Energy & Sustainability Statement

23a Hampton Road

Listen. Consider. Apply. Deliver.

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1.0 Introduction

1.1 Executive Summary

MES have been commissioned to provide an energy sustainability statement in order to address the requirements of Richmond-upon-Thames Council in relation to the proposed development at 23a Hampton Road, Teddington. The purpose of this energy & sustainability statement is to provide an overview of how sustainability will be promoted, to establish the predicted energy requirements and associated carbon dioxide emissions for the proposed development and show how the design addresses overheating. It will also show how domestic potable water use will be minimised and provide an indication of the likely carbon payback period by assessing the embodied carbon of the proposed development.

The relevant policies this report will address are laid out in the Richmond Local Plan as adopted in 2018. The main policies relevant to energy and sustainability in the Local Plan are LP20 & LP22.

In order to calculate the total operational energy requirement for the development we have used PHPP10. The associated carbon emissions have been calculated by applying the Part L2010 carbon factors to the energy consumption date extracted from the PHPP models. The embodied carbon assessment has been undertaken using PHRibbon based on the dimensional data contained in the PHPP models. The operational energy efficiency and carbon improvements required by the Richmond Local plan have been achieved by the use of;

- Improved building fabric over the Part L 2021 ‘Notional Building’ specification
- Reduced air leakage to limit heat loss via uncontrolled ventilation
- Specification of an MVHR unit to limit heat loss from controlled ventilation
- Use of an ASHP for the space and DHW heating
- 1.6kWp PV array

Table 1.1, below, shows the modelled performance based on the PHPP calculations for each stage of the Energy Hierarchy. Further details can be found in Section 3 and the appendices to this report.

Table 1.1: Total reduction in energy use and carbon emissions

	Regulated Energy Consumption (kWh per annum)	Regulated CO_2 Emissions (Tonnes per annum)	Regulated CO_2 savings	
			(Tonnes per annum)	(%)
Baseline	15,139	4.4		
Be Lean	9,239	3.0	1.4	**31%**
Be Clean	9,239	3.0	0.0	**0%**
Be Green	8,398	1.1	1.9	**43%**
Cumulative on site savings	**6,580**		**3.3**	**74%**

As required by the GLA’s June 2022 updated guidance for the production of energy statements, the Energy Use Intensity (EUI), space heating demand and FEES performance have been calculated using the same PHPP models as the energy and CO_2 consumption. Although PHPP doesn’t include the Part L calculation for FEES this can still be determined from the information within PHPP. As FEES is defined as the space heating and cooling requirements per square metre of floor area, this information can be extracted from the relevant PHPP models. The performance against these metrics (EUI, space heating demand and FEES) can be found in Table 1.2 below.

Table 1.2: EUI, space heating demand & FEES			
Building Type	**Energy Use Intensity (kWh/m²/year, excluding renewable energy)**	**Space Heating Demand (kWh/m²/year, excluding renewable energy)**	**Design Fabric Energy Efficiency (FEES)**
Residential	32	36	36.2
Target	35	15	62.0

In line with Richmond Local Plan LP22 and London Plan 2021 policy SI5 water efficient fittings will be specified for this development to ensure the new dwelling achieves the Optional Requirement of the Building Regulations – a mains water consumption of 105 litres per person per day (excluding any allowance for external use). For the full specification and calculation associated with this please see Section 6 and Appendix 5 to this report.

An overheating assessment has been undertaken using the PHPP models. These which indicates that the development will achieve the PassivHaus criteria when it comes to overheating. Full details of this can be found in Section 6 and Appendices 3 & 6 to this report. It is worth noting that this development will need to comply with the new 2021 Part O of the Building Regulations so overheating will be addressed further as part of the Building Regulations compliance process.

Finally, an embodied carbon assessment has been undertaken for the design as proposed. Two construction material options have been modelled and both of these show that the development achieves a reduction overt the LETI 'business as usual' baseline of 19-28% (depending on the construction method modelled). It also shows that the development does achieve a carbon payback across the standard 60 year design life of the building. In reality this building would be expected to last significantly longer than 60 years, and so the carbon benefit of replacing the existing dwelling would be significantly greater than calculated.

1.2 Planning Policy

The relevant policies laid out in the Richmond Local Plan as adopted in 2018. The relevant policies that this report will address are LP20 & LP22. These are reproduced below for clarity.

Policy LP 20

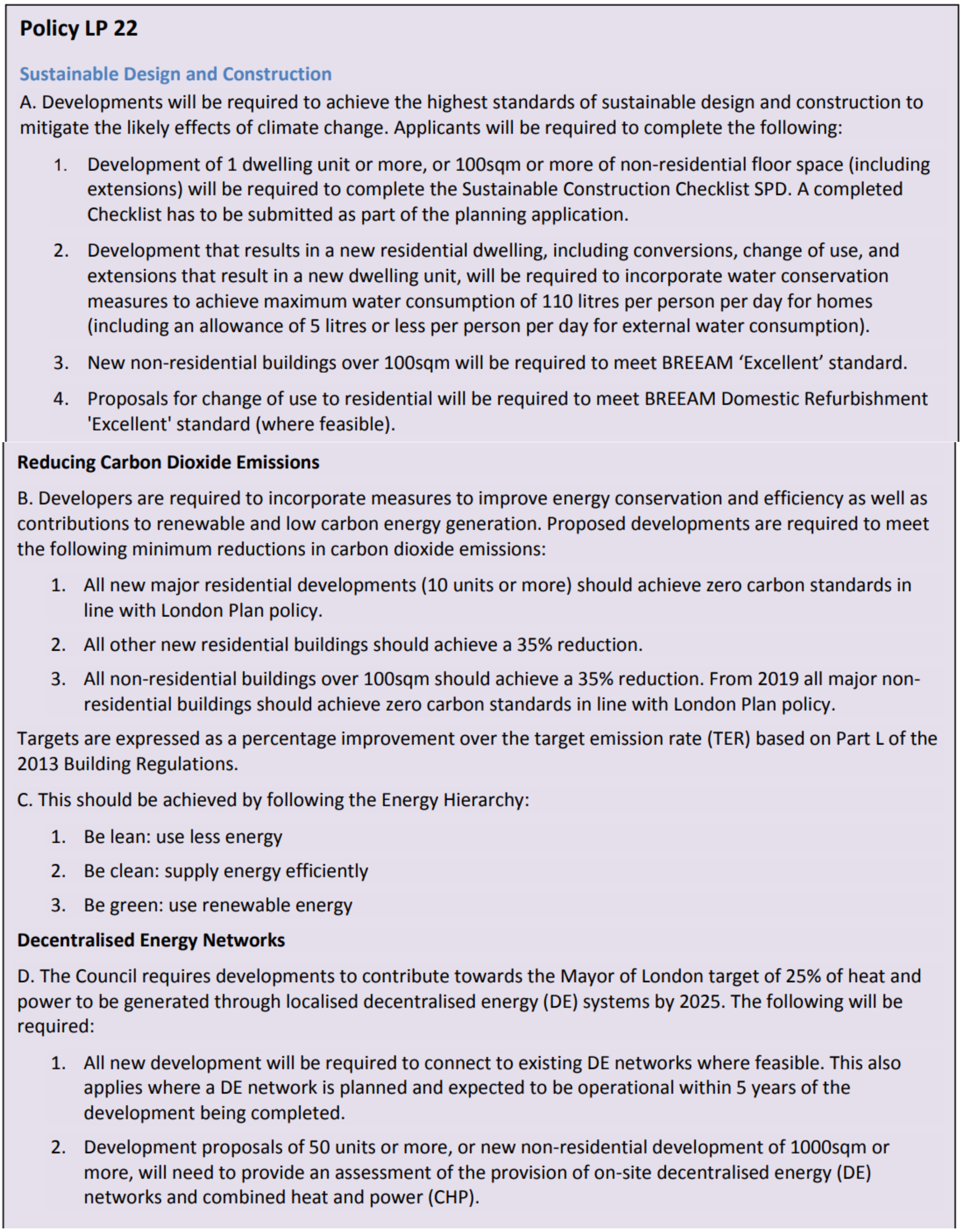
Climate Change Adaption

A. The Council will promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property.

B. New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:

1. minimise internal heat generation through energy efficient design
2. reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls
3. manage the heat within the building through exposed internal thermal mass and high ceilings
4. passive ventilation
5. mechanical ventilation
6. active cooling systems (ensuring they are the lowest carbon options).

C. Opportunities to adapt existing buildings, places and spaces to the likely effects of climate change should be maximised and will be supported.



Policy LP 22

Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

1. Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.
2. Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).
3. New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.
4. Proposals for change of use to residential will be required to meet BREEAM Domestic Refurbishment 'Excellent' standard (where feasible).

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

1. All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
2. All other new residential buildings should achieve a 35% reduction.
3. All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.

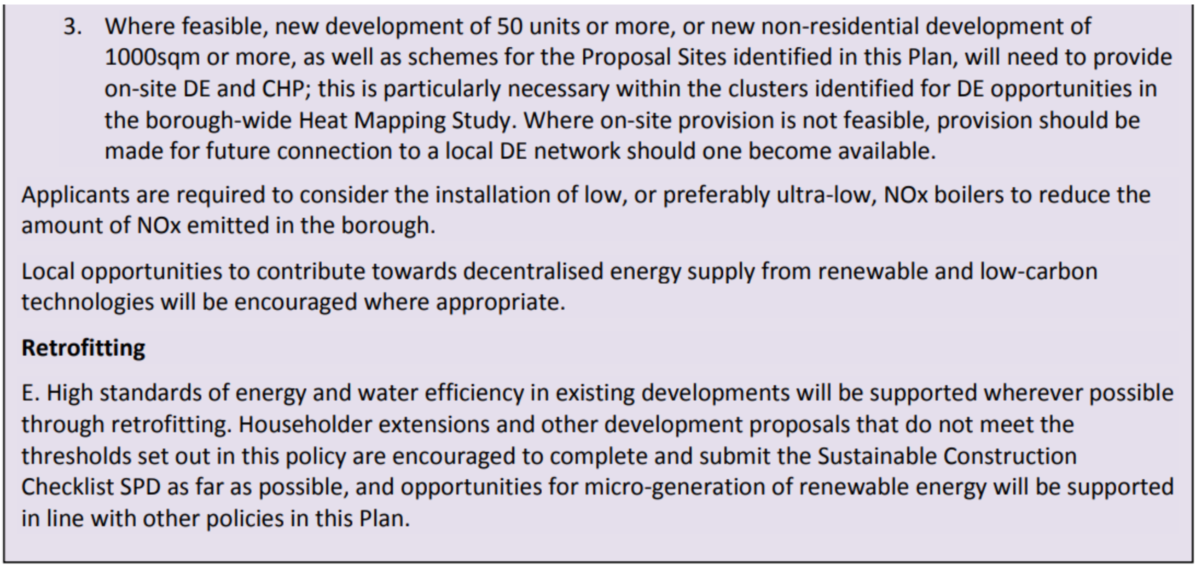
C. This should be achieved by following the Energy Hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

Decentralised Energy Networks

D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:

1. All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.
2. Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralised energy (DE) networks and combined heat and power (CHP).



3. Where feasible, new development of 50 units or more, or new non-residential development of 1000sqm or more, as well as schemes for the Proposal Sites identified in this Plan, will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to a local DE network should one become available.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

Retrofitting

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

2.0 Description of the Development

2.1 Location

The proposed development is located on Hampton Road, Teddington. The surrounding area is comprised of a mix of residential and commercial buildings ranging from 2 to 4 storeys in height. The site location can be found in Figure 2.1, below.

Figure 2.1: Aerial photograph showing site location

2.2 Details of the Development

The application is for the demolition of an existing bungalow, that appears to be of early 20th century construction, and the construction of a new detached dwelling.

The existing house is in a very poor condition and lacks insulation throughout. The property is of either single skin brick construction or has an small, uninsulated cavity and the roof is not lined and lacks any form of thermally proficient construction which compounds the issue of heat loss. The proposed dwelling, however, will be constructed to achieve higher than statutorily required standards of insulation and air permeability. This, combined with the use of renewable and energy efficient heating systems will ensure a highly sustainable and energy efficient home. The lack of insulation makes the existing property an unsuitable candidate for installation of energy efficient heating systems such as the proposed air source heat pump and ventilation heat recovery system. The restrictions that the existing construction places on retrofit thermal efficiency (solid walls, solid ground floor and issues with addressing thermal bridging between these elements and any retrofitted insulation) mean that much greater thermal efficiency can be achieved in the proposed new building than by retrofitting the existing. LZC heating and ventilation systems are only economically viable for buildings with good thermal performance as they are significantly more efficient in highly efficient buildings and provide much better occupant comfort.

Floor plans and elevations showing the proposed development can be found in Figures 2.2-2.8, below.

