46 Maresfield Gardens

For Russell Ambrose February 2025

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Contents

1	Executive Summary	4
1.1	Energy Strategy	4
1.2	Sustainability Strategy	4
2	Introduction	7
2.1	Site	7
2.2	Planning policies	8
3	Energy Strategy	10
3.1	Be Lean	10
3.2	Be Clean	12
3.3	Be Green	13
3.4	Results	14
4	Sustainability Strategies	15
4.1	Health and Wellbeing	15
4.2	Nature, Landscape and Biodiversity	16
4.3	Climate Resilience	16
4.4	Water and Surface Water Runoff	16
4.5	Materials and Waste	17
4.6	Sustainable transport	17
5	Conclusions	18
Ар	pendix A – GLA policies	Α
Ар	oendix B – Camden policies	в
Ар	pendix C – Energy calculation assumptio	ons C
Ар	oendix B – Planning stage SAP output	D

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1 Executive Summary

This Energy and Sustainability Statement presents the key measures proposed to meet the London Plan's carbon reduction targets and the sustainability strategy in support of the planning application for 46 Maresfield Gardens in Hampstead, within the London Borough of Camden.

The proposed scheme comprises demolition of the existing dwelling and erection of a replacement dwelling with three above ground storeys. The existing garage at basement level will be retained and utilised for storage.

The energy and sustainability strategy for the proposal has been developed in accordance with relevant policies within the London Plan and Camden's Local Plan (see Table 1 in the following page).

1.1 Energy Strategy

The energy strategy for the project has been developed in line with the London Plan (2021) Policies SI2, SI3 and SI4, and the GLA's Guidance on Energy Assessments (2022). The CO₂ emissions for the development has been assessed using the Standard Assessment Procedure (SAP).

Proposed energy measures for the development includes:

- Be Lean: Passive design with a fabric first approach (enhanced u-values, low air tightness target and careful thermal bridging detailing), low energy lighting and installation of Mechanical Ventilation with Heat Recovery (MVHR).
- Be Clean: There are no existing or proposed district heat networks in proximity to the proposed development. A standalone heating system is proposed.
- Be Green: A high efficiency Air Source Heat Pump (ASHP) system will generate both space heating and domestic hot water for the dwelling. A photovoltaic array will also be provided at roof level.

Overall, the proposed development is anticipated to achieve a 65% reduction in regulated CO2 emissions over the Part L 2021 baseline. This meets the minimum onsite reduction target of 35% set out by the GLA, as well as the benchmark reduction target of 50% for residential developments stipulated within GLA's Energy Assessment Guidance (2022).

The scheme will also achieve a 21% reduction in regulated CO₂ over the baseline at the Be Lean stage with building fabric and system efficiencies measures alone, which exceeds the 10% Be Lean reduction target set out by the GLA for residential developments.

Carbon offset payments are not deemed applicable for the minor development.

1.2 Sustainability Strategy

The sustainability strategy for the proposal has been developed in accordance with relevant policies within the London Plan and Camden's Local Plan.

The image to the right summarises the sustainability measures integrated into the scheme, and demonstrates the client and design team's aspirations to meet and exceed planning policy requirements.

Climate resilience

- Solar control and natural ventilation are the main measures to mitigate overheating risk. The dwelling will benefit from windows and rooflight with generous openable areas.
- The site is not located in an area at risk of flooding.

Ecology and biodiversity

biodiverse/green roofs is proposed to improve ecological value at the site.



Health and Wellbeing

- There will be no notable daylight and sunlight impact to neighbouring properties.
- Air, noise and light pollution from proposed development will be limited and mitigated.
- Scheme has been developed with safety and accessibility in mind.
- The extensive private garden will provide valuable external amenity to future residents.

Energy and Carbon

- high efficiency building fabric and systems to minimise energy demand.
- with the biosolar roofs. • Energy strategy to achieve a 65%
 - onsite, exceeding GLA and Camden policies for minor developments.
 - been carried out. Strategies are in place to minimise both embodied and operation carbon emissions throughout the lifetime of the building.

Figure 1. Summary of Energy and Sustainability Measures at 46 Maresfield Gardens.

• Extensive soft landscaping, tree retention and planting, as well as

Sustainable transport

- Cycle storage will be provided in the front driveway.
- An EV charging point will be installed.
- Future residents will have good access to public transport via overground, underground and local buses.



• Fabric first approach together with • Air Source Heat Pump is proposed as a low/zero carbon technology for the supply of space heating and hot water. • 2.8 kWp of photovoltaics proposed for the first floor roof, to be integrated

reduction in regulated CO₂ emissions • A Whole Life Carbon Assessment has

Resource efficiency

- Materials will be responsibly sourced.
- Materials with low environmental impact and with recycled content will be prioritised.
- Construction and demolition waste will be limited through reduction/reuse/recycling measures.
- Water efficient sanitary fittings and appliances will be installed to target a consumption of 105 l/p/d.

Table 1. Planning policies applicable for the proposed development, and the report sections where they are responded to.

	3 Energy Strategy	4.1 Health and Wellbeing	4.2 Nature, Landscape and Biodiversity	4.3 Climate Resilience	4.4 Water and Surface Water Runoff	4.5 Materials and Waste	4.6 Sustainable transport
The London Plan (2021)							
GG2 Making the best use of land							
GG3 Creating a healthy city	•	•					
GG6 Increasing efficiency and resilience	•			•			
D2 Infrastructure requirements for sustainable densities							•
D11 Safety, security, and resilience to emergency		•		•			
D14 Noise		•					
G1 Green infrastructure, G5 Urban greening, G6 Biodiversity and access to nature			•				
SII Improving air quality		•					
SI2 Minimising greenhouse gas emissions, Policy SI3 Energy infrastructure	•						
SI4 Managing heat risk				•			
SI5 Water infrastructure					•		
SI7 Reducing waste and supporting the circular economy						•	
SI12 Flood risk management, SI13 Sustainable Drainage				•	•		
T5 Cycling							•
Camden Local Plan (2017)							
C1 Health and wellbeing		•					
C5 Safety and Security		•					
C6 Access for all		•					
Al Managing the impact of development		•					
A2 Open space		•					
A3 Biodiversity			•				
A4 Noise and Vibration		•					
CCI Climate change mitigation				•			
CC2 Adapting to climate change	•	•	•	•	•	•	
CC3 Water and flooding				•	•		
CC4 Air Quality		•					
CC5 Waste						•	
TI Prioritising walking, cycling and public transport							•
T2 Parking and car free development							•
Camden Planning Guidance – Energy Efficiency and Adaptation (2021)							
Energy hierarchy	•						
Making buildings more energy efficient	•						
Energy reduction	•						

	3 Energy Strategy	4.1 Health and Wellbeing	4.2 Nature, Landscape and Biodiversity	4.3 Climate Resilience	4.4 Water and Surface Water Runoff	4.5 Materials and Waste	4.6 Sustainable transport
Energy efficiency in existing buildings	•						
Reuse and optimising resource efficiency	•					•	
Sustainable design and construction measures	•			•			

2 Introduction

2.1 Site

46 Maresfield Gardens is located in Hampstead, in the London Borough of Camden. The site is within a predominantly residential setting and currently comprises a two-storey plus basement midcentury dwelling. Residential properties can be found to the immediate north and east of the site, as well as across Maresfield Gardens to the west. The site closely adjoins an underground railway line and exhaust vent to the south.

The proposed scheme comprises demolition of the existing dwelling and erection of a replacement dwelling with three above ground storeys. The existing garage at basement level will be retained and utilised for storage.

The site location is presented in Figure 2.



Figure 2. Approximate site location of 46 Maresfield Gardens

2.2 Planning policies

A review of the applicable policies for the proposed development has been undertaken. A full summary of the relevant Greater London Authority (GLA) and Camden policies are presented in Appendices A and B.

The proposed development has been designed to meet and exceed (where feasible) the following main policy drivers.

2.2.1 London Plan (2021)

Energy and carbon:

- A minimum of 35% reduction in regulated CO₂ emissions on site compared to Part L 2021 baseline, with an aspiration to meet the 50% reduction benchmark for residential developments, brought in under the Energy Assessment Guidance 2023.
- A minimum of 10% reduction in regulated CO₂ emissions at the Be Lean stage through energy efficiency measures.

Sustainability:

- Enhance health and wellbeing provision of high quality buildings and associated amenity spaces, limiting exposure to sources of air and noise pollution.
- Provision of accessible housing.
- Optimise land use and promote higher density development.
- Design in measures to ensure safety, security and resilience (including resilience to flood risk and overheating).
- Contribute to urban greening, biodiversity and access to nature within the city where feasible.
- Water efficiency residential schemes to meet a maximum water consumption of 105 l/p/d.
- Waste management and reduction.
- Sustainable urban drainage.
- Sustainable transport.

2.2.2 Camden Local Plan (2017)

Energy and carbon:

- Achieve CO₂ emission targets set out within the London Plan.

Sustainability:

- Contribute to enhancing health and wellbeing, accessibility, safety and security.
- Manage development impacts including daylight/sunlight, privacy, outlook, transport, noise, vibration, air quality etc. Provide outdoor amenity.
- Improve biodiversity value where feasible.
- Climate change mitigation/adaptation.
- Water efficiency.
- Waste management. -
- Prioritise sustainable transport.

2.2.3 Camden Planning Guidance -**Energy Efficiency and Adaptation** (2021)

Energy and carbon:

- Reduce carbon dioxide emissions through the application of the energy hierarchy.
- Natural 'passive' measures should be prioritised over active measures.
- All new build residential development (of 1 – 9 dwellings) must meet 19% carbon dioxide reduction.
- A 20% reduction in regulated CO2 emissions from onsite renewable technologies for major developments.

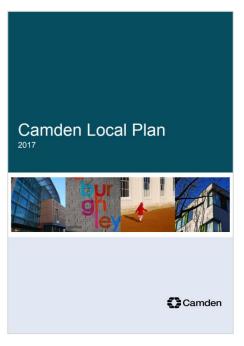
Sustainability:

- Consider and incorporate sustainable design principles.
- Repurpose existing buildings and minimising demolition where feasible.
- Seek to optimise resource efficiency and use circular economy principles.



MARCH 2021

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Camden Planning Guidance

Energy efficiency and adaptation

January 2021



2.2.4 Emerging Draft New Camden Local Plan (Regulation 18 Consultation Version, 2024)

The regulation 18 consultation for Camden's Draft Local Plan took place between January and March 2024. Although the Draft Local Plan has not been adopted yet, the client and design team have considered the proposed energy and sustainability related policies during development of the scheme as far as feasible, including:

- Reviewing estimated Space Heating Demand and Energy Use Intensity of development against targets.
- Assessment of Embodied Carbon and Whole Life Carbon performance.
- Following circular economy principles.
- Target net zero carbon in operation.
- Design for climate resilience. Maximise passive cooling in and around buildings.
- Protect and enhance existing ecology.
- Minimise water use. Include means for rainwater re-use on site.

The proposed Energy and Sustainability Strategy for 46 Maresfield Gardens are presented in the following chapters.



3 Energy Strategy

The Energy Strategy for the proposed development at 46 Maresfield Gardens has been developed in line with the Energy Hierarchy set out in Policy SI 2 of the London Plan:

- 1. Be Lean: use less energy.
- 2. Be Clean: supply energy efficiently.
- 3. Be green: access low or zero carbon (LZC) energy sources.
- 4. Be Seen: monitor and report operational energy.

The CO₂ emissions at each stage of the Hierarchy are compared to a Building Regulations Part L1A 2021 (adopted June 2022) compliant baseline.

It should be noted that the estimations presented within this statement are based on the Part L calculation methodology and the associated standard assumptions regarding occupancy, space/system usage and climatic conditions; and should not be considered as a predictive assessment of the likely in-use energy requirements for the development.

The following sections present the measures adopted at each stage of the Energy Hierarchy at the proposed development.

3.1 Be Lean

A range of energy efficiency measures has been applied to the design of the building fabric and building services systems to minimise energy demand and CO_2 emissions at the Be Lean stage.

3.1.1 Passive Design

The dwelling has generously sized east/south/west facing windows, with good potential for passive solar heating to reduce space heating energy demand from active systems. Low-e glazing will be specified, which promotes heat retention within the dwelling in the cooler months.

The home is quadruple aspect with windows on all facades for natural cross ventilation and passive cooling during the warmer months.

Reasonably sized windows are to enable satisfactory access to natural light for all habitable spaces, reducing the need for artificial lighting during the day. A rooflight is proposed to the stairwell which will bring daylight deeper into the home and also enable the potential for stack driven ventilation on the warmest days.

3.1.2 Fabric Performance

A fabric first approach has been undertaken to minimise unwanted heat loss through the building fabric and reduce heating energy demand over the cooler months.

The proposed building fabric specification will go beyond the notional building standards set out within Building Regulations Part L1 2021. Details regarding targeted u-values, air permeability and thermal bridging are presented in Appendix C. U-values beyond Part L 2021 levels, low airtightness and provision of MVHR to limit unwanted fabric and ventilative heat losses.



Satisfactory levels of operable glazed areas across the development to enable good daylight penetration and potential for passive cooling through natural ventilation.

Figure 3. Passive design measures considered for the proposed development.

Table 2. Proposed fabric specification at 46 Maresfield Gardens

Element	Part L 2021 limiting specification	Part L 2021 Notional Building specification	Proposed specification
External walls u-value (W/m².K)	0.26	0.18	0.15
Roof u-value (W/m².K)	0.16	0.11	0.1
Floor u-value (W/m².K)	0.18	0.13	0.1
Windows u-value (W/m².K)	1.6	1.2	1.2
Windows g-value	-	0.63	0.4
Doors u-value (W/m².K)	1.6	1.0	1.0
Air permeability (m³/m².hr)	8	5	3

G-value of 0.4 targeted for all glazing to achieve a balance between passive heating, solar protection and daylight access.

Generous glazed areas on east, south and west façades to facilitate passive heating and reduce space heating demand during the cooler months.

3.1.3 Efficient lighting

All light fittings within the proposed dwelling will be specified as low energy lighting, and will incorporate LEDs with an average efficacy of more than 100 lm/W.

3.1.4 Heat Recovery Ventilation

Mechanical Ventilation with Heat Recovery (MVHR) is proposed to provide good levels of fresh air supply whilst reducing ventilative heat loss during the cooler months.

3.1.5 Controls and Energy Monitoring

Time and temperature zone control will be provided for space heating the dwelling. Hot water will be independently controlled from space heating.

Where feasible, a smart meter will also be installed at an accessible location to enable occupants to monitor and reduce their energy consumption.

3.1.6 The Cooling Hierarchy

The scheme has been designed in line with the 6 steps of the Cooling Hierarchy in Policy SI4 of the London plan and Policy CC2 of the Local Plan.

1. Reduce the amount of heat entering the buildina

- Reasonably sized glazed areas are proposed for all facades to enable good daylight ingress without excessive solar gains. Full height glazing has been limited to where access to external amenity spaces is required.
- Solar control glazing will be specified to all windows.
- 2. Minimise internal heat generation through energy efficient design
 - All heat sources (e.g. cylinders) will be factory insulated to reduced heat loss. Lateral heat distribution pipework will be minimised as far as feasible.
 - All light fixtures will be low energy and will not result in notable internal lighting heat gains.

3. Manage the heat within the building through exposed internal thermal mass and high ceilings

- Exposed internal thermal mass is more effective for non-domestic buildings when it is possible to significantly precool spaces during night-time when they are unoccupied.
- The inclusion of exposed internal thermal mass will result in notably higher space heating demand for domestic developments.
- Exposed internal thermal mass (at ceiling level) also requires exposed building services and is not deemed suitable for a scheme of this nature.

4. Provide passive ventilation

- Natural ventilation through openable windows will be the main strategy for fresh air provision and passive cooling.
- Generous openable areas are provided to all glazing. Windows are present on all orientations and the dwelling will have good natural cross ventilation potential.
- An openable roof window is proposed above the stairwell to facilitate stack ventilation across the dwelling.

5. **Provide mechanical ventilation**

Mechanical ventilation with heat recovery will be provided as part of the overall energy strategy. The system will have boost and bypass modes available as a back-up to reduce overheating risks during the summer.

6. **Provide active cooling systems**

Cooling is not currently proposed for the home.

3.1.7 Overheating Risk Assessment

An Overheating Assessment has been undertaken in line with the Part O methodology to inform design at planning stage.

Please refer to the accompany Overheating Report for further information.

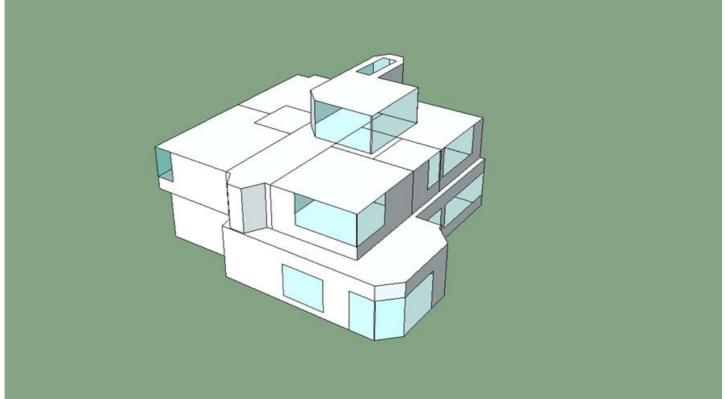


Figure 4. Technical model used for the overheating assessment.

3.2 Be Clean

Policy SI 3 of the London Plan stipulates that major development proposals within Heat Network Priority Areas should have a communal heating system connected to local existing or planned heat networks, or to low/zero emission local heat sources.

