.5698	38.0624	39.5551	41.0477 (42c)

Average daily hot water use (litres/day) 130.8399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	142.3231	139.3136	135.6319	129.9932	125.4287	120.5157	118.5979	122.2634	126.1335	131.2951	137.0219	141.9482	(44)
Energy conte	225.4050	198.3808	208.4612	177.9541	168.8511	148.1881	143.4339	151.3876	155.5352	178.1663	195.2128	222.2566	(45)
Energy content (annual)										Total = Sum(45)m =		2173.2326	
Distribution loss (46)m = 0.15 x (45)m													
	33.8107	29.7571	31.2692	26.6931	25.3277	22.2282	21.5151	22.7081	23.3303	26.7249	29.2819	33.3385	(46)

Water storage loss:

Store volume 150.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8802 (55)

Total storage loss

	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)

If cylinder contains dedicated solar storage

	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(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

	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(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

	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(64)
										Total per year (kWh/year) = Sum(64)m =		2768.4016	(64)
12Total per year (kWh/year)												2768	(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

	115.3860	102.4870	109.7522	98.3042	96.5819	88.4069	88.1306	90.7753	90.8499	99.6792	104.0427	114.3392	(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	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	(66)

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

	121.8232	134.8757	121.8232	125.8840	121.8232	125.8840	121.8232	121.8232	125.8840	121.8232	125.8840	121.8232	(67)

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

	210.5274	212.7120	207.2068	195.4870	180.6928	166.7884	157.4993	155.3147	160.8199	172.5397	187.3339	201.2384	(68)

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

	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	(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)

	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	(71)

Water heating gains (Table 5)

	155.0888	152.5105	147.5164	136.5335	129.8143	122.7874	118.4552	122.0098	126.1804	133.9774	144.5037	153.6817	(72)

Total internal gains

	546.1273	558.7861	535.2344	516.5924	491.0183	474.1477	456.4656	457.8356	471.5721	487.0282	516.4095	535.4312	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6900	10.6334	0.6300	0.7000	0.7700	2.2423	(74)
West	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(80)
Horizontal	4.2000	26.0000	0.6300	0.7000	1.0000	43.3415	(82)

Solar gains	58.0086	118.6076	207.3394	320.1211	407.3603	423.5014	400.5326	334.1030	247.0114	143.9622	73.2688	47.0934	(83)
Total gains	604.1358	677.3937	742.5737	836.7135	898.3785	897.6490	856.9983	791.9387	718.5835	630.9904	589.6783	582.5246	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.2187	20.4268	20.6392	21.7710	22.0087	23.1868	23.1868	23.4189	22.7184	22.0087	21.5349	21.0776	
alpha	2.3479	2.3618	2.3759	2.4514	2.4672	2.5458	2.5458	2.5613	2.5146	2.4672	2.4357	2.4052	
util living area													
	0.9695	0.9586	0.9389	0.8902	0.8084	0.6713	0.5436	0.5890	0.7803	0.9127	0.9571	0.9719	(86)
Living	19.7931	19.8708	20.0054	20.2245	20.3978	20.5479	20.6016	20.5945	20.4859	20.2581	20.0178	19.8167	

Non living	18.9182	19.0039	19.1459	19.4046	19.5799	19.7590	19.8031	19.8067	19.6899	19.4482	19.1937	18.9761	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.0654	20.0749	20.0844	20.1320	20.1414	20.1850	20.1850	20.1931	20.1682	20.1414	20.1225	20.1035	(88)
util rest of house													
	0.9657	0.9534	0.9309	0.8750	0.7793	0.6189	0.4656	0.5136	0.7378	0.8978	0.9511	0.9685	(89)
MIT 2	20.0654	20.0749	20.0844	20.1320	20.1414	20.1850	20.1850	20.1931	20.1682	20.1414	20.1225	20.1035	(90)
Living area fraction										fLA = Living area / (4) =		0.3472	(91)
MIT	20.3899	20.3961	20.4023	20.4334	20.4395	20.4680	20.4680	20.4732	20.4570	20.4395	20.4271	20.4147	(92)
Temperature adjustment												0.3000	
adjusted MIT	20.6899	20.6961	20.7023	20.7334	20.7395	20.7680	20.7680	20.7732	20.7570	20.7395	20.7271	20.7147	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9683	0.9570	0.9364	0.8858	0.8001	0.6573	0.5226	0.5691	0.7688	0.9085	0.9553	0.9709	(94)
Useful gains	585.0102	648.2411	695.3726	741.1422	718.8345	589.9962	447.8877	450.6867	552.4534	573.2529	563.3411	565.5520	(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													
	2323.4984	2216.5096	1972.3595	1557.9357	1177.2543	762.4679	515.2327	535.2492	839.8882	1320.5126	1813.7699	2245.8029	(97)
Space heating kWh													
	1293.4352	1053.8764	950.0783	588.0913	341.0643	0.0000	0.0000	0.0000	0.0000	555.9612	900.3087	1250.1067	(98a)
Space heating requirement - total per year (kWh/year)												6932.9222	
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													
	1293.4352	1053.8764	950.0783	588.0913	341.0643	0.0000	0.0000	0.0000	0.0000	555.9612	900.3087	1250.1067	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6932.9222	
Space heating per m2											(98c) / (4) =	91.4151	(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 %)												369.2748	(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													
	1293.4352	1053.8764	950.0783	588.0913	341.0643	0.0000	0.0000	0.0000	0.0000	555.9612	900.3087	1250.1067	(98)
Space heating efficiency (main heating system 1)													
	369.2748	369.2748	369.2748	369.2748	369.2748	0.0000	0.0000	0.0000	0.0000	369.2748	369.2748	369.2748	(210)
Space heating fuel (main heating system)													
	350.2636	285.3908	257.2822	159.2557	92.3606	0.0000	0.0000	0.0000	0.0000	150.5549	243.8045	338.5302	(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													
	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(64)
Efficiency of water heater												116.0400	(216)
(217)m	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	(217)
Fuel for water heating, kWh/month													
	237.8090	210.3047	223.2073	195.5120	189.0725	169.8604	167.1686	174.0230	176.1920	197.1000	210.3851	235.0958	(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	24.7951	19.8915	17.9101	13.1217	10.1356	8.2809	9.2460	12.0183	15.6106	20.4820	23.1344	25.4842	(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	1877.4426	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	116.0400	
Water heating fuel used	2385.7304	(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)	200.1105	(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	4463.2835	(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	1877.4426	0.1542	289.5552	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2385.7304	0.1410	336.2975	(264)
Space and water heating			625.8527	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	200.1105	0.1443	28.8821	(268)
Total CO2, kg/year			654.7348	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.6300	(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	1877.4426	1.5710	2949.4543	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2385.7304	1.5212	3629.2440	(278)
Space and water heating			6578.6983	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	200.1105	1.5338	306.9362	(282)
Total Primary energy kWh/year			6885.6345	(286)
Dwelling Primary energy Rate (DPER)			90.7900	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.8400	(1b)	x 2.5500	(2b) =	193.3920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		193.3920	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1551	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4051	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4051	(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	0.5165	0.5064	0.4963	0.4456	0.4355	0.3849	0.3849	0.3747	0.4051	0.4355	0.4558	0.4760	(22b)
Effective ac	0.6334	0.6282	0.6231	0.5993	0.5948	0.5741	0.5741	0.5702	0.5821	0.5948	0.6039	0.6133	(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)			2.7600	1.1450	3.1603			(27)
Roof			4.2000	1.5918	6.6854			(27a)
External Wall	76.0900		76.0900	0.1800	13.6962			(29a)
Dromer	15.7600	2.7600	13.0000	0.1800	2.3400			(29a)
External Roof	13.2800		13.2800	0.1100	1.4608			(30)
Flat Roof	62.5600	4.2000	58.3600	0.1100	6.4196			(30)
Total net area of external elements Aum(A, m2)			167.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7623			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							136.0583	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							8.3845	(36)
Point Thermal bridges					(36a) =		0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		42.1468	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4234	40.0928	39.7688	38.2467	37.9619	36.6363	36.6363	36.3908	37.1469	37.9619	38.5380	39.1403	(38)
Heat transfer coeff	82.5702	82.2396	81.9156	80.3935	80.1087	78.7831	78.7831	78.5376	79.2937	80.1087	80.6848	81.2871	(39)
Average = Sum(39)m / 12 =												80.3922	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0887	1.0844	1.0801	1.0600	1.0563	1.0388	1.0388	1.0356	1.0455	1.0563	1.0639	1.0718	(40)
HLP (average)												1.0600	
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												2.3792	(42)
Hot water usage for mixer showers	64.1110	63.1475	61.7435	59.0573	57.0750	54.8643	53.6077	55.0010	56.5284	58.9020	61.6459	63.8653	(42a)
Hot water usage for baths	27.6930	27.2818	26.7026	25.6347	24.8351	23.9484	23.4695	24.0446	24.6708	25.6196	26.7094	27.5994	(42b)
Hot water usage for other uses	38.9953	37.5773	36.1593	34.7413	33.3233	31.9053	31.9053	33.3233	34.7413	36.1593	37.5773	38.9953	(42c)
Average daily hot water use (litres/day)												120.2343	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.7993	128.0066	124.6054	119.4333	115.2333	110.7180	108.9825	112.3689	115.9405	120.6809	125.9327	130.4601	(44)
Energy conte	207.1541	182.2796	191.5139	163.4982	155.1262	136.1406	131.8048	139.1362	142.9662	163.7628	179.4142	204.2689	(45)
Energy content (annual)										Total = Sum(45)m =		1997.0659	
Distribution loss (46)m = 0.15 x (45)m	31.0731	27.3419	28.7271	24.5247	23.2689	20.4211	19.7707	20.8704	21.4449	24.5644	26.9121	30.6403	(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	253.7490	224.3654	238.1088	208.5901	201.7211	181.2325	178.3998	185.7311	188.0580	210.3577	224.5060	250.8638	(62)
WWHRS	-29.3089	-25.9210	-27.1430	-22.4754	-20.9463	-17.9239	-16.8008	-17.8660	-18.5448	-21.8622	-24.7673	-28.7661	(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	224.4402	198.4444	210.9658	186.1146	180.7748	163.3086	161.5989	167.8651	169.5133	188.4955	199.7388	222.0977	(64)
										Total per year (kWh/year) = Sum(64)m =		2273.3577	(64)
12Total per year (kWh/year)												2273	(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	106.1547	94.2766	100.9543	90.4366	88.8554	81.3402	81.1010	83.5387	83.6097	91.7271	95.7287	105.1953	(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	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.8232	134.8757	121.8232	125.8840	121.8232	125.8840	121.8232	121.8232	125.8840	121.8232	125.8840	121.8232	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.5274	212.7120	207.2068	195.4870	180.6928	166.7884	157.4993	155.3147	160.8199	172.5397	187.3339	201.2384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	(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)	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	(71)
Water heating gains (Table 5)	142.6810	140.2925	135.6913	125.6064	119.4293	112.9726	109.0068	112.2832	116.1246	123.2890	132.9565	141.3916	(72)
Total internal gains	536.7195	549.5681	526.4092	508.6653	483.6332	464.3328	447.0172	448.1091	461.5164	479.3399	507.8623	526.1411	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6900	10.6334	0.6300	0.7000	0.7700	2.2423	(74)
West	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(80)
Horizontal	4.2000	26.0000	0.6300	0.7000	1.0000	43.3415	(82)