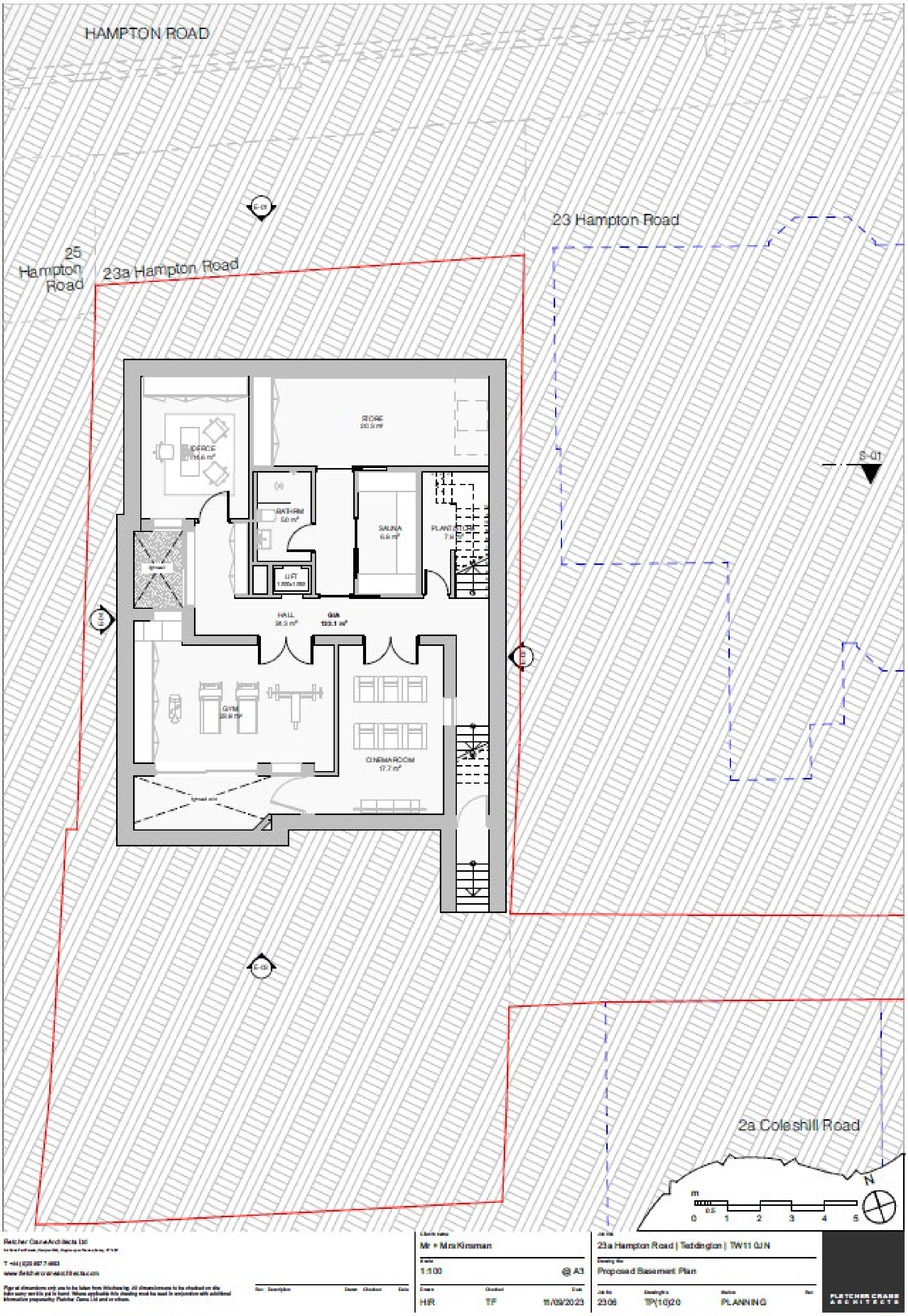


Figure 2.2 – Basement floor plan

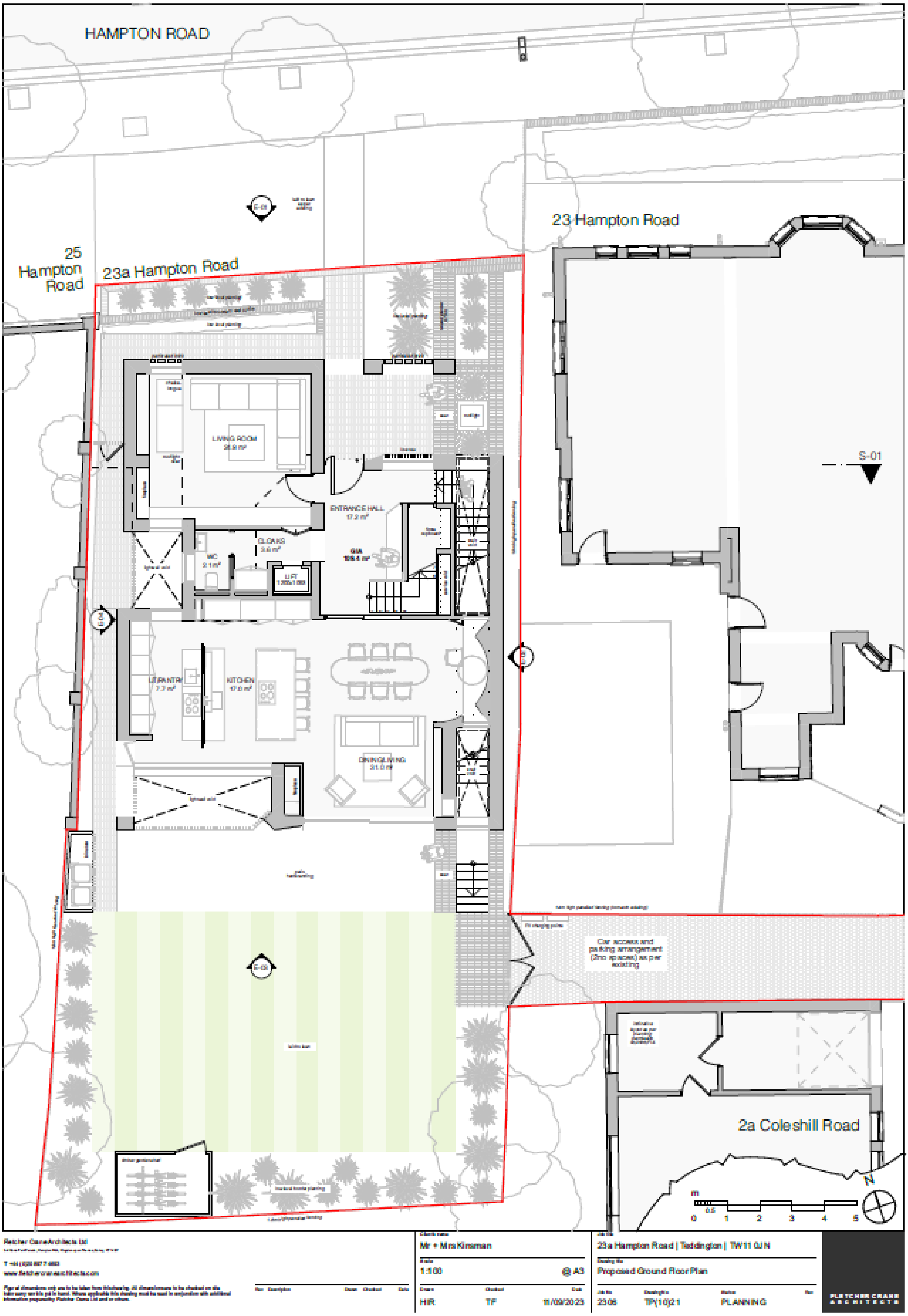


Figure 2.3 – Ground floor plan

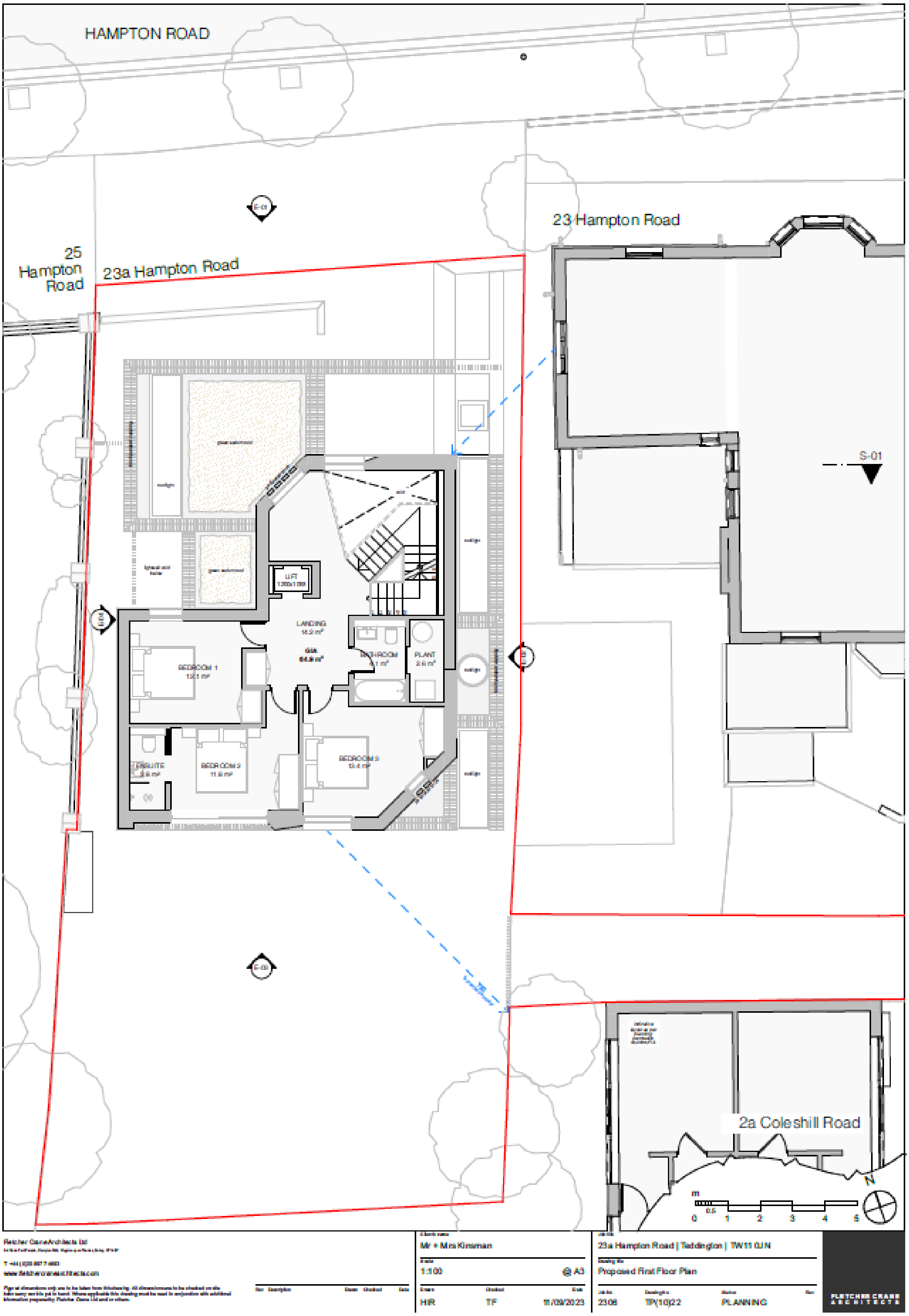


Figure 2.4 –First floor plan

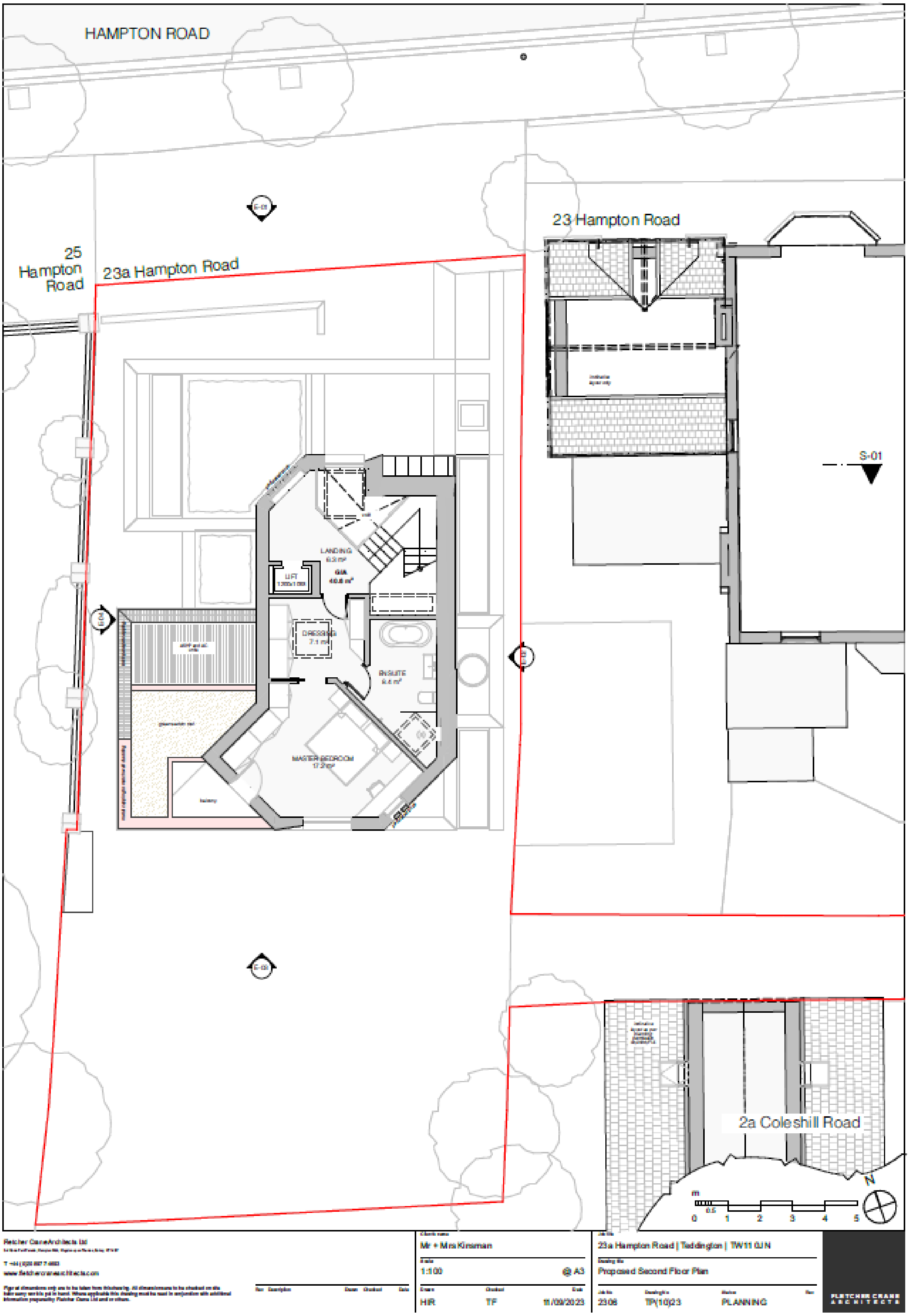


Figure 2.5 – Second floor plan

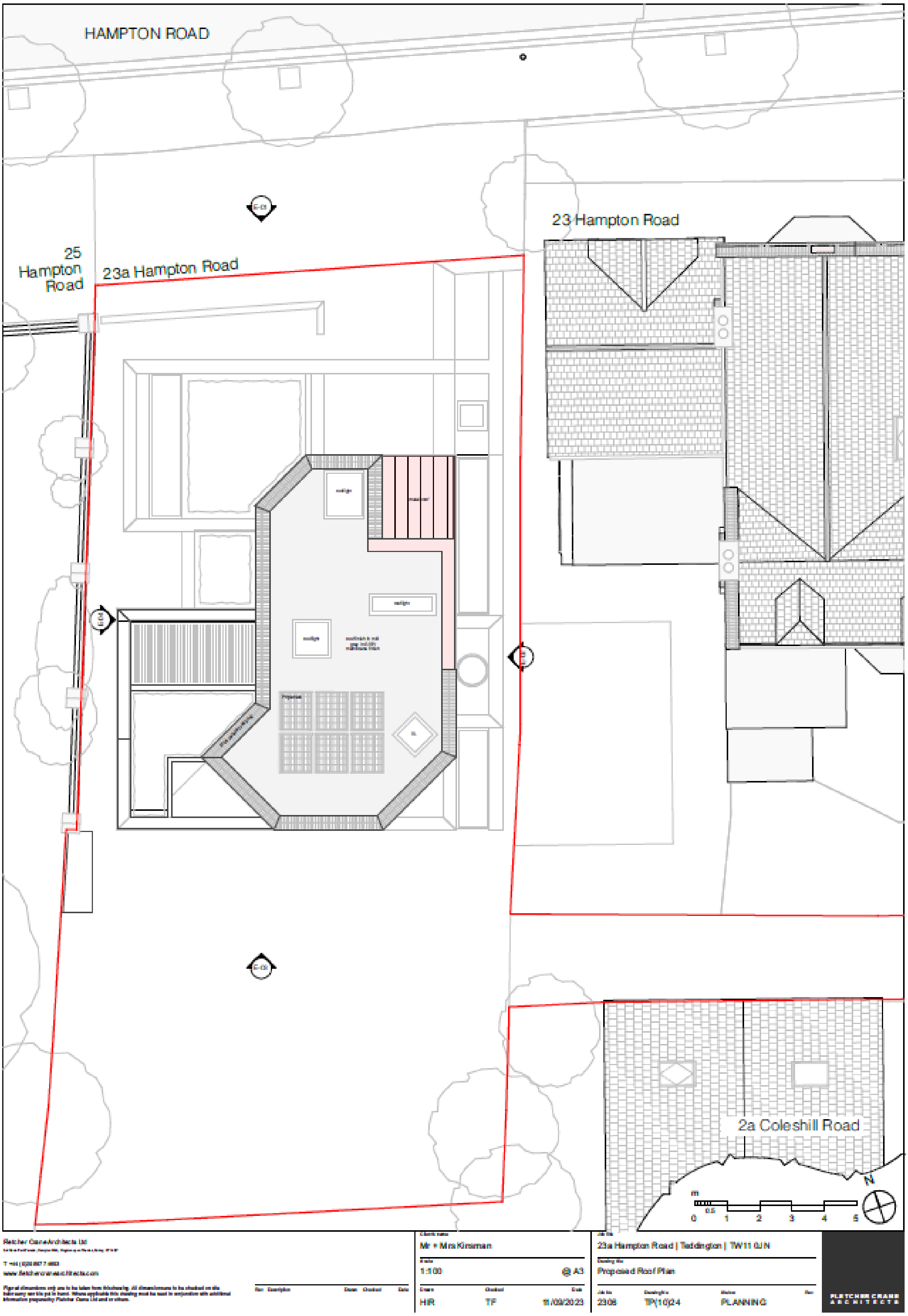


Figure 2.6 – Roof plan

Figure 2.7 – Front elevation

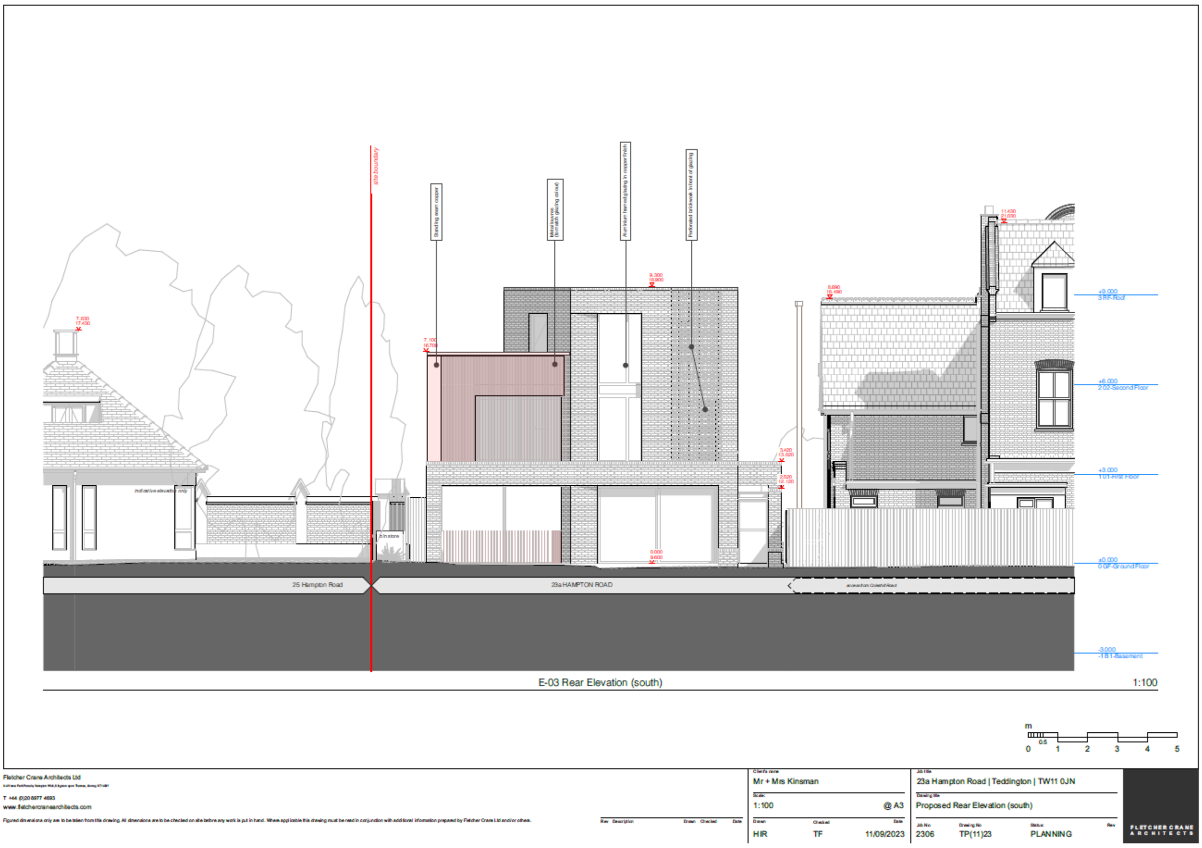


Figure 2.8 – Rear elevation

3.0 Energy Statement

3.1 The Energy Hierarchy

In order to address energy efficiency the design team have adopted the energy hierarchy. The energy hierarchy is generally accepted as the most effective way of reducing a buildings' carbon emissions.

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy
4. Be seen: monitor, verify and report on energy performance

Development proposals should:

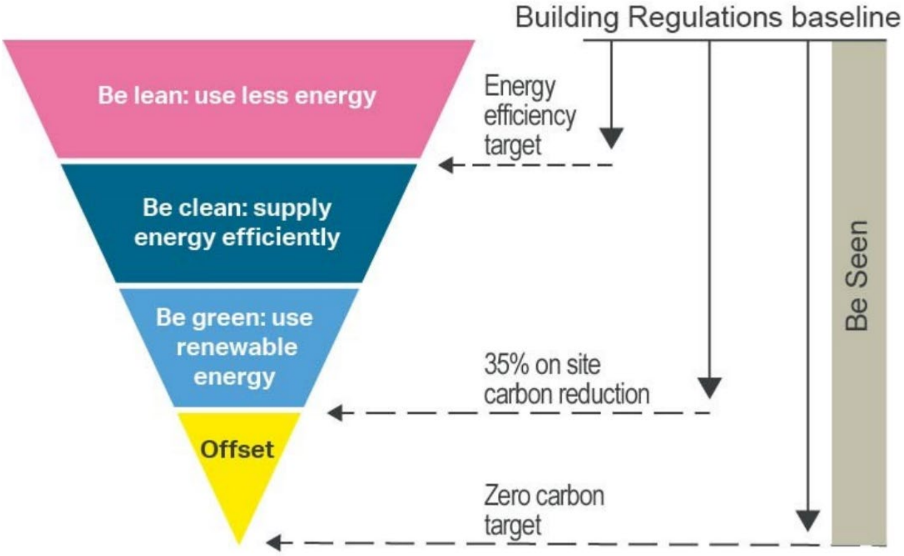


Figure 3.1: The Energy Hierarchy

- ***Reducing energy demand***

  The first step in the process of reducing the overall energy used and CO_2 produced by the building is to minimise the energy required to heat it. A well-insulated building envelope and passive design will reduce the energy requirement for heating and ventilating the building.

- ***Energy efficient systems***

  The second step is to specify services and controls, lighting and appliances that are energy efficient and which result in further reduction in energy requirements.

- ***Making use of Low or zero-carbon (LZC) technologies***

  When the energy demand has been reduced by implementing the processes of improving the fabric and energy efficiency, then LZC technologies can be employed to reduce the environmental impact of the remaining energy consumption.

- ***Monitoring and reporting***

  Ensure comprehensive monitoring and reporting of energy demand and carbon emissions. Major developments are required to undertake this process for at least five years.

3.2 Calculating Baseline Energy Demand

The first step is to calculate a Building Regulations Part L 2021 compliant specification in order to establish baseline emissions for the development. For this development energy modelling has been undertaken using

PHPP10. To model a Building Regulations compliant baseline the PHPP model reflects the development as designed but with the U-Values and building services as per the Part L1 2021 Notional Building. These can be found in Table 3.1, below;

Table 3.1: 'Baseline Specification'

Element	'Baseline' Specification
External Walls	0.18W/m^{2}K
Floors	0.13W/m^{2}K
Roof	0.13W/m^{2}K
Windows	1.40W/m^{2}K
Front Doors	1.00W/m^{2}K
Air Permeability	5.00m^3/m^2/hr
Thermal Bridging	Appendix R values
Ventilation	Mechanical extract (MEV)
Lighting	Low-E lamps throughout
Space Heating	Mains Gas Boiler
DHW	DHW cylinder heated from main heating system
LZC Technology	PV as notional building

To calculate the associated carbon emissions the energy consumption has been taken from the PHPP PER worksheet (before primary energy corrections) and SAP10 carbon factors applied. The results are shown in Table 3.2 below.

Table 3.2: 'Baseline' energy use and carbon emissions

	Regulated Energy Consumption (kWh per annum)	Regulated CO_2 Emissions (Tonnes per annum)	Regulated CO_2 savings	
			(Tonnes per annum)	(%)
Baseline	15,139	4.4		

It should be noted that as PHPP includes for all energy uses in a building, the above figures include for both regulated and unregulated energy and, therefore, carbon. These figures are, therefore, the total operational energy consumption and associated carbon dioxide emissions for the development.

3.3 'Be Lean' – Building Fabric Improvements

The first step of the energy hierarchy looks at reducing energy consumption in the buildings through improvements to their fabric. This reduces the energy required to run the buildings and thus the emissions associated with that energy use.

The new 2021 Part L is already very stringent in terms of fabric performance targets. It can be difficult to achieve further improvements over the fabric specification used for the 'Notional Building'. As such, further opportunities for improvement to the building fabric and services beyond those which meet the current 2021 Building Regulations requirements can be very limited. However, some further improvements are possible by considering the following steps:

- Reduce elemental U-Values
- Reducing heat loss through uncontrolled ventilation (air leakage)
- Address heat loss at junctions (thermal bridging)

The full specification used for modelling at this stage of the energy hierarchy can be found in Table 3.3, below.

Table 3.3: 'Be Lean' Specification

Element	Specification
External Walls	0.17W/m^{2}K
Basement Walls	0.14W/m^{2}K
Flat Roofs	0.13W/m^{2}K
Sloped Roofs	0.13W/m^{2}K
Basement Floor	0.08W/m^{2}K