A review of the London Heat Map (Figure 5) shows that there are no existing or proposed district heating network in proximity to the site.

The application of a standalone heating system is therefore considered as the most suitable heating strategy for the proposed dwelling.

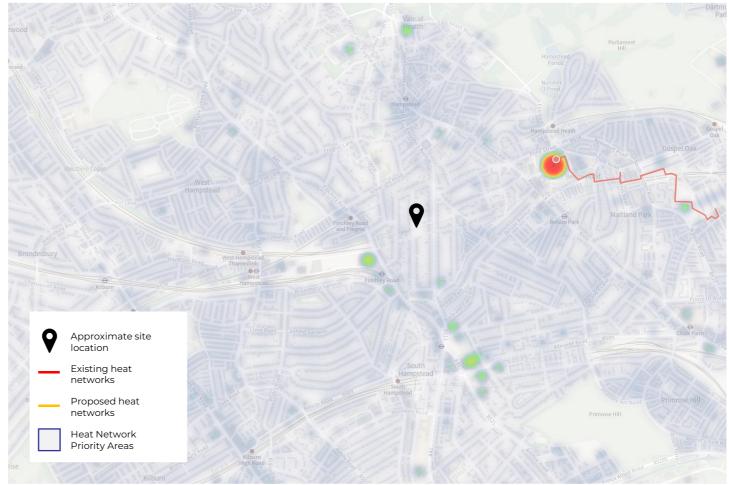


Figure 5. London Heat Map for site and surroundings (accessed 13/1/2025).

3.3 Be Green

The opportunity for producing and utilising renewable energy onsite will be maximised for the proposed dwelling, in line with Policy SI 2 of the London Plan.

An outline feasibility study has been undertaken (see Table 3), which identified an air source heat pump system and photovoltaics as the most suitable low/zero carbon technologies for the scheme.

A PV array of 2.8 kWp is proposed at roof level as part of a biosolar roof application in conjunction with biodiverse roof planting.

The roof plan in Figure 6 shows the proposed indictive PV array.

Table 3. Outline LZC feasibility

LZC Technology	Feasibility
Photovoltaics (adopted)	Photovoltaics are deemed suitable for the scheme and are proposed on the roof above the first floor.
Solar thermal (not adopted)	Roofs are prioritised for PV installation. Solar thermal panels not fully compatible with air source heat pump without the need for additional plumbing systems.
Wind turbines (not adopted)	The installation of wind turbines at the proposed building/site will have a significant visual impact on the site and surroundings. The site is also relatively sheltered and is anticipated to experience low wind speeds.
Ground source heat pump (GSHP) (not adopted)	The installation of ground source borehole systems requires notable space, time and cost, and is not deemed feasible for a scheme of this scale and nature. Ground trenches are not seemed feasible due to the extent of trees present onsite.
Air source heat pump (ASHP) (adopted)	Air source heat pump is an effective way of providing low carbon heating and hot water for the home.
Biomass (not adopted)	Biomass systems emit high NOx levels and are not supported within urban areas. There is also no suitable space onsite for the storage of biomass.

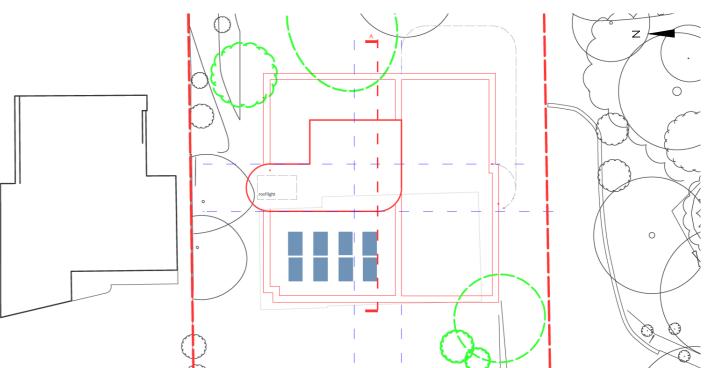


Figure 6. Roof plan showing indicative PV provision.

3.4 Results

Through the measures outlined for each stage of the Energy Hierarchy, it is anticipated the proposed development can achieve a 65% reduction in regulated CO₂ emissions over the Part L1 2021. This meets the minimum onsite reduction target of 35% set out by the GLA, as well as the benchmark reduction target of 50% for residential developments stipulated within GLA's Energy Assessment Guidance (2022).

The scheme is also anticipated to achieve a 21% reduction in regulated CO₂ over the Part L1 2021 at the Be Lean stage with building fabric and system efficiencies measures alone, which exceeds the 10% Be Lean reduction target set out by the GLA for residential developments.

Carbon offset payments are not considered applicable for this minor development.

The Space Heating Demand and Energy Use Intensity (without inclusion of PVs) are 31.6kWh/m².yr and 41.8 kWh/m².yr respectively.

Table 4, Table 5 and Figure 7 present the anticipated CO₂ emissions and savings at each stage of the Energy Hierarchy.

Table 4. Carbon emissions after each stage of the Energy Hierarchy

	Carbon Dioxide Emissions (tCO ₂ /yr)		
	Regulated	Unregulated	
Baseline: Part L 2021 Compliant Development	3.4	1.2	
After energy demand reduction (be lean)	2.7	1.2	
After heat network connection (be clean)	2.7	1.2	
After renewable energy (be green)	1.2	1.2	

Table 5. Regulated carbon savings from each stage of the Energy Hierarchy

	Regulated domestic carbon dioxide savings				
	(Tonnes CO ₂ per annum)	(%)			
Be lean: Savings from energy demand reduction	0.7	21%			
Be clean: Savings from heat network	0.0	0%			
Be green: Savings from renewable energy	1.5	44%			
Cumulative on-site savings	2.2	65%			

Energy Hierarchy



---- London Plan 50% target (benchmark)

Figure 7. Regulated carbon emissions at each stage of the Energy Hierarchy.

4 Sustainability Strategies

This section of the report presents the key elements of the development which responds to the sustainable development policies set out within the London Plan and Camden's Local Plan.

4.1 Health and Wellbeing

4.1.1 Air Quality

In line with GLA's SPG on The Control of Dust and Emissions during Construction and Demolition, any potential dust and stationary plant emissions during the construction period, and any potential impact from traffic flows on the local road network, during and after construction will be mitigated.

The proposed scheme is not anticipated to result in greater traffic flows compared to the existing use. It will therefore will not result in notable air quality impact from operational traffic. A heat pump system driven by electricity will supply space heating and hot water at the proposed dwelling. There will be no PM and NOx emissions associated with fossil fuel combustion from the operation of the building services systems at the scheme.

4.1.2 Noise

The development will incorporate building fabric measures to ensure the impact of any external sources on internal ambient noise levels are within acceptable limits, in line with BS8233:2014 or latest standards. Any potential noise impact during demolition and construction will be mitigated accordingly.

All external building services plant will be acoustically attenuated where required

4.1.3 Daylight and Sunlight

The proposed scheme will not result in any notable daylight and sunlight impact to neighbouring properties. Surrounding residential windows, rooms and amenity spaces are anticipated to retain good daylight and sunlight levels with the proposed scheme in place. Further details can be found in the accompanying Daylight and Sunlight Assessment Report. Well sized windows and rooflight are provided to the proposed home.

4.1.4 External Lighting

The external lighting design and specification will be in accordance with the ILP's Guidance Note for The Reduction of Obtrusive Light (2021).

The scheme will limit the amount of up-lighting and all external lighting (aside from security lighting) will be connected to daylight sensors and be time controlled.

4.1.5 Safety and Security

Secure by Design principles have been incorporated into the design to ensure safe and secure spaces are provided to all users.

4.1.6 Accessibility and Inclusiveness

The property, while being on a steeply sloping street, is accessed via a level crossover from the public highway. The approach to the house is step/ramp free within the curtilage of the site, and the threshold from the front garden into the entrance hall is level also.

Within the house, doorways and openings are purposefully wide. The proposed house will be designed in detail to comply with the DDA and Part M4(3) of the Building Regulations Approved Documents.

4.1.7 External Amenity

Carefully landscaped areas are proposed for the front and rear gardens. The occupants will have access to plenty of external spaces at the dwelling.



Figure 8. Daylight and sunlight technical model.

4.2 Nature, Landscape and **Biodiversity**

Any features of ecological value currently present on site will be retained and protected as far as feasible. Any new soft landscaping will comprise native plant species where appropriate. A biodiversity roof integrated with PV panels is proposed.

Only trees that are of low public visual amenity value or are structurally compromised will be removed.

Further information can be found in the Tree Survey and Arboricultural Method Statement prepared by Tretec.

4.3 Climate Resilience

Managing risk of overheating 4.3.1

The proposed development has been designed in line with GLA's Cooling Hierarchy. Refer to the Energy Strategy section and the accompanying Overheating Assessment Report for further details.

4.3.2 Managing flood risk

The site is located in an area with a low probability of flooding from rivers and seas (see Figure 10).

4.4 Water and Surface Water Runoff

4.4.1 Water Efficiency

The proposed development will target a mains water consumption of less than 105 litres/person/day. This is consistent with Building Regulations Part G(2) requirement and London Plan policy SI5.

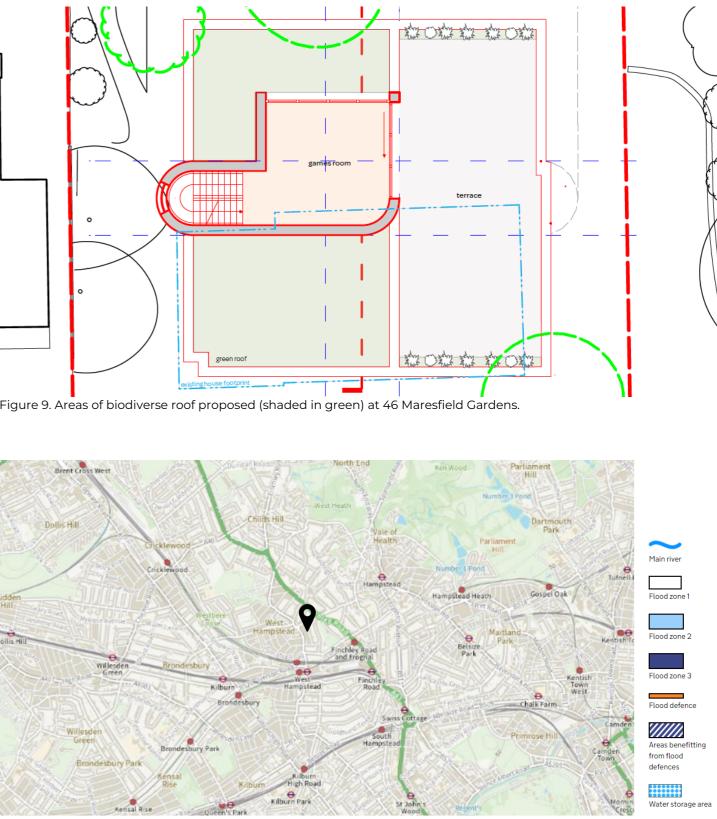
The following suggested flow rates shall be considered during detailed design of the development to achieve the water consumption target:

- WCs: 6 litre / 3 litre dual flush. _
- Wash basin taps: 4 litres/min.
- Kitchen sink taps: 6 litres/min. -
- Showers: 8 litres/min. _
- Baths: 180 litres to overflow;
- Dishwasher: 1.25 litres/place setting.
- Washing Machine: 8.17 litres/kg dry load.

A rainwater collection butt will also be installed for landscape irrigation to reduce potable water use.

4.4.2 Surface water runoff

Sustainable drainage systems will be considered, including the biodiverse roof proposed above the first floor.



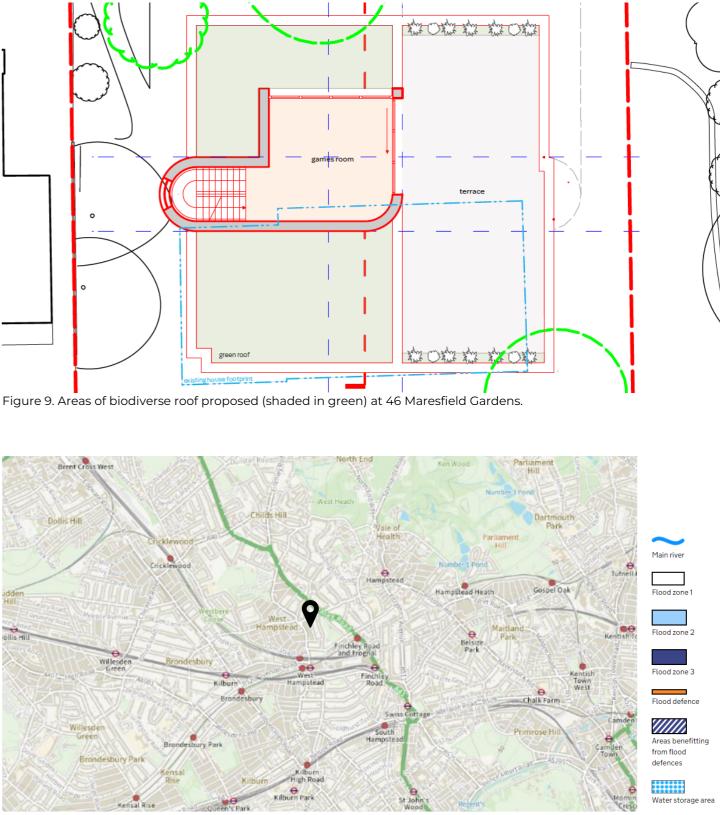


Figure 10. Flood risk map – rivers and sea flooding. (Accessed 29 January 2025)

4.5 Materials and Waste

4.5.1 Whole Life Carbon

The proposed development will aim to minimise use of the materials with high embodied carbon as far as possible. It is proposed that the above ground structure be mainly constructed from prefabricated Structural Insulated Panels (SIPs).

The structure grid of the proposed building has been rationalised and stacked to minimise the associated structural requirements.

To reduce embodied carbon of the proposed development, materials with recycled content will be prioritised during detailed design stage specification.

Whole Life Carbon assessment has been carried out which indicates that the proposed scheme can meet GLA's residential benchmark for embodied carbon emissions.

Further assessments were carried out to compare the proposed development with alternative design options for the site. These included carrying out minor upgrades to the existing building as well as an option where part demolition, refurbishment and extension was explored to create an equivalent scheme to the one proposed for the application site.

The assessment indicated that the proposed development which entails mainly retention of the front façade would outperform the other two options from a whole life carbon emissions perspective, as shown in Figure 11. For further details, please refer to the Whole Life Carbon Assessment for the planning application.

4.5.2 Material Selection and Procurement

All materials utilised for the scheme will be selected for longevity and durability as well as recoverability and recyclability at end of life. To minimise potential sources of indoor air pollution, low VOC materials, paints and finishes will be prioritised where possible.

All timber used on the site will be FSC or PEFC certified. Where feasible, all other construction materials utilised at the development will be

certified under BES6001 and EMS or other similar responsible sourcing certification schemes.

Where practicable, the contractor will source items locally, and where possible amalgamate deliveries to reduce the overall number of vehicle movements taking place.

4.5.3 Waste Management and Circular Economy

Waste streams will be efficiently segregated (offsite) and processed during both construction and operation stages, with a target to maximise potential re-use of materials and diversion from landfill in line with GLA and Camden policies.

All waste that cannot be reused or recycled will be disposed of in accordance with legislation and best practice.

4.6 Sustainable transport

The site is within walking distance to Finchley Road and Frognal Overground Station and Finchley Road Underground Station. There are also numerous buses available along Finchley Road circa 250m to the west with connections into Central London and other national destinations.

4.6.1 Cycle Parking

Cycle storage spaces will be installed within the front garden of the dwelling.

4.6.2 Car Parking

The existing car parking space along the driveway will be retained. An EV charging point will be installed in line with Part S of the Building Regulations.

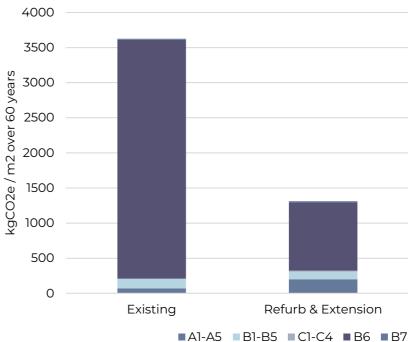


Figure 11. Whole Life Carbon Assessment results for three development options at 46 Maresfield Gardens. The lifecycle assessment study period is 60 years.

Whole life carbon comparis

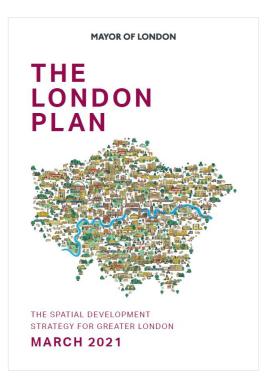
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5 Conclusions

Through the adoption of the energy and sustainability strategies presented in this report, the client and design team demonstrated that the proposed development at 46 Maresfield Gardens will fulfil the relevant policy requirements stipulated by the London Plan, and by Camden's Local Plan.

Appendix A – GLA policies

London Plan (March 2021)



The London Plan is part of the statutory development plan for London and sets out a framework for how for how the city will develop sustainably over the next 20-25 years.

The energy and sustainability policies within the London Plan relevant to the proposed development at 46 Maresfield Gardens are summarised below.