Solar gains	58.0086	118.6076	207.3394	320.1211	407.3603	423.5014	400.5326	334.1030	247.0114	143.9622	73.2688	47.0934	(83)
Total gains	594.7281	668.1757	733.7486	828.7864	890.9935	887.8342	847.5499	782.2121	708.5278	623.3021	581.1311	573.2345	(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	34.7134	34.8530	34.9908	35.6533	35.7800	36.3821	36.3821	36.4958	36.1478	35.7800	35.5246	35.2614	
alpha	3.3142	3.3235	3.3327	3.3769	3.3853	3.4255	3.4255	3.4331	3.4099	3.3853	3.3683	3.3508	

util living area													
	0.9640	0.9462	0.9124	0.8290	0.6987	0.5294	0.3975	0.4437	0.6651	0.8690	0.9442	0.9676	(86)
MIT	19.1884	19.4422	19.8314	20.3521	20.7219	20.9221	20.9777	20.9676	20.8272	20.3383	19.7025	19.1673	(87)
Th 2	20.0100	20.0136	20.0171	20.0336	20.0367	20.0511	20.0511	20.0538	20.0456	20.0367	20.0304	20.0239	(88)
util rest of house													
	0.9577	0.9369	0.8971	0.8003	0.6510	0.4621	0.3163	0.3593	0.5988	0.8401	0.9331	0.9619	(89)
MIT 2	17.9104	18.2312	18.7181	19.3590	19.7808	19.9949	20.0400	20.0366	19.9078	19.3599	18.5741	17.8929	(90)
Living area fraction										fLA = Living area / (4) =		0.3472	(91)
MIT	18.3541	18.6516	19.1047	19.7038	20.1075	20.3168	20.3656	20.3598	20.2270	19.6995	18.9659	18.3353	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3541	18.6516	19.1047	19.7038	20.1075	20.3168	20.3656	20.3598	20.2270	19.6995	18.9659	18.3353	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9437	0.9207	0.8800	0.7893	0.6547	0.4816	0.3437	0.3873	0.6123	0.8283	0.9176	0.9488	(94)
Useful gains	561.2208	615.1694	645.6939	654.1290	583.3304	427.5502	291.3224	302.9626	433.8011	516.2642	533.2220	543.8607	(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	1160.4496	1130.9288	1032.5183	868.5563	673.5175	450.3869	296.6641	310.9942	485.8305	728.9531	957.3972	1149.0213	(97)
Space heating kWh	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(98a)
Space heating requirement - total per year (kWh/year)												2215.5870	
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	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2215.5870	
Space heating per m2											(98c) / (4) =	29.2140	(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	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(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)	483.0186	375.5041	311.8065	167.2672	72.6969	0.0000	0.0000	0.0000	0.0000	171.4416	330.8843	487.8001	(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	224.4402	198.4444	210.9658	186.1146	180.7748	163.3086	161.5989	167.8651	169.5133	188.4955	199.7388	222.0977	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5685	85.2974	84.7567	83.6438	82.0511	79.8000	79.8000	79.8000	79.8000	83.6701	85.0090	85.6105	(217)
Fuel for water heating, kWh/month	262.2931	232.6499	248.9074	222.5087	220.3197	204.6473	202.5049	210.3573	212.4227	225.2842	234.9618	259.4282	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.3125	20.3066	18.2838	13.3955	10.3471	8.4537	9.4390	12.2691	15.9364	20.9094	23.6171	26.0160	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-25.7532	-37.4436	-55.4741	-64.3392	-71.0656	-66.9413	-66.1364	-61.6276	-53.9182	-43.7211	-28.7207	-22.1355	(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	-11.2617	-24.0132	-48.3354	-73.4881	-98.0410	-98.8281	-97.6499	-82.2606	-59.7555	-34.6134	-15.1238	-8.8800	(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												2400.4193	(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												2736.2853	(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)												204.2860	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1249.5273	(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												4177.4633	(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	2400.4193	0.2100	504.0881	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2736.2853	0.2100	574.6199	(264)
Space and water heating			1078.7080	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	204.2860	0.1443	29.4848	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-597.2766	0.1339	-80.0029	
PV Unit electricity exported	-652.2508	0.1255	-81.8843	
Total			-161.8872	(269)
Total CO2, kg/year			958.2349	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6300	(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	2400.4193	1.1300	2712.4738	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2736.2853	1.1300	3092.0024	(278)
Space and water heating			5804.4763	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	204.2860	1.5338	313.3407	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-597.2766	1.4950	-892.9321	
PV Unit electricity exported	-652.2508	0.4608	-300.5608	
Total			-1193.4929	(283)
Total Primary energy kWh/year			5054.4249	(286)
Target Primary Energy Rate (TPER)			66.6500	(287)

Full SAP Calculation Printout

Property Reference	123 Station Road - 2 Flats	**Issued on Date**	06/09/2024
Assessment Reference	Option 2 - Flat 2	**Prop Type Ref**	123 Station Road - 2 Flats
Property	123, Station Road, LONDON, TW12 2AL		

SAP Rating	65 D	**DER**	8.60	**TER**	13.13
Environmental	93 A	**% DER < TER**			34.50
CO_2 Emissions (t/year)	0.58	**DFEE**	82.03	**TFEE**	38.99
Compliance Check	See BREL	**% DFEE < TFEE**			-110.40
% DPER < TPER	-30.49	**DPER**	90.33	**TPER**	69.22

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
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	77.9600 (1b)	x	2.5100 (2b)	=	195.6796	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.6796	(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) =	0.1533 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9033 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.9033 (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	1.1517	1.1291	1.1066	0.9936	0.9711	0.8581	0.8581	0.8356	0.9033	0.9711	1.0162	1.0614	(22b)
Effective ac	1.1517	1.1291	1.1066	0.9937	0.9715	0.8682	0.8682	0.8491	0.9080	0.9715	1.0162	1.0614	(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 = 1.40)			10.4300	1.3258	13.8277			(27)
Entrance Door			1.6900	1.4000	2.3660			(26)
External Wall	76.4300	10.4300	66.0000	0.2500	16.5000	135.0000	8910.0000	(29a)
Hallway	29.2900	1.6900	27.6000	0.1700	4.6920	18.0000	496.8000	(29a)
External Roof	77.9600		77.9600	0.1300	10.1348	9.0000	701.6400	(30)
Total net area of external elements Aum(A, m2)			183.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5205			(33)
Party Wall			20.8800	0.0000	0.0000	180.0000	3758.4000	(32)
Party Floor			77.9600			40.0000	3118.4000	(32d)
Internal Wall			149.8500			9.0000	1348.6500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18333.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		235.1705 (35)
Thermal bridges (Default value 0.200 * total exposed area)		36.7360 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	84.2565 (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	74.3716	72.9134	71.4551	64.1651	62.7325	56.0639	56.0639	54.8289	58.6325	62.7325	65.6220	68.5386	(38)

Heat transfer coeff

	158.6281	157.1698	155.7116	148.4215	146.9890	140.3203	140.3203	139.0854	142.8890	146.9890	149.8785	152.7950 (39)
Average = Sum(39)m / 12 =												148.2665