Exposed Floor	0.22W/m^{2}K
Windows	1.20W/m^{2}K
Front Door	1.20W/m^{2}K
Air Permeability	1.40ACH (n50)
Thermal Bridging	Allowance made as PassivHaus conventions
Ventilation	MVHR
Lighting	LED lamps throughout (100 lumens/watt)
Space Heating	Mains gas combi boiler
DHW	From main heating system
LZC Technology	As per notional building (40% of orthogonal projection)

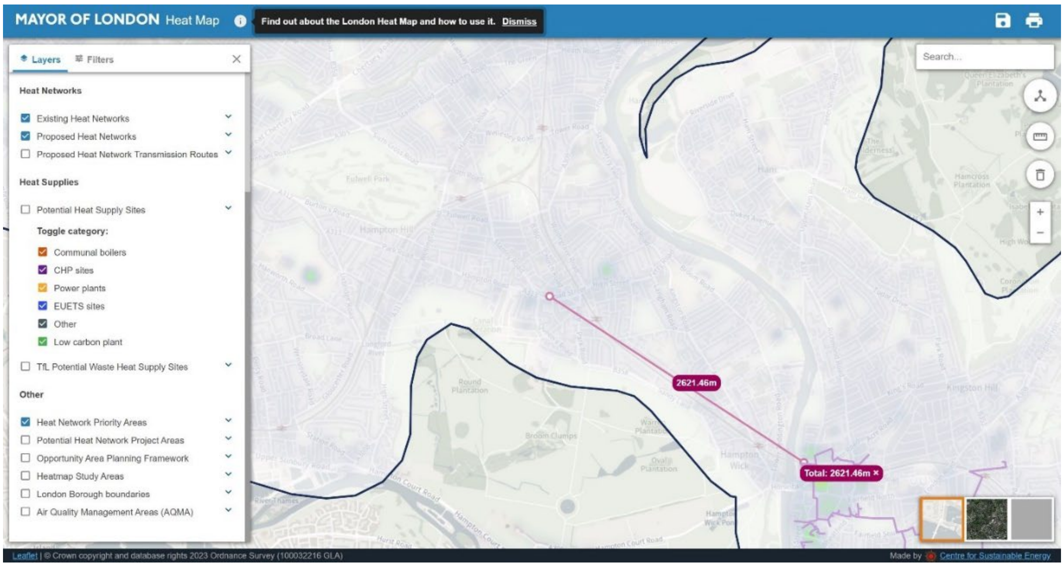
The improved 'Be Lean' carbon dioxide emissions and energy consumption figures as taken from the PHPP models for the above specification are shown in Table 3.4, below, and full details can be found in Appendix 2.

Table 3.4: Total reduction in energy use and carbon emissions

	Regulated Energy Consumption (kWh per annum)	Regulated CO_2 Emissions (Tonnes per annum)	Regulated CO_2 savings	
			(Tonnes per annum)	(%)
Baseline	15,139	4.4		
Be Lean	9,239	3.0	1.4	**31%**

3.4 'Be Clean' – Communal Heating & CHP

London Plan 2021 Policy SI3, Energy Infrastructure, requires that connection to existing decentralised energy networks be considered. According to the Mayor's Heat Map (shown below as Figure 3.2) the site is located within a Heat Network Priority Area. No existing heat networks are shown in close proximity to the development site. There is a proposed heat network shown to the south-east of the site, but this is located almost 3km away on the opposite side of the river Thames.



Heat Networks
☑ Existing Heat Networks
☑ Proposed Heat Networks
☐ Proposed Heat Network Transmission Routes

Heat Supplies
☐ Potential Heat Supply Sites
Toggle category:
☑ Communal boilers
☑ CHP sites
☑ Power plants
☑ EUETS sites
☑ Other
☑ Low carbon plant
☐ TfL Potential Waste Heat Supply Sites

Other
☑ Heat Network Priority Areas
☐ Potential Heat Network Project Areas
☐ Opportunity Area Planning Framework
☐ Heatmap Study Areas
☐ London Borough boundaries
☐ Air Quality Management Areas (AQMA)

Figure 3.2: London Heat Map – 23a Hampton Road

As there is no relevant either existing or proposed DHN in connectable distance to the development site it is not considered to be possible to connect this development to a DHN.

Similarly, it is not considered viable to introduce a communal heating system into this development. The small scale of this would result in significant inefficiencies and the scheme is far too small to utilise CHP or provide an energy centre for surrounding buildings.

As such Table 3.5, below, shows the performance following the 'Be Clean' stage of the energy hierarchy.

Table 3.5: Total reduction in energy use and carbon emissions

	Regulated Energy Consumption (kWh per annum)	Regulated CO_2 Emissions (Tonnes per annum)	Regulated CO_2 savings	
			(Tonnes per annum)	(%)
Baseline	15,139	4.4		
Be Lean	9,239	3.0	1.4	**31%**
Be Clean	9,239	3.0	0.0	**0%**

3.5 'Be Green' – CO_2 Reduction Through the Use of LZC Technologies

This section will examine the available renewable energy generation technologies and determine which is most appropriate for the proposed development.

Available Renewable Generation Technologies

Energy resources accepted as renewable or low carbon technologies are defined by the Department of Energy and Climate Change Low Carbon Buildings Program as:

- Solar photovoltaics
- Wind turbines
- Small hydro
- Solar thermal hot water
- Ground source heat pumps
- Air source heat pumps
- Bio-energy
- Renewable CHP
- Micro CHP (Combined heat and power)

Solar Photovoltaics

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting. When excess power is generated this can be sold back to the grid or stored onsite.

The roof of the proposed development is not large and, although flat, also has rooflights which further reduce the available space for PV. As a result it is unlikely that this technology will be able to provide a significant reduction in energy consumption or carbon emissions for the development. This is, therefore, a suitable technology for the development but will need to be used in combination with another technology to achieve significant energy and carbon reductions.

Wind Turbines

Wind turbines harness the power of the wind and use it to generate electricity. Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines. Urban sites such as the location of this development are generally unsuitable for wind turbine installations due to the interrupted turbulent wind flows caused by surrounding buildings and large obstacles. There are also possible issues with noise and 'flicker' for the neighbouring buildings.

The urban nature of the site and lack of space mean that a wind turbine cannot be recommended as a viable option for this development. There are also general issues surrounding the use of building mounted turbines with the potential for excessive noise and vibration within the building and the effect of flicker on surrounding buildings and amenity spaces.