Policy GG2 Making the best use of land

- enable the development of brownfield land, particularly in Opportunity Areas, on surplus public sector land, and sites within and on the edge of town centres, as well as utilising small sites.
- proactively explore the potential to intensify the use of land, promoting higher density development.
- protect and enhance London's open spaces, and promote the creation of new green infrastructure and urban greening, including aiming to secure net biodiversity gains where possible.

 plan for good local walking, cycling and public transport connections.

Policy GG3 Creating a healthy city

- promote more active and healthy lives for all Londoners and enable them to make healthy choices, utilise the Healthy Streets Approach
- seek to improve London's air quality and green spaces.
- ensure that new buildings are well-insulated and sufficiently ventilated to avoid the health problems associated with damp, heat and cold.
- seek to create a healthy food environment.

Policy GG6 Increasing efficiency and resilience

- seek to improve energy efficiency and support the move towards a low carbon circular economy, contributing towards London becoming a zero carbon city by 2050.
- ensure buildings and infrastructure are designed to adapt to a changing climate.

Policy D2 Infrastructure requirements for sustainable densities

- density of development proposals should consider, and be linked to, the provision of future planned levels of infrastructure rather than existing levels.
- density of development should be proportionate to the site's connectivity and accessibility by walking, cycling, and public transport to jobs and services.

Policy D11 Safety, security, and resilience to emergency

- maximise building resilience and minimise potential physical risks, including those arising as a result of extreme weather, fire, flood and related hazards.
- Include measures to design out crime.

Policy D14 Noise

- avoiding significant adverse noise impacts on health and quality of life.
- mitigating and minimising the existing and potential adverse impacts of noise on, from, within, as a result of, or in the vicinity of new development without placing unreasonable restrictions on existing noise-generating uses.
- improving and enhancing the acoustic environment and promoting appropriate soundscapes.

Policy G1 Green infrastructure

- incorporate appropriate elements of green infrastructure that are integrated into London's wider green infrastructure network.

Policy G5 Urban greening

- contribute to the greening of London by including urban greening as a fundamental element of site and building design, and by incorporating measures such as high-quality landscaping (including trees), green roofs, green walls and nature-based sustainable drainage.

Policy G6 Biodiversity and access to nature

- manage impacts on biodiversity and aim to secure net biodiversity gain.

Policy SI1 Improving air quality

- demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.
- 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 SI2 Minimising greenhouse gas emissions

- Major development should be net zerocarbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
 - 1. be lean: use less energy and manage demand during operation
 - 2. be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
 - 3. be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
 - 4. be seen: monitor, verify and report on energy performance.
- 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:
 - through a cash in lieu contribution to the borough's carbon offset fund, or
 - off-site provided that an alternative proposal is identified and delivery is certain.

Policy SI3 Energy infrastructure

- identify the need for, and suitable sites for, any necessary energy infrastructure requirements including energy centres, energy storage and upgrades to existing infrastructure. 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.

Policy SI4 Managing heat risk

- minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.
- Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the cooling hierarchy.

Policy SI5 Water infrastructure

- to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.
- <minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)>
- seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided

Policy SI7 Reducing waste and supporting the circular economy

- 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.
- design developments with adequate, flexible, and easily accessible storage space and collection systems that support, as a

minimum, the separate collection of dry recyclables (at least card, paper, mixed plastics, metals, glass) and food.

Policy SI12 Flood risk management

- ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

Policy SI13 Sustainable Drainage

 aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the drainage hierarchy.

Policy T5 Cycling

- securing the provision of appropriate levels of cycle parking which should be fit for purpose, secure and well-located. Developments should provide cycle parking at least in accordance with the minimum standards set out in Table 10.2 and Figure 10.3 the London Plan.
- Cycle parking should be designed and laid out in accordance with the guidance contained in the London Cycling Design Standards.

Energy Assessment Guidance (June 2022)

MAYOR OF LONDON	
Energy Assessment Guidan Greater London Authority guidance on preparing ener assessments as part of planning applications (June 20	gy

This document provides guidance on how to prepare energy statements that meets London Plan Policy SI2 for GLA referable projects. It is also useful reference for Major Developments (>10 dwellings or >1,000m² non-domestic space) proposed for within Greater London.

The main requirements relevant to the proposed scheme at 46 Maresfield Gardens are summarised below:

- Major developments are required to achieve a minimum 35 per cent on-site carbon reduction over Part L 2021. Residential developments are expected to be able to exceed this, and so an additional benchmark (50 per cent reduction) has been set that residential developments should be aiming to achieve.
- Energy demand should be reduced as far as possible before the heating strategy and installation of low carbon and renewable technologies is considered. This is important in protecting consumers from high prices. Developments are expected to achieve

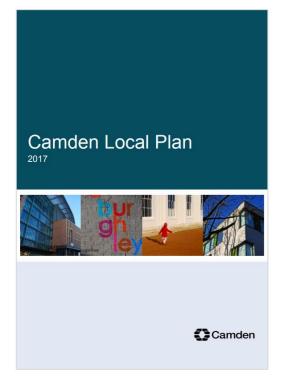
carbon reductions beyond Part L 2021 of 10 per cent for residential developments and 15 per cent for non-residential developments through energy efficiency measures alone, before other measures are applied.

- Applicants should also report the Energy Use Intensity (EUI) and the space heating demand of the development. These metrics will help applicants to demonstrate that they have maximised energy efficiency measures in line with the energy hierarchy, in addition to the percentage improvement target.

Although the scheme at 46 Maresfield Gardens do not fall under the threshold for major development, the principles of the energy assessment guidance have been followed when developing the energy strategy.

Appendix B – Camden policies

Camden Local Plan (2017)



The Local Plan sets out the sets out the Council's vision for the borough and help deliver the objectives of creating the conditions for harnessing the benefits of economic growth, reducing inequality and securing sustainable neighbourhoods. The Local Plan will cover the period from 2016-2031.

The energy and sustainability policies within the Camden Local Plan relevant to the proposed development at 46 Maresfield Gardens are summarised below.

Policy C1 Health and wellbeing

- Measures that will help contribute to healthier communities and reduce health inequalities must be incorporated in a development where appropriate.
- Developments to positively contribute to creating high quality, active, safe and accessible places.

Policy C5 Safety and Security

- Developments to demonstrate the incorporation of design principles which contribute to community safety and security, particularly in wards with relatively high levels of crime.
- Provide appropriate security and community safety measures in buildings and spaces.

Policy C6 Access for all

- All buildings to meet the highest practicable standards of accessible and inclusive design so they can be used safely, easily and with dignity by all.
- Spaces, routes and facilities between buildings to be designed to be fully accessible.
- Developments to meet the principles of lifetime neighbourhoods.

Policy A1 Managing the impact of development

- Developments to contribute towards strong and successful communities by balancing the needs of development with the needs and characteristics of local areas and communities.
 - The following will be considered:
 - Visual privacy and outlook
 Sunlight, daylight and overshadowing
 - Artificial lighting levels
 - Transport impacts
 - Impacts of the construction phase
 - Noise and vibration levels
 - Odour, fumes and dust
 - Microclimate
 - Contaminated land
 - Impact upon water and wastewater infrastructure

Policy A2 Open space

 Protect all designated public and private open spaces as shown on the policy map unless equivalent or better provision of open space in terms of quality and quantity is provided within the local catchment area.

- Apply a standard of 9m2 per occupant for residential schemes and 0.74m2 for commercial and higher education developments while taking into account any funding for open spaces through the CIL.
- Developments to seek opportunities for providing private amenity space.

Policy A3 Biodiversity

- Developments will be assessed against their ability to realise benefits for biodiversity through the layout, design and materials used in the built structure and landscaping elements.
- Improve opportunities to experience nature, in particular where such opportunities are lacking.
- Require the demolition and construction phase of development, including the movement of works vehicles, to be planned to avoid disturbance to habitats and species and ecologically sensitive areas, and the spread of invasive species.
- Secure management plans, where appropriate, to ensure that nature conservation objectives are met.
- Developments should incorporate additional trees and vegetation where possible.

Policy A4 Noise and Vibration

- Planning permission will not be granted for developments likely to generate unacceptable noise and vibration impacts.
- Developments sensitive to noise in locations which experience high levels of noise, unless appropriate attenuation measures can be provided and will not harm the continued operation of existing uses.

Policy CC1 Climate change mitigation

- Developments are encouraged to meet the highest feasible environmental standards that are financially viable during construction and operation.
- All developments to reduce carbon dioxide emissions through following the steps in the energy hierarchy.
- All major developments to demonstrate how London Plan targets for carbon dioxide have been met.
- Location of developments and mix of land uses to minimise the need to travel by car and help to support decentralised energy networks.
- All proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building.
- All developments to optimise resource efficiency.

Policy CC2 Adapting to climate change

- Developments should adopt appropriate climate change adaptation measures including:
 - Protection of existing green spaces and promoting new appropriate green infrastructure.
 - Not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of SuDs.
 - Incorporate biodiverse roofs, combination of green and blue roofs and green walls where appropriate.
 - Implementing measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.
- Developments to demonstrate how adaptive measures and sustainable development principles have been incorporated into the design and proposed implementation.

Policy CC3 Water and flooding

- Developments to:
 - Incorporate water efficiency measures.
 - Avoid harm to the water environment and improve water quality.
 - Consider the impact of development in areas at risk of flooding.
 - Incorporate flood resilient measures in areas prone to flooding.
 - Utilise SuDs in line with drainage hierarchy to achieve greenfield runoff rate where feasible.
 - Not locate vulnerable development in flood-prone areas.

Policy CC4 Air Quality

- Developments that introduce sensitive receptors in locations of poor air quality will not be acceptable unless designed to mitigate the impact.
- Development that involves significant demolition, construction or earthworks will be required to access the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

Policy CC5 Waste

- Developments to include facilities for the storage and collection of waste and recycling.

Policy TI Prioritising walking, cycling and public transport

- Developments to improve the pedestrian environment by supporting high quality public realm improvement works.
- Developments should be adequately lit.
- Accessible and secure cycle parking facilities exceeding minimum standards outlined in the London Plan and Camden's Planning Guidance on

Transport should be provided. Higher levels of provision may also be required in areas well served by cycle route infrastructure, taking into account the size and location of the development. Camden Planning Guidance – Energy Efficiency and Adaptation (2021)

Camden Planning Guidance

Energy efficiency and adaptation

January 2021



This planning guidance provides information on key energy and resource issues within the borough and supports Local Plan Policies CC1 Climate change mitigation and CC2 Adapting to climate change.

Main requirements and guidance elements from the document are summarised below.

Energy hierarchy

- All development in Camden is expected to reduce carbon dioxide emissions by following the energy hierarchy in accordance with Local Plan policy CC1.

Making buildings more energy efficient

- Natural 'passive' measures should be prioritised over active measures to reduce energy.

Energy reduction

- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.
- All new build residential development (of 1 – 9 dwellings) must meet 19% carbon dioxide reduction.
- The 20% carbon reduction target (using on-site renewable energy technologies) applies for developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace.
- For minor developments, renewables should be incorporated where feasible.

Reuse and optimising resource efficiency

- All development should seek to optimise resource efficiency and use circular economy principles.

Sustainable design and construction measures

- Active cooling (air conditioning) will only be permitted where its need is demonstrated and the steps in the cooling hierarchy are followed (Local Plan policy CC2).
- Development is expected to reduce overheating risk through following the steps in the cooling hierarchy. All new development should submit a statement demonstrating how the cooling hierarchy has been followed (Local Plan policy CC2).
- All developments should seek opportunities to make a positive contribution to green space provision or greening.

Emerging Draft New Camden Local Plan (Regulation 18 Consultation Version, January 2024)

Draft New Camden Local Plan



The Council has started preparing a new Local Plan for Camden to replace the current Camden Local Plan (2017) and Site Allocations Plan (2013). Consultation for the Regulation 18 Draft Local Plan was undertaken between January to March 2024.

Although the Draft Local Plan has not been adopted yet, the client and design team have considered the proposed energy and sustainability related policies during development of the scheme as far as feasible.

Policy CC1 - Responding to the climate emergency

The Council will prioritise the provision of measures to mitigate and adapt to climate change and require all development in Camden to respond to the climate emergency by:

- Supporting the retrofitting of existing buildings to make them more energy efficient.

- Prioritising and enabling the repurposing and re-use of existing buildings.
- Following circular economy principles, minimising waste and increasing re-use.
- Reducing whole life carbon emissions, by taking a whole life carbon approach.
- Being designed and constructed to be net zero carbon in operation.
- Utilising low carbon technologies and maximising opportunities for renewable energy generation, and heat networks.
- Being designed to be resilient to climate change and meet the highest standards of sustainable design and construction.
- Minimising the risk of overheating through design and avoiding reliance on air conditioning.
- Improving water efficiency.
- Minimising and avoiding the risk of flooding from all sources, and incorporating multifunctional SuDs to reduce surface water run-off.
- Protecting and enhancing existing green spaces and water sources, enhancing biodiversity, strengthening nature recovery and providing multi-functional green infrastructure.
- Prioritising sustainable transport.

Policy CC2 - Repurposing, Refurbishment and Re-use of Existing Buildings

The Council will only permit proposals that involve the partial or substantial demolition of existing building/s, where it can be demonstrated to the Council's satisfaction that:

- The applicant has comprehensively explored a range of alternative development options, informed by the condition and feasibility assessment, prior to considering full or partial demolition.
- The proposal constitutes the best use of the site, when considered against alternative options involving the retention, repurposing, refurbishment and/or re-use of the existing building/s.

Where it is demonstrated to the Council's satisfaction that the partial or full demolition of existing building/s is justified, the applicant will be

required to submit a pre-demolition audit. This should demonstrate that the re-use of materials has been explored on site; identify all materials within the building and document how they will be managed; show how building material waste will be minimised; and demonstrate that circular economy principles have been applied in accordance with Policy CC3 Circular Economy and Reduction of Waste.

Policy CC3 - Circular economy and reduction of waste

The Council will require all developments to optimise resource efficiency by:

- Reducing waste through the application of the waste hierarchy (Prevention, Preparing for reuse, Recycling, Other recovery, Disposal);
- Reducing energy and water use during demolition and construction, whilst effectively mitigating air quality impacts;
- Minimising the amount of materials required;
- Using materials with low embodied carbon content; and
- Enabling low energy and water demands once the building is in use.

Require all developments to be designed for:

- easy maintenance and renovation;
- flexibility and adaptation; and
- longer life and facilitating deconstruction for future re-use.

Policy CC4 - Minimising carbon emissions

The Council will seek to ensure that all development minimises carbon emissions over the lifespan of the building(s). The Council will:

 Require applicants for all new build development and all development proposing substantial demolition to submit a whole life carbon emissions assessment (including operational and embodied carbon), following the GLA Whole Life Cycle Carbon Assessment template, as part of the planning application; and demonstrate that they have done all they can to minimise carbon emissions over the lifespan of the building/s, targeting the GLA Whole Life Carbon aspirational benchmarks in modules B – C.

- Require new build developments to meet embodied carbon limits of less than 500kg CO2/m2 for residential.
- Require applicants to demonstrate what action they have taken to reduce embodied carbon in the development, as part of the Energy or Sustainability Statement.

Policy CC6 - Energy reduction in new buildings

The Council will ensure that all new buildings are designed and built to be net zero carbon in operation. The Council will:

- Require new buildings to be fossil fuel free, ultra-low energy, use low carbon heat, and contribute to the generation of renewable energy on-site.
- Require new buildings to use as little energy as possible to heat them. The Council will require all new residential and non-residential buildings to achieve a space heating demand of 15 or less kWh/m2 GIA/yr.
- Require new buildings to use as little (total) energy as possible (expressed as EUI – Energy Use Intensity). Residential buildings must achieve an EUI of no more than 35 kWh/m2GIA/yr.
- Require renewable energy generation onsite to match, or be in excess of, the predicted total annual energy demand of the building (EUI), in accordance with the following requirements:
 - the proposed building must not use fossil fuels on-site;
 - it must have a level of space heating demand and energy use intensity (EUI) compliant with levels in this policy; and
 - on-site renewable energy generation (e.g. through photovoltaics (PVs) has been maximised and achieves at least

80 kWh/m2 building footprint for all building types.

- Require applicants/landowners to monitor the total energy use and renewable energy generation of the development for the first 5 years of occupation and submit the annual figures to the Local Planning Authority.
- Require applicants to demonstrate that the development will deliver all the requirements of this policy through the provision of a detailed Energy Statement and through the use of an energy assured performance method.

Policy CC8 - Overheating and cooling

The Council will ensure that development is designed to minimise overheating and promote cooling. The Council will:

- Support proposals which seek to adapt and improve existing buildings, to improve ventilation, and address overheating and promote cooling, where they are in accordance with the other policies in this Plan.
- Require all development to minimise the adverse impacts of overheating through the application of the London Plan cooling hierarchy. Applicants should include information demonstrating that the risk of overheating has been mitigated through the incorporation of design measures in the Sustainability Statement.
- Require applicants to incorporate measures to cool buildings through the use of materials and finishes. The Council will expect materials and finishes to have the ability to reflect sunlight.
- Require applicants to incorporate measures to cool the spaces around and between buildings using appropriate materials, finishes, and greening. Trees should provide adequate canopy cover for greater cooling effect.

Policy CC9 - Water efficiency

To maximise water efficiency in Camden the Council will:

- Require all new development to be designed to be water efficient;
- Require all residential developments to meet the optional requirement for water efficiency set out in Part G of the Building Regulations of 110 litres per person per day (including 5 litres for external water use). Proposals will be strongly encouraged to reduce daily water use even further than this (to, for example, 85 litres per day per person) where possible;
- Require all new buildings to include rain water harvesting appropriate to the scale and nature of the proposed .