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0347	2.0160	1.9973	1.9038	1.8854	1.7999	1.7999	1.7841	1.8329	1.8854	1.9225	1.9599	(40)
HLP (average)												1.9018	
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												2.4230	(42)
Hot water usage for mixer showers													
	72.9514	71.8551	70.2575	67.2009	64.9452	62.4296	60.9998	62.5853	64.3232	67.0241	70.1464	72.6719	(42a)
Hot water usage for baths													
	29.4831	29.0453	28.4287	27.2918	26.4404	25.4965	24.9866	25.5989	26.2656	27.2756	28.4360	29.3835	(42b)
Hot water usage for other uses													
	41.5201	40.0103	38.5004	36.9906	35.4808	33.9710	33.9710	35.4808	36.9906	38.5004	40.0103	41.5201	(42c)
Average daily hot water use (litres/day)												132.3398	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.9546	140.9106	137.1866	131.4833	126.8664	121.8971	119.9574	123.6650	127.5794	132.8002	138.5927	143.5754	(44)
Energy conte	227.9889	200.6548	210.8507	179.9940	170.7866	149.8867	145.0781	153.1230	157.3182	180.2087	197.4507	224.8044	(45)
Energy content (annual)										Total = Sum(45)m =		2198.1449	
Distribution loss (46)m = 0.15 x (45)m													
	34.1983	30.0982	31.6276	26.9991	25.6180	22.4830	21.7617	22.9685	23.5977	27.0313	29.6176	33.7207	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8802	(55)
Total storage loss													
	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)
If cylinder contains dedicated solar storage													
	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(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													
	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(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													
	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(64)
										Total per year (kWh/year) = Sum(64)m =		2793.3139	(64)
12Total per year (kWh/year)												2793	(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													
	116.2452	103.2432	110.5468	98.9824	97.2254	88.9717	88.6773	91.3523	91.4427	100.3583	104.7867	115.1864	(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	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	117.5702	130.1670	117.5702	121.4892	117.5702	121.4892	117.5702	117.5702	121.4892	117.5702	121.4892	117.5702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(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)													
	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)													
	156.2435	153.6357	148.5843	137.4756	130.6793	123.5718	119.1900	122.7853	127.0037	134.8901	145.5371	154.8204	(72)
Total internal gains													
	548.2831	560.5044	537.2309	518.0654	492.2329	474.8364	457.0436	458.4067	472.1695	488.1126	517.7958	537.3681	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.7200	10.6334	0.6300	0.7000	0.7700	12.0889	(74)
South	2.8500	46.7521	0.6300	0.7000	0.7700	40.7209	(78)
West	3.8600	19.6403	0.6300	0.7000	0.7700	23.1690	(80)

Solar gains	75.9788	135.1162	198.8496	267.9300	318.4068	323.7912	308.9971	270.4047	222.7522	153.2123	92.0703	64.3175	(83)
Total gains	624.2619	695.6206	736.0805	785.9954	810.6398	798.6275	766.0408	728.8114	694.9217	641.3249	609.8662	601.6856	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.1050	32.4028	32.7063	34.3127	34.6471	36.2937	36.2937	36.6160	35.6413	34.6471	33.9792	33.3306	
alpha	3.1403	3.1602	3.1804	3.2875	3.3098	3.4196	3.4196	3.4411	3.3761	3.3098	3.2653	3.2220	
util living area													
	0.9918	0.9877	0.9807	0.9617	0.9193	0.8168	0.6843	0.7220	0.8844	0.9665	0.9871	0.9928	(86)
Living	20.0801	20.1377	20.2332	20.3914	20.5245	20.6511	20.7000	20.6950	20.6080	20.4337	20.2518	20.0985	

Non living	18.2353	18.3197	18.4523	18.7081	18.8815	19.0756	19.1142	19.1238	19.0128	18.7742	18.5217	18.3032	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.3103	19.3227	19.3351	19.3982	19.4108	19.4701	19.4701	19.4812	19.4471	19.4108	19.3855	19.3602	(88)
util rest of house	0.9889	0.9833	0.9732	0.9448	0.8771	0.7101	0.4964	0.5450	0.8066	0.9482	0.9817	0.9904	(89)
MIT 2	19.3103	19.3227	19.3351	19.3982	19.4108	19.4701	19.4701	19.4812	19.4471	19.4108	19.3855	19.3602	(90)
Living area fraction										fLA = Living area / (4) =		0.2700	(91)
MIT	19.7665	19.7756	19.7847	19.8307	19.8399	19.8832	19.8832	19.8913	19.8664	19.8399	19.8214	19.8030	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7665	19.7756	19.7847	19.8307	19.8399	19.8832	19.8832	19.8913	19.8664	19.8399	19.8214	19.8030	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9898	0.9847	0.9756	0.9502	0.8907	0.7441	0.5543	0.6004	0.8323	0.9541	0.9834	0.9911	(94)
Useful gains	617.9126	684.9530	718.1109	746.8324	722.0250	594.2736	424.6134	437.6107	578.3726	611.9196	599.7559	596.3431	(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	2453.4244	2337.9898	2068.5739	1622.3544	1196.4757	741.3355	460.6949	485.5854	823.9544	1358.1636	1906.6686	2384.0540	(97)
Space heating kWh	1365.6208	1110.8408	1004.7444	630.3759	352.9913	0.0000	0.0000	0.0000	0.0000	555.2056	940.9771	1330.0569	(98a)
Space heating requirement - total per year (kWh/year)												7290.8127	
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	1365.6208	1110.8408	1004.7444	630.3759	352.9913	0.0000	0.0000	0.0000	555.2056	940.9771		1330.0569	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7290.8127	
Space heating per m2											(98c) / (4) =	93.5199	(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 %)	371.5084	(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	1365.6208	1110.8408	1004.7444	630.3759	352.9913	0.0000	0.0000	0.0000	0.0000	555.2056	940.9771	1330.0569	(98)
Space heating efficiency (main heating system 1)	371.5084	371.5084	371.5084	371.5084	371.5084	0.0000	0.0000	0.0000	0.0000	371.5084	371.5084	371.5084	(210)
Space heating fuel (main heating system)	367.5881	299.0083	270.4500	169.6801	95.0157	0.0000	0.0000	0.0000	0.0000	149.4463	253.2856	358.0153	(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	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(64)
Efficiency of water heater												116.0400	(216)
(217)m	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	116.0400	(217)
Fuel for water heating, kWh/month	240.0358	212.2644	225.2666	197.2699	190.7404	171.3243	168.5855	175.5185	177.7285	198.8601	212.3136	237.2915	(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	23.9294	19.1971	17.2849	12.6636	9.7817	7.9918	8.9232	11.5988	15.0656	19.7669	22.3267	24.5945	(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	1962.4895	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	116.0400	
Water heating fuel used	2407.1991	(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)	193.1244	(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	4562.8129	(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	1962.4895	0.1543	302.8707	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2407.1991	0.1410	339.3370	(264)
Space and water heating			642.2076	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	193.1244	0.1443	27.8738	(268)
Total CO2, kg/year			670.0815	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.6000	(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	1962.4895	1.5714	3083.8037	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2407.1991	1.5213	3661.9524	(278)
Space and water heating			6745.7561	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	193.1244	1.5338	296.2206	(282)
Total Primary energy kWh/year			7041.9767	(286)
Dwelling Primary energy Rate (DPER)			90.3300	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.9600 (1b)	x	2.5100 (2b)	=	195.6796	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.6796	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1533	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4033	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4033	(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	0.5142	0.5041	0.4941	0.4436	0.4336	0.3831	0.3831	0.3731	0.4033	0.4336	0.4537	0.4739	(22b)
Effective ac	0.6322	0.6271	0.6220	0.5984	0.5940	0.5734	0.5734	0.5696	0.5813	0.5940	0.6029	0.6123	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.6900	1.0000	1.6900			(26)
TER Opening Type (Uw = 1.20)			10.4300	1.1450	11.9427			(27)
External Wall	76.4300	10.4300	66.0000	0.1800	11.8800			(29a)
Hallway	29.2900	1.6900	27.6000	0.1800	4.9680			(29a)
External Roof	77.9600		77.9600	0.1100	8.5756			(30)
Total net area of external elements Aum(A, m2)			183.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0563			(33)
Party Wall			20.8800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							235.1705	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.1840	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		48.2403	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.8247	40.4931	40.1682	38.6419	38.3563	37.0269	37.0269	36.7807	37.5390	38.3563	38.9340	39.5380	(38)
Heat transfer coeff	89.0650	88.7335	88.4085	86.8822	86.5966	85.2673	85.2673	85.0211	85.7793	86.5966	87.1743	87.7783	(39)
Average = Sum(39)m / 12 =												86.8808	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1424	1.1382	1.1340	1.1144	1.1108	1.0937	1.0937	1.0906	1.1003	1.1108	1.1182	1.1259	(40)
HLP (average)												1.1144	
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												2.4230	(42)
Hot water usage for mixer showers	64.8457	63.8712	62.4511	59.7341	57.7290	55.4930	54.2220	55.6313	57.1762	59.5770	62.3524	64.5972	(42a)
Hot water usage for baths	28.0090	27.5930	27.0072	25.9272	25.1184	24.2217	23.7373	24.3190	24.9523	25.9119	27.0142	27.9143	(42b)
Hot water usage for other uses	39.4441	38.0098	36.5754	35.1411	33.7068	32.2724	32.2724	33.7068	35.1411	36.5754	38.0098	39.4441	(42c)
Average daily hot water use (litres/day)												121.6125	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.2987	129.4739	126.0338	120.8024	116.5542	111.9871	110.2317	113.6571	117.2696	122.0643	127.3763	131.9556	(44)
Energy conte	209.5289	184.3692	193.7092	165.3724	156.9044	137.7012	133.3157	140.7312	144.6051	165.6401	181.4709	206.6106	(45)
Energy content (annual)										Total = Sum(45)m =		2019.9589	
Distribution loss (46)m = 0.15 x (45)m	31.4293	27.6554	29.0564	24.8059	23.5357	20.6552	19.9974	21.1097	21.6908	24.8460	27.2206	30.9916	(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	256.1238	226.4549	240.3041	210.4643	203.4993	182.7930	179.9106	187.3261	189.6970	212.2350	226.5627	253.2055	(62)
WWHRS	-29.6447	-26.2180	-27.4540	-22.7330	-21.1864	-18.1293	-16.9933	-18.0707	-18.7573	-22.1128	-25.0511	-29.0958	(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	226.4790	200.2368	212.8501	187.7313	182.3130	164.6637	162.9173	169.2554	170.9397	190.1222	201.5116	224.1097	(64)
									Total per year (kWh/year) = Sum(64)m =			2293.1299	(64)
12Total per year (kWh/year)												2293	(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	106.9443	94.9713	101.6842	91.0598	89.4466	81.8591	81.6034	84.0690	84.1547	92.3513	96.4125	105.9739	(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	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.5702	130.1670	117.5702	121.4892	117.5702	121.4892	117.5702	117.5702	121.4892	117.5702	121.4892	117.5702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(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)	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)	143.7423	141.3264	136.6724	126.4720	120.2240	113.6932	109.6820	112.9960	116.8815	124.1280	133.9063	142.4381	(72)
Total internal gains	538.7819	551.1951	528.3189	510.0617	484.7775	464.9578	447.5357	448.6174	462.0472	480.3505	509.1650	527.9858	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.7200	10.6334	0.6300	0.7000	0.7700	12.0889	(74)
South	2.8500	46.7521	0.6300	0.7000	0.7700	40.7209	(78)
West	3.8600	19.6403	0.6300	0.7000	0.7700	23.1690	(80)