Table 3.6: Average Wind Speeds

45m above ground level	6.4m/s
25m above ground level	5.8m/s
10m above ground level	5.2m/s

Small Hydro Generation

Hydroelectricity generation uses running water to generate electricity, whether it is a small stream or a larger river. All streams and rivers flow downhill. Before the water flows down the hill, it has potential energy because of its height. Hydro power systems convert this potential energy into kinetic energy in a turbine, which drives a generator to produce electricity. Small, or 'micro' hydro generation requires a reliable source of flowing water with a reasonably constant flow velocity. Systems of this nature are normally installed in locations with a natural moving water source such as a river, stream or spring where part of the flow can be diverted through a generator.

There is no such source of flowing water in this case and small hydro generation is not an option for this development.

Solar Water heating

Solar water heating systems use free heat from the sun to warm domestic hot water. Solar hot water heating can generate a large proportion of a buildings annual DHW requirement. The displaced fuel would be mains gas meaning that the CO_2 savings of this type of system would be relatively low due to the low carbon intensity of the displaced fuel. However, this technology would need sufficient space on the roof for the panels and to provide heat to each apartment would need individual pipework taking down through the building. This technology cannot provide a significant carbon reduction on its own, so combination with another technology would be required. As PV is much simpler and more reliable to integrate into a building this technology is not considered suitable for this development, as the available roofspace would be better used for PV than solar thermal.

Heat Pumps

Heat pumps use similar technology as refrigerators but reversed. A refrigerant liquid is used as a medium to extract heat from a source and convert it into useful heat energy. The heat source used can be generally one of three types; the ground, the air or a body of water. Both ground and water sourced heat pumps use a long circuitous pipe through which a refrigerant is pumped. In ground sourced heat pumps this can be either a coiled pipe or 'slinky' that is buried in a series of horizontal trenches or a loop inside a vertical bore hole to depths that

can be up to 200m or deeper. Water sourced heat pumps generally use a similar system to the ‘slinky’ used for ground sourced systems but either floated on or submerged in a body of water (either a large pool or running water source). Air source heat pumps have a refrigerant coil mounted outside the building through which is passed air so that heat can be extracted. All three types of heat pump generally use the collected heat from the source to heat water. The heated water can then be used for space heating and DHW. Heat pumps require an input of energy to drive pumps, this is usually electricity and so their renewable generation is the difference between the input and output energy. Most have very good efficiencies; energy produced by heat pumps is typically in the region of 2.5 times that which is required to run them, giving efficiencies of 250% and above.

Ground source heat pumps is likely to be difficult to integrate into this site as ground loops will most likely require more space than is available on site. However, air source heat pumps do not need the ground interface and their external condensers could be located on the flat roofs to the rear elevation of the building. As such ASHPs can be considered as a suitable technology for this development.

Bio Energy

The Low Carbon Buildings Program (LCBP) defines biomass as follows:

“Biomass is often called 'bioenergy' or 'biofuels'. These biofuels are produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. Biofuels fall into two main categories:

- *Woody biomass includes forest products, untreated wood products, energy crops, short rotation coppice (SRC), e.g. willow.*
- *Non-woody biomass includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops, e.g. rape, sugar cane, maize.”*

For small-scale domestic [and small scale commercial] applications of biomass the fuel usually takes the form of wood pellets, wood chips and logs. The LCBP goes on to state:

“There are two main ways of using biomass to heat a domestic property:

- *Stand-alone stoves providing space heating for a single room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 5-11 kW in output, and some models can be fitted with a back boiler to provide water heating.*
- *Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW”*

(http://www.lowcarbonbuildings.org.uk/micro/biomass)

This technology is dismissed as the space requirements needed for the boiler and pellet store make this impractical along with complying with clean air zone requirements.

‘Be Green’ Modelled Performance

As identified above, PV and ASHPs have been identified as the most suitable technologies for this development. These will generate renewable electricity and also renewable heat for both space & hot water heating. The combination of this technology and the fabric specification detailed in the ‘Be Lean’ step results in a final specification for the scheme as shown in Table 3.7, below.

Table 3.7: 'Be Breen' Specification	
Element	**Specification**
External Walls	0.17W/m^{2}K
Basement Walls	0.14W/m^{2}K
Flat Roofs	0.13W/m^{2}K
Sloped Roofs	0.13W/m^{2}K
Basement Floor	0.08W/m^{2}K
Exposed Floor	0.22W/m^{2}K
Windows	1.20W/m^{2}K
Front Door	1.20W/m^{2}K
Air Permeability	1.40ACH (n50)
Thermal Bridging	Allowance made as PassivHaus conventions
Ventilation	MVHR
Lighting	LED lamps throughout (100 lumens/watt)
Space Heating	ASHP
DHW	From main heating system
LZC Technology	1.6kWp of PV

The improved 'Be Green' carbon dioxide emissions and energy consumption figures as taken from the PHPP model for the above specification are shown in Table 3.8, below, and full details can be found in Appendix 3.

Table 3.8: Total reduction in energy use and carbon emissions				
	Regulated Energy Consumption (kWh per annum)	**Regulated CO_2 Emissions (Tonnes per annum)**	**Regulated CO_2 savings**	
			(Tonnes per annum)	**(%)**
Baseline	15,139	4.4		
Be Lean	9,239	3.0	1.4	**31%**
Be Clean	9,239	3.0	0.0	**0%**
Be Green	8,398	1.1	1.9	**43%**
Cumulative on site savings	**6,580**		**3.3**	**74%**

3.6 M & E Specification Information

Heat Pump Details

Paragraph 10.9 of the GLA Energy Assessment Guidance (June 2022) document requires that specific information is provided when Heat Pumps are proposed for a development.

SCOP/SEER

For the purposes of this report the 'Be Green' PHPP modelling has used the 'Default' values taken from PHPP10 for a standard air to water heat pump. This is due to the stage of design development not having identified a specific make or model of ASHP at time of writing.

Although no specific models have been designed at this stage a suitable unit for this development would be something like the Mitsubishi Ecodan. Product information and MCS certification for this unit can be found in Appendix 4.

Integration with other heating/cooling technologies

No other heating technologies are proposed for this development – it is proposed that 100% of the space heating demand for the entire development will be provided by ASHPs.

The DHW will also be provided by the ASHP through the heating of a dedicated cylinder. This will be provided with an immersion backup and the impact of this has been modelled through the PHPP calculations.

Installation & minimum efficiencies

The proposed location of the external condensers is on either the rear elevation or the roof. Although no specific heat pump has been specified for performance purposes the dimensions of the condensers would be expected to be no larger than those of a Mitsubishi Ecodan. Full details of this, in terms of the manufacturer's data sheet and confirmation of the MCS certification can also be found in Appendix 4 to this report.

Information Provision

Full details of the installation, controls, instructions for operation and details of the required maintenance regime will be provided to the occupants via their Home User Guide.

PV Details

Paragraph 10.10 of the GLA Energy Assessment Guidance (April 2020) document requires that specific information is provided when PV is proposed for a development.

Available Roofspace

The suitability of the roof for PV has been assessed. This identifies that, after allowing space for the rooflights, access for maintenance, 'mansafe' fall arrest and an allowance for a green roof that a total of 6 PV panels could be provided.

The roof level of the proposed building is the same height as the surrounding ridges/roofs of the existing buildings, so there should be no shading issues.

A drawing showing an indicative layout for the roof, showing the location of the PV panels can be found as Figure 3c below.

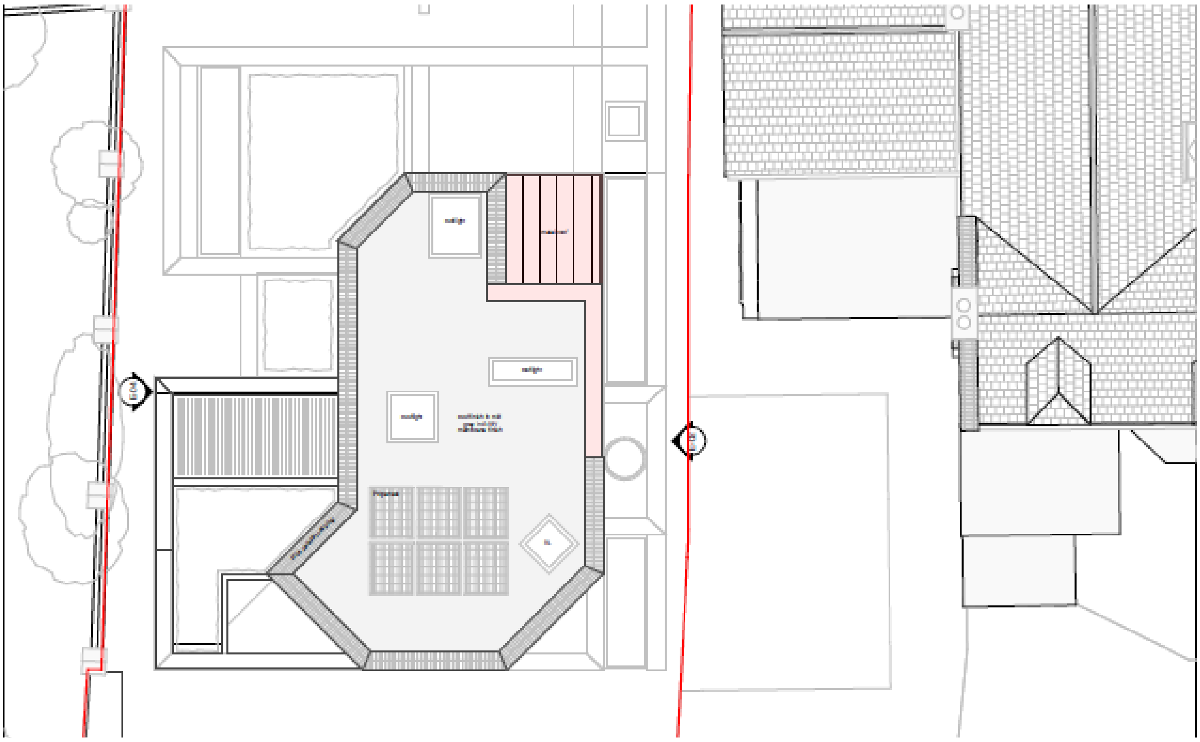


Figure 3c: Roof layout, showing PV location

Estimated Performance

This would give a potential array size of 1.6kWp (based on 400Wp panels) with a total array size of around 9.6m^2. This would be expected to generate around 1,690kWh per year (using PHPP's modelling approach for panels oriented due south at an elevation of 0°). This would save, based on the same carbon factors as used in this report, a total of 0.23t/CO_2/year.

3.6 EUI, space heating demand & FEES

As required by the June 2022 updated guidance for the production of energy statements, the Energy Use Intensity (EUI), space heating demand and FEES performance should all be calculated and documented as part of the Energy Statement.

For this report all of these have been calculated using the same PHPP model as the energy and CO_2 consumption. This information can be found in Table 3.9, below.

Table 3.9: EUI, space heating demand & FEES

Building Type	Energy Use Intensity (kWh/m^2/year, excluding renewable energy)	Space Heating Demand (kWh/m^2/year, excluding renewable energy)	Design Fabric Energy Efficiency (FEES)
Residential	32	36	36.2
Target	35	15	62.0

FEES
Although PHPP doesn't include the Part L calculation for FEES this can still be determined from the information within PHPP. As FEES is defined as the space heating and cooling requirements per square metre of floor area, this information can be extracted from the relevant PHPP models. The target FEE in the above table is the space heating demand taken from the 'Baseline' PHPP verification worksheet provided in Appendix 1 to this report. The as designed FEE in the above table is the space heating demand taken from the 'Be Green' PHPP verification worksheet provided as Appendix 3 to this report. This is around an 40% improvement over the notional/baseline target.

EUI
Energy Use Intensity (EUI) is defined as an annual measure of the total energy consumed within a building. This, therefore, is the total of both regulated and unregulated energy consumption. However, it does not include energy used for electric vehicle charging or any reductions due to on-site renewable energy generation. This total is then divided by the Gross Internal Area (GIA) to be expressed in kWh/m^2/year.

The regulated and unregulated energy consumption for the proposed development has been taken from the 'Be Green' PHPP PER worksheet provided in Appendix 3 to this report. This gives a total of 10,008Wh/year – and accounts for all energy used for space heating, DHW, ventilation, lighting, cooling, cooking, appliances and small power in the development. This equates to an EUI of 32.4 kWh/m^2/year.

Space Heating Demand
The space heating demand has been taken directly from the space heating demand box 'Be Green' PHPP verification worksheet as provided in Appendix 3 to this report.

4.0 Running Costs

Section 3 of this report has identified the proposed energy strategy for the development. This section of the report will detail the steps that have been taken to protect the individual occupants/consumers from high energy costs.

In line with the energy hierarchy the proposed development has prioritised energy demand reduction as the main means by which this will be done. The proposed building fabric exceeds the requirements of the 2021 Part L by a significant margin. This will ensure that the energy consumption of the development is reduced, limiting the impact of any price rises or energy cost increases in future.

No communal heating system has been specified for this development. The use of these systems can lock building occupants into restrictive contracts for space heating, where there is no ability for occupants to 'shop around' for different suppliers. In addition there is sometimes no ability for occupants to even turn off heating systems, depending on the specific billing arrangements. Ensuring that each unit has an individual electricity connection and meter gives the occupants the greatest flexibility to use only the energy they require and access the most competitive energy tariffs available on the market.

5.0 Water Consumption

Water is a precious commodity even in the UK and with ever increasing demand for clean drinking water measures need to be taken to safeguard future supplies.

Approximately 50% of the water consumed in domestic dwellings is not used for consumption, (the percentage is even higher in many commercial buildings) it is for washing and flushing of toilets etc. Measures to reduce the amount of potable water used for these activities reduce the demand for potable water and make better use of this limited resource.

In line with the requirement of London Plan 2021 policy SI5 water use in the residential units will be reduced to at least 105l/person/day (which excludes the allowance of 5l/person/day for external water use). This reduction in water use will be achieved through specification of water use fittings that do not exceed the following specification;

Taps (other than kitchen taps)		6.00(litres/min)
Kitchen Taps		10.00(litres/min)
Showers		8.00(litres/min)
Baths (with shower over)		170(litres to overflow)
WCs (Flush Volume)	Full Flush:	4.00(litres)
	Part Flush:	2.60(litres)
Washing Machine		8.17(litres/kg dry load)
Dishwasher		1.25(litres/place setting)

For full details of the consumption of this specification please see Appendix 5 to this report.

6.0 Overheating

As the energy modelling has been carried out using PHPP, a detailed overheating assessment has also been undertaken. This gives a frequency of overheating, following the PassivHaus methodology, of 7%. This is equal to the PassivHaus Classic compliance threshold of 7%, which meets the PassivHaus criteria, so it can be taken that the proposed development should not be at significant risk of overheating.

However, in order to demonstrate how the development has applied the cooling hierarchy the Good Homes Alliance Overheating Risk Tool has been used. The completed tool can be found in Appendix 6, but a summary of the key factors likely to increase the likelihood of overheating can be found below;

- The site is located in the Greater London area of the South East of England
- The site does not have any specific characteristics other than security considerations that would require windows to be closed or non-openable. As such there will likely be barriers to opening ground floor windows during the day. However, there are several windows that are provided with secure shading in the form of perforated brickwork or slatted screens, so it seems possible to have sufficient windows openable overnight to ventilate all areas of the building as necessary.
- The development is for a multiple storey house, not a flat.
- No community heating is proposed for the development.
- The amount of glazing on the south facade of the development does not exceed 35%.
- The development is dual aspect so enables cross-ventilation

Similarly, the counterbalancing factors that reduce the likelihood of overheating can be found in the completed tool, but a summary of those proposed for the development can be found below.

- Windows will be designed to provide large opening areas to help dissipate heat – the opening areas of these will provide at least a 100% increase in the purge ventilation provision required by Part F (2021).

The result of this is that the GHA tool also estimates a low likelihood of overheating.