Appendix C – Energy calculation assumptions

The items listed below are assumptions only, based on a combination of best judgement at <planning stage> and information from the design team where appropriate. Throughout the design and construction stages the fabric and system requirements (including provisions of renewable technologies) may change whilst the building designs are being progressed. All information detailed in this summary sheet is preliminary recommendation at the Planning Stage. It should be noted that this document is not exhaustive and the design and construction teams should allow for flexibility on site where necessary.

Building fabric parameter	Part L 2021 notional	Proposed specification	Unit	Note	Building fabric parameter	Part L 2021 notional	Proposed specification	Unit	Note
Walls					Thermal Bridging				
External walls	0.18	0.15	W/m2K	1	The following psi values are recommended. All junc construction details and other accredited details wi			eet enhance	∋d
Floors					E1 lintels	0.05	0.05	W/mK	1
Ground floors	0.13	0.10	W/m2K	1	E3 Sill	0.05	0.05	W/mK	1
Exposed floors	0.13	0.10	W/m2K	1	E4 Jambs	0.05	0.05	W/mK	1
	0.15	0.10	VV/IIIZIX	1	E5 Ground Floor	0.16	0.08	W/mK	1
Roofs/ceilings					E6 Inter floor within dwelling	0	0	W/mK	1
Roofs	0.11	0.10	W/m2K	1	E14 Flat roof to terrace	0.08	0.08	W/mK	1
ROOIS	0.11	0.10	VV/IIIZK		E15 Flat roof with parapet	0.56	0.28	W/mK	1
Openings					E24 Eaves (ins. at ceiling level - inverted)	0.24	0.16	W/mK	1
Flat entrance doors	1.0	1.0	W/m2K	1	E16 Corner (normal)	0.09	0.09	W/mK	1
New windows (inc. rooflights) - pane and frame	1.2	1.2	W/m2K	1	E17 Corner (inverted)	-0.09	-0.09	W/mK	1
Windows solar transmittance factor (g-value)	0.63	0.4	W/m2K	1, 2	E19 Ground floor (inverted)	0.07	0.07	W/mK	1
Windows frame factor	0.7	0.8	W/m2K	1, 2	E20 Exposed floor (normal)	0.32	0.32	W/mK	1
	0.7	0.0	VV/IIIZK		E21 Exposed floor (inverted)	0.32	0.32	W/mK	1
Air permeability					E1 lintels	0.05	0.05	W/mK	1
Maximum average air permeability across units	5	3	m3/m2.h	1					
Air permeability test required prior to handover.									

Proposed specification	Unit	Note
Mechanical ventilation with heat recovery		1
	W/I/s	1, 3, 4
		1, 3, 4
Rigid		1
Level 1		1
Assumed		1
MRXBOX-ECO2		1, 4
Air source heat pump		1, 3, 4
>300	%	1, 3, 4
>200	%	1, 3, 4
Underfloor or Radiators		1, 3, 4
Electricity		1, 3, 4
Standard		1, 3, 4
Yes		1, 3, 4
Time and temperature zone control by arrangement		1, 3, 4
Yes		1, 3, 4
Yes		1
150	Litres	1, 4
Factory – 100mm		1, 4
Yes		1, 4
Yes		1, 4
	Mechanical ventilation with heat recovery <0.54 >88 Rigid Level 1 Assumed MRXBOX-ECO2 Air source heat pump >300 >200 Underfloor or Radiators Electricity Standard Yes Time and temperature zone control by arrangement Yes Time and temperature zone control by arrangement Yes	Nechanical ventilation with heat recoveryV//s<0.54

Building Services Systems	Proposed specification	Unit	Note
Water consumption			
Part G Water consumption	<105	l/p/d	1
Showers flow rate	<8	l/min	1
Photovoltaics			
Capacity of PV system	2.8	kWp	1, 4
No. of panels	8		1, 4
Panel capacity	350 W/panel		1, 4
Orientation	South		1, 4
Tilt from horizontal	10° from horizontal		1, 4
Export capable meter	Yes		1, 4
Battery	Not currently assumed		1, 4
Waste water heat recovery	Not currently assumed		1, 4

Notes	
1	Planning stage assumption to achieve planning policy of
2	Subject to detailed overheating assessment to be carrie
3	Building regulations requirement
4	subject to MEP design by others
	as a refer to Approved Decument 11 2021 for all requirement

46 Maresfield Gardens

v or Building Regulations targets ied out where required

NB. Please refer to Approved Document L1 2021 for all requirements to comply with Building Regulations Part L.

Appendix B – Planning stage SAP output

Planning stage SAP output the dwelling is included in this appendix. The Lean Stage DER has been adjusted to include the PV allowance included in the Notional Building and to enable calculation of Be Lean stage savings as per GLA's methodology.

Table 6. Planning stage SAP results.

Unit Reference	TER (kgCO ₂ /m ²)	Lean DER (kgCO ₂ /m ²)	Green DER (kgCO ₂ /m ²)	TFEE (kWh/m²)	DFEE (kWh/m²)
46 Maresfield Gardens	7.85	6.78	2.93	46.21	44.60





Property Reference					Issued on Date 29/01/202								
Assessment Refe	rence		Lean					Prop Type F	Ref				
Property													
SAP Rating					88 B		DER	9.3	20	TER		7.85	
Environmental					89 B		% DER < TE		50			-18.47	
CO ₂ Emissions (t/	(voar)				3.56		DFEE		50	TFE	-	46.21	
Compliance Chec					See BREL		% DFEE < T				-	8.03	
% DPER < TPER	,r				-25.44		DPER		99	TPE	2	42.24	
70 DI ER STI ER					-23.44		DIEK	52	99		,	42.24	
Assessor Details		Ms. S	Sherleen Pang							Asse	essor ID	BA17-00	01
SAP 10 WORKSHEET													
CALCULATION OF I	DWELLING EMIS	SSIONS	FOR REGULAT										
								Area	Stor	ey height		Volume	
Ground floor First floor Second floor Total floor area Dwelling volume	a TFA = (1a)+	+(1b)+	(1c)+(1d)+(1d	e)(ln)	43	6.3700		(m2) 209.2300 194.2300 32.9100	(1b) x (1c) x (1d) x 3a) + (3b) + (3c)	(m) 3.0000 3.0000 2.5800	(2b) = (2c) = (2d) =	(m3) 627.6900 582.6900 84.9078	(1b) - (3b) (1c) - (3c) (1d) - (3d) (4)
2. Ventilation											r	m3 per hour	
Number of open of Number of open of Number of chimme Number of flues Number of blocke Number of interr Number of passi Number of flues	flues eys / flues a attached to attached to ed chimneys mittent extra ve vents	solid other act fa	fuel boiler heater	fire							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	ethod AP50 te	s, flu	es and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	+(6g)+(7a)+	(7b)+(7c) =		0.0000) / (5) =	es per hour 0.0000 Yes Blower Door 3.0000 0.1500 0	(8)
Shelter factor Infiltration rat	te adjusted t	to inc	lude shelter	factor					(20) = 1 - (2)		x (19)] = x (20) =	1.0000 0.1500	
Wind speed Wind factor Adj infilt rate		Feb 5.000 1.250			May 4.3000 1.0750	Jun 3.8000 0.9500				Oct 4.3000 1.0750	Nov 4.5000 1.1250		
Balanced mechan If mechanical ve If exhaust air h	0.1912 nical ventila entilation		with heat rea	covery	0.1612 Emv (equati	0.1425				0.1612	0.1687	0.1762 0.5000 0.5000	(23a)
If balanced with									/			79.2000	
Effective ac	0.2952	0.291	5 0.2877	0.2690	0.2652	0.2465	0.2465	0.2427	0.2540	0.2652	0.2727	0.2802	(25)
3. Heat losses a	and heat loss	s para	neter										
Element				Gross	Openings	Ne	etArea	U-value	Ax		-value	AxK	
Windows (Uw = 1	.20)			m2	m2	115	m2 5.9000	W/m2K 1.1450	132.709	9	kJ/m2K	kJ/K	(27)
Doors Ground floor or Exposed floor External Wall 1 All roofs Total net area of	of external e			441.9000 220.8900	119.5000	209 12 322 220	3.6000 9.2300 2.7200 2.4000 0.8900 4.7400	1.0000 0.1000 0.1000 0.1500 0.1000	3.600 20.923 1.272 48.360 22.089	0 2 0 2 0	20.0000 20.0000 9.0000 9.0000	4184.6000 254.4000 2901.6000 1988.0100	(28b) (29a) (30) (31)
Fabric heat loss Internal Wall 1 Internal Ceiling Internal Ceiling	g 1	(A x	((194	(26) 3.1800 4.2300 2.9100	(30) + (32)	= 228.953	9	9.0000 9.0000 9.0000	3943.6200 1748.0700 296.1900	(32e)
Heat capacity Cr	n = Sum(A x }	c)						(28)	(30) + (32) + (32a).	(32e) =	15316.4900	(34)



HLP (average) 0.90	0 5 (37) 5 (38) 0 (39) 5 5 (40)
Point Thermal bridges (36a) = 0.000 Total fabric heat loss (33) + (36) + (36a) = 281.44 Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) (33) + (36) + (36a) = 281.44 Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (38)m 126.2031 124.6002 122.9973 114.9827 113.3798 105.3652 105.3652 103.7623 108.5710 113.3798 116.5856 119.79 Heat transfer coeff 407.6437 406.0407 404.4378 396.4232 394.8203 386.8057 385.2028 390.0115 394.8203 398.0261 401.233 Average = Sum(39)m / 12 = Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec HLP 0.9342 0.9305 0.9085 0.9048 0.8864 0.8864 0.8827 0.8938 0.9048 0.9121 0.9121	0 5 (37) 5 (38) 0 (39) 5 (40) 5
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 126.2031 124.6002 122.9973 114.9827 113.3798 105.3652 103.7623 108.5710 113.3798 116.5856 119.79 Heat transfer coeff 407.6437 406.0407 404.4378 396.4232 394.8203 386.8057 386.8057 385.2028 390.0115 394.8203 398.0261 401.233 Average = Sum(39) m / 12 = Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec 396.021 396.021 396.021 396.021 HLP (average) 0.9342 0.9305 0.9085 0.9048 0.8864 0.8864 0.8827 0.8938 0.9048 0.9121 0.911	5 (38) 0 (39) 5 5 (40) 5
(38)m 126.2031 124.6002 122.9973 114.9827 113.3798 105.3652 103.7623 108.5710 113.3798 116.5856 119.79 Heat transfer coeff 407.6437 406.0407 404.4378 396.4232 394.8203 386.8057 385.2028 390.0115 394.8203 398.0261 401.233 Average = Sum(39)m / 12 = Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec HLP 0.9342 0.9305 0.9268 0.9085 0.9048 0.8864 0.8864 0.8827 0.8938 0.9048 0.9121 0.9121	0 (39) 5 5 (40) 5
407.6437 406.0407 404.4378 396.4232 394.8203 386.8057 386.8057 385.2028 390.0115 394.8203 398.0261 401.23: Average = Sum(39)m / 12 = Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec HIP 0.9342 0.9305 0.9268 0.9085 0.9048 0.8864 0.8864 0.8867 0.8938 0.9048 0.9121 0.91 HLP (average) 0.901	5 5 (40) 5
HLP 0.9342 0.9305 0.9268 0.9085 0.9048 0.8864 0.8864 0.8827 0.8938 0.9048 0.9121 0.91 HLP (average) 0.90	5
4. Water heating energy requirements (kWh/year)	
Assumed occupancy 3.30	2 (42)
Hot water usage for mixer showers 79.7045 78.5067 76.7613 73.4217 70.9572 68.2088 66.6466 68.3788 70.2777 73.2286 76.6399 79.39 Hot water usage for baths	2 (42a)
34.3988 33.8879 33.1685 31.8420 30.8488 29.7474 29.1525 29.8669 30.6448 31.8232 33.1770 34.28 Hot water usage for other uses	5 (42b)
48.5196 46.7553 44.9909 43.2266 41.4622 39.6979 39.6979 41.4622 43.2266 44.9909 46.7553 48.51 Average daily hot water use (litres/day) 149.48	6 (42c) 8 (43)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Daily hot water use	
162.6229 159.1499 154.9207 148.4903 143.2682 137.6541 135.4970 139.7080 144.1490 150.0428 156.5722 162.202 Energy conte 257.5550 226.6274 238.1074 203.2758 192.8666 169.2618 163.8719 172.9876 177.7501 203.6066 223.0658 253.966 Energy content (annual) Distribution loss (46)m = 0.15 x (45)m Total = Sum(45)m = 2482.94	0 (45)
38.6332 33.9941 35.7161 30.4914 28.9300 25.3893 24.5808 25.9481 26.6625 30.5410 33.4599 38.099 Water storage loss:	
Store volume 150.00 b) If manufacturer declared loss factor is not known : Hot water storage loss factor from Table 2 (kWh/litre/day) 0.01	0 (47) 3 (51)
Volume factor from Table 2a 0.92 Temperature factor from Table 2b 0.54 Enter (49) or (54) in (55) 0.77	3 (52) 3 (52) 0 (53) 6 (55)
Total storage loss 23.9825 21.6616 23.9825 23.2088 23.9825 23.2088 23.9825 23.9825 23.2088 23.9825 23.2088 23.9825 If cylinder contains dedicated solar storage	5 (56)
23.9825 21.6616 23.9825 23.2088 23.9825 23.2088 23.9825 23.9825 23.2088 23.9825 23.2088 23.9825 23.2088 23.9825 23.2088 23.9825 23.2088 23.9825 23.982	5 (57) 4 (59) 0 (61)
Total heat required for water heating calculated for each month 304.7999 269.3002 285.3522 248.9967 240.1114 214.9826 211.1168 220.2325 223.4710 250.8515 268.7867 301.21	
PV diverter 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000 0.000 0.000 0.000 0.000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.000000	0 (63a) 0 (63b) 0 (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 0.0000 0.0000 0.0000 Output from w/h 304.7999 269.3002 285.3522 248.9967 240.1114 214.9826 211.1168 220.2325 223.4710 250.8515 268.7867 301.21:	0 (63d) 9 (64)
Total per year (kWh/year) = Sum(64)m = 3039.21- 12Total per year (kWh/year) 303	
	0 (64a) 0 (64a)
Heat gains from water heating, kWh/month 123.4329 109.4918 116.9666 104.1659 101.9240 92.8562 92.2833 95.3143 95.6786 105.4951 110.7461 122.24	
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 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.460 Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
283.0502 313.3770 283.0502 292.4852 283.0502 292.4852 283.0502 292.4852 283.0502 292.4852 283.0502 292.4852 283.050 Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	0 (68) 1 (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 3.000 Losses e.g. evaporation (negative values) (Table 5)	0 (70)
-132.3684 -132.3	
Total internal gains Total internal gains 1085.7715 1118.9514 1068.2290 1033.8855 977.3351 938.6790 899.5530 897.8036 926.6894 960.4022 1021.2919 1059.40	
6. Solar gains	
[Jan] Area Solar flux g FF Access Gain	s