Solar gains	75.9788	135.1162	198.8496	267.9300	318.4068	323.7912	308.9971	270.4047	222.7522	153.2123	92.0703	64.3175	(83)
Total gains	614.7606	686.3113	727.1685	777.9918	803.1844	788.7489	756.5328	719.0221	684.7994	633.5628	601.2353	592.3033	(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	57.1801	57.3937	57.6047	58.6167	58.8100	59.7269	59.7269	59.8998	59.3703	58.8100	58.4203	58.0183	
alpha	4.8120	4.8262	4.8403	4.9078	4.9207	4.9818	4.9818	4.9933	4.9580	4.9207	4.8947	4.8679	

util living area													
	0.9916	0.9847	0.9711	0.9286	0.8322	0.6536	0.4882	0.5318	0.7663	0.9400	0.9834	0.9929	(86)
MIT	19.7318	19.9115	20.1668	20.5224	20.8010	20.9560	20.9915	20.9872	20.9022	20.5566	20.0994	19.7151	(87)
Th 2	19.9663	19.9698	19.9731	19.9891	19.9920	20.0060	20.0060	20.0085	20.0006	19.9920	19.9860	19.9797	(88)
util rest of house													
	0.9891	0.9801	0.9621	0.9060	0.7814	0.5670	0.3819	0.4232	0.6875	0.9162	0.9776	0.9908	(89)
MIT 2	18.5068	18.7368	19.0605	19.5071	19.8233	19.9802	20.0031	20.0038	19.9346	19.5578	18.9885	18.4951	(90)
Living area fraction										fLA = Living area / (4) =		0.2700	(91)
MIT	18.8376	19.0540	19.3592	19.7812	20.0873	20.2437	20.2700	20.2694	20.1958	19.8275	19.2885	18.8245	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8376	19.0540	19.3592	19.7812	20.0873	20.2437	20.2700	20.2694	20.1958	19.8275	19.2885	18.8245	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9747	0.9553	0.9005	0.7867	0.5887	0.4106	0.4525	0.7043	0.9115	0.9723	0.9874	(94)
Useful gains	605.6793	668.9511	694.6457	700.5761	631.8982	464.3407	310.6599	325.3463	482.3038	577.4888	584.5759	584.8348	(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													
	1294.7870	1255.9319	1136.8633	945.3862	726.3128	481.2237	312.9293	328.9766	522.8964	799.0673	1062.5229	1283.7136	(97)
Space heating kWh													
	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(98a)
Space heating requirement - total per year (kWh/year)												2511.6069	
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													
	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2511.6069	
Space heating per m2											(98c) / (4) =	32.2166	(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													
	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(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)													
	555.4670	427.3576	356.4571	190.9678	76.1045	0.0000	0.0000	0.0000	0.0000	178.6072	372.8298	563.3433	(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													
	226.4790	200.2368	212.8501	187.7313	182.3130	164.6637	162.9173	169.2554	170.9397	190.1222	201.5116	224.1097	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8339	85.5512	85.0328	83.9187	82.1147	79.8000	79.8000	79.8000	79.8000	83.7416	85.2492	85.8826	(217)
Fuel for water heating, kWh/month													
	263.8572	234.0549	250.3152	223.7062	222.0222	206.3455	204.1570	212.0994	214.2101	227.0344	236.3796	260.9488	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4288	19.5977	17.6455	12.9279	9.9859	8.1585	9.1094	11.8408	15.3800	20.1794	22.7926	25.1077	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-26.4119	-38.3742	-56.8190	-65.8632	-72.7212	-68.4890	-67.6535	-63.0408	-55.1698	-44.7732	-29.4410	-22.7039	(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	-11.6377	-24.8006	-49.8924	-75.8169	-101.1126	-101.9142	-100.7112	-84.8696	-61.6814	-35.7511	-15.6292	-9.1786	(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												2721.1343	(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												2755.1306	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												197.1541	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1284.4561	(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												4474.9629	(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	2721.1343	0.2100	571.4382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2755.1306	0.2100	578.5774	(264)
Space and water heating			1150.0156	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.1541	0.1443	28.4554	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-611.4608	0.1340	-81.9110	
PV Unit electricity exported	-672.9953	0.1256	-84.4971	
Total			-166.4080	(269)
Total CO2, kg/year			1023.9923	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1300	(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	2721.1343	1.1300	3074.8817	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2755.1306	1.1300	3113.2976	(278)
Space and water heating			6188.1793	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.1541	1.5338	302.4015	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-611.4608	1.4951	-914.1683	
PV Unit electricity exported	-672.9953	0.4609	-310.1515	
Total			-1224.3198	(283)
Total Primary energy kWh/year			5396.3619	(286)
Target Primary Energy Rate (TPER)			69.2200	(287)

iii. Be Green

Full SAP Calculation Printout

Property Reference	123 Station Road - 2 Flats	**Issued on Date**	06/09/2024
Assessment Reference	Option 3 - Flat 1	**Prop Type Ref**	123 Station Road - 2 Flats
Property	123, Station Road, LONDON, TW12 2AL		

SAP Rating	75 C	**DER**	6.08	**TER**	12.63
Environmental	95 A	**% DER < TER**			51.86
CO_2 Emissions (t/year)	0.38	**DFEE**	69.82	**TFEE**	35.86
Compliance Check	See BREL	**% DFEE < TFEE**			-94.67
% DPER < TPER	3.52	**DPER**	64.30	**TPER**	66.65

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
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	75.8400	(1b)	x 2.5500	(2b) =	193.3920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		193.3920	(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) =	0.1551 (8)
Pressure test		No
Pressure Test Method		Blower Door
Measured/design AP50		15.0000 (17)
Infiltration rate		0.9051 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.9051 (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	1.1540	1.1314	1.1088	0.9956	0.9730	0.8599	0.8599	0.8372	0.9051	0.9730	1.0183	1.0635	(22b)
Effective ac	1.1540	1.1314	1.1088	0.9956	0.9734	0.8697	0.8697	0.8505	0.9096	0.9734	1.0183	1.0635	(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 = 1.40)			2.7600	1.3258	3.6591			(27)
Roof			4.2000	1.3258	5.5682			(27a)
External Wall	76.0900		76.0900	0.1800	13.6962	70.0000	5326.3000	(29a)
Dromer	15.7600	2.7600	13.0000	0.1800	2.3400	18.0000	234.0000	(29a)
External Roof	13.2800		13.2800	0.1300	1.7264	9.0000	119.5200	(30)
Flat Roof	62.5600	4.2000	58.3600	0.1300	7.5868	9.0000	525.2400	(30)
Total net area of external elements Aum(A, m2)			167.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.5767			(33)
Party Floor			75.8400			40.0000	3033.6000	(32d)
Internal Wall			120.0000			9.0000	1080.0000	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	10318.6600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.0583 (35)
Thermal bridges (Default value 0.200 * total exposed area)		33.5380 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	68.1147 (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	73.6498	72.2057	70.7615	63.5416	62.1201	55.5029	55.5029	54.2775	58.0517	62.1201	64.9851	67.8733	(38)

Heat transfer coeff

	141.7644	140.3203	138.8762	131.6563	130.2348	123.6176	123.6176	122.3922	126.1664	130.2348	133.0998	135.9880 (39)
Average = Sum(39)m / 12 =												131.4974

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.8693	1.8502	1.8312	1.7360	1.7172	1.6300	1.6300	1.6138	1.6636	1.7172	1.7550	1.7931	(40)
HLP (average)												1.7339	
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 2.3792 (42)