7.0 Embodied Carbon

In order to assess the impact of the replacement of an existing dwelling with a new construction an embodied carbon assessment has been undertaken of the proposed development. Full details of this can be found in Appendix 7 to this report.

In order to assess the carbon benefit the operational energy performance of the existing building on the site needs to be taken into account. This has been done by extracting the energy performance information from the existing EPC. This can be found on the EPC register for England at the following link; https://find-energy-certificate.service.gov.uk/energy-certificate/9617-2287-2002-0304-2506. The EPC provides information on the current space and hot water heating demand, but the additional energy required for lighting, ventilation and cooking/appliances (to make the data comparable with that generated from PHPP) has been estimated using SAP & PHPP based on the floor area of the existing dwelling. This gives the following energy and, using SAP10 carbon factors, CO_2 emissions.

Table 7.1: Existing energy & CO_2 consumption – 23a Hampton Road

Energy Use	Energy Consumption (kWh)	Carbon Emissions (kg/year)
Space Heating	20,588	4,787
DHW	2,172	506
Lighting & Ventilation	436	59
Unregulated Energy	2122	289

The embodied carbon emissions associated with the proposed development have been calculated using PHRibbon using the dimensional data taken from the PHPP model. This closely follows the RICS guidelines. As detailed design hasn't been completed for this development we have modelled two options, one with masonry cavity construction for the above ground walls and an alternative with a timber frame for the above ground walls. To provide a comparison with current standard practice the performance has been compared to the 'baseline' embodied carbon as outlined in the LETI Embodied Carbon Primer[1]. This gives a 'business as usual' embodied carbon performance of $800kgCO_2e/m^2$. The results of the modelling, and a performance comparison with the LETI baseline target can be found in Table 7.2, below.

Table 7.2: Embodied carbon – 23a Hampton Road

Option	Embodied carbon ($kgCO_2e/m^2$)	Reduction over LETI 'business as usual'
Option 1 (masonry)	646.9	19%
Option 2 (timber frame)	574.5	28%

To calculate the expected carbon benefit we have determined the net operational energy reduction that would be expected. This is the operational energy consumption of the existing building less the operational energy consumption of the replacement. This gives an annual decrease in carbon emissions of $4,290kg/CO_2$. This, over the same 60 year design life as the embodied carbon calculations, gives a total reduction in operational CO_2 of $257,391kg/CO_2$.

Therefore, the expected carbon payback periods for the two options (as modelled they both can achieve the same operational energy and carbon performance) is as per Table 7.3, below.

Table 7.3: Carbon payback – 23a Hampton Road

Option	Embodied Carbon ($kgCO_2$)	Reduction in Operational Carbon (kg/CO_2)	Carbon Payback (years)
Option 1 (masonry)	199,892	257,391	47
Option 2 (timber frame)	177,521	257,391	41

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[1] https://www.leti.uk/ecp - figure 7.1, page 24

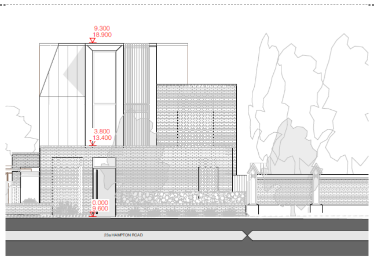
This shows that the replacement dwelling does achieve a carbon payback across the standard 60 year design life of the building. In reality this building would be expected to last significantly longer than 60 years, and so the carbon benefit of replacing the existing dwelling would be significantly greater than calculated above.

Appendix 1

‘Notional/Baseline’ PHPP

10.4a EN

Passive House-Verification



E-05 Street Elevation

Building:	23a Hampton Road 'Baseline'	
Street:	Hampton Road	
Postcode/City:	TW11 0JN	Teddington
Province/Country:	London	GB-United Kingdom/ Britain
Building type:	1-Freestanding single family house	
Climate data set:	GB0027a-Northolt, Altitude corrected, +1K summer correction	
Climate zone:	4: Warm-temperate	Altitude of location: 10 m

Home owner / Client:	Mr & Mrs Kinsman	
Street:		
Postcode/City:		
Province/Country:		

Architecture:	Fletcher Crane	
Street:	44 Union St,	
Postcode/City:	KT1 1RP	Kingston upon Thames
Province/Country:	London	GB-United Kingdom/ Britain

Mechanical engineer:	TBC	
Street:		
Postcode/City:		
Province/Country:		

Energy consultancy:	MES Building Solutions	
Street:	Newark Beacon, Cafferata Way	
Postcode/City:	NG24 2TN	Newark
Province/Country:	Nottinghamshire	GB-United Kingdom/ Britain

Certification:	TBC	
Street:		
Postcode/City:		
Province/Country:		

Year of construction:	2023	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) winter [W/m^2]:	2.3	IHG summer [W/m²]:	2.3
No. of occupants:	3.2	Specific heat capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

							Fullfilled?^{2}
	Treated floor area	m²	308.9		Criteria	Alternative criteria	
Space heating	Heating demand	kWh/(m²a)	62	≤	15	-	No
	Heating load	W/m²	33	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-		-
	Frequency of overheating (> 25 °C)	%	8	≤	10		Yes
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	20		Yes
Airtightness	Pressurisation test result n_{50}	1/h	5.0	≤	0.6		No
Moisture protection							
	Smallest temperature factor $f_{Rsi=0.25\ m^2K/W}$	-	0.75	≥	0.37	0.19	Yes
Thermal comfort	All requirements fulfilled?	-					No
	0.18	W/(m²K)		≤	1.23		
	0.13	W/(m²K)		≤	1.46		
	0.13	W/(m²K)		≤	1.60		
	0.13	W/(m²K)		≤	0.67		
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	101	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	139	≤	60	75	No
	Renew. energy generation (in rel. to projected building footprint area)	kWh/(m²a)	71	≥	-	28	

I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive house Classic? No

Task:	First name:	Surname:	Signature:
	Tom	Reynolds	
Certificate-ID	Issued on:	City:	

Project data imported from designPH 1.1.55

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Primary Energy Renewable PER

23a Hampton Road 'Baseline' / Climate: Northolt / TFA: 309 m^2 / Heating: 62.2 kWh/(m^2a) / Overheating: 8 % / PER: 139.4 kWh/(m^2a)

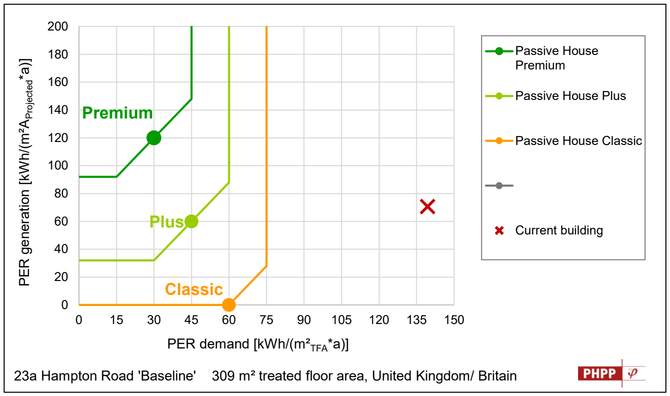
Selection of the heat generation system	**Contribution (useful energy)**		
	Heating	**DHW**	
4-Heating boiler	100%	100%	
-			
-			
-			
Additionally:			
Solar thermal	0.0	0.0	kWh/(m^2a)

Building type:	1-Freestanding single family house	
Treated floor area A_{TFA}:	309	m^2
Projected building footprint $A_{Projected}$:	166	m^2
Heating demand incl. distribution & hydr. frost protection	65.0	kWh/(m^2a)
Cooling energy demand incl. dehumidification		kWh/(m^2a)
DHW demand including distribution:	11.0	kWh/(m^2a)
Biomass contingent (PER):	20	kWh/(m^2a)

Energy demand referred to treated floor area	**Efficiency** Calcula-tion	 User defined	**Useful energy** **Covered fraction**	**Final energy** **demand**	**PER** PER factor	 **PER demand**	**PE** PE factor	 PE demand	**CO$_2$** Emission factor (CO$_2$-eq)	 CO$_2$eq emissions	
	-	-		kWh/(m^2a)	kWh/kWh	kWh/(m^2a)	kWh/kWh	kWh/(m^2a)	kg/kWh	kg/a	
							1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)		
Heating			100%								
Electricity (HP compact unit)					1.65		1.50		0.363		
Electricity (heat pump)					1.65		1.50		0.363		
Other (heating)					1.65		1.50		0.363		
Boiler Condensing Natural gas	0.97		100%	66.9	1.75	117.1	1.10	73.6	0.250	5170	
District heating					0.91		0.30		0.000		
Solar thermal system											
Aux. electricity (heating, wintertime ventilation)				1.6	1.65	2.7	1.50	2.4	0.363	182	
Total heating						**119.8**		**76.1**		**5352**	
Cooling and dehumidification					**PER**		**PE**		**CO$_2$**		
Electricity cooling (HP)					1.00		1.50		0.363		
Electricity dehumidification (HP)					1.15		1.50		0.363		
Auxiliary electricity cooling, ventilation summer				0.7	1.00	0.7	1.50	1.1	0.363	83.5	
Auxiliary electricity (dehumidification)					1.15		1.50		0.363		
Total cooling and dehumidification						**0.74**		**1.12**		**83.54**	
DHW generation			100%		**PER**		**PE**		**CO$_2$**		
Electricity (HP compact unit)					1.30		1.50		0.363		
Electricity (heat pump)					1.30		1.50		0.363		
Electricity (direct)					1.30		1.50		0.363		
Boiler Condensing Natural gas	0.89		100%	12.3	1.75	21.5	1.10	13.5	0.250	948	
District heating					0.88		0.30		0.000		
Solar thermal system											
Aux. electricity (DHW + solar DHW)				0.1	1.30	0.2	1.50	0.2	0.363	14	
Total DHW						**21.6**		**13.7**		**962**	
Household electricity + Auxiliary electricity (other)					**PER**		**PE**		**CO$_2$**		
Household electricity (lighting, electrical devices, etc.)				6.9	1.30	9.0	1.50	10.4	0.363	777	
Auxiliary electricity (other)					1.30		1.50		0.363		
Total household electricity and auxiliary electricity						**9.0**		**10.4**		**777**	
Additional gas demand					**PER**		**PE**		**CO$_2$**		
Drying/Cooking				0.0	1.75	0.0	0.00	0.0	0.000		
Total additional gas demand						**0.00**		**0.00**		**0**	
Total PER demand without bioenergy budget						**151.2**					
Bioenergy utilisation						**-11.8**	The bioenergy budget will be used with 20 kWh/(m^2a).				
Total energy demand kWh/(m^2_{TFA} a)					**PER:**	**139.4**	**PE:**	**101.3**	**CO$_2$:**	**7174**	kg/a

Energy generation **referred to projected building footprint**		**Final energy** Final energy generation	 **Final energy generation**	**PER** PER factor	 **PER generation**	**PE** PE factor	 PE generation	**CO$_2$** Emission factor (CO$_2$-eq)	 Emissions generated	 Emissions saved
		kWh/a	**kWh/($m^2A_{Projected}$*a)**	kWh/kWh	kWh/($m^2A_{Projected}$a)	kWh/kWh	kWh/($m^2A_{Projected}$a)	kg/kWh	kg/a	kg/a
PV electricity		11704	70.7	1.00	70.7	0.00	0.0	0.13 I 0.363	1522	2727
Solar thermal system		0	0.0	-	0.0	0.00	0.0			
			0.0							
Total energy production kWh/($m^2_{\text{Projected building footprint}}$ a)				**PER:**	**70.70**	**PE:**	**0.00**	**CO$_2$:**	**1522**	**2727**

Verification Passive House/EnerPHit standard



23a Hampton Road 'Baseline' 309 m² treated floor area, United Kingdom/ Britain

Classes in subdivisions:				PHI Criteria Low Energy Building	Criteria Passive House :			Achieved class
	Current value:				Classic	Plus	Premium	
Heating demand referred to TFA	**62**	kWh/(m²a)	≤	30	15			PHI Low Energy Building
Heating load referred to TFA	**33**	W/m²	≤	-	10			
Cooling and dehumidification demand referred to TFA	**-**	kWh/(m²a)	≤	-	-			-
Airtightness n_{50}	**5.0**	1/h	≤	1	0.6			Not achieved
PER demand referred to TFA	**139**	kWh/(m²a)	≤	75	60	45	30	Not achieved
PER generation referred to projected building footprint	**71**	kWh/(m²a)	≥	-	0	60	120	
PE demand (non-renewable primary energy)	**101**	kWh/(m²a)	≤	85	85			Not relevant

Energy standard of the whole building

With the selected verification method PER (renewable) the following class can be reached: **Not achieved**

Standard criteria

Summary

Different final energy sources are added up here. Though this is not scientifically correct, it is required by other single verifications.

	Final energy	**PER (renewable primary energy)**	**PE (non-renewable primary energy)**	**CO2eq emissions**	**CO$_2$eq substitution**
			1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	**27.4**	**43.1**	31.29	7174	7174
Generation	**-11.7**	**-11.7**	0.00	1522	-2727
Cumulated demand and generation (annual balance)	**15.68**	**31.36**	31.29	8696	4447
Demand without occupant electricity consumption	25.24	40.28	28.08	-232748	-232748
Demand without occupant electricity consumption, accumulated generation	13.54	28.58	28.08	-231227	-235475

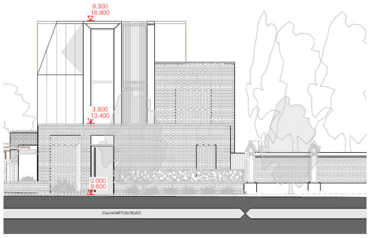
Appendix 2

‘Be Lean’ PHPP

Passive House-Verification

10.4a EN

PHPP



E-05 Street Elevation

Building:	23a Hampton Road 'Be Lean'	
Street:	Hampton Road	
Postcode/City:	TW11 0JN	Teddington
Province/Country:	London	GB-United Kingdom/ Britain
Building type:	1-Freestanding single family house	
Climate data set:	GB0027a-Northolt, Altitude corrected, +1K summer correction	
Climate zone:	4: Warm-temperate	Altitude of location: 10 m
Home owner / Client:	Mr & Mrs Kinsman	
Street:		
Postcode/City:		
Province/Country:		

Architecture:	Fletcher Crane	
Street:	44 Union St,	
Postcode/City:	KT1 1RP	Kingston upon Thames
Province/Country:	London	GB-United Kingdom/ Britain
Energy consultancy:	MES Building Solutions	
Street:	Newark Beacon, Cafferata Way	
Postcode/City:	NG24 2TN	Newark
Province/Country:	Nottinghamshire	GB-United Kingdom/ Britain

Mechanical engineer:	TBC	
Street:		
Postcode/City:		
Province/Country:		
Certification:	TBC	
Street:		
Postcode/City:		
Province/Country:		

Year of construction:	2023	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) winter [W/m^2]:	2.3	IHG summer [W/m²]:	2.3
No. of occupants:	3.2	Specific heat capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?^{2}
	Treated floor area	m²	308.9				
Space heating	Heating demand	kWh/(m²a)	**36**	≤	15	-	**No**
	Heating load	W/m²	**19**	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	**-**	≤	-		**-**
	Frequency of overheating (> 25 °C)	%	**10**	≤	10		**Yes**
	Frequency of excessively high humidity (> 12 g/kg)	%	**0**	≤	20		**Yes**
Airtightness	Pressurisation test result n_{50}	1/h	**1.4**	≤	0.6		**No**
Moisture protection							
	Smallest temperature factor $f_{Rsi=0.25\ m^2K/W}$	-	**0.75**	≥	0.37	0.19	**Yes**
Thermal comfort	All requirements fulfilled?	-					**No**
	0.17	W/(m²K)		≤	1.23		
	0.13	W/(m²K)		≤	1.46		
	0.14	W/(m²K)		≤	1.60		
	0.11	W/(m²K)		≤	0.67		
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	**82**	≤	-		**-**
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	**108**	≤	60	75	**No**
	Renew. energy generation (in rel. to projected building footprint area)	kWh/(m²a)	**71**	≥	-	28	