				m2	Table 6a W/m2		fic data Table 6b			fact Table		W	
North East South West			12.6 40.0 37.6 25.5	200 5800 5100	19.6403 46.7521 19.6403		0.4000 0.4000 0.4000 0.4000	C C C	.8000 .8000 .8000 .8000	0.77 0.77 0.77 0.77	00	29.9238 174.3041 390.6564 111.1069	(76) (78)
Solar gains Total gains			1831.6383 2899.8674										
7. Mean inte	rnal tempera	ature (heat	ing season)										
Temperature Utilisation	during heati	ing periods	in the livi	ng area fro	m Table 9,							21.0000	(85)
tau	Jan 10.4370	Feb 10.4782	Mar	Apr 10.7324		Jun 10.9993	Jul 10.9993	Aug 11.0450	Sep 10.9089	Oct 10.7760	Nov 10.6892	Dec 10.6038	
alpha util living		1.6985		1.7155	1.7184	1.7333	1.7333	1.7363	1.7273	1.7184	1.7126	1.7069	10.51
MTT	0.9212	0.8781		0.7301	0.6220	0.4975	0.3935	0.4321 20.6019	0.6024	0.7868	0.8904	0.9297	
Th 2 util rest of	20.1386	20.1417		20.1603	20.1634	20.1791	20.1791	20.1822	20.1728	20.1634	20.1572	20.1510	
MIT 2	0.9151 16.0853	0.8690 16.6296		0.7097 18.3076	0.5917 19.0528	0.4535 19.5941	0.3348 19.8210	0.3733 19.7871	0.5609 19.3778	0.7659 18.3563	0.8808 17.0686	0.9243 16.0109	
Living area MIT	16.6606	17.1650	17.8638	18.7228	19.4210	19.9314	20.1528	20.1166	fLA = 19.7214	Living are 18.7619			
Temperature adjusted MIT		17.1650	17.8638	18.7228	19.4210	19.9314	20.1528	20.1166	19.7214	18.7619	17.5674	0.0000 16.5906	(93)
8. Space hea													
Utilisation Useful gains Ext temp.			2213.0284	Apr 0.6692 2310.0220 8.9000	May 0.5619 2130.1944 11.7000	Jun 0.4392 1655.7425 14.6000	Jul 0.3328 1202.6584 16.6000	Aug 0.3682 1221.3544 16.4000	Sep 0.5356 1587.7194 14.1000	Oct 0.7231 1721.8492 10.6000	Nov 0.8415 1579.6407 7.1000	Dec 0.8923 1478.2569 4.2000	(95)
Heat loss ra	te W		4595.9407									4971.4871	
Space heating	g kWh 2574.2829	2025.5314	1772.8867	1140.4474	683.1503	0.0000	0.0000	0.0000		1116.4607	1862.3889	2598.9633	
Space heating Solar heating	g kWh			-	0.0000	0 0000	0.0000					13774.1117	(0.01.)
Solar heatin Space heatin				0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(386)
Space heatin	2574.2829		1772.8867 lar contribu			0.0000 (kWh/year)	0.0000	0.0000	0.0000	1116.4607		2598.9633 13774.1117	(98c)
Space heatin	g per m2									(98c) / (4) =	31.5652	(99)
9a. Energy r													
Fraction of Fraction of Efficiency o Efficiency o Efficiency o	space heat f f main space f main space	from main s e heating s e heating s	ystem(s) ystem 1 (in ystem 2 (in	%) %)	m (Table 11)						0.0000 1.0000 92.3000 0.0000 0.0000	(202) (206) (207)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	2574.2829	2025.5314	1772.8867		683.1503	0.0000	0.0000	0.0000	0.0000	1116.4607	1862.3889	2598.9633	(98)
Space heatin	92.3000	92.3000	92.3000	1) 92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating	2789.0389	2194.5086	1920.7874		740.1412	0.0000	0.0000	0.0000	0.0000	1209.5999	2017.7561	2815.7782	(211)
Space heatin	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 heatin	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heatin Water heatin			285.3522	248.9967	240.1114	214.9826	211.1168	220.2325	223.4710	250.8515	268.7867	301.2129	(64)
Efficiency o (217)m				92.3000	92.3000	92.3000	92.3000	92.3000	92.3000	92.3000	92.3000	92.3000 92.3000	(216)
Fuel for wat	er heating,			269.7689	260.1424	232.9172	228.7289	238.6051	242.1137	271.7784	291.2098	326.3411	
Space coolin (221)m		rement 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Pumps and Fa Lighting	69.6495	84.9719 55.8754	50.3096	91.0413 36.8590	94.0760 28.4710	91.0413 23.2610	94.0760 25.9722	94.0760 33.7596	91.0413 43.8504	94.0760 57.5341	91.0413 64.9846	94.0760 71.5853	
Electricity (233a)m Electricity	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)
(234a)m Electricity	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)
(235a)m	0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000 eneration)	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity	0.0000	0.0000			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
(235c)m Electricity	generated by	y PVs (Appe	ndix M) (neg										
(235c)m Electricity (233b)m Electricity	generated by 0.0000 generated by	y PVs (Appe 0.0000 y wind turb	ndix M) (neg 0.0000 ines (Append	0.0000 lix M) (nega	0.0000 tive quanti		0.0000	0.0000	0.0000	0.0000	0.0000		(233b)
(235c)m Electricity (233b)m Electricity (234b)m Electricity	generated by 0.0000 generated by 0.0000 generated by	y PVs (Appe 0.0000 y wind turb 0.0000 y hydro-ele	ndix M) (neg 0.0000 ines (Append 0.0000 ctric genera	0.0000 lix M) (nega 0.0000 ators (Appen	0.0000 tive quanti 0.0000 dix M) (neg	ty) 0.0000 ative quant	0.0000 ity)	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
(235c)m Electricity (233b)m Electricity (234b)m Electricity (235b)m Electricity	generated by 0.0000 generated by 0.0000 generated by 0.0000 used or net	y PVs (Appe 0.0000 y wind turb 0.0000 y hydro-ele 0.0000 electricit	ndix M) (neg 0.0000 ines (Append 0.0000 ctric genera 0.0000 y generated	0.0000 dix M) (nega 0.0000 ators (Appen 0.0000 by micro-CH	0.0000 tive quanti 0.0000 dix M) (neg 0.0000 P (Appendix	ty) 0.0000 ative quant 0.0000 N) (negati	0.0000 ity) 0.0000 ve if net g	0.0000 0.0000 generation)	0.0000	0.0000	0.0000	0.0000	(234b) (235b)
(235c)m Electricity (233b)m Electricity (234b)m Electricity (235b)m	generated by 0.0000 generated by 0.0000 generated by 0.0000 used or net 0.0000 s kWh/year	<pre>/ PVs (Appe 0.0000 / wind turb 0.0000 / hydro-ele 0.0000 electricit 0.0000</pre>	ndix M) (neg 0.0000 ines (Append 0.0000 ctric genera 0.0000 y generated 0.0000	0.0000 dix M) (nega 0.0000 ators (Appen 0.0000	0.0000 tive quanti 0.0000 dix M) (neg 0.0000 P (Appendix	ty) 0.0000 ative quant 0.0000	0.0000 ity) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b) (235b) (235d)



Space heating fuel - main system 2 Space heating fuel - secondary		0.0000	
Efficiency of water heater Water heating fuel used		92.3000 3292.7565	(219)
Space cooling fuel		0.0000	(221)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6750) mechanical ventilation fans (SFP = 0.6750)		1066.6695	
central heating pump Total electricity for the above, kWh/year		41.0000 1107.6695	(230c) (231)
Electricity for lighting (calculated in Appendix L) Energy saving/generation technologies (Appendices M ,N and Q)		562.1117	(232)
PV generation Wind generation		0.0000	(234)
Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features		0.0000	(235a) (235)
Energy saved or generated Energy used		-0.0000 0.0000	(237)
Total delivered energy for all uses		19885.7356	(238)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP	-		
Energ	y Emission factor		
Space heating - main system 1 kWh/yea Total CO2 associated with community systems 14923.197		kg CO2/year 3133.8716 0.0000	(261)
Water heating (other fuel) 3292.756 Space and water heating	5 0.2100	691.4789 3825.3504	(264)
Pumps, fans and electric keep-hot 1107.669 Energy for lighting 562.111		153.6474 81.1301	(267) (268)
Total CO2, kg/year EPC Dwelling Carbon Dioxide Emission Rate (DER)		4060.1279 9.3000	
	_		
13a. Primary energy - Individual heating systems including micro-CHP		Deimours	,
kWh/yea Space heating - main system 1 14923.197	y Primary energy factor r kg CO2/kWh 9 1.1300	kWh/year 16863.2136	(275)
Total CO2 associated with community systems Water heating (other fuel) 3292.756	5 1.1300		(278)
Space and water heating 1107.669 Pumps, fans and electric keep-hot 1507.669 Energy for lighting 562.111			(281)
Total Primary energy kWh/year Dwelling Primary energy Rate (DPER)		23121.8966 52.9900	(286)
	-		
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS	-		
	-		
1. Overall dwelling characteristics	-		
Are (m2) (m)	(m3)	
Ground floor 209.230 First floor 194.230 Second floor 32.910	0 (1c) x 3.0000	(2c) = 582.6900	(1b) - (3b) (1c) - (3c) (1d) - (3d)
Total floor area $TFA = (1a) + (1b) + (1c) + (1d) + (1e) \dots (1n)$ 436.3700	(3a) + (3b) + (3c) + (3d) + (3e		(4)
2. Ventilation rate	-		
	-	m3 per hour	
Number of open chimneys Number of open flues		0 * 80 = 0.0000 0 * 20 = 0.0000	
Number of chimneys / flues attached to closed fire Number of flues attached to solid fuel boiler		0 * 10 = 0.0000 0 * 20 = 0.0000	(6c) (6d)
Number of flues attached to other heater Number of blocked chimneys		0 * 35 = 0.0000 0 * 20 = 0.0000	(6e) (6f)
Number of intermittent extract fans Number of passive vents Number of flueless gas fires		$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	(7b)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = $(6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)$ Pressure test Pressure Test Method	= 40.000	0 / (5) = 0.0309 Yes Blower Door	5
Pressure Test Method Measured/design AP50 Infiltration rate		Blower Door 5.0000 0.2809	(17)
Number of sides sheltered	(20) - 1 (0.075	0	(19)
Shelter factor Infiltration rate adjusted to include shelter factor	(20) = 1 - [0.075 (21) = (18)		
Jan Feb Mar Apr May Jun Jul Aug Wind speed 5.1000 5.0000 4.9000 4.4000 4.3000 3.8000 3.8000 3.700	Sep Oct 0 4.0000 4.3000	Nov Dec 4.5000 4.7000	(22)
nina opeca - 5.0000 - 5.0000 - 4.9000 - 4.3000 - 5.0000 - 5.0000 - 5.0000 - 5.0000		4./000	()



Wind factor Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Effective ac	0.3581 0.5641	0.3511 0.5616	0.3441 0.5592	0.3090 0.5477		0.2668	0.2668	0.2598	0.2809 0.5394	0.3019 0.5456		0.3300 (22b) 0.5545 (25)

Slement			Gross	Opening		tArea	U-value	As		K-value	A x K	
TER Opaque door TER Opening Type (Uw = 1 Ground floor or to stora Exposed floor External Wall 1 All roofs Total net area of extern Tabric heat loss, W/K =	ge al elements	2	m2 441.9000 220.8900	mi 109.100	3 105 209 12 0 332 220	m2 .6000 .5000 .2300 .7200 .8000 .8900 .7400 (26)(W/m2K 1.0000 1.1450 0.1300 0.1300 0.1800 0.1100 30) + (32)	3.60 120.80 27.19 1.65 59.90 24.29	015 099 036 040 079	kJ/m2K	kJ/K	(26) (27) (28a (28b (29a (30) (31) (33)
Chermal mass parameter (TMP = Cm /	TFA) in kJ/r	m2K								35.0998	(35)
List of Thermal Bridges KI Element E2 Other lintels E3 Sill E4 Jamb E5 Ground floor E6 Intermediate E14 Flat roof E15 Flat roof wi E24 Eaves (insul E16 Corner (norm E17 Corner (inve E19 Ground floor E20 Exposed floo E21 Exposed floo E21 Exposed floo	<pre>(normal) floor withi th parapet ation at ce al) rted - inte (inverted) r (normal) r (inverted</pre>	n a dwelling iling level rnal area g:)	g - inverted reater than	external a	rea)		57 38 80 67 31 26 72 39 35 20 7 7 10	ength .7800 .3900 .9700 .4900 .4700 .3700 .5800 .5800 .5800 .5500 .55100 .3800	Psi-value 0.0500 0.0500 0.1600 0.0800 0.5600 0.2400 0.0900 -0.0900 0.3200 0.3200	Tot 2.88 1.91 4.00 10.87 0.00 2.12 40.58 9.44 3.16 -1.85 0.55 3.36 4.28	90 95 52 00 72 32 88 44 42 25 53 2 16	(26)
Point Thermal bridges (Sum(L x Point Thermal bridges Potal fabric heat loss	rsi) caicu	iated using	Appendix K)					(33) + (36)	(36a) = + (36a) =	81.3654 0.0000 318.8223	
Jentilation heat loss ca Jan (38)m 241.1329	lculated mo Feb 240.0685	nthly (38)m Mar 239.0252	= 0.33 x (Apr 234.1249	25)m x (5) May 233.2080	Jun 228.9400	Jul 228.9400	Aug 228.1496	Sep 230.5840	Oct 233.2080	Nov 235.0628	Dec 237.0019	(38)
leat transfer coeff 559.9552 werage = Sum(39)m / 12	558.8909	557.8476	552.9472	552.0304	547.7623	547.7623	546.9719	549.4063	552.0304	553.8851	555.8242 552.9428	
Jan ILP 1.2832 ILP (average)	Feb 1.2808	Mar 1.2784	Apr 1.2672	May 1.2651	Jun 1.2553	Jul 1.2553	Aug 1.2535	Sep 1.2590	Oct 1.2651	Nov 1.2693	Dec 1.2737 1.2671	
. Water heating energy ssumed occupancy ot water usage for mixe 79.7045	r showers 78.5067			70.9572	68.2088	66.6466	68.3788	70.2777	73.2286	76.6399	3.3092 79.3992	
ot water usage for bath 34.3988	33.8879	33.1685	31.8420	30.8488	29.7474	29.1525	29.8669	30.6448	31.8232	33.1770	34.2825	(42
ot water usage for othe 48.5196 verage daily hot water	46.7553	44.9909 /day)	43.2266	41.4622	39.6979	39.6979	41.4622	43.2266	44.9909	46.7553	48.5196 149.4868	
Jan aily hot water use	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
162.6229 nergy conte 257.5550 nergy content (annual) istribution loss (46)m	159.1499 226.6274	154.9207 238.1074	148.4903 203.2758	143.2682 192.8666	137.6541 169.2618	135.4970 163.8719	139.7080 172.9876	144.1490 177.7501	150.0428 203.6066 Total =		162.2013 253.9680 2482.9441	(45
38.6332 ater storage loss:	33.9941		30.4914	28.9300	25.3893	24.5808	25.9481	26.6625	30.5410	33.4599	38.0952	(46
tore volume) If manufacturer decl Temperature factor fro nter (49) or (54) in (5	m Table 2b	actor is kno	own (kWh/d	ay):							150.0000 1.3938 0.5400 0.7527	(48 (49
otal 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
	21.0745 21.0112 0.0000	23.3325 23.2624 0.0000	22.5798 22.5120 0.0000	23.2624 0.0000	22.5120	23.3325 23.2624 0.0000		22.5798 22.5120 0.0000		22.5120	23.3325 23.2624 0.0000	(59
	268.7131	284.7023	248.3677	239.4615		210.4668		222.8420				
WHRS -36.4376 V diverter -0.0000 olar input 0.0000 GHRS 0.0000	-32.2257 -0.0000 0.0000 0.0000	-33.7449 -0.0000 0.0000 0.0000	-27.9421 -0.0000 0.0000 0.0000	-26.0410 -0.0000 0.0000 0.0000	-22.2835 -0.0000 0.0000 0.0000	-20.8872 -0.0000 0.0000 0.0000	-22.2115 -0.0000 0.0000 0.0000	-23.0554 -0.0000 0.0000 0.0000	-27.1797 -0.0000 0.0000 0.0000	-0.0000 0.0000	-35.7628 -0.0000 0.0000 0.0000	(63 (63
	236.4874		220.4256		192.0701	189.5796	197.3711			237.3663 Sum(64)m =	264.8001 2692.9986	(64 (64
2Total per year (kWh/ye lectric shower(s) 0.0000	ar) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2693 0.0000	
eat gains from water he	ating, kWh/		Tot	al Energy u			lectric sho	wer(s) (kWh	n/year) = S		0.0000	(64
5. Internal gains (see T												
etabolic gains (Table 5 Jan		Mar	Apr	Мау	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec (66)m 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 165.4605 (66) Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5



28	3.0502	313.3770	283.0502	292.4852	283.0502	292.4852	283.0502	283.0502	292.4852	283.0502	292.4852	283.0502	(67)
Appliances gains	(calcula	ated in App	endix L, eq	uation L13	or L13a), a	lso see Tab	le 5						
56	1.1787	567.0020	552.3275	521.0873	481.6521	444.5886	419.8279	414.0046	428.6791	459.9193	499.3545	536.4180	(68)
Cooking gains (ca	lculated	d in Append	ix L, equat	ion L15 or	L15a), also	see Table	5						
3	9.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	(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. evapo	ration ((negative v	alues) (Tab	le 5)									
-13	2.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	(71)
Water heating gai	ns (Tabl	Le 5)											
16	5.2056	162.2354	156.5143	143.9760	136.2958	128.2681	123.3378	127.4117	132.1880	141.0956	153.1151	163.6025	(72)
Total internal ga	ins												
108	5.0727	1118.2525	1067.5302	1033.1866	976.6363	937.9801	898.8541	897.1047	925.9905	959.7033	1020.5930	1058.7089	(73)

6. Solar gai	ns												
[Jan]			A	rea m2			g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		s I
North East South West			11.5 36.4 34.3 23.2	300 000	10.6334 19.6403 46.7521 19.6403		0.6300 0.6300 0.6300 0.6300	C	.7000 .7000 .7000 .7000	0.7700 0.7700 0.7700 0.7700 0.7700		37.5341 (* 218.6645 (* 490.0797 (* 139.3739 (*	
Solar gains Total gains	885.6522 1970.7248	1574.7529 2693.0054	2297.7444 3365.2746	3033.5642 4066.7508	3529.5320 4506.1683	3551.6299 4489.6100	3405.0916 4303.9457	3034.6123 3931.7170	2556.0838 3482.0743		1073.6465 2094.2395	749.1976 1807.9065	