Hot water usage for mixer showers

	72.1248	71.0409	69.4615	66.4395	64.2093	61.7223	60.3087	61.8761	63.5944	66.2647	69.3516	71.8485 (42a)

Hot water usage for baths

	29.1506	28.7176	28.1080	26.9839	26.1422	25.2089	24.7047	25.3101	25.9693	26.9680	28.1152	29.0520 (42b)

Hot water usage for other uses

	41.0477	39.5551	38.0624	36.5698	35.0771	33.5845	33.5845	35.0771	36.5698	38.0624	39.5551	41.0477 (42c)

Average daily hot water use (litres/day) 130.8399 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	142.3231	139.3136	135.6319	129.9932	125.4287	120.5157	118.5979	122.2634	126.1335	131.2951	137.0219	141.9482	(44)
Energy conte	225.4050	198.3808	208.4612	177.9541	168.8511	148.1881	143.4339	151.3876	155.5352	178.1663	195.2128	222.2566	(45)
Energy content (annual)										Total = Sum(45)m =		2173.2326	
Distribution loss (46)m = 0.15 x (45)m													
	33.8107	29.7571	31.2692	26.6931	25.3277	22.2282	21.5151	22.7081	23.3303	26.7249	29.2819	33.3385	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8802	(55)
Total storage loss													
	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)
If cylinder contains dedicated solar storage													
	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(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													
	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(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													
	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(64)
										Total per year (kWh/year) = Sum(64)m =		2768.4016	(64)
12Total per year (kWh/year)												2768	(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													
	115.3860	102.4870	109.7522	98.3042	96.5819	88.4069	88.1306	90.7753	90.8499	99.6792	104.0427	114.3392	(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	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	121.8232	134.8757	121.8232	125.8840	121.8232	125.8840	121.8232	121.8232	125.8840	121.8232	125.8840	121.8232	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	210.5274	212.7120	207.2068	195.4870	180.6928	166.7884	157.4993	155.3147	160.8199	172.5397	187.3339	201.2384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	(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)													
	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	(71)
Water heating gains (Table 5)													
	155.0888	152.5105	147.5164	136.5335	129.8143	122.7874	118.4552	122.0098	126.1804	133.9774	144.5037	153.6817	(72)
Total internal gains													
	546.1273	558.7861	535.2344	516.5924	491.0183	474.1477	456.4656	457.8356	471.5721	487.0282	516.4095	535.4312	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6900	10.6334	0.6300	0.7000	0.7700	2.2423	(74)
West	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(80)
Horizontal	4.2000	26.0000	0.6300	0.7000	1.0000	43.3415	(82)

Solar gains	58.0086	118.6076	207.3394	320.1211	407.3603	423.5014	400.5326	334.1030	247.0114	143.9622	73.2688	47.0934	(83)
Total gains	604.1358	677.3937	742.5737	836.7135	898.3785	897.6490	856.9983	791.9387	718.5835	630.9904	589.6783	582.5246	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	20.2187	20.4268	20.6392	21.7710	22.0087	23.1868	23.1868	23.4189	22.7184	22.0087	21.5349	21.0776	
alpha	2.3479	2.3618	2.3759	2.4514	2.4672	2.5458	2.5458	2.5613	2.5146	2.4672	2.4357	2.4052	
util living area													
	0.9695	0.9586	0.9389	0.8902	0.8084	0.6713	0.5436	0.5890	0.7803	0.9127	0.9571	0.9719	(86)
Living	19.7931	19.8708	20.0054	20.2245	20.3978	20.5479	20.6016	20.5945	20.4859	20.2581	20.0178	19.8167	

Non living	18.0024	18.1122	18.2935	18.6247	18.8434	19.0659	19.1126	19.1211	18.9837	18.6828	18.3580	18.0786	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3826	19.8708	20.0054	20.2245	20.3978	20.5479	20.6016	20.5945	20.4859	20.2581	20.0178	19.9822	(87)
Th 2	19.4219	19.4351	19.4483	19.5152	19.5285	19.5914	19.5914	19.6032	19.5670	19.5285	19.5017	19.4748	(88)
util rest of house	0.9628	0.9493	0.9244	0.8625	0.7551	0.5748	0.4011	0.4501	0.7007	0.8850	0.9460	0.9657	(89)
MIT 2	18.8560	18.1122	18.2935	18.6247	18.8434	19.0659	19.1126	19.1211	18.9837	18.6828	18.3580	18.3302	(90)
Living area fraction										fLA = Living area / (4) =		0.3472	(91)
MIT	19.3860	18.7227	18.8879	19.1801	19.3831	19.5804	19.6296	19.6327	19.5052	19.2297	18.9343	18.9037	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3860	18.7227	18.8879	19.1801	19.3831	19.5804	19.6296	19.6327	19.5052	19.2297	18.9343	18.9037	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9626	0.9441	0.9180	0.8550	0.7488	0.5740	0.4054	0.4534	0.6965	0.8779	0.9408	0.9630	(94)
Useful gains	581.5260	639.5446	681.6671	715.3756	672.7332	515.2353	347.4443	359.0882	500.5074	553.9768	554.7850	560.9432	(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	2138.6600	1939.6080	1720.3777	1353.4407	1000.6006	615.6682	374.5102	395.6520	681.9598	1123.8894	1575.1374	1999.5294	(97)
Space heating kWh	1158.5077	873.6426	772.8007	459.4068	243.9334	0.0000	0.0000	0.0000	0.0000	424.0149	734.6537	1070.3082	(98a)
Space heating requirement - total per year (kWh/year)												5737.2681	
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	1158.5077	873.6426	772.8007	459.4068	243.9334	0.0000	0.0000	0.0000	0.0000	424.0149	734.6537	1070.3082	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5737.2681	
Space heating per m2											(98c) / (4) =	75.6496	(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 %)	343.2561	(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	1158.5077	873.6426	772.8007	459.4068	243.9334	0.0000	0.0000	0.0000	0.0000	424.0149	734.6537	1070.3082	(98)
Space heating efficiency (main heating system 1)	343.2561	343.2561	343.2561	343.2561	343.2561	0.0000	0.0000	0.0000	0.0000	343.2561	343.2561	343.2561	(210)
Space heating fuel (main heating system)	337.5053	254.5162	225.1382	133.8379	71.0645	0.0000	0.0000	0.0000	0.0000	123.5273	214.0249	311.8103	(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	275.9536	244.0376	259.0098	226.8721	219.3997	197.1061	193.9825	201.9362	204.4532	228.7149	244.1308	272.8052	(64)
Efficiency of water heater												175.9093	(216)
(217)m	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	175.9093	(217)
Fuel for water heating, kWh/month	156.8727	138.7292	147.2405	128.9711	124.7232	112.0498	110.2742	114.7957	116.2265	130.0187	138.7823	155.0829	(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	24.7951	19.8915	17.9101	13.1217	10.1356	8.2809	9.2460	12.0183	15.6106	20.4820	23.1344	25.4842	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-7.0162	-12.5168	-23.1556	-32.2262	-39.5123	-37.4639	-36.6571	-31.7501	-24.0126	-16.0817	-8.3944	-5.7118	(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	-0.7214	-1.9984	-5.4140	-10.9738	-17.6269	-20.1361	-19.5893	-14.9731	-9.1074	-3.5599	-1.1096	-0.5378	(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	1671.4247	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	175.9093	
Water heating fuel used	1573.7668	(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)	200.1105	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-380.2464	(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	3065.0556	(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	1671.4247	0.1547	258.6440	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1573.7668	0.1410	221.8414	(264)
Space and water heating			480.4854	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	200.1105	0.1443	28.8821	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-274.4987	0.1310	-35.9490	
PV Unit electricity exported	-105.7477	0.1186	-12.5371	
Total			-48.4860	(269)
Total CO2, kg/year			460.8815	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.0800	(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	1671.4247	1.5729	2628.9692	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1573.7668	1.5212	2394.0607	(278)
Space and water heating			5023.0299	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	200.1105	1.5338	306.9362	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-274.4987	1.4838	-407.3043	
PV Unit electricity exported	-105.7477	0.4347	-45.9690	
Total			-453.2733	(283)
Total Primary energy kWh/year			4876.6928	(286)
Dwelling Primary energy Rate (DPER)			64.3000	(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	75.8400	(1b)	x 2.5500	(2b) =	193.3920	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		193.3920	(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) =	0.1551	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4051	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4051	(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	0.5165	0.5064	0.4963	0.4456	0.4355	0.3849	0.3849	0.3747	0.4051	0.4355	0.4558	0.4760	(22b)
Effective ac	0.6334	0.6282	0.6231	0.5993	0.5948	0.5741	0.5741	0.5702	0.5821	0.5948	0.6039	0.6133	(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)			2.7600	1.1450	3.1603			(27)
Roof			4.2000	1.5918	6.6854			(27a)
External Wall	76.0900		76.0900	0.1800	13.6962			(29a)

Dromer	15.7600	2.7600	13.0000	0.1800	2.3400		(29a)
External Roof	13.2800		13.2800	0.1100	1.4608		(30)
Flat Roof	62.5600	4.2000	58.3600	0.1100	6.4196		(30)
Total net area of external elements Aum(A, m2)			167.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		33.7623		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		136.0583 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		8.3845 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	42.1468 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.4234	40.0928	39.7688	38.2467	37.9619	36.6363	36.6363	36.3908	37.1469	37.9619	38.5380	39.1403	(38)
Heat transfer coeff	82.5702	82.2396	81.9156	80.3935	80.1087	78.7831	78.7831	78.5376	79.2937	80.1087	80.6848	81.2871	(39)
Average = Sum(39)m / 12 =												80.3922	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0887	1.0844	1.0801	1.0600	1.0563	1.0388	1.0388	1.0356	1.0455	1.0563	1.0639	1.0718	(40)
HLP (average)												1.0600	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3792 (42)