I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive house Classic? **No**

Task:	First name:	Surname:	Signature:
	Tom	Reynolds	

Certificate-ID	Issued on:	City:

Project data imported from designPH 1.1.55

-

Primary Energy Renewable PER

23a Hampton Road 'Be Lean' / Climate: Northolt / TFA: 309 m² / Heating: 36.2 kWh/(m²a) / Overheating: 10 % / PER: 107.5 kWh/(m²a)

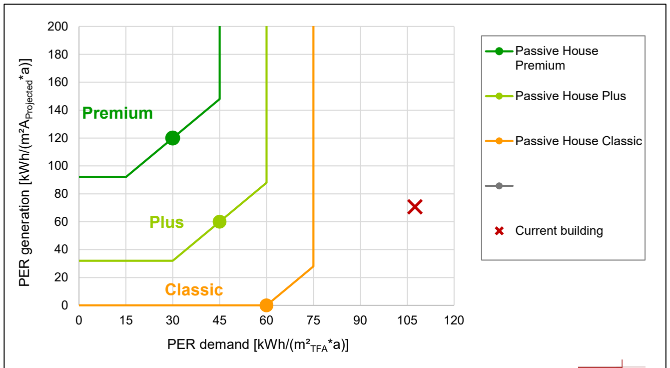
Selection of the heat generation system	Contribution (useful energy) Heating	DHW	
4-Heating boiler	100%	100%	
-			
-			
-			
Additionally:			
Solar thermal	0.0	0.0	kWh/(m²a)

Building type:	1-Freestanding single family house	
Treated floor area A_{TFA}:	309	m²
Projected building footprint $A_{Projected}$:	166	m²
Heating demand incl. distribution & hydr. frost protection	46.1	kWh/(m²a)
Cooling energy demand incl. dehumidification		kWh/(m²a)
DHW demand including distribution:	11.0	kWh/(m²a)
Biomass contingent (PER):	20	kWh/(m²a)

Energy demand	**Efficiency**		**Useful energy**	**Final energy**	**PER**		**PE**		**CO_2**	
referred to treated floor area	Calcula-tion	User defined	**Covered fraction**	**demand**	PER factor	**PER demand**	PE factor	PE demand	Emission factor (CO_2-eq)	CO_2eq emissions
	-	-		kWh/(m²a)	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a
							1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)	
Heating			100%							
Electricity (HP compact unit)					1.65		1.50		0.363	
Electricity (heat pump)					1.65		1.50		0.363	
Other (heating)					1.65		1.50		0.363	
Boiler Condensing Natural gas	0.96		100%	47.7	1.75	83.6	1.10	52.5	0.250	3687
District heating					0.91		0.30		0.000	
Solar thermal system										
Aux. electricity (heating, wintertime ventilation)				2.5	1.65	4.2	1.50	3.8	0.363	282
					Total heating	**87.7**		**56.3**		**3969**
Cooling and dehumidification					**PER**		**PE**		**CO_2**	
Electricity cooling (HP)					1.00		1.50		0.363	
Electricity dehumidification (HP)					1.15		1.50		0.363	
Auxiliary electricity cooling, ventilation summer				0.7	1.00	0.7	1.50	1.1	0.363	83.5
Auxiliary electricity (dehumidification)					1.15		1.50		0.363	
					Total cooling and dehumidification	**0.74**		**1.12**		**83.54**
DHW generation			100%		**PER**		**PE**		**CO_2**	
Electricity (HP compact unit)					1.30		1.50		0.363	
Electricity (heat pump)					1.30		1.50		0.363	
Electricity (direct)					1.30		1.50		0.363	
Boiler Condensing Natural gas	0.88		100%	12.4	1.75	21.7	1.10	13.7	0.250	959
District heating					0.87		0.30		0.000	
Solar thermal system										
Aux. electricity (DHW + solar DHW)				0.1	1.30	0.2	1.50	0.2	0.363	14
					Total DHW	**21.9**		**13.8**		**972**
Household electricity + Auxiliary electricity (other)					**PER**		**PE**		**CO_2**	
Household electricity (lighting, electrical devices, etc.)				6.9	1.30	9.0	1.50	10.4	0.363	777
Auxiliary electricity (other)					1.30		1.50		0.363	
					Total household electricity and auxiliary electricity	**9.0**		**10.4**		**777**
Additional gas demand					**PER**		**PE**		**CO_2**	
Drying/Cooking				0.0	1.75	0.0	0.00	0.0	0.000	
					Total additional gas demand	**0.00**		**0.00**		**0**
Total PER demand without bioenergy budget						**119.3**				
Bioenergy utilisation						**-11.8**	The bioenergy budget will be used with 20 kWh/(m²a).			
Total energy demand kWh/(m^2_{TFA} a)					**PER:**	**107.5**	**PE:**	**81.6**	**CO_2:**	**5802** kg/a

Energy generation	**Final energy**		**PER**		**PE**		**CO_2**		
referred to projected building footprint	Final energy generation	**Final energy generation**	PER factor	**PER generation**	PE factor	PE generation	Emission factor (CO_2-eq)	Emissions generated	Emissions saved
	kWh/a	**kWh/($m^2A_{Projected}$*a)**	kWh/kWh	kWh/($m^2A_{Projected}$a)	kWh/kWh	kWh/($m^2A_{Projected}$a)	kg/kWh	kg/a	kg/a
PV electricity	11704	70.7	1.00	70.7	0.00	0.0	0.13 I 0.363	1522	2727
Solar thermal system	0	0.0	-	0.0	0.00	0.0			
		0.0							
Total energy production kWh/($m^2_{Projected\ building\ footprint}$ a)			**PER:**	**70.70**	**PE:**	**0.00**	**CO_2:**	**1522**	**2727**

Verification Passive House/EnerPHit standard



23a Hampton Road 'Be Lean' 309 m² treated floor area, United Kingdom/ Britain

Classes in subdivisions:	Current value:			PHI Criteria Low Energy Building	Criteria Passive House : Classic	Plus	Premium	Achieved class
Heating demand referred to TFA	**36**	kWh/(m²a)	≤	30		15		PHI Low Energy Building
Heating load referred to TFA	**19**	W/m²	≤	-		10		
Cooling and dehumidification demand referred to TFA	**-**	kWh/(m²a)	≤	-		-		-
Airtightness n_{50}	**1.4**	1/h	≤	1		0.6		Not achieved
PER demand referred to TFA	**108**	kWh/(m²a)	≤	75	60	45	30	Not achieved
PER generation referred to projected building footprint	**71**	kWh/(m²a)	≥	-	0	60	120	
PE demand (non-renewable primary energy)	**82**	kWh/(m²a)	≤	85		85		Classic
Energy standard of the whole building				**With the selected verification method PER (renewable) the following class can be reached:**				**Not achieved**

Standard criteria

Summary Different final energy sources are added up here. Though this is not scientifically correct, it is required by other single verifications.	**Final energy** MWh/a	**PER (renewable primary energy)** MWh/a	**PE (non-renewable primary energy)** 1-PE factors (non-renewable) PHI Certification MWh/a	**CO2eq emissions** 1-CO2 factors GEMIS (Germany) kg/a	**CO$_2$eq substitution** 1-CO2 factors GEMIS (Germany) kg/a
Demand	**21.8**	**33.2**	25.22	5802	5802
Generation	**-11.7**	**-11.7**	0.00	1522	-2727
Cumulated demand and generation (annual balance)	**10.06**	**21.51**	25.22	7323	3075
Demand without occupant electricity consumption	19.63	30.43	22.01	-234121	-234121
Demand without occupant electricity consumption, accumulated generation	7.92	18.73	22.01	-232599	-236848

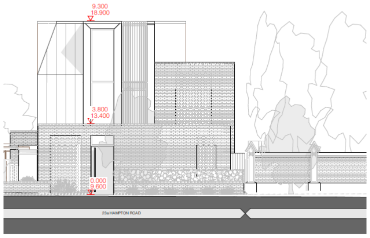
Appendix 3

‘Be Green’ PHPP

10.4a EN

Passive House-Verification

PHPP



E-05 Street Elevation

Building: 23a Hampton Road 'Be Green'
Street: Hampton Road
Postcode/City: TW11 0JN | Teddington
Province/Country: London | GB-United Kingdom/ Britain
Building type: 1-Freestanding single family house
Climate data set: GB0027a-Northolt, Altitude corrected, +0K summer correction
Climate zone: 4: Warm-temperate | Altitude of location: 10 m

Home owner / Client: Mr & Mrs Kinsman
Street:
Postcode/City:
Province/Country:

Architecture: Fletcher Crane
Street: 44 Union St,
Postcode/City: KT1 1RP | Kingston upon Thames
Province/Country: London | GB-United Kingdom/ Britain

Mechanical engineer: TBC
Street:
Postcode/City:
Province/Country:

Energy consultancy: MES Building Solutions
Street: Newark Beacon, Cafferata Way
Postcode/City: NG24 2TN | Newark
Province/Country: Nottinghamshire | GB-United Kingdom/ Britain

Certification: TBC
Street:
Postcode/City:
Province/Country:

Year of construction: 2023
No. of dwelling units: 1
No. of occupants: 3.2

Interior temperature winter [°C]: 20.0
Internal heat gains (IHG) winter [W/m^2]: 2.3
Specific heat capacity [Wh/K per m² TFA]: 60

Interior temp. summer [°C]: 25.0
IHG summer [W/m²]: 2.3
Mechanical cooling:

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?^{2}
	Treated floor area	m²	308.9				
Space heating	Heating demand	kWh/(m²a)	**37**	≤	15	-	**No**
	Heating load	W/m²	**19**	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	**-**	≤	-		**-**
	Frequency of overheating (> 25 °C)	%	**7**	≤	10		**Yes**
	Frequency of excessively high humidity (> 12 g/kg)	%	**0**	≤	20		**Yes**
Airtightness	Pressurisation test result n_{50}	1/h	**1.4**	≤	0.6		**No**
Moisture protection							
	Smallest temperature factor $f_{Rsi=0.25\ m^2K/W}$	-	**0.75**	≥	0.36	0.17	**Yes**
Thermal comfort	All requirements fulfilled?	-					**No**
	0.17	W/(m²K)		≤	1.23		
	0.13	W/(m²K)		≤	1.46		
	0.14	W/(m²K)		≤	1.60		
	0.11	W/(m²K)		≤	0.67		
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	**49**	≤	-		**-**
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	**42**	≤	60	60	**Yes**
	Renew. energy generation (in rel. to projected building footprint area)	kWh/(m²a)	**10**	≥	-	-	

I confirm that the values given here have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive house Classic? **No**

Task:
First name: Tom
Surname: Reynolds
Signature:
Certificate-ID
Issued on:
City:

Project data imported from designPH 1.1.55

Primary Energy Renewable PER

23a Hampton Road 'Be Green' / Climate: Northolt / TFA: 309 m² / Heating: 37.2 kWh/(m²a) / Overheating: 7 % / PER: 42.4 kWh/(m²a)

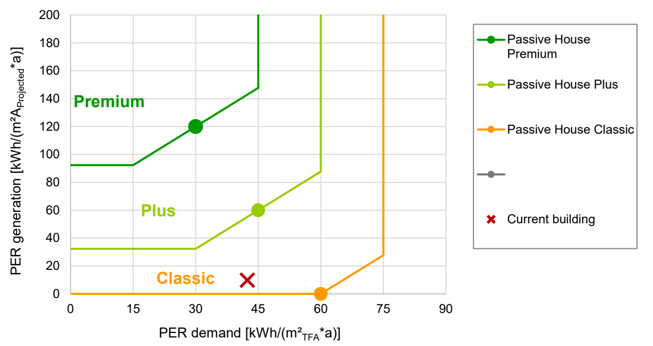
Selection of the heat generation system	**Contribution (useful energy)**		
	Heating	**DHW**	
2-Heat pump(s)	100%	100%	
-			
-			
-			
Additionally:			
Solar thermal	0.0	0.0	kWh/(m²a)

Building type:	1-Freestanding single family house	
Treated floor area A_{TFA}:	309	m²
Projected building footprint $A_{Projected}$:	167	m²
Heating demand incl. distribution & hydr. frost protection	46.3	kWh/(m²a)
Cooling energy demand incl. dehumidification		kWh/(m²a)
DHW demand including distribution:	11.0	kWh/(m²a)
Biomass contingent (PER):	20	kWh/(m²a)

Energy demand referred to treated floor area	**Efficiency**		**Useful energy**	**Final energy**	**PER**		**PE**		**CO_2**		
	Calculation	User defined	**Covered fraction**	**demand**	PER factor	**PER demand**	PE factor	PE demand	Emission factor (CO_2-eq)	CO_2eq emissions	
	-	-		kWh/(m²a)	kWh/kWh	kWh/(m²a)	kWh/kWh	kWh/(m²a)	kg/kWh	kg/a	
							1-PE factors (non-renewable) PHI Certification		1-CO2 factors GEMIS (Germany)		
Heating			100%								
Electricity (HP compact unit)					1.65		1.50		0.363		
Electricity (heat pump)	2.51		100%	18.4	1.65	30.4	1.50	27.6	0.363	2064	
Other (heating)					1.65		1.50		0.363		
Boiler					0.00						
District heating					0.91		0.30		0.000		
Solar thermal system											
Aux. electricity (heating, wintertime ventilation)				1.9	1.65	3.1	1.50	2.9	0.363	214	
Total heating						**33.5**		**30.5**		**2278**	
Cooling and dehumidification					**PER**		**PE**		**CO_2**		
Electricity cooling (HP)					1.00		1.50		0.363		
Electricity dehumidification (HP)					1.15		1.50		0.363		
Auxiliary electricity cooling, ventilation summer				0.7	1.00	0.7	1.50	1.1	0.363	81.7	
Auxiliary electricity (dehumidification)					1.15		1.50		0.363		
Total cooling and dehumidification						**0.73**		**1.09**		**81.69**	
DHW generation			100%		**PER**		**PE**		**CO_2**		
Electricity (HP compact unit)					1.30		1.50		0.363		
Electricity (heat pump)	2.37		100%	4.6	1.30	6.0	1.50	7.0	0.363	521	
Electricity (direct)					1.30		1.50		0.363		
Boiler					0.00						
District heating					0.88		0.30		0.000		
Solar thermal system											
Aux. electricity (DHW + solar DHW)					1.30		1.50		0.363		
Total DHW						**6.0**		**7.0**		**521**	
Household electricity + Auxiliary electricity (other)					**PER**		**PE**		**CO_2**		
Household electricity (lighting, electrical devices, etc.)				6.9	1.30	9.0	1.50	10.4	0.363	777	
Auxiliary electricity (other)					1.30		1.50		0.363		
Total household electricity and auxiliary electricity						**9.0**		**10.4**		**777**	
Additional gas demand					**PER**		**PE**		**CO_2**		
Drying/Cooking				0.0	1.75	0.0	0.00	0.0	0.000		
Total additional gas demand						**0.00**		**0.00**		**0**	
Total PER demand without bioenergy budget						**49.3**					
Bioenergy utilisation						**-6.9**	The bioenergy budget will be used with 11.7 kWh/(m²a).				
Total energy demand kWh/(m²$_{TFA}$ a)					**PER:**	**42.4**	**PE:**	**49.0**	**CO_2:**	**3658**	kg/a

Energy generation **referred to projected building footprint**		**Final energy**		**PER**		**PE**		**CO_2**		
		Final energy generation	**Final energy generation**	PER factor	**PER generation**	PE factor	PE generation	Emission factor (CO_2-eq)	Emissions generated	Emissions saved
		kWh/a	**kWh/(m²$A_{Projected}$*a)**	kWh/kWh	kWh/(m²$A_{Projected}$a)	kWh/kWh	kWh/(m²$A_{Projected}$a)	kg/kWh	kg/a	kg/a
PV electricity		1641	9.8	1.00	9.8	0.00	0.0	0.13 I 0.363	213	382
Solar thermal system		0	0.0	-	0.0	0.00	0.0			
			0.0							
Total energy production kWh/(m²$_{Projected\ building\ footprint}$ a)				**PER:**	**9.81**	**PE:**	**0.00**	**CO_2:**	**213**	**382**

Verification Passive House/EnerPHit standard



23a Hampton Road 'Be Green'   309 m² treated floor area, United Kingdom/ Britain

Classes in subdivisions:	Current value:			PHI Criteria Low Energy Building	Criteria Passive House : Classic	Plus	Premium	Achieved class
Heating demand referred to TFA	**37**	kWh/(m²a)	≤	30		15		PHI Low Energy Building
Heating load referred to TFA	**19**	W/m²	≤	-		10		
Cooling and dehumidification demand referred to TFA	**-**	kWh/(m²a)	≤	-		-		-
Airtightness n_{50}	**1.4**	1/h	≤	1		0.6		Not achieved
PER demand referred to TFA	**42**	kWh/(m²a)	≤	75	60	45	30	Classic
PER generation referred to projected building footprint	**10**	kWh/(m²a)	≥	-	0	60	120	
PE demand (non-renewable primary energy)	**49**	kWh/(m²a)	≤	85		85		Classic

Energy standard of the whole building

With the selected verification method PER (renewable) the following class can be reached: **Not achieved**

Standard criteria

Summary

Different final energy sources are added up here. Though this is not scientifically correct, it is required by other single verifications.