7. Mean internal temperature (heating season)

Temperature du	ring heatir	ng periods i	n the livin	g area from	Table 9, T	'h1 (C)						21.0000	(85)
Utilisation fa	ctor for ga	ains for liv	ing area, n	il,m (see I	able 9a)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	7.5981	7.6125	7.6268	7.6944	7.7071	7.7672	7.7672	7.7784	7.7440	7.7071	7.6813	7.6545	
alpha	1.5065	1.5075	1.5085	1.5130	1.5138	1.5178	1.5178	1.5186	1.5163	1.5138	1.5121	1.5103	
util living ar	ea												
	0.9229	0.8805	0.8251	0.7413	0.6409	0.5273	0.4269	0.4667	0.6280	0.7978	0.8943	0.9313	(86)
MIT	15.8992	16.5057	17.3920	18.4859	19.4621	20.2156	20.6053	20.5300	19.8972	18.5663	17.0206	15.7864	(87)
Th 2	19.8540	19.8559	19.8578	19.8667	19.8683	19.8760	19.8760	19.8775	19.8731	19.8683	19.8650	19.8615	(88)
util rest of h	louse												
	0.9155	0.8695	0.8086	0.7160	0.6024	0.4683	0.3445	0.3850	0.5743	0.7720	0.8827	0.9248	(89)
MIT 2	14.1502	14.8779	15.9383	17.2356	18.3684	19.2138	19.6138	19.5504	18.8896	17.3611	15.5127	14.0164	(90)
Living area fr	action								fLA =	Living area	/ (4) =	0.4044	(91)
MIT	14.8575	15.5362	16.5262	17.7412	18.8107	19.6189	20.0147	19.9466	19.2971	17.8485	16.1225	14.7322	(92)
Temperature ad	ljustment											0.0000	
adjusted MIT	14.8575	15.5362	16.5262	17.7412	18.8107	19.6189	20.0147	19.9466	19.2971	17.8485	16.1225	14.7322	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8639	0.8078	0.7430	0.6564	0.5603	0.4533	0.3555	0.3905	0.5421	0.7104	0.8243	0.8763	(94)
Useful gains	1702.5900	2175.4456	2500.5637	2669.3210	2524.6014	2035.2982	1530.1906	1535.4735	1887.5467	1947.8690	1726.2489	1584.3223	(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 rat	e W												
	5911.7217	5944.4487	5593.0795	4888.7350	3925.2990	2749.1585	1870.4632	1939.8790	2855.2989	4001.3907	4997.4357	5854.0558	(97)
Space heating	kWh												
	3131.5940	2532.7701	2300.8318	1597.9781	1042.1190	0.0000	0.0000	0.0000	0.0000	1527.8201	2355.2545	3176.6818	(98a)
Space heating	requiremen	t - total p	er year (kW	h/year)								17665.0494	
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	contributi	on - total	per vear (k	Wh/vear)								0.0000	
Space heating			1 . 1										
-1	3131.5940	2532.7701	2300.8318	1597.9781	1042.1190	0.0000	0.0000	0.0000	0.0000	1527.8201	2355.2545	3176.6818	(98c)
Space heating												17665.0494	(,
Space heating						((98c		40.4818	(99)
opuce neacting	per mr									(500	, , (-)	10.1010	(33)

9a. Energy re)a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from main system(s) Efficiency of main space heating system 1 (in %) Efficiency of main space heating system 2 (in %) Efficiency of secondary/supplementary heating system, %													(201) (202) (206) (207) (208)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating														
				1597.9781	1042.1190	0.0000	0.0000	0.0000	0.0000	1527.8201	2355.2545	3176.6818	(98)	
Space heating	92.3000	(main neat 92.3000	92.3000	1) 92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
Space heating				92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)	
opuce neacing	3392.8429			1731.2872	1129.0563	0.0000	0.0000	0.0000	0.0000	1655.2764	2551.7384	3441.6920	(211)	
Space heating	efficiency	(main heat	ing 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														
	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														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating		t.												
	267.7123	236.4874	250.9574	220.4256	213.4204	192.0701	189.5796	197.3711	199.7866	223.0218	237.3663	264.8001	(64)	
Efficiency of	water heat	er										79.8000	(216)	
(217)m	88.0182	87.9529	87.8259	87.6024	87.1296	79.8000	79.8000	79.8000	79.8000	87.5424	87.8924	88.0360	(217)	
Fuel for wate														
	304.1556	268.8796	285.7443	251.6206	244.9458	240.6894	237.5684	247.3322	250.3591	254.7587	270.0645	300.7860	(219)	
Space cooling			0 0000	0 0000	0 0000		0 0000	0 0000	0 0000	0 0000	0 0000	0 0000	(001)	
(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)	



	7.0685 7.3041 7.0274 48.5819	7.0685 7.3041 54.8731 60.4468	
(233a)m -156.9101 -204.0693 -270.6265 -279.6150 -281.7192 -255.5188 -251.5589 -246.2121 -235 Electricity generated by wind turbines (Appendix M) (negative guantity)	5.3601 -219.8512	-165.8769 -137.6794	(233a)
	0.0000 0.0000	0.0000 0.0000	(234a)
	0.0000 0.0000	0.0000 0.0000	(235a)
	0.0000 0.0000	0.0000 0.0000	(235c)
(233b)m -149.4438 -304.5783 -588.5536 -861.1132 -1117.8924 -1116.4719 -1104.0189 -944.6792 -705 Electricity generated by wind turbines (Appendix M) (negative guantity)	5.4603 -428.4849	-197.0025 -119.0207	(233b)
	0.0000 0.0000	0.0000 0.0000	(234b)
	0.0000 0.0000	0.0000 0.0000	(235b)
	0.0000 0.0000	0.0000 0.0000	(235d)
Space heating fuel - main system 1 Space heating fuel - main system 2 Space heating fuel - secondary Efficiency of water heater Water heating fuel used		19138.7317 0.0000 0.0000 79.8000 3156.9042	(213) (215)
Space cooling fuel		0.0000	
Electricity for pumps and fans: Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)		86.0000 474.6485	
Energy saving/generation technologies (Appendices M ,N and Q) PV generation Wind generation Hydro-electric generation (Appendix N) Electricity generated - Micro CHP (Appendix N) Appendix Q - special features		-10341.7170 0.0000 0.0000 0.0000	(234) (235a)
Energy used Total delivered energy for all uses		-0.0000 0.0000 12514.5675	(237)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	19138.7317	0.2100	4019.1337 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3156.9042	0.2100	662.9499 (264)
Space and water heating			4682.0835 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	474.6485	0.1443	68.5064 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2704.9974	0.1364	-369.0690
PV Unit electricity exported	-7636.7196	0.1267	-967.3591
Total			-1336.4282 (269)
Total CO2, kg/year			3426.0911 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.8500 (273)

	Energy	Primary energy factor	Primary energy	
	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	19138.7317	1.1300	21626.7668 (27	75)
Total CO2 associated with community systems			0.0000 (47	73)
Water heating (other fuel)	3156.9042	1.1300	3567.3018 (27	78)
Space and water heating			25194.0686 (27	79)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (28	81)
Energy for lighting	474.6485	1.5338	728.0317 (28	32)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2704.9974	1.5044	-4069.2872	
PV Unit electricity exported	-7636.7196	0.4650	-3551.1238	
Total			-7620.4110 (28	83)
Total Primary energy kWh/year			18431.7901 (28	36)
Target Primary Energy Rate (TPER)			42.2400 (28	37)



Property Reference House										Issued on D	Date	29/01/2025		
Assessment Refe	rence		Green					Prop Type F	Ref					
Property														
SAP Rating					84 B		DER	2.1	77	TER		7.85		
Environmental					97 A		% DER < TE		11			64.71		
CO ₂ Emissions (t/	voar)				1.04		DFEE		50	TFE	F	46.21		
Compliance Chec					See BREL		% DFEE < T				-	8.03		
% DPER < TPER					30.12		DPER		.52	TPE	R	42.24		
70 BI ER VII ER					50.12		DIER	23			ĸ	42.24		
Assessor Details		Ms. S	herleen Pang							Ass	essor ID	BA17-000	01	
SAP 10 WORKSHEET CALCULATION OF I	F FOR New Buil	Ld (As	Designed)	(Version 10	.2, February									
1. Overall dwell								Area	Stor	ey height		Volume		
Ground floor First floor Second floor Total floor area Dwelling volume	a TFA = (1a)+	(1b)+	(1c)+(1d)+(1e)	(ln)	43	6.3700		194.2300 32.9100	(1b) x (1c) x (1d) x 3a)+(3b)+(3c)	(m) 3.0000 3.0000 2.5800	(2b) = (2c) = (2d) =	582.6900 84.9078	(1c) - (3c) (1d) - (3d) (4)	
2. Ventilation r	rate											n3 per hour		
Number of open of Number of open f Number of chimme Number of flues Number of flues Number of blocke Number of passiv Number of flues	flues eys / flues at attached to s attached to d ed chimneys mittent extrac ye vents	olid	fuel boiler heater	ire							$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(6b) (6c) (6d) (6e) (6f) (7a) (7b)	
Infiltration due Pressure test Pressure Test Me Measured/design Infiltration rat Number of sides	AP50	flue	es and fans	= (6a)+(6b)	+(6c)+(6d)+(6e)+(6f)+	-(6g)+(7a)+	(7b)+(7c) =		0.000	0 / (5) =	es per hour 0.0000 Yes Blower Door 3.0000 0.1500 0	(8)	
Shelter factor Infiltration rat	te adjusted to	o incl	ude shelter f.	actor					(20) = 1 - (2		x (19)] = x (20) =	1.0000 0.1500		
Wind speed Wind factor	5.1000 5	Feb 5.0000		Apr 4.4000 1.1000	May 4.3000 1.0750	Jun 3.8000 0.9500	Jul 3.8000 0.9500			Oct 4.3000 1.0750		Dec 4.7000 1.1750		
Adj infilt rate	0.1912 (.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762	(22b)	
Balanced mechan If mechanical ve If exhaust air h	entilation neat pump usir	ng App	endix N, (23b) = (23a) x					3a)			0.5000	(23b)	
If balanced with	heat recover	ry: ef	ficiency in %	allowing f	or in-use fa	ctor (fro	om Table 4h	.) =				79.2000	(23c)	
Effective ac	0.2952 0	.2915	0.2877	0.2690	0.2652	0.2465	0.2465	0.2427	0.2540	0.2652	0.2727	0.2802	(25)	
3. Heat losses a	and heat loss	param	neter											
Element				Gross	Openings	Ne	etArea	U-value	A x		K-value	АхК		
Windows (Uw = 1.	.20)			m2	m2		m2 5.9000	W/m2K 1.1450	W/ 132.709		kJ/m2K	kJ/K	(27)	
Doors Ground floor or Exposed floor External Wall 1			4	41.9000	119.5000	3 209 12	8.6000 9.2300 2.7200 2.4000	1.0000 0.1000 0.1000 0.1500	3.600 20.923 1.272 48.360	10 10 10	20.0000 20.0000 9.0000	4184.6000 254.4000 2901.6000	(26) (28a) (28b)	
All roofs Total net area o Fabric heat loss Internal Wall 1	s, W/K = Sum		s Aum(A, m2)	20.8900		884	3.1800	0.1000 (30) + (32)	22.089 = 228.953		9.0000	1988.0100 3943.6200	(30) (31) (33) (32c)	
Internal Ceiling Internal Ceiling							.2300 .9100				9.0000 9.0000	1748.0700 296.1900	(32e)	
Heat capacity Cm								(28)	(30) + (32) + (32a)				



Thermal mass p	parameter (5	TMP = Cm /	TFA) in kJ/	m2K								35.0998	(35)
List of Therma Kl Ele	al Bridges ement								ength .7800	Psi-value 0.0500	Tot	al	,
E2 OU E3 Sil E4 Jan		(including	other stee	i linteis)				38	.3900 .1800	0.0500 0.0500	2.88 1.91 4.00	.95	
E6 Int	ound floor termediate : lat roof		n a dwellin	a				31	.9700 .4900 .5900	0.0800 0.0000 0.0800	5.43 0.00 2.12	000	
E15 F1	lat roof wit aves (insula		iling level	- inverted	1)			72	.4700	0.2800 0.1600	20.29	916	
E17 Cc	orner (norma orner (inven	rted - inte	rnal area g	reater than	external a	irea)		20	.1600	0.0900	3.16	522	
E20 E3	round floor xposed floor xposed floor	r (normal))					10	.9500 .5100 .3800	0.0700 0.3200 0.3200	0.55 3.36 4.28	32	
Thermal bridge Point Thermal Total fabric b	es (Sum(L x bridges			Appendix K	.)					(33) + (36)	(36a) =	52.4866 0.0000 281.4405	
Ventilation he	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m Heat transfer	126.2031 coeff 407.6437	124.6002 406.0407	122.9973	114.9827	113.3798 394.8203	105.3652	105.3652	103.7623	108.5710 390.0115	113.3798	116.5856 398.0261	119.7915	
Average = Sum			404.4378	396.4232	394.8203	386.8057	386.8057	385.2028	390.0115	394.8203	398.0261	401.2320 396.0225	
HLP	Jan 0.9342	Feb 0.9305	Mar 0.9268	Apr 0.9085	May 0.9048	Jun 0.8864	Jul 0.8864	Aug 0.8827	Sep 0.8938	Oct 0.9048	Nov 0.9121	Dec 0.9195	
HLP (average) Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9075 31	
4. Water heats		requirement	s (kWh/year)								3 3000	(40)
Assumed occupa Hot water usag		r showers 78.5067	76.7613	73.4217	70.9572	68.2088	66.6466	68.3788	70.2777	73.2286	76.6399	3.3092 79.3992	
Hot water usag	ge for baths 34.3988	s 33.8879	33.1685	31.8420	30.8488	29.7474	29.1525	29.8669	30.6448	31.8232	33.1770	34.2825	
Hot water usage Average daily	48.5196	46.7553	44.9909	43.2266	41.4622	39.6979	39.6979	41.4622	43.2266	44.9909	46.7553	48.5196 149.4868	
Average daily	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(43)
Daily hot wate Energy conte Energy content	162.6229 257.5550	159.1499 226.6274	154.9207 238.1074	148.4903 203.2758	143.2682 192.8666	137.6541 169.2618	135.4970 163.8719	139.7080 172.9876	144.1490 177.7501	150.0428 203.6066 Total = S	156.5722 223.0658 Sum(45)m =	162.2013 253.9680 2482.9441	(45)
Distribution 1	loss (46)m 38.6332	= 0.15 x (33.9941	45)m 35.7161	30.4914	28.9300	25.3893	24.5808	25.9481	26.6625	30.5410	33.4599	38.0952	
Water storage Store volume		laved loop	factor is n	at known .								150.0000	(47)
b) If manufa Hot water st Volume facto	torage loss	factor fro			lay)							0.0103 0.9283	
Temperature Enter (49) or Total storage	factor from (54) in (55	m Table 2b										0.5400 0.7736	(53)
If cylinder co				23.2088	23.9825	23.2088	23.9825	23.9825	23.2088	23.9825	23.2088	23.9825	
Primary loss Combi loss	23.9825 23.2624 0.0000	21.6616 21.0112 0.0000	23.9825 23.2624 0.0000	23.2088 22.5120 0.0000	23.9825 23.2624 0.0000	23.2088 22.5120 0.0000	23.9825 23.2624 0.0000	23.9825 23.2624 0.0000	23.2088 22.5120 0.0000	23.9825 23.2624 0.0000	23.2088 22.5120 0.0000	23.9825 23.2624 0.0000	(59)
Total heat red WWHRS	quired for N 304.7999 0.0000	water heati 269.3002 0.0000	ng calculat 285.3522 0.0000	ed for each 248.9967 0.0000	0.0000	214.9826 0.0000	211.1168	220.2325 0.0000	223.4710	250.8515 0.0000	268.7867	301.2129 0.0000	
PV diverter Solar input	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000 0.0000	-0.0000	-0.0000	-0.0000	-0.0000 0.0000	(63b) (63c)
FGHRS Output from w/	0.0000 /h 304.7999	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12Total per ye	ear (kWh/yea									Nh/year) = S		3039.2142	
Electric showe	er(s) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 used by inst	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Heat gains fro			month 116.9666			92.8562	92.2833	95.3143		105.4951			
5. Internal ga Metabolic gair													
(66) m	Jan 165.4605	Feb 165.4605				Jun 165.4605		Aug 165.4605	Sep 165.4605	Oct 165.4605	Nov 165.4605	Dec 165.4605	(66)
Lighting gains	s (calculate 283.0502	ed in Appen 313.3770	dix L, equa 283.0502	tion L9 or 292.4852	L9a), also 283.0502	see Table 5 292.4852	283.0502	283.0502	292.4852	283.0502	292.4852	283.0502	
Appliances gai Cooking gains	561.1787	567.0020	552.3275	521.0873	481.6521	444.5886	419.8279	414.0046	428.6791	459.9193	499.3545	536.4180	(68)
Pumps, fans	39.5461 3.0000	39.5461 3.0000	39.5461 3.0000	39.5461 3.0000	39.5461 3.0000	39.5461 0.0000	39.5461 0.0000	39.5461 0.0000	39.5461 0.0000	39.5461 3.0000	39.5461 3.0000	39.5461 3.0000	
Losses e.g. ev	vaporation -132.3684	(negative v -132.3684	alues) (Tab	le 5)		-132.3684							
Water heating	165.9045		157.2132	144.6748	136.9947	128.9670	124.0367	128.1106	132.8869	141.7945	153.8140	164.3014	(72)
Total internal		1118.9514	1068.2290	1033.8855	977.3351	938.6790	899.5530	897.8036	926.6894	960.4022	1021.2919	1059.4078	(73)
6. Solar gains	s												
[Jan]					Solar flux		g		FF	Acce	ss	Gains	