Hot water usage for mixer showers

64.1110	63.1475	61.7435	59.0573	57.0750	54.8643	53.6077	55.0010	56.5284	58.9020	61.6459	63.8653	(42a)

Hot water usage for baths

27.6930	27.2818	26.7026	25.6347	24.8351	23.9484	23.4695	24.0446	24.6708	25.6196	26.7094	27.5994	(42b)

Hot water usage for other uses

38.9953	37.5773	36.1593	34.7413	33.3233	31.9053	31.9053	33.3233	34.7413	36.1593	37.5773	38.9953	(42c)

Average daily hot water use (litres/day)		120.2343 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	130.7993	128.0066	124.6054	119.4333	115.2333	110.7180	108.9825	112.3689	115.9405	120.6809	125.9327	130.4601	(44)
Energy conte	207.1541	182.2796	191.5139	163.4982	155.1262	136.1406	131.8048	139.1362	142.9662	163.7628	179.4142	204.2689	(45)
Energy content (annual)										Total = Sum(45)m =		1997.0659	
Distribution loss (46)m = 0.15 x (45)m	31.0731	27.3419	28.7271	24.5247	23.2689	20.4211	19.7707	20.8704	21.4449	24.5644	26.9121	30.6403	(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	253.7490	224.3654	238.1088	208.5901	201.7211	181.2325	178.3998	185.7311	188.0580	210.3577	224.5060	250.8638	(62)
WWHRS	-29.3089	-25.9210	-27.1430	-22.4754	-20.9463	-17.9239	-16.8008	-17.8660	-18.5448	-21.8622	-24.7673	-28.7661	(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	224.4402	198.4444	210.9658	186.1146	180.7748	163.3086	161.5989	167.8651	169.5133	188.4955	199.7388	222.0977	(64)
									Total per year (kWh/year) = Sum(64)m =			2273.3577	(64)
12Total per year (kWh/year)												2273	(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	106.1547	94.2766	100.9543	90.4366	88.8554	81.3402	81.1010	83.5387	83.6097	91.7271	95.7287	105.1953	(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	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	118.9597	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	121.8232	134.8757	121.8232	125.8840	121.8232	125.8840	121.8232	121.8232	125.8840	121.8232	125.8840	121.8232	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.5274	212.7120	207.2068	195.4870	180.6928	166.7884	157.4993	155.3147	160.8199	172.5397	187.3339	201.2384	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	34.8960	(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)	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	-95.1678	(71)
Water heating gains (Table 5)	142.6810	140.2925	135.6913	125.6064	119.4293	112.9726	109.0068	112.2832	116.1246	123.2890	132.9565	141.3916	(72)
Total internal gains	536.7195	549.5681	526.4092	508.6653	483.6332	464.3328	447.0172	448.1091	461.5164	479.3399	507.8623	526.1411	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	0.6900	10.6334	0.6300	0.7000	0.7700	2.2423	(74)
West	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(80)
Horizontal	4.2000	26.0000	0.6300	0.7000	1.0000	43.3415	(82)

Solar gains	58.0086	118.6076	207.3394	320.1211	407.3603	423.5014	400.5326	334.1030	247.0114	143.9622	73.2688	47.0934	(83)
Total gains	594.7281	668.1757	733.7486	828.7864	890.9935	887.8342	847.5499	782.2121	708.5278	623.3021	581.1311	573.2345	(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	34.7134	34.8530	34.9908	35.6533	35.7800	36.3821	36.3821	36.4958	36.1478	35.7800	35.5246	35.2614	
alpha	3.3142	3.3235	3.3327	3.3769	3.3853	3.4255	3.4255	3.4331	3.4099	3.3853	3.3683	3.3508	
util living area	0.9640	0.9462	0.9124	0.8290	0.6987	0.5294	0.3975	0.4437	0.6651	0.8690	0.9442	0.9676	(86)
MIT	19.1884	19.4422	19.8314	20.3521	20.7219	20.9221	20.9777	20.9676	20.8272	20.3383	19.7025	19.1673	(87)
Th 2	20.0100	20.0136	20.0171	20.0336	20.0367	20.0511	20.0511	20.0538	20.0456	20.0367	20.0304	20.0239	(88)
util rest of house	0.9577	0.9369	0.8971	0.8003	0.6510	0.4621	0.3163	0.3593	0.5988	0.8401	0.9331	0.9619	(89)
MIT 2	17.9104	18.2312	18.7181	19.3590	19.7808	19.9949	20.0400	20.0366	19.9078	19.3599	18.5741	17.8929	(90)
Living area fraction										fLA = Living area / (4) =		0.3472	(91)
MIT	18.3541	18.6516	19.1047	19.7038	20.1075	20.3168	20.3656	20.3598	20.2270	19.6995	18.9659	18.3353	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3541	18.6516	19.1047	19.7038	20.1075	20.3168	20.3656	20.3598	20.2270	19.6995	18.9659	18.3353	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9437	0.9207	0.8800	0.7893	0.6547	0.4816	0.3437	0.3873	0.6123	0.8283	0.9176	0.9488	(94)
Useful gains	561.2208	615.1694	645.6939	654.1290	583.3304	427.5502	291.3224	302.9626	433.8011	516.2642	533.2220	543.8607	(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	1160.4496	1130.9288	1032.5183	868.5563	673.5175	450.3869	296.6641	310.9942	485.8305	728.9531	957.3972	1149.0213	(97)
Space heating kWh	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(98a)
Space heating requirement - total per year (kWh/year)												2215.5870	
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	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2215.5870	
Space heating per m2											(98c) / (4) =	29.2140	(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	445.8262	346.5903	287.7974	154.3876	67.0992	0.0000	0.0000	0.0000	0.0000	158.2406	305.4062	450.2395	(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)	483.0186	375.5041	311.8065	167.2672	72.6969	0.0000	0.0000	0.0000	0.0000	171.4416	330.8843	487.8001	(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	224.4402	198.4444	210.9658	186.1146	180.7748	163.3086	161.5989	167.8651	169.5133	188.4955	199.7388	222.0977	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.5685	85.2974	84.7567	83.6438	82.0511	79.8000	79.8000	79.8000	79.8000	83.6701	85.0090	85.6105	(217)
Fuel for water heating, kWh/month	262.2931	232.6499	248.9074	222.5087	220.3197	204.6473	202.5049	210.3573	212.4227	225.2842	234.9618	259.4282	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.3125	20.3066	18.2838	13.3955	10.3471	8.4537	9.4390	12.2691	15.9364	20.9094	23.6171	26.0160	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-25.7532	-37.4436	-55.4741	-64.3392	-71.0656	-66.9413	-66.1364	-61.6276	-53.9182	-43.7211	-28.7207	-22.1355	(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	-11.2617	-24.0132	-48.3354	-73.4881	-98.0410	-98.8281	-97.6499	-82.2606	-59.7555	-34.6134	-15.1238	-8.8800	(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 2400.4193 (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 2736.2853 (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) 204.2860 (232)

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

PV generation -1249.5273 (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	4177.4633	(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	2400.4193	0.2100	504.0881	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2736.2853	0.2100	574.6199	(264)
Space and water heating			1078.7080	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	204.2860	0.1443	29.4848	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-597.2766	0.1339	-80.0029	
PV Unit electricity exported	-652.2508	0.1255	-81.8843	
Total			-161.8872	(269)
Total CO2, kg/year			958.2349	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.6300	(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	2400.4193	1.1300	2712.4738	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2736.2853	1.1300	3092.0024	(278)
Space and water heating			5804.4763	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	204.2860	1.5338	313.3407	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-597.2766	1.4950	-892.9321	
PV Unit electricity exported	-652.2508	0.4608	-300.5608	
Total			-1193.4929	(283)
Total Primary energy kWh/year			5054.4249	(286)
Target Primary Energy Rate (TPER)			66.6500	(287)

Full SAP Calculation Printout

Property Reference	123 Station Road - 2 Flats	**Issued on Date**	06/09/2024
Assessment Reference	Option 3 - Flat 2	**Prop Type Ref**	123 Station Road - 2 Flats
Property	123, Station Road, LONDON, TW12 2AL		

SAP Rating	72 C	**DER**	7.02	**TER**	13.13
Environmental	94 A	**% DER < TER**			46.53
CO_2 Emissions (t/year)	0.46	**DFEE**	82.03	**TFEE**	38.99
Compliance Check	See BREL	**% DFEE < TFEE**			-110.40
% DPER < TPER	-6.01	**DPER**	73.38	**TPER**	69.22