	Final energy	**PER (renewable primary energy)**	**PE (non-renewable primary energy)**	**CO2eq emissions**	**CO_2eq substitution**
			1-PE factors (non-renewable) PHI Certification	1-CO2 factors GEMIS (Germany)	1-CO2 factors GEMIS (Germany)
	MWh/a	MWh/a	MWh/a	kg/a	kg/a
Demand	**10.1**	**13.1**	15.12	3658	3658
Generation	**-1.6**	**-1.6**	0.00	213	-382
Cumulated demand and generation (annual balance)	**8.43**	**11.46**	15.12	3871	3275
Demand without occupant electricity consumption	7.94	10.32	11.91	-236265	-236265
Demand without occupant electricity consumption, accumulated generation	6.30	8.67	11.91	-236051	-236647

Appendix 4

M & E Specification Information

Heating | **Product Information**

MITSUBISHI ELECTRIC

PUZ-WM60VAA(-BS)

Ecodan R32

Monobloc Air Source Heat Pump

R32

Key Features:	**Key Benefits:**
A+++ high efficiency system	Ultra low running cost
Ultra quiet noise levels	Flexible product placement
Maintains full heating capacity at low temperatures	Confident and quick product selection
Zero carbon solution	Help to tackle the climate crisis
MELCloud enabled	Remote control, monitoring, maintenance and technical support

MELCloud

Manufactured in the UK

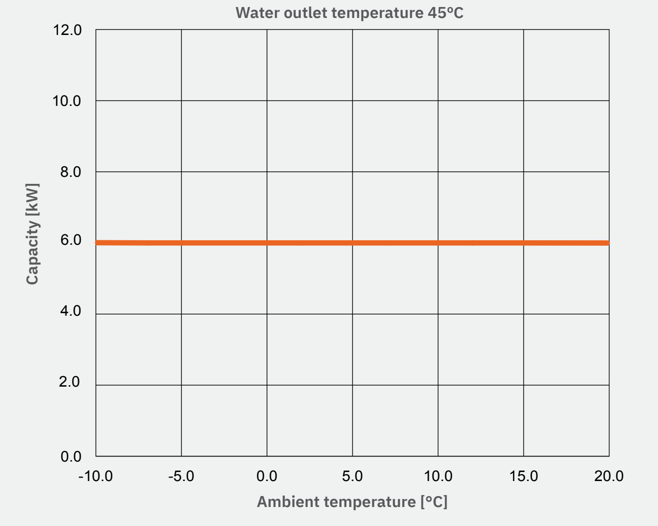
037-0033-20-01

Heating | Product Information

PUZ-WM60VAA(-BS)
Ecodan R32
Monobloc Air Source Heat Pump

OUTDOOR UNIT		PUZ-WM60VAA(-BS)
HEAT PUMP SPACE HEATER - 55˚C	ErP Rating	A++
	η_s	142%
	SCOP (MCS)	3.57
HEAT PUMP SPACE HEATER - 35˚C	ErP Rating	A+++
	η_s	190%
	SCOP (MCS)	4.81
HEAT PUMP COMBINATION HEATER - Large Profile[*1]	ErP Rating	A+
	η_{wh}	145%
HEATING[*2] (A-7/W35)	Capacity (kW)	6.0
	Power Input (kW)	1.88
	COP	3.20
OPERATING AMBIENT TEMPERATURE (°C DB)		-20 ~ +35
SOUND DATA[*3]	Pressure Level at 1m (dBA)	45
	Power Level (dBA)[*4]	58
WATER DATA	Pipework Size (mm)	22
	Flow Rate (l/min)	17
	Water Pressure Drop (kPa)	8.0
DIMENSIONS (mm)	Width	1050
	Depth	480
	Height	1020
WEIGHT (kg)		98
ELECTRICAL DATA	Electrical Supply	220-240v, 50Hz
	Phase	Single
	Nominal Running Current [MAX] (A)[*5]	5.68 [13]
	Fuse Rating - MCB Sizes (A)[*6]	16
REFRIGERANT CHARGE (kg) / CO_2 EQUIVALENT (t)	R32 (GWP 675)	2.2 / 1.49

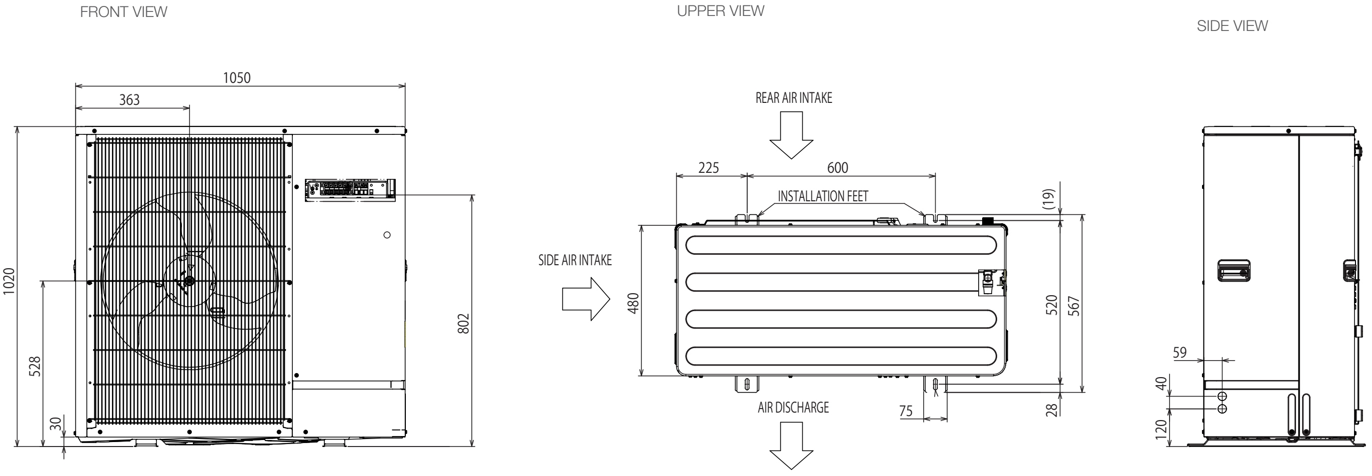
NOMINAL HEATING CAPACITY



Notes:
*1 Combination with E*PT20X Cylinder
*2 Under normal heating conditions at outdoor temp: -7°CDB / -8°CWB, outlet water temp 35°C, inlet water temp 30°C.
*3 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 55°C, inlet water temp 47°C as tested to BS EN14511.
*4 Sound power level tested to BS EN12102.
*5 Under nominal heating conditions at outdoor temp: 7ºC, outlet water temp: 35ºC.
*6 MCB Sizes BS EN60898-2 & BS EN60947-2.

η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

PUZ-WM60VAA(-BS) DIMENSIONS



All dimensions (mm)

Telephone: **01707 282880**
email: **heating@meuk.mee.com**
heating.mitsubishielectric.co.uk

@meuk_les
@green_gateway
Mitsubishi Electric Living Environmental Systems UK
Mitsubishi Electric Cooling and Heating UK
mitsubishielectricuk_les
Mitsubishi Electric Living Environmental Systems UK
BLOG thehub.mitsubishielectric.co.uk

UNITED KINGDOM Mitsubishi Electric Europe Living Environment Systems Division, Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England. Telephone: 01707 282880 Fax: 01707 278881
IRELAND Mitsubishi Electric Europe, Westgate Business Park, Ballymount, Dublin 24, Ireland. Telephone: (01) 419 8800 Fax: (01) 419 8890 International code: (003531)

Note: Refer to 'Installation Manual' and 'Instruction Book' for further 'Technical Information'. The fuse rating is for guidance only and please refer to the relevant databook for detailed specification. It is the responsibility of a qualified electrician/electrical engineer to select the correct cable size and fuse rating based on current regulation and site specific conditions. Mitsubishi Electric's air conditioning equipment and heat pump systems contain a fluorinated greenhouse gas, R410A (GWP:2088), R32 (GWP:675), R407C (GWP:1774), R134a (GWP:1430), R513A (GWP:631), R454B (GWP:466), R1234ze (GWP:7) or R1234yf (GWP:4). *These GWP values are based on Regulation (EU) No 517/2014 from IPCC 4th edition. In case of Regulation (EU) No.626/2011 from IPCC 3rd edition, these are as follows. R410A (GWP:1975), R32 (GWP:550), R407C (GWP:1650) or R134a (GWP:1300).

Effective as of August 2020

MCS

Product directory

PRODUCT DIRECTORY |

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Mitsubishi

SEARCH PRODUCTS

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Ecodan

Certification Number: 037-0001-18-01
Model Number: PUHZ-W60VAA
Certification Period: 09/10/2018 - 08/10/2028

Ecodan

Certification Number: 037-0001-18-02
Model Number: PUHZ-W60VAA-BS
Certification Period: 09/10/2018 - 08/10/2028

Ecodan

Certification Number: 037-0001-18-03
Model Number: PUHZ-W85VAA
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0001-18-04
Model Number: PUHZ-W85VAA-BS
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0001-18-05
Model Number: PUHZ-W85YAA
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0001-18-06
Model Number: PUHZ-W85YAA-BS
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0002-18-01
Model Number: PUHZ-W112VAA
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0002-18-02
Model Number: PUHZ-W112VAA-BS
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0002-18-03
Model Number: PUHZ-W112YAA
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0002-18-04
Model Number: PUHZ-W112YAA-BS
Certification Period: 09/10/2018 - 08/10/2028

Ecodan
Certification Number: 037-0032-20-01
Model Number: PUZ-WM50VHA
Certification Period: 22/06/2020 - 21/06/2030

Ecodan
Certification Number: 037-0032-20-02
Model Number: PUZ-WM50VHA-BS
Certification Period: 22/06/2020 - 21/06/2030

Ecodan

Certification Number: 037-0033-20-01
Model Number: PUZ-WM60VAA
Certification Period: 22/06/2020 - 21/06/2030

Ecodan

Certification Number: 037-0033-20-02
Model Number: PUZ-WM60VAA-BS
Certification Period: 22/06/2020 - 21/06/2030

Product Details

Manufacturer:	Mitsubishi
Product Name:	Ecodan
Model Number:	PUZ-WM60VAA-BS
Technology:	Air Source Heat Pump
Certification Body:	HP Keymark
Manufacturer's Website:	Visit manufacturer's website
Certification Period:	22/06/2020 - 21/06/2030
Current Certification Status:	Certified

SCOP Values

Flow Temperature	SCOP
53°C	3.67
54°C	3.62
55°C	3.57
56°C	0
57°C	0
58°C	0

Ecodan

Certification Number: 037-0033-20-03
Model Number: PUZ-WM85VAA
Certification Period: 22/06/2020 - 21/06/2030

Ecodan

Certification Number: 037-0033-20-04
Model Number: PUZ-WM85VAA-BS
Certification Period: 22/06/2020 - 21/06/2030

Ecodan

Certification Number: 037-0033-20-05
Model Number: PUZ-WM85YAA
Certification Period: 22/06/2020 - 21/06/2030

Ecodan

Certification Number: 037-0033-20-06
Model Number: PUZ-WM85YAA-BS
Certification Period: 22/06/2020 - 21/06/2030

Ecodan

Certification Number: 037-0034-20-01
Model Number: PUZ-WM112VAA
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0034-20-02
Model Number: PUZ-WM112VAA-BS
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0034-20-03
Model Number: PUZ-WM112YAA
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0034-20-04
Model Number: PUZ-WM112YAA-BS
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0035-20-01
Model Number: PUZ-HWM140VHA
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0035-20-02
Model Number: PUZ-HWM140VHA-BS
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0035-20-03
Model Number: PUZ-HWM140YHA
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: 037-0035-20-04
Model Number: PUZ-HWM140YHA-BS
Certification Period: 27/07/2020 - 26/07/2030

Ecodan

Certification Number: MCS HP0002/01
Model Number: PUHZ-W85VHA-BS
Certification Period: 12/09/2008 - Present

Ecodan

Certification Number: MCS HP0002/03
Model Number: PUHZ-W50VHA-BS
Certification Period: 16/10/2008 - Present

Ecodan

Certification Number: MCS HP0002/04
Model Number: PUHZ-HW140VHA-BS
Certification Period: 16/10/2008 - Present

Ecodan

Certification Number: MCS HP0002/05
Model Number: Ecodan PUHZ-W85VHA2
Certification Period: 24/12/2009 - Present

Ecodan

Certification Number: MCS HP0002/06
Model Number: Ecodan PUHZ-W85VHA2-BS
Certification Period: 24/12/2009 - Present

Ecodan

Certification Number: MCS HP0002/07
Model Number: Ecodan PUHZ-HW140VHA2
Certification Period: 24/12/2009 - Present

Ecodan

Certification Number: MCS HP0002/08
Model Number: Ecodan PUHZ-HW140VHA2-BS
Certification Period: 24/12/2009 - Present

Ecodan

Certification Number: MCS HP0002/09
Model Number: Ecodan PUHZ-HW140YHA2
Certification Period: 01/06/2011 - Present

Ecodan

Certification Number: MCS HP0002/10
Model Number: Ecodan PUHZ-HW140YHA2-BS
Certification Period: 01/06/2011 - Present

Ecodan

Certification Number: MCS HP0002/11
Model Number: CAHV-P500YA-HPB
Certification Period: 26/08/2011 - Present

Ecodan

Certification Number: MCS HP0002/15
Model Number: Ecodan PUHZ SW75VHA / 6kW Hydrobox
Certification Period: 07/06/2013 - Present

Ecodan

Certification Number: MCS HP0002/16
Model Number: Ecodan PUHZ SW75VHA / 2kW Hydrobox
Certification Period: 07/06/2013 - Present

Ecodan

Certification Number: MCS HP0002/17
Model Number: Ecodan PUHZ SW75VHA / 2kW Cylinder
Certification Period: 07/06/2013 - Present