				m2	Table 6a W/m2			Specific or Tab		fact Table		W	
North East South West			12.6 40.0 37.6 25.5	200 800 100	10.6334 19.6403 46.7521 19.6403		0.4000 0.4000 0.4000 0.4000	0 0 0 0	.8000 .8000 .8000 .8000	0.77 0.77 0.77 0.77	00 00	29.9238 174.3041 390.6564 111.1069	(76) (78)
Solar gains Total gains				2418.2020 3452.0875								597.2171 1656.6249	
7. Mean inte													
Temperature o Utilisation :	during heati	ng periods	in the livi	ng area fro	m Table 9,							21.0000	(85)
tau	Jan 10.4370	Feb 10.4782	Mar 10.5197	Apr 10.7324		Jun 10.9993	Jul 10.9993	Aug 11.0450	Sep 10.9089	Oct 10.7760	Nov 10.6892	Dec 10.6038	
alpha util living a		1.6985	1.7013	1.7155	1.7184	1.7333	1.7333	1.7363	1.7273	1.7184	1.7126 0.8904	1.7069	(0.0)
MIT	0.9212	0.8781	0.8207	0.7301	0.6220	0.4975	0.3935	0.4321 20.6019	0.6024	0.7868	18.3020	0.9297	
Th 2 util rest of	20.1386	20.1417	20.1448	20.1603	20.1634	20.1791	20.1791	20.1822	20.1728	20.1634	20.1572	20.1510	
MIT 2	0.9151 16.0853	0.8690 16.6296	0.8073 17.3828	0.7097 18.3076	0.5917 19.0528	0.4535 19.5941	0.3348 19.8210	0.3733 19.7871	0.5609 19.3778	0.7659 18.3563	0.8808	0.9243	(90)
Living area : MIT Temperature a	16.6606	17.1650	17.8638	18.7228	19.4210	19.9314	20.1528	20.1166	19.7214	Living are 18.7619		0.4044 16.5906 0.0000	
adjusted MIT		17.1650	17.8638	18.7228	19.4210	19.9314	20.1528	20.1166	19.7214	18.7619	17.5674		(93)
8. Space heat		ment											
	Jan	Feb							Con	Oct	Nov	Dog	
Utilisation Useful gains Ext temp. Heat loss rat	0.8811 1578.6748 4.3000	0.8280	Mar 0.7631 2213.0284 6.5000	Apr 0.6692 2310.0220 8.9000	May 0.5619 2130.1944 11.7000	Jun 0.4392 1655.7425 14.6000	Jul 0.3328 1202.6584 16.6000	Aug 0.3682 1221.3544 16.4000	Sep 0.5356 1587.7194 14.1000	0.7231	0.8415	Dec 0.8923 1478.2569 4.2000	(95)
Space heating	5038.7324	4980.1037	4595.9407	3893.9768	3048.4072	2062.2162	1374.2538	1431.6490	2192.4082	3222.4684	4166.2920	4971.4871	(97)
Space heating	2574.2829 g requiremen		1772.8867 Der year (kW		683.1503	0.0000	0.0000	0.0000	0.0000	1116.4607		2598.9633 13774.1117	(98a)
Solar heating Solar heating Space heating	0.0000 g contributi		0.0000 per year (k	0.0000 Wh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 0.0000	(98b)
Space heating Space heating	2574.2829 g requiremen			1140.4474 tion - tota		0.0000 (kWh/year)	0.0000	0.0000	0.0000	1116.4607 (98c		2598.9633 13774.1117 31.5652	
9a. Energy re Fraction of : Fraction of : Efficiency of	space heat f space heat f	rom seconda from main sy	ary/suppleme vstem(s)	entary syste								0.0000 1.0000 219.3000	(202)
Efficiency of Efficiency of	f main space	heating sy	vstem 2 (in	%)								0.0000 0.0000	
Space heating	Jan g requiremen	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	g efficiency	(main heat	ing system			0.0000	0.0000	0.0000		1116.4607			
Space heating	g fuel (main	heating sy	219.3000 (stem) 808.4299		219.3000 311.5141	0.0000	0.0000	0.0000	0.0000	219.3000 509.1020	219.3000	219.3000	
Space heating					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Space heating	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	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	g requiremen		0.05 0500	0.40 0.007	040 1114	014 0000	011 11/0	000 0005	000 4710	050 0515		201 0100	(64)
Efficiency o: (217)m	f water heat	269.3002 er 190.4000	285.3522	248.9967 190.4000	240.1114 190.4000	214.9826 190.4000	211.1168 190.4000	220.2325 190.4000	223.4710 190.4000	250.8515 190.4000	268.7867	301.2129 190.4000 190.4000	(216)
Fuel for wate	er heating,			130.7756	126.1089	112.9110	110.8807	115.6683	117.3692	131.7497	141.1695	158.2000	
Space cooling (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	
Pumps and Fa Lighting Electricity (69.6495		90.5938 50.3096 dix M) (neo	87.6715 36.8590	90.5938 28.4710 itv)	87.6715 23.2610	90.5938 25.9722	90.5938 33.7596	87.6715 43.8504	90.5938 57.5341	87.6715 64.9846	90.5938 71.5853	
(233a)m Electricity (-30.5904 generated by	-53.8393 wind turbi	-97.5760 nes (Append	-132.3405 lix M) (nega	-157.5877 tive quanti	ty)			-94.0886	-68.0183	-36.4220	-25.0182	
(234a)m Electricity (0.0000 generated by	0.0000 hydro-eled	0.0000 tric genera	0.0000 tors (Appen	0.0000 dix M) (neg	0.0000 ative quant		0.0000	0.0000	0.0000	0.0000		(234a)
(235a)m Electricity (235c)m	0.0000 used or net 0.0000				0.0000 P (Appendix 0.0000	0.0000 N) (negati 0.0000	0.0000 ve if net g 0.0000	0.0000 generation) 0.0000	0.0000	0.0000	0.0000		(235a) (235c)
Electricity (233b)m	generated by	PVs (Apper	ndix M) (neg		ity)		-114.1890		-54.2890	-19.9761	-6.1559	-2.9800	
Electricity (234b)m	generated by 0.0000	wind turbi 0.0000	nes (Append 0.0000	lix M) (nega 0.0000	tive quanti 0.0000	ty) 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(234b)
Electricity ((235b)m Electricity)	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 (235d)m Annual total:	0.0000	0.0000				0.0000	.ve if net g 0.0000		0.0000	0.0000	0.0000	0.0000	(235d)
Space heating		n system 1										6280.9447	(211)



Der Persteng für - instructurg 1000 (100 (100 (100 (100 (100 (100 (100			,		
if in program if in progra	Space heating fuel - main system 2			0.0000	(213)
See working feed 0.000 (20) Herearthy for property of set (1000 (100	Space heating fuel - secondary Efficiency of water heater			190.4000	
Link Statistics Statistics - Link Statistics - Link - Li	Water heating fuel used Space cooling fuel				
method work it is in it is proved in the second is a second is in the second is in th	Electricity for pumps and fans: (BalancedwithHeatBecovery, Database, in-use factor = 1 2500, SEP = 0 6750)				
marge section					
maintain -1720.000 1000 model -1720.000 10000 model	Electricity for lighting (calculated in Appendix L)			562.1117	(232)
Descripting encounts 0.000 (200) Descripting encounts 0.000 (PV generation				
Specific Construction -0.000 (201) Title Cliffered Genery for all uses -0.000 (201) <	Hydro-electric generation (Appendix N)			0.0000	(235a)
Discreption 0.0000 (201) Status 0.0000 (201) <	Appendix Q - special features				,
Data Califier distribution Distristrest distribution Distristrest dis	Energy used Total delivered energy for all uses				
Description Description <thdescription< th=""> <thdescription< th=""></thdescription<></thdescription<>					
call 00 account of this 138.2200 0.101 2.000 17.000 bees and vice back bing 138.2200 0.101 2.000 101.000 compary account of the backing 138.2200 0.101 2.000 101.000 compary account of the backing 138.2200 0.101 2.000 101.000 compary account of the backing 138.2200 0.101 2.000 101.000 compary account of the backing 138.2200 0.101 2.000 101.000 compary account of the backing 138.2200 0.101 2.000 1.001.000 compary account of the backing 1.001.000 1.00		Energy	Emission factor	Emissions	
base basing other fusion 129.220 0.141 22.132 0.041 mergy for input inp	Space heating - main system 1		kg CO2/kWh 0.1543	kg CO2/year 968.9444	(261)
International Properties 120,1213 0.1413 11.132 0.000 Work provide properties 1.132 0.1413 11.132 0.000 Work provide provid	Nater heating (other fuel)	1596.2260	0.1411	0.0000 225.1535	(373) (264)
Dergy sping/decreation technologies -198.973 0.3136 -142.923 Visit additional technologies -198.973 0.3136 -142.923 Stol COL sylvest 0.3136 -142.923 -131.00 Stol COL sylvest 1000.000 (190.94 1000.000 (100.900 (Pumps, fans and electric keep-hot		0.1387	1194.0978 147.9602 81 1301	(207)
V Dut: destructly used in dealing -198.018 -198.018 -148.053 V Dut: destructly spectra -108.018 -148.053 -148.053 V Dut: destructly spectra -108.018 -148.053 -148.053 Ja. Frinzy energy - individual hosting systems including micro-CMP -148.053 -148.053 Ja. Frinzy energy - individual hosting systems including micro-CMP -148.053 -148.053 Dec Hosting - main system including micro-CMP -148.053 -151.00 (60) Dec Hosting - main system including micro-CMP -148.051 -148.053 Dec Hosting - main system including micro-CMP -148.051 -151.00 (60) Dec Hosting - main system including micro-CMP -148.051 -151.00 (60) Dec Hosting - main system including micro-CMP -164.051 -248.0740 -151.00 (60) Dec Hosting - main system including micro-CMP -151.00 (60) -152.000 (17) -153.00 (17) -153.00 (17) Dec Hosting - main system including micro-CMP -154.000 (18) -153.00 (17) -164.000 (18) -164.000 (18) V Dist Sector - 0.000 (18) -164.000 (18) -164.000 (18) -164.000 (18) -164.000 (18)		502.1117			
0:01.002, hd/ser 1027.001 (022) 2.7000 (223) 2.700 (223) 3.8. Filmary energy - individual basing systems including micro-CAP Survey Filmary energy factor	PV Unit electricity used in dwelling PV Unit electricity exported		0.1318 0.1180	-71.8198	
h. Frimary energy - individual hasting systems including micro-dust h. Frimary energy Frimary energy factor Frimary energy factor Frimary energy factor h. State itseling (observation factor) 1552,5447 1.5711 h. State itseling (observation factor) 1552,2200 1.3216 222,227,240 h. State itseling (observation factor) 1562,6200 1.3216 222,227,210 1532,657 h. State and H-Extry energy factor 1562,6200 1.3216 222,227,210 1532,657 h. State and H-Extry energy factor 1562,6200 1.3216 222,5200 1623,157 h. State and H-Extry energy factor 1562,1570 153,157 153,157 153,157 h. State and H-Extry energy factor -1094,9719 1.4689 -1-122,0953 -1253,152 h. State and H-Extry energy factor -1094,9719 1.4689 -1253,152 123,152 h. State and H-Extry energy factor -1094,9719 1.4689 -1253,152 123,152 h. State and H-Extry energy factor -1094,9719 1.4689 -1253,152 123,152 h. State and H-Extry energy factor -1094,9719 1.4689 -1254,1520 123,152 h.	Total Total CO2, kg/year PEC Dwalling Carbon Diovide Emission Rate (DER)			1207.0761	(272)
Ja. Trimary energy - Individual heating systems including micro-DEP Energy Primary energy factor primary factor is primary energy f				2.7700	(2,0)
best best <th< td=""><td>13a. Primary energy - Individual heating systems including micro-CHP</td><td></td><td></td><td></td><td></td></th<>	13a. Primary energy - Individual heating systems including micro-CHP				
ctal CD_associated with_community systems 1966.2800 1.5216 20.0000 (473) press and setty resting 1066.6905 1.528 163.6576 (283) mapy for lighting 522.117 1.538 82.1857 (283) Pressy saving/energy they light -1094.9713 1.4665 -1626.0953 Volt electricity used in dwelling -1094.9713 -467.500 -265.2827 volt electricity associated welling -1094.9713 -1626.0953 -265.2827 volt electricity electricit		kWh/year	kg CO2/kWh	kWh/year	
pace and water heating mary farm and bicktric keep-hot mary for lighting 12286-2956 (279) 1066.6605 1.112 1.2286-2956 (279) 051.117 Sherry sain/generation technologies Volte dectricity exported to the feature of the second of the second total primary energy KBA/year -1094.9713 1.4669 -1228.2937 -263.2937 Coll Coll Coll Coll Coll Coll Coll Coll	Total CO2 associated with community systems			0.0000	(473)
Energy saving/generation technologies -104,9719 1.4669 -462.0933 Ordal Primary energy Mathe (DER) -608.3320 0.4327 -762.2873 Otal Primary energy Mathe (DER) -20.2873 -20.2873 -20.2873 Welling Primary energy Mathe (DER) 20.5200 (287) -20.2873 And Primary energy Mathe (DER) -20.2873 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2873 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2874 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2874 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2874 -20.2874 -20.2876 And Primary energy Mathe (DER) -20.2874 -20.2876 -20.2876 And Primary energy Mathe (DER) -20.2876 -20.2876 -20.2876 And Primary energy Mathe (DER) -20.2876 -20.2876 -20.2876 -20.2876 And Primary energy Mathe (DER) -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20	Space and water heating		1.5128	12296.8926 1613.6576	(279)
Energy saving/generation technologies -104,9719 1.4669 -462.0933 Ordal Primary energy Mathe (DER) -608.3320 0.4327 -762.2873 Otal Primary energy Mathe (DER) -20.2873 -20.2873 -20.2873 Welling Primary energy Mathe (DER) 20.5200 (287) -20.2873 And Primary energy Mathe (DER) -20.2873 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2873 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2874 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2874 -20.2873 -20.2873 And Primary energy Mathe (DER) -20.2874 -20.2874 -20.2876 And Primary energy Mathe (DER) -20.2874 -20.2876 -20.2876 And Primary energy Mathe (DER) -20.2876 -20.2876 -20.2876 And Primary energy Mathe (DER) -20.2876 -20.2876 -20.2876 -20.2876 And Primary energy Mathe (DER) -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20.2876 -20	nergy for lighting		1.5338	862.1857	
Otal Primary energy MM/year -1991.3827 (283) welling Primary energy Rate (DPER) 1281.3827 (283)	Energy saving/generation technologies 2V Unit electricity used in dwelling			-1628.0953	
welling Primary energy Rate (DPER) 29.5200 (297) AP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)	Fotal	-608.5320	0.4327	-1891.3827	(283)
AP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) ALCULATION OF TARGET EMISSIONS	Dwelling Primary energy Rate (DPER)				
ALCULATION OF TARGET EMISSIONS					
$\frac{1}{10000000000000000000000000000000000$	CALCULATION OF TARGET EMISSIONS				
Area Storey height Volume (n2) (m) (m3) irist floor 194,2300 (1c) 3.0000 (2c) = 582,6900 (1c) - (3c) iscond floor 194,2300 (1c) x 3.0000 (2c) = 582,6900 (1c) - (3c) istat floor area TFA = (1a) + (1b) + (1c) + (1d) + (1e) (1n) 436.3700 (4) (4) welling volume (3a) + (3b) + (3c) + (3d) + (3e) (3n) = 1295.2878 (5) (4)					
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			Storey height	Volume	
tecond floor 32.9100 (ld) x 2.5800 (2d) = 84.9078 (ld) - (3d total floor area TFA = (la)+(lb)+(lc)+(ld)+(le)(ln) 436.3700 (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) (1d) - (3d (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) (1d) - (3d (1d) - (3d (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) (1d) - (3d (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) (1d) - (3d (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) (1d) - (3d	Ground floor	209.2300 (1b) x 3.0000 (2b)	= 627.6900	
welling volume (3a)+(3b)+(3c)+(3d)+(3e)(3n) = 1295.2878 (5) Ventilation rate (3n) = 0.0000 (6a) Ventilation due to chimneys (1000 (6b) Ventilation due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 40.0000 / (7b) (20000 / (7b) Ventilation due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0309 (8) Yes Ventilation due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 40.0000 / (5) = Ventilation (5) = Ventilation (5) = Ventilation (5) = Ventin (5) = Ventilation (5) = Ventilation (5)	Second floor				(1d) - (3d
	Welling volume 436.3700	(3a)+(3b)+(3c)+(3d)+(3e)	3n) = 1295.2878	
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 other heater $0 + 20 = 0.0000$ (6d)Number of flues attached to other heater $0 + 20 = 0.0000$ (6d)Number of blocked chimneys $0 + 20 = 0.0000$ (6d)Number of blocked chimneys $0 + 20 = 0.0000$ (6f)Number of blocked chimneys $0 + 20 = 0.0000$ (6f)Number of passive vents $0 + 10 = 40.0000$ (7a)Number of flueless gas fires $0 + 10 = 0.0000$ (7c)Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0309 (8)Yerssure testYesYerssure Test MethodBlower Door	. Ventilation rate				
humber of open flues 0 * 20 = 0.0000 (6b) humber of chimneys / flues attached to closed fire 0 * 20 = 0.0000 (6c) humber of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6c) humber of flues attached to other heater 0 * 35 = 0.0000 (6c) humber of blocked chimneys 0 * 35 = 0.0000 (6c) humber of blocked chimneys 0 * 20 = 0.0000 (6c) humber of passive vents 0 * 20 = 0.0000 (7c) humber of flueless gas fires 0 * 10 = 0.0000 (7c) infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = Air changes per hour ressure test Yes ressure test Method Blower Door				-	
humber of flues attached to solid fuel boiler 0 * 20 = 0.0000 (6d) humber of flues attached to other heater 0 * 35 = 0.0000 (6e) humber of blocked chimneys 0 * 20 = 0.0000 (6f) humber of intermittent extract fans 4 * 10 = 40.0000 (7a) humber of fluess gas fires 0 * 40 = 0.0000 (7b) infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = Yerssure test Yes Yressure Test Method Blower Door	Number of open chimneys Number of open flues		× 0	20 = 0.0000	(6b)
humber of blocked chimneys 0 * 20 = 0.0000 (6f) humber of intermittent extract fans 4 * 10 = 40.0000 (7a) humber of passive vents 0 * 40 = 0.0000 (7b) humber of flueless gas fires 0 * 40 = 0.0000 (7c) infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = Air changes per hour ressure test Yes irresure Test Method Blower Door	Number of flues attached to solid fuel boiler		0 *	20 = 0.0000	(6d)
humber of passive vents 0 * 10 = 0.0000 (7b) humber of flueless gas fires 0 * 40 = 0.0000 (7c) infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = Air changes per hour versesure test Yes ressure Test Method Blower Door	Number of blocked chimneys		0 *	20 = 0.0000	(6f)
Air changes per hour infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = Air changes per hour vressure test 40.0000 / (5) = 0.0309 (8) vressure Test Method Elower Door	Number of flueless gas fires		0 *	10 = 0.0000	(7b)
infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0309 (8) Vressure test Yes Yes ressure Test Method Blower Door			Air	changes per hour	
	Pressure test	(7a)+(7b)+(7c) =		(5) = 0.0309 Yes	(8)
	Pressure Test Method Measured/design AP50				(17)