Assessor Details	Mr. Mark Simons	**Assessor ID**	5542-0001
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	77.9600 (1b)	x	2.5100 (2b)	=	195.6796	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	195.6796	(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) =	0.1533	(8)
Pressure test		No	
Pressure Test Method		Blower Door	
Measured/design AP50		15.0000	(17)
Infiltration rate		0.9033	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.9033	(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	1.1517	1.1291	1.1066	0.9936	0.9711	0.8581	0.8581	0.8356	0.9033	0.9711	1.0162	1.0614	(22b)
Effective ac	1.1517	1.1291	1.1066	0.9937	0.9715	0.8682	0.8682	0.8491	0.9080	0.9715	1.0162	1.0614	(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 = 1.40)			10.4300	1.3258	13.8277			(27)
Entrance Door			1.6900	1.4000	2.3660			(26)
External Wall	76.4300	10.4300	66.0000	0.2500	16.5000	135.0000	8910.0000	(29a)
Hallway	29.2900	1.6900	27.6000	0.1700	4.6920	18.0000	496.8000	(29a)
External Roof	77.9600		77.9600	0.1300	10.1348	9.0000	701.6400	(30)
Total net area of external elements Aum(A, m2)			183.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		47.5205			(33)
Party Wall			20.8800	0.0000	0.0000	180.0000	3758.4000	(32)
Party Floor			77.9600			40.0000	3118.4000	(32d)
Internal Wall			149.8500			9.0000	1348.6500	(32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	18333.8900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		235.1705	(35)
Thermal bridges (Default value 0.200 * total exposed area)		36.7360	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	84.2565	(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	74.3716	72.9134	71.4551	64.1651	62.7325	56.0639	56.0639	54.8289	58.6325	62.7325	65.6220	68.5386	(38)

Heat transfer coeff

	158.6281	157.1698	155.7116	148.4215	146.9890	140.3203	140.3203	139.0854	142.8890	146.9890	149.8785	152.7950 (39)
Average = Sum(39)m / 12 =												148.2665

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	2.0347	2.0160	1.9973	1.9038	1.8854	1.7999	1.7999	1.7841	1.8329	1.8854	1.9225	1.9599	(40)
HLP (average)												1.9018	
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												2.4230	(42)
Hot water usage for mixer showers													
	72.9514	71.8551	70.2575	67.2009	64.9452	62.4296	60.9998	62.5853	64.3232	67.0241	70.1464	72.6719	(42a)
Hot water usage for baths													
	29.4831	29.0453	28.4287	27.2918	26.4404	25.4965	24.9866	25.5989	26.2656	27.2756	28.4360	29.3835	(42b)
Hot water usage for other uses													
	41.5201	40.0103	38.5004	36.9906	35.4808	33.9710	33.9710	35.4808	36.9906	38.5004	40.0103	41.5201	(42c)
Average daily hot water use (litres/day)												132.3398	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.9546	140.9106	137.1866	131.4833	126.8664	121.8971	119.9574	123.6650	127.5794	132.8002	138.5927	143.5754	(44)
Energy conte	227.9889	200.6548	210.8507	179.9940	170.7866	149.8867	145.0781	153.1230	157.3182	180.2087	197.4507	224.8044	(45)
Energy content (annual)										Total = Sum(45)m =		2198.1449	
Distribution loss (46)m = 0.15 x (45)m													
	34.1983	30.0982	31.6276	26.9991	25.6180	22.4830	21.7617	22.9685	23.5977	27.0313	29.6176	33.7207	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8802	(55)
Total storage loss													
	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(56)
If cylinder contains dedicated solar storage													
	27.2862	24.6456	27.2862	26.4060	27.2862	26.4060	27.2862	27.2862	26.4060	27.2862	26.4060	27.2862	(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													
	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(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													
	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(64)
										Total per year (kWh/year) = Sum(64)m =		2793.3139	(64)
12Total per year (kWh/year)												2793	(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													
	116.2452	103.2432	110.5468	98.9824	97.2254	88.9717	88.6773	91.3523	91.4427	100.3583	104.7867	115.1864	(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	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	117.5702	130.1670	117.5702	121.4892	117.5702	121.4892	117.5702	117.5702	121.4892	117.5702	121.4892	117.5702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(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)													
	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)													
	156.2435	153.6357	148.5843	137.4756	130.6793	123.5718	119.1900	122.7853	127.0037	134.8901	145.5371	154.8204	(72)
Total internal gains													
	548.2831	560.5044	537.2309	518.0654	492.2329	474.8364	457.0436	458.4067	472.1695	488.1126	517.7958	537.3681	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.7200	10.6334	0.6300	0.7000	0.7700	12.0889	(74)
South	2.8500	46.7521	0.6300	0.7000	0.7700	40.7209	(78)
West	3.8600	19.6403	0.6300	0.7000	0.7700	23.1690	(80)

Solar gains	75.9788	135.1162	198.8496	267.9300	318.4068	323.7912	308.9971	270.4047	222.7522	153.2123	92.0703	64.3175	(83)
Total gains	624.2619	695.6206	736.0805	785.9954	810.6398	798.6275	766.0408	728.8114	694.9217	641.3249	609.8662	601.6856	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	32.1050	32.4028	32.7063	34.3127	34.6471	36.2937	36.2937	36.6160	35.6413	34.6471	33.9792	33.3306	
alpha	3.1403	3.1602	3.1804	3.2875	3.3098	3.4196	3.4196	3.4411	3.3761	3.3098	3.2653	3.2220	
util living area													
	0.9918	0.9877	0.9807	0.9617	0.9193	0.8168	0.6843	0.7220	0.8844	0.9665	0.9871	0.9928	(86)
Living	20.0801	20.1377	20.2332	20.3914	20.5245	20.6511	20.7000	20.6950	20.6080	20.4337	20.2518	20.0985	

Non living	18.2353	18.3197	18.4523	18.7081	18.8815	19.0756	19.1142	19.1238	19.0128	18.7742	18.5217	18.3032	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5294	20.1377	20.2332	20.3914	20.5245	20.6511	20.7000	20.6950	20.6080	20.4337	20.2518	20.2246	(87)
Th 2	19.3103	19.3227	19.3351	19.3982	19.4108	19.4701	19.4701	19.4812	19.4471	19.4108	19.3855	19.3602	(88)
util rest of house													
	0.9889	0.9833	0.9732	0.9448	0.8771	0.7101	0.4964	0.5450	0.8066	0.9482	0.9817	0.9904	(89)
MIT 2	18.8817	18.3197	18.4523	18.7081	18.8815	19.0756	19.1142	19.1238	19.0128	18.7742	18.5217	18.4937	(90)
Living area fraction									fLA = Living area / (4) =			0.2700	(91)
MIT	19.3266	18.8106	18.9332	19.1626	19.3251	19.5010	19.5424	19.5480	19.4435	19.2223	18.9889	18.9611	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3266	18.8106	18.9332	19.1626	19.3251	19.5010	19.5424	19.5480	19.4435	19.2223	18.9889	18.9611	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9816	0.9709	0.9416	0.8741	0.7128	0.5069	0.5544	0.8064	0.9453	0.9800	0.9896	(94)
Useful gains	617.3769	682.7951	714.6438	740.0894	708.6189	569.2631	388.2802	404.0536	560.3610	606.2221	597.6388	595.4157	(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													
	2383.6434	2186.3240	1935.9859	1523.1882	1120.8131	687.7093	412.8758	437.8414	763.5302	1267.3769	1781.8876	2255.4163	(97)
Space heating kWh													
	1314.1023	1010.3714	908.6785	563.8312	306.6725	0.0000	0.0000	0.0000	0.0000	491.8992	852.6591	1235.0404	(98a)
Space heating requirement - total per year (kWh/year)												6683.2546	
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													
	1314.1023	1010.3714	908.6785	563.8312	306.6725	0.0000	0.0000	0.0000	0.0000	491.8992	852.6591	1235.0404	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6683.2546	
Space heating per m2											(98c) / (4) =	85.7267	(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 %)												348.0366	(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													
	1314.1023	1010.3714	908.6785	563.8312	306.6725	0.0000	0.0000	0.0000	0.0000	491.8992	852.6591	1235.0404	(98)
Space heating efficiency (main heating system 1)													
	348.0366	348.0366	348.0366	348.0366	348.0366	0.0000	0.0000	0.0000	0.0000	348.0366	348.0366	348.0366	(210)
Space heating fuel (main heating system)													
	377.5759	290.3061	261.0870	162.0034	88.1150	0.0000	0.0000	0.0000	0.0000	141.3355	244.9912	354.8593	(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													
	278.5375	246.3116	261.3993	228.9120	221.3352	198.8047	195.6267	203.6716	206.2362	230.7573	246.3687	275.3530	(64)
Efficiency of water heater												176.6565	(216)
(217)m	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	176.6565	(217)
Fuel for water heating, kWh/month													
	157.6718	139.4297	147.9704	129.5803	125.2913	112.5374	110.7384	115.2925	116.7442	130.6248	139.4620	155.8692	(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	23.9294	19.1971	17.2849	12.6636	9.7817	7.9918	8.9232	11.5988	15.0656	19.7669	22.3267	24.5945	(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												1920.2734	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												176.6565	
Water heating fuel used												1581.2118	(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)												193.1244	(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												3694.6096	(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	1920.2734	0.1546	296.7952	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1581.2118	0.1410	222.8996	(264)
Space and water heating			519.6947	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	193.1244	0.1443	27.8738	(268)
Total CO2, kg/year			547.5686	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			7.0200	(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	1920.2734	1.5722	3019.0701	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1581.2118	1.5213	2405.4190	(278)
Space and water heating			5424.4890	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	193.1244	1.5338	296.2206	(282)
Total Primary energy kWh/year			5720.7096	(286)
Dwelling Primary energy Rate (DPER)			73.3800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.9600	(1b)	x 2.5100	(2b) =	195.6796	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		195.6796	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1533	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4033	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.4033	(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	0.5142	0.5041	0.4941	0.4436	0.4336	0.3831	0.3831	0.3731	0.4033	0.4336	0.4537	0.4739	(22b)
Effective ac	0.6322	0.6271	0.6220	0.5984	0.5940	0.5734	0.5734	0.5696	0.5813	0.5940	0.6029	0.6123	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.6900	1.0000	1.6900			(26)
TER Opening Type (Uw = 1.20)			10.4300	1.1450	11.9427			(27)
External Wall	76.4300	10.4300	66.0000	0.1800	11.8800			(29a)
Hallway	29.2900	1.6900	27.6000	0.1800	4.9680			(29a)
External Roof	77.9600		77.9600	0.1100	8.5756			(30)
Total net area of external elements Aum(A, m2)			183.6800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0563			(33)
Party Wall			20.8800	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							235.1705	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							9.1840	(36)
Point Thermal bridges						(36a) =	0.0000	
Total fabric heat loss					(33) + (36) + (36a) =		48.2403	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.8247	40.4931	40.1682	38.6419	38.3563	37.0269	37.0269	36.7807	37.5390	38.3563	38.9340	39.5380	(38)
Heat transfer coeff	89.0650	88.7335	88.4085	86.8822	86.5966	85.2673	85.2673	85.0211	85.7793	86.5966	87.1743	87.7783	(39)
Average = Sum(39)m / 12 =												86.8808	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1424	1.1382	1.1340	1.1144	1.1108	1.0937	1.0937	1.0906	1.1003	1.1108	1.1182	1.1259	(40)
HLP (average)												1.1144	
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												2.4230	(42)
Hot water usage for mixer showers	64.8457	63.8712	62.4511	59.7341	57.7290	55.4930	54.2220	55.6313	57.1762	59.5770	62.3524	64.5972	(42a)
Hot water usage for baths	28.0090	27.5930	27.0072	25.9272	25.1184	24.2217	23.7373	24.3190	24.9523	25.9119	27.0142	27.9143	(42b)
Hot water usage for other uses	39.4441	38.0098	36.5754	35.1411	33.7068	32.2724	32.2724	33.7068	35.1411	36.5754	38.0098	39.4441	(42c)
Average daily hot water use (litres/day)												121.6125	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.2987	129.4739	126.0338	120.8024	116.5542	111.9871	110.2317	113.6571	117.2696	122.0643	127.3763	131.9556	(44)
Energy conte	209.5289	184.3692	193.7092	165.3724	156.9044	137.7012	133.3157	140.7312	144.6051	165.6401	181.4709	206.6106	(45)
Energy content (annual)										Total = Sum(45)m =		2019.9589	
Distribution loss (46)m = 0.15 x (45)m	31.4293	27.6554	29.0564	24.8059	23.5357	20.6552	19.9974	21.1097	21.6908	24.8460	27.2206	30.9916	(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	256.1238	226.4549	240.3041	210.4643	203.4993	182.7930	179.9106	187.3261	189.6970	212.2350	226.5627	253.2055	(62)
WWHRS	-29.6447	-26.2180	-27.4540	-22.7330	-21.1864	-18.1293	-16.9933	-18.0707	-18.7573	-22.1128	-25.0511	-29.0958	(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	226.4790	200.2368	212.8501	187.7313	182.3130	164.6637	162.9173	169.2554	170.9397	190.1222	201.5116	224.1097	(64)
									Total per year (kWh/year) = Sum(64)m =			2293.1299	(64)
12Total per year (kWh/year)												2293	(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	106.9443	94.9713	101.6842	91.0598	89.4466	81.8591	81.6034	84.0690	84.1547	92.3513	96.4125	105.9739	(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	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	121.1507	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	117.5702	130.1670	117.5702	121.4892	117.5702	121.4892	117.5702	117.5702	121.4892	117.5702	121.4892	117.5702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.1242	217.3565	211.7311	199.7554	184.6382	170.4301	160.9383	158.7060	164.3313	176.3071	191.4243	205.6323	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	35.1151	(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)	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	-96.9206	(71)
Water heating gains (Table 5)	143.7423	141.3264	136.6724	126.4720	120.2240	113.6932	109.6820	112.9960	116.8815	124.1280	133.9063	142.4381	(72)
Total internal gains	538.7819	551.1951	528.3189	510.0617	484.7775	464.9578	447.5357	448.6174	462.0472	480.3505	509.1650	527.9858	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.7200	10.6334	0.6300	0.7000	0.7700	12.0889	(74)
South	2.8500	46.7521	0.6300	0.7000	0.7700	40.7209	(78)
West	3.8600	19.6403	0.6300	0.7000	0.7700	23.1690	(80)

Solar gains	75.9788	135.1162	198.8496	267.9300	318.4068	323.7912	308.9971	270.4047	222.7522	153.2123	92.0703	64.3175	(83)
Total gains	614.7606	686.3113	727.1685	777.9918	803.1844	788.7489	756.5328	719.0221	684.7994	633.5628	601.2353	592.3033	(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	57.1801	57.3937	57.6047	58.6167	58.8100	59.7269	59.7269	59.8998	59.3703	58.8100	58.4203	58.0183	
alpha	4.8120	4.8262	4.8403	4.9078	4.9207	4.9818	4.9818	4.9933	4.9580	4.9207	4.8947	4.8679	

util living area													
	0.9916	0.9847	0.9711	0.9286	0.8322	0.6536	0.4882	0.5318	0.7663	0.9400	0.9834	0.9929	(86)
MIT	19.7318	19.9115	20.1668	20.5224	20.8010	20.9560	20.9915	20.9872	20.9022	20.5566	20.0994	19.7151	(87)
Th 2	19.9663	19.9698	19.9731	19.9891	19.9920	20.0060	20.0060	20.0085	20.0006	19.9920	19.9860	19.9797	(88)
util rest of house													
	0.9891	0.9801	0.9621	0.9060	0.7814	0.5670	0.3819	0.4232	0.6875	0.9162	0.9776	0.9908	(89)
MIT 2	18.5068	18.7368	19.0605	19.5071	19.8233	19.9802	20.0031	20.0038	19.9346	19.5578	18.9885	18.4951	(90)
Living area fraction										fLA = Living area / (4) =		0.2700	(91)
MIT	18.8376	19.0540	19.3592	19.7812	20.0873	20.2437	20.2700	20.2694	20.1958	19.8275	19.2885	18.8245	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8376	19.0540	19.3592	19.7812	20.0873	20.2437	20.2700	20.2694	20.1958	19.8275	19.2885	18.8245	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9747	0.9553	0.9005	0.7867	0.5887	0.4106	0.4525	0.7043	0.9115	0.9723	0.9874	(94)
Useful gains	605.6793	668.9511	694.6457	700.5761	631.8982	464.3407	310.6599	325.3463	482.3038	577.4888	584.5759	584.8348	(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													
	1294.7870	1255.9319	1136.8633	945.3862	726.3128	481.2237	312.9293	328.9766	522.8964	799.0673	1062.5229	1283.7136	(97)
Space heating kWh													
	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(98a)
Space heating requirement - total per year (kWh/year)												2511.6069	
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													
	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2511.6069	
Space heating per m2											(98c) / (4) =	32.2166	(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													
	512.6961	394.4511	329.0099	176.2633	70.2445	0.0000	0.0000	0.0000	0.0000	164.8544	344.1219	519.9659	(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)													
	555.4670	427.3576	356.4571	190.9678	76.1045	0.0000	0.0000	0.0000	0.0000	178.6072	372.8298	563.3433	(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													
	226.4790	200.2368	212.8501	187.7313	182.3130	164.6637	162.9173	169.2554	170.9397	190.1222	201.5116	224.1097	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8339	85.5512	85.0328	83.9187	82.1147	79.8000	79.8000	79.8000	79.8000	83.7416	85.2492	85.8826	(217)
Fuel for water heating, kWh/month													
	263.8572	234.0549	250.3152	223.7062	222.0222	206.3455	204.1570	212.0994	214.2101	227.0344	236.3796	260.9488	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.4288	19.5977	17.6455	12.9279	9.9859	8.1585	9.1094	11.8408	15.3800	20.1794	22.7926	25.1077	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-26.4119	-38.3742	-56.8190	-65.8632	-72.7212	-68.4890	-67.6535	-63.0408	-55.1698	-44.7732	-29.4410	-22.7039	(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	-11.6377	-24.8006	-49.8924	-75.8169	-101.1126	-101.9142	-100.7112	-84.8696	-61.6814	-35.7511	-15.6292	-9.1786	(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												2721.1343	(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												2755.1306	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												197.1541	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1284.4561	(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												4474.9629	(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	2721.1343	0.2100	571.4382	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2755.1306	0.2100	578.5774	(264)
Space and water heating			1150.0156	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	197.1541	0.1443	28.4554	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-611.4608	0.1340	-81.9110	
PV Unit electricity exported	-672.9953	0.1256	-84.4971	
Total			-166.4080	(269)
Total CO2, kg/year			1023.9923	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.1300	(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	2721.1343	1.1300	3074.8817	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2755.1306	1.1300	3113.2976	(278)
Space and water heating			6188.1793	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	197.1541	1.5338	302.4015	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-611.4608	1.4951	-914.1683	
PV Unit electricity exported	-672.9953	0.4609	-310.1515	
Total			-1224.3198	(283)
Total Primary energy kWh/year			5396.3619	(286)
Target Primary Energy Rate (TPER)			69.2200	(287)