Infiltration rat Number of sides												0.2809	(18) (19)
Shelter factor Infiltration rat	e adjusted	d to inclu	de shelter :	factor				(20) = 1 - (21		x (19)] = x (20) =	1.0000 0.2809	
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000	(22)
Wind factor Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750		1.1750	
Effective ac	0.3581 0.5641	0.3511 0.5616	0.3441 0.5592	0.3090 0.5477	0.3019 0.5456	0.2668 0.5356	0.2668 0.5356	0.2598 0.5338	0.2809 0.5394	0.3019 0.5456		0.3300 0.5545	
3. Heat losses a													
Element				Gross	Openings	s Ne	tArea	U-value	AxU		X-value	АхК	
TER Opaque door TER Opening Type Ground floor or Exposed floor External Wall 1 All roofs Total net area c Fabric heat loss	e (Uw = 1.2 to storage of external	e 1 elements	2	m2 441.9000 220.8900	m2 109.1000	3 105 209 12) 332 220	m2 .6000 .5000 .2300 .7200 .8000 .8900 .7400 (26)(3	W/m2K 1.0000 1.1450 0.1300 0.1300 0.1800 0.1100 30) + (32) =	W/K 3.6000 120.8015 27.1999 1.6536 59.9040 24.2979 237.4569		kJ/m2K	kJ/K	(26) (27) (28a) (28b) (29a) (30) (31) (33)
Thermal mass par List of Thermal		MP = Cm / 1	TFA) in kJ/r	n2K								35.0998	(35)
K1 Eleme E2 Other E3 Sill E5 Groun E6 Inter E14 Flat E15 Flat E14 E24 Eave E16 Corr E17 Corn E19 Grou E20 Expc	ent i lintels id floor () mediate f: roof with is (insulai her (insulai her (invertion sed floor besed floor	normal) loor within h parapet tion at ce: l) ted - inte: (inverted) (inverted))	g - inverted reater than	external an	cea)		57. 38. 80. 67. 31. 26. 72. 39. 35. 20. 7. 7. 10.	7800 3900 1800 9700 4900 5900 4700 3700 1600 5800	i-value 0.0500 0.0500 0.1600 0.0800 0.2400 0.2400 0.0900 -0.0900 0.0700 0.3200	Tota 2.889 1.919 4.009 10.875 0.000 2.127 40.583 9.448 3.164 -1.852 0.556 3.363 4.281	0 5 0 2 0 2 2 2 8 4 4 2 5 5 2	(36)
Point Thermal br Total fabric hea	idges	isi) caica	facca asing	Appendix A)				(33) + (36)	(36a) = + (36a) =	0.0000 318.8223	
Ventilation heat (38)m 2	loss calo Jan 241.1329	Feb	nthly (38)m Mar 239.0252	= 0.33 x (Apr 234.1249	May	Jun 228.9400	Jul 228.9400	Aug 228.1496	Sep 230.5840	Oct 233.2080	Nov 235.0628	Dec 237.0019	(38)
Heat transfer co 5 Average = Sum(39	59.9552		557.8476	552.9472	552.0304	547.7623	547.7623	546.9719	549.4063	552.0304	553.8851	555.8242 552.9428	(39)
HLP HLP (average) Days in mont	Jan 1.2832 31	Feb 1.2808 28	Mar 1.2784 31	Apr 1.2672 30	May 1.2651 31	Jun 1.2553 30	Jul 1.2553 31	Aug 1.2535 31	Sep 1.2590 30	Oct 1.2651 31		Dec 1.2737 1.2671 31	(40)
4. Water heating Assumed occupanc Hot water usage	 су)								3.3092	(42)
Hot water usage				73.4217	70.9572	68.2088	66.6466	68.3788	70.2777	73.2286		79.3992	
Hot water usage	34.3988 for other 48.5196	33.8879 uses 46.7553	33.1685 44.9909	31.8420 43.2266	30.8488 41.4622	29.7474 39.6979	29.1525 39.6979	29.8669 41.4622	30.6448 43.2266	31.8232		34.2825 48.5196	
Average daily ho	Jan	se (litres, Feb				Tura	71		0	0-1	Narr	149.4868	(43)
Daily hot water 1 Energy conte 2 Energy content (use 62.6229 57.5550	159.1499	Mar 154.9207 238.1074	Apr 148.4903 203.2758	May 143.2682 192.8666	Jun 137.6541 169.2618	Jul 135.4970 163.8719	Aug 139.7080 172.9876	177.7501	Oct 150.0428 203.6066 Total = 5			
Distribution los	s (46)m = 38.6332		45)m 35.7161	30.4914	28.9300	25.3893	24.5808	25.9481	26.6625	30.5410		38.0952	(46)
Water storage lo Store volume a) If manufactu Temperature fa Enter (49) or (5	arer declam actor from 54) in (55)	Table 2b	actor is kno	own (kWh/d	ay):							150.0000 1.3938 0.5400 0.7527	(48) (49)
Total storage lo If cylinder cont	23.3325	21.0745		22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
Primary loss	23.3325 23.2624 0.0000	21.0745 21.0112 0.0000	23.3325 23.2624 0.0000	22.5798 22.5120 0.0000	23.2624 0.0000	22.5798 22.5120 0.0000	23.3325 23.2624 0.0000	23.3325 23.2624 0.0000	22.5798 22.5120 0.0000	23.3325 23.2624 0.0000	22.5120	23.3325 23.2624 0.0000	(59)
WHRS -	04.1499 -36.4376 -0.0000 0.0000 0.0000	268.7131 -32.2257	284.7023	248.3677		214.3536 -22.2835 -0.0000 0.0000 0.0000	210.4668 -20.8872 -0.0000 0.0000 0.0000				-30.7913 -0.0000 0.0000	300.5629 -35.7628 -0.0000 0.0000 0.0000	(63a) (63b) (63c)
2 12Total per year	:67.7123 : (kWh/yea:		250.9574	220.4256	213.4204	192.0701	189.5796				237.3663 Sum(64)m =		(64)
Electric shower((s) 0.0000	0.0000	0.0000	0.0000 Tot	0.0000 al Energy us	0.0000 sed by inst	0.0000 antaneous ei	0.0000 lectric show	0.0000 er(s) (kWh/y	0.0000 ear) = Si		0.0000	
Heat gains from 1			month 116.4466			92.3530	91.7633	94.7943			110.2429		



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

Metabolic gai	ns (Table 5), Watts											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	165.4605	(66)
Lighting gain	s (calculat												
	283.0502	313.3770	283.0502	292.4852	283.0502	292.4852	283.0502	283.0502	292.4852	283.0502	292.4852	283.0502	(67)
Appliances ga	ins (calcul	ated in App	endix L, eq	uation L13		lso see Tab	le 5						
	561.1787	567.0020	552.3275	521.0873	481.6521	444.5886	419.8279	414.0046	428.6791	459.9193	499.3545	536.4180	(68)
Cooking gains	(calculate	d in Append	ix L, equat	ion L15 or	L15a), also	see Table	5						
	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	39.5461	(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. e	vaporation	(negative v	alues) (Tab	le 5)									
	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	-132.3684	(71)
Water heating	gains (Tab	le 5)											
	165.2056	162.2354	156.5143	143.9760	136.2958	128.2681	123.3378	127.4117	132.1880	141.0956	153.1151	163.6025	(72)
Total interna	l gains												
	1085.0727	1118.2525	1067.5302	1033.1866	976.6363	937.9801	898.8541	897.1047	925.9905	959.7033	1020.5930	1058.7089	(73)

6. Solar gains						
[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	11.5500	10.6334	0.6300	0.7000	0.7700	37.5341 (74)
East	36.4300	19.6403	0.6300	0.7000	0.7700	218.6645 (76)
South	34.3000	46.7521	0.6300	0.7000	0.7700	490.0797 (78)
West	23.2200	19.6403	0.6300	0.7000	0.7700	139.3739 (80)

Solar gains 885.6522 1574.7529 2297.7444 3033.5642 3529.5320 3551.6299 3405.0916 3034.6123 2556.0838 1782.1727 1073.6465 749.1976 (83) Total gains 1970.7248 2693.0054 3365.2746 4066.7508 4506.1683 4489.6100 4303.9457 3931.7170 3482.0743 2741.8760 2094.2395 1807.9065 (84)

7. Mean internal temperature (heating season)

Temperature (h1 (C)						21.0000 (8	5)
Utilisation :	factor for ga	ains for liv	ving area, r	il,m (see I	able 9a)								
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	7.5981	7.6125	7.6268	7.6944	7.7071	7.7672	7.7672	7.7784	7.7440	7.7071	7.6813	7.6545	
alpha	1.5065	1.5075	1.5085	1.5130	1.5138	1.5178	1.5178	1.5186	1.5163	1.5138	1.5121	1.5103	
util living a	area												
-	0.9229	0.8805	0.8251	0.7413	0.6409	0.5273	0.4269	0.4667	0.6280	0.7978	0.8943	0.9313 (8	6)
MIT	15.8992	16.5057	17.3920	18.4859	19.4621	20.2156	20.6053	20.5300	19.8972	18.5663	17.0206	15.7864 (8	;7)
Th 2	19.8540	19.8559	19.8578	19.8667	19.8683	19.8760	19.8760	19.8775	19.8731	19.8683	19.8650	19.8615 (8	(8)
util rest of	house												
	0.9155	0.8695	0.8086	0.7160	0.6024	0.4683	0.3445	0.3850	0.5743	0.7720	0.8827	0.9248 (8	(9)
MIT 2	14.1502	14.8779	15.9383	17.2356	18.3684	19.2138	19.6138	19.5504	18.8896	17.3611	15.5127	14.0164 (9	(0)
Living area	fraction								fLA =	Living area	/ (4) =	0.4044 (9)1)
MIT	14.8575	15.5362	16.5262	17.7412	18.8107	19.6189	20.0147	19.9466	19.2971	17.8485	16.1225	14.7322 (9	(2)
Temperature a	adjustment											0.0000	
adjusted MIT	14.8575	15.5362	16.5262	17.7412	18.8107	19.6189	20.0147	19.9466	19.2971	17.8485	16.1225	14.7322 (9	13)

8. Space heating requirement

Utilisation	Jan 0.8639	Feb 0.8078	Mar 0.7430	Apr 0.6564	May 0.5603	Jun 0.4533	Jul 0.3555	Aug 0.3905	Sep 0.5421	Oct 0.7104	Nov 0.8243	Dec 0.8763	(94)
Useful gains Ext temp.	1702.5900	2175.4456	2500.5637	2669.3210 8.9000	2524.6014 11.7000	2035.2982	1530.1906	1535.4735	1887.5467	1947.8690	1726.2489 7.1000	1584.3223	(95)
Heat loss rat													()
	5911.7217	5944.4487	5593.0795	4888.7350	3925.2990	2749.1585	1870.4632	1939.8790	2855.2989	4001.3907	4997.4357	5854.0558	(97)
Space heating	3131.5940	2532.7701	2300.8318	1597.9781	1042.1190	0.0000	0.0000	0.0000	0.0000	1527.8201	2355.2545	3176.6818	(98a)
Space heating		t - total p	er year (kW	h/year)								17665.0494	
Solar heating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating Space heating		on - total	per year (k	Wh/year)								0.0000	
	3131.5940	2532.7701			1042.1190	0.0000	0.0000	0.0000	0.0000	1527.8201	2355.2545	3176.6818	(98c)
Space heating Space heating		t after sol	ar contribu	tion - tota	l per year	(kWh/year)				(98c		17665.0494 40.4818	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP													
Fraction of space heat from secondary/supplementary system (Table 11) Fraction of space heat from main system(s) Efficiency of main space heating system 1 (in %) Efficiency of secondary/supplementary heating system, %									202) 206) 207)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating	requiremen	t											
	3131.5940	2532.7701	2300.8318	1597.9781	1042.1190	0.0000	0.0000	0.0000	0.0000	1527.8201	2355.2545	3176.6818 (9	98)
Space heating	efficiency	/ (main heat	ing 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 (2	210)
Space heating	fuel (main	heating sy	/stem)										
	3392.8429	2744.0629	2492.7755	1731.2872	1129.0563	0.0000	0.0000	0.0000	0.0000	1655.2764	2551.7384	3441.6920 (2	211)
Space heating	efficiency	(main heat	ing 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 (2	212)
Space heating	fuel (main	heating sy	/stem 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 (2	213)
Space heating	fuel (seco	ndary)											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (2	215)



Water heating			
Water heating requirement	100 2000 000 0010	007 0000 000 0001	15.43
267.7123 236.4874 250.9574 220.4256 213.4204 192.0701 189.5796 197.3711 Efficiency of water heater	199.7866 223.0218	237.3663 264.8001 79.8000	
(217)m 88.0182 87.9529 87.8259 87.6024 87.1296 79.8000 79.8000 79.8000	79.8000 87.5424	87.8924 88.0360	(217)
Fuel for water heating, kWh/month 304.1556 268.8796 285.7443 251.6206 244.9458 240.6894 237.5684 247.3322 Space cooling fuel requirement	250.3591 254.7587	270.0645 300.7860	(219)
(221)m 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	(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	
Lighting 58.8122 47.1814 42.4816 31.1238 24.0409 19.6417 21.9310 28.5067 Electricity generated by PVs (Appendix M) (negative quantity)	37.0274 48.5819	54.8731 60.4468	(232)
(233a)m -156.9101 -204.0693 -270.6265 -279.6150 -281.7192 -255.5188 -251.5589 -246.2121 Electricity generated by wind turbines (Appendix M) (negative guantity)	-235.3601 -219.8512	-165.8769 -137.6794	(233a)
(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 Electricity provide a set of the set of	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 Electricity provides NU (constitute supervise)	0.0000 0.0000	0.0000 0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m -149.4438 -304.5783 -588.5536 -861.1132 -1117.8924 -1116.4719 -1104.0189 -944.6792	-705.4603 -428.4849	-197.0025 -119.0207	(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 Electricity generated by hydro-electric generators (Appendix M) (negative guantity)	0.0000 0.0000	0.0000 0.0000	(234b)
(235b)m 0.000000	0.0000 0.0000	0.0000 0.0000	(235b)
(235d)m 0.000000	0.0000 0.0000	0.0000 0.0000	(235d)
Space heating fuel - main system 1 Space heating fuel - main system 2 Space heating fuel - secondary		19138.7317 0.0000 0.0000	(213)
Efficiency of water heater		79.8000	
Water heating fuel used Space cooling fuel		3156.9042 0.0000	
Electricity for pumps and fans: Total electricity for the above, kWh/year Electricity for lighting (calculated in Appendix L)		86.0000 474.6485	
Energy saving/generation technologies (Appendices M ,N and Q)			
PV generation		-10341.7170	
Wind generation Hydro-electric generation (Appendix N)		0.0000	
Electricity generated - Micro CHP (Appendix N)		0.0000	
Appendix Q - special features Energy saved or generated		-0.0000	(236)
Energy used		0.0000	(237)
Total delivered energy for all uses		12514.5675	(238)
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP			
Energy	Emission factor	Emissions	
kWh/year Space heating - main system 1 19138.7317	kg CO2/kWh 0.2100	kg CO2/year 4019.1337	(261)
Total CO2 associated with community systems Water heating (other fuel) 3156.9042	0.2100	0.0000 662.9499	
Space and water heating		4682.0835	(265)
Pumps, fans and electric keep-hot 86.0000 Energy for lighting 474.6485	0.1387 0.1443	11.9293 68.5064	
	0.1443	00.3004	(200)
Energy saving/generation technologies PV Unit electricity used in dwelling -2704.9974	0.1364	-369.0690	
PV Unit electricity exported -7636.7196	0.1267	-967.3591	
Total Total CO2, kg/year		-1336.4282 3426.0911	
EPC Target Carbon Dioxide Emission Rate (TER)		7.8500	
bie larget carbon browide barrosion hate (TEK)			

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

	Energy Prima	ry energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	19138.7317	1.1300	21626.7668 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3156.9042	1.1300	3567.3018 (278)
Space and water heating			25194.0686 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	474.6485	1.5338	728.0317 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2704.9974	1.5044	-4069.2872
PV Unit electricity exported	-7636.7196	0.4650	-3551.1238
Total			-7620.4110 (283)
Total Primary energy kWh/year			18431.7901 (286)
Target Primary Energy Rate (TPER)			42.2400 (287)
· · · · · · · · · · · · · · · · · · ·			

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