Ecodan

Certification Number: MCS HP0002/18
Model Number: Ecodan PUHZ SW120VHA / 6kW Hydrobox
Certification Period: 07/06/2013 - Present

Ecodan

Certification Number: MCS HP0002/19
Model Number: Ecodan PUHZ SW120VHA / 2kW Hydrobox
Certification Period: 07/06/2013 - Present

Ecodan

Certification Number: MCS HP0002/20
Model Number: Ecodan PUHZ SW120VHA / 2kW Cylinder
Certification Period: 07/06/2013 - Present

Ecodan

Certification Number: MCS HP0002/21
Model Number: PUHZ-W112VHA
Certification Period: 18/08/2014 - Present

Ecodan

Certification Number: MCS HP0002/22
Model Number: CRHV-P600YA-HPB
Certification Period: 23/09/2014 - Present

Ecodan

Certification Number: MCS HP0002/23
Model Number: PUHZ-W85VHA
Certification Period: 28/08/2015 - Present

Ecodan

Certification Number: MCS HP0002/24
Model Number: PUHZ-W50VHA
Certification Period: 28/08/2015 - Present

Ecodan

Certification Number: MCS HP0002/25
Model Number: CAHV-P500YA-HPB-BS
Certification Period: 28/08/2015 - Present

Ecodan

Certification Number: MCS HP0002/26
Model Number: PUHZ-W112VHA-BS
Certification Period: 28/08/2015 - Present

Ecodan

Certification Number: MCS HP0002/30
Model Number: PUHZ-HW140VHA
Certification Period: 28/08/2015 - Present

Ecodan

Certification Number: MCS HP0002/31
Model Number: Ecodan PUHZ SW75VHA-BS/ 6kW Hydrobox
Certification Period: 28/08/2015 - Present

Showing 1 to 50 of 68 products

Previous 1 2 Next

CONTACT US
FREQUENTLY ASKED QUESTIONS
WHAT TO DO IF THINGS GO WRONG
MCS INSTALLATIONS DATABASE (MID)
COOKIE POLICY
PRIVACY POLICY

TWITTER
FACEBOOK
INSTAGRAM
LINKEDIN

Appendix 5

Water Consumption Calculations

breglobal

Job no:

Date: 10/08/2023

Assessor name: Tom Reynolds

Registration no:

Development name: 23a Hampton Road

Issue Date:

Rainwater **Greywater** **Results**

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS

(for use with the Code for Sustainable Homes issues Wat 1 for the May 2009 and subsequent versions)

Dwelling Description n/a

1st step - Select from options below:

Is a Rain and/or Greywater system specified?	**No**
Is a shower AND bath present?	**Yes**
Has a washing machine been specified?	**No**
Has a dishwasher been specified?	**No**

2nd step - Build spreadsheet (click button below)

BUILD SPREADSHEET

As soon as this button is pressed the spreadsheet will change according to the options selected previously in the 1st step. Scroll down to see the changes.

3rd step - Enter consumption details for the specified fittings

TAPS **(excluding kitchen taps)**	**Fitting type**	**Flow rate (litres/min)**	**Number of fittings**
1	Basin Taps	6.00	5
2			
3			
4			
	Proportionate flow rate (litres/min)		4.20

	Consumption / person / day (Litres)	**11.06**

BATHS	Fitting type	Capacity to overflow (litres)	Number of fittings
1	Bath	170.00	2
2			
3			
4			
		Proportionate capacity to overflow (litres)	119.00
		Consumption / person / day (Litres)	**18.70**

SHOWERS	Fitting type	Flow rate (litres/min)	Number of fittings
1	Showers	8.00	4
2			
3			
4			
		Proportionate flow rate (litres/min)	5.60
		Consumption / person / day (Litres)	**34.96**

DISHWASHER	
Where no dishwasher is specified, a default consumption figure of 1.25 litres per place setting is used.	
Consumption / person / day (Litres)	**4.50**

WASHING MACHINES	**Number of fittings**
Where no washing machine is specified, a default consumption figure of 8.17 litres per kilogram of dry load is used.	
Where no washing machines have been specified but plumbing for future supply of grey/rainwater was installed, please enter details:	
Consumption / person / day (Litres)	**17.16**

WC's	**Fitting Type**	**Flush Type**	**Volume****	**Number of fittings**
1	**WCs**	**Full Flush**	4.00	5
		Part Flush	2.60	
2		**Full Flush**		
		Part Flush		
3		**Full Flush**		
		Part Flush		
4		**Full Flush**		
		Part Flush		
		Average effective flushing volume (litres)		3.06
		Consumption / person / day (Litres)		**13.53**

KITCHEN SINK TAPS	Fitting Type	Flow rate (litres/minute)	Number of fittings
1	Kitchen Taps	10.00	2
2			
3			
4			
		Proportionate flow rate (litres/min)	7.00
		Consumption / person / day (Litres)	**14.76**

WASTE DISPOSAL UNIT

Is a waste disposal unit specified for the dwelling?	No	
	Consumption / person / day (Litres)	**0.00**

WATER SOFTENER

Water Softener in use?	No	
Total capacity used per regeneration (%)		
Water consumed per regeneration (litres)		
Average number of regeneration cycles per day (No.)		
Number of occupants served by the system (No.)		
	Water consumed beyond 4% person / day (Litres)	**0.00**

4th step - Analyse Results

Go to Start

INTERNAL WATER CONSUMPTION

NET INTERNAL WATER CONSUMPTION	(litres/person/day)	**114.67**
RAINWATER ONLY COLLECTION SAVING	(litres/person/day)	**0.00**
GREYWATER ONLY RECYCLING SAVING	(litres/person/day)	**0.00**
RAIN/GREYWATER COLLECTION SAVING (combined system)	(litres/person/day)	**0.00**
NORMALISATION FACTOR	(litres/person/day)	**0.91**
TOTAL WATER CONSUMPTION	(litres/person/day)	**104.4**
	CSH CREDITS ACHIEVED	**3**
	CSH MANDATORY LEVEL:	**Level 3/4**

17. K COMPLIANCE

EXTERNAL WATER USE	(litres / person / day)	5.00
TOTAL WATER CONSUMPTION	(litres / person / day)	**109.4**
	17. K COMPLIANCE?	**Yes**

Permission is given for this tool to be copied without infringement of copyright for use only on projects where a Code for Sustainable Homes assessment is carried out. Whilst every care is taken in preparing the Wat 1 assessment tool, BREG cannot accept responsibility for any inaccuracies or for consequential loss incurred as a result of such inaccuracies arising through the use of the Wat 1 tool.

PRINTING: before printing please make sure that in "Page Setup" you have selected the page to be as "Landscape" and that the Scale has been set up to 75% (maximum)

Appendix 6

GHA Overheating Tool

EARLY STAGE OVERHEATING RISK TOOL

Version 1.0, July 2019

Good
Homes
Alliance

This tool provides guidance on how to assess overheating risk in residential schemes at the early stages of design. It is specifically a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

The questions can be answered for an overall scheme or for individual units. Score zero wherever the question does not apply. Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at goodhomes.org.uk/overheating-in-new-homes.

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING | **KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING**

Geographical and local context

#1 Where is the scheme in the UK? See guidance for map	South east	**4**	4
	Northern England, Scotland & NI	**0**	
	Rest of England and Wales	**2**	

#2 Is the site likely to see an Urban Heat Island effect? See guidance for details	Central London (see guidance)	**3**	2
	Grtr London, Manchester, B'ham	**2**	
	Other cities, towns & dense sub-urban areas	**1**	

#8 Do the site surroundings feature significant blue/green infrastructure? Proximity to green spaces and large water bodies has beneficial effects on local temperatures; as guidance, this would require at least 50% of surroundings within a 100m radius to be blue/green, or a rural context	**1**	0

Site characteristics

#3 Does the site have barriers to windows opening? - Noise/Acoustic risks - Poor air quality/smells e.g. near factory or car park or very busy road - Security risks/crime - Adjacent to heat rejection plant	**Day** - reasons to keep all windows closed	**8**	4
	Day - barriers some of the time, or for some windows e.g. on quiet side	**4**	
	Night - reasons to keep all windows closed	**8**	0
	Night - bedroom windows OK to open, but other windows are likely to stay closed	**4**	

#9 Are immediate surrounding surfaces in majority pale in colour, or blue/green? Lighter surfaces reflect more heat and absorb less so their temperatures remain lower; consider horizontal and vertical surfaces within 10m of the scheme	**1**	0
#10 Does the site have existing tall trees or buildings that will shade solar-exposed glazed areas? Shading onto east, south and west facing areas can reduce solar gains, but may also reduce daylight levels	**1**	0

Scheme characteristics and dwelling design

#4 Are the dwellings flats? Flats often combine a number of factors contributing to overheating risk e.g. dwelling size, heat gains from surrounding areas; other dense and enclosed dwellings may be similarly affected - see guidance for examples	**3**	0
#5 Does the scheme have community heating? i.e. with hot pipework operating during summer, especially in internal areas, leading to heat gains and higher temperatures	**3**	0

#11 Do dwellings have high exposed thermal mass AND a means for secure and quiet night ventilation? Thermal mass can help slow down temperature rises, but it can also cause properties to be slower to cool, so needs to be used with care - see guidance	**1**	0

#12 Do floor-to-ceiling heights allow ceiling fans, now or in the future? Higher ceilings increase stratification and air movement, and offer the potential for ceiling fans	>2.8m and fan installed	**2**	0
	> 2.8m	**1**	

Solar heat gains and ventilation

#6 What is the estimated average glazing ratio for the dwellings? (as a proportion of the facade on solar-exposed areas i.e. orientations facing east, south, west, and anything in between). Higher proportions of glazing allow higher heat gains into the space	>65%	**12**	0
	>50%	**7**	
	>35%	**4**	

#7 Are the dwellings single aspect? Single aspect dwellings have all openings on the same facade. This reduces the potential for ventilation	Single-aspect	**3**	0
	Dual aspect	**0**	

		Full	Part	
#13 Is there useful external shading? Shading should apply to solar exposed (E/S/W) glazing. It may include shading devices, balconies above, facade articulation etc. See guidance on "full" and "part". Scoring depends on glazing proportions as per **#6**	>65%	**6**	**3**	0
	>50%	**4**	**2**	
	>35%	**2**	**1**	

		Openings compared to Part F purge rates			
		= Part F	+50%	+100%	
#14 Do windows & openings support effective ventilation? Larger, effective and secure openings will help dissipate heat - see guidance	Single-aspect	minimum required	3	4	3
	Dual aspect		2	3	

TOTAL SCORE 7 = Sum of contributing factors: 10 *minus* Sum of mitigating factors: 3

High 12 Medium 8 Low

score >12: Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score between 8 and 12:** Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	**score <8:** Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

Appendix 7

Embodied Carbon Calculations

Consultant: MES Building Solutions
Street: Newark Beacon, Cafferata Way
Postcode/City: NG24 2TN | Newark
Province/Country: Nottinghamshire | United Kingdom

Client: Mr & Mrs Kinsman
Street:
Postcode/City:
Province/Country:

Building: 23a Hampton Road
Street: Hampton Road
Postcode/City: TW11 0JN | Teddington
Province/Country: London | United Kingdom
Building type: House

AECB Embodied Carbon Assessment

Year of construction: **2023**
No. of dwelling units: **1**
TFA: **309**
Building Life, yrs **60**
For this Certificate Building life must be 60 yrs
Both graphs show all categories, not RIBA or LETI

if Operational varies then adjust these cells

Operational	Option 1	Option 2	Option 3	Option 4
Space Heating kWh/m2.a	36.0	36.0		
Final Energy kWh/m2.a (excl PV)	49.0	49.0		
tonnes CO_2e (incl PV if any)	1.4	1.4		
kgCO2e/m² GIA (incl PV if any)	4.4	4.4		

Embodied	Option 1	Option 2	Option 3	Option 4
All categories, tonnes CO2e A-C	199.8	177.5	#DIV/0!	#DIV/0!
RIBA kgCO2e/m² GIA	646.9	574.5		
LETI kgCO2e/m² GIA	643.5	571.1		

Type of building: Domestic

Taking into consideration the total lifetime carbon emissions (sum of embodied and operational) for your development, please explain which option you have chosen and why.

Option 1 is for a traditional masonry build, which is the current proposal for this development.
Option 2 is for a timber frame alternative from ground floor upwards.

I confirm that the values given herein have been determined following the RICS methodology and based on the characteristic values of the building. The PH Ribbon calculations are attached to this verification.

Task: **Designer**
Name: **MES Building Solutions**
23a Hampton Road 'Be Green'
Issued on: **11/08/23**
City: **Newark**
Signature: **TR**

Calculation Scope Summary

Date of assessment 11/08/2023 Year of project completion 2024
Carried out by MES Building Solutions
Project type New build
Assessment objective Inclusion in Energy & Sustainability Statement
Project location Teddington

Property type Residential
Building description Single
Size TFA 308.9 m^2 GIA 309 m^2 for option 1

Project design life: Required to be 60 years for this assessment
Assessment scope Cradle to Grave
Assessment stage Before construction
Data sources PHPP for quantities of thermal elements, drawings and correspondence for others.
EPD certificates, ICE Database 2019 (using PHribbon)

Building elements coverage

# Building parts	**Building elements**	**Est of Coverage**	Clarification if needed
0 Facilitating works	0.1 Temporary/Enabling works/Preliminaries	0%	
	0.2 Specialist groundworks	0%	
1 Substructure	1.1 Substructure	100%	
2 Superstructure	2.1 Frame	100%	
	2.2 Upper floors incl. balconies	100%	
	2.3 Roof	100%	
	2.4 Stairs and ramps	100%	
	2.5 External Walls	100%	
	2.6 Windows and External Doors	100%	
	2.7 Internal Walls and Partitions	100%	
	2.8 Internal Doors	100%	
3 Finishes	3.1 Wall finishes	100%	
	3.2 Floor finishes	100%	
	3.3 Ceiling finishes	100%	
4 Fittings, furnishings and equip (FF&E)	Building-related	100%	
	Non Building-related	0%	
5 Building Services/MEP	5.1–5.14 Building-related services	100%	
	Non Building-related	0%	
6 Prefab Buildings/Units	6.1 Prefabricated Buildings and Building Units	0%	
7 Existing Building	7.1 Minor Demolition and Alteration Works	0%	
8 External works	8.1 Site preparation works	0%	
	8.2 Roads, Paths, Pavings and Surfacings	0%	
	8.3 Soft landscaping, Planting and Irrigation Systems	0%	
	8.4 Fencing, Railings and Walls	0%	
	8.5 External fixtures	0%	
	8.6 External fittings drainage	0%	
	8.7 External Services	0%	
	8.8 Minor Building Works and Ancillary Buildings	0%	

Assumptions

This calculation only covers Cradle to Grave (stages A-C), and D where information is available. It follows the RICS professional statement very closely though is not an official RICS calculation. It is based on the external dimensions in PHPP which overestimates quantities slightly.

A1-A3 manufacturing emissions are from EPDs or ICE2019. Carbon storage of timber based products is included if it is from 100% FSC/PEFC approved sources. If only a proportion is approved then it is pro-rata. For timber based products the net figure is separated out into emissions and storage so they are visible on the graph. Window manufacture emissions are approximate when chosen by m2, separation into materials would be more accurate.
A5 construction is based on the standard RICS assumptions of the nominal project value in table 2a E501:E504. It is calculated for the total, no figure is needed for each row because this becomes complex when there is more than 1 option.
A4 transport to site uses RICS methodology to ensure UK transport distances. Emissions are based on kg per km.tonne from table 3 using government figures.

B1,B2,B3 the use stage B1 includes emissions or CO2 absorption e.g. from concrete where this is available. B2 and B3 maintenance, repair are included where EPD info is available. Technically the "life of the product" in the EPD may assume no repair, life with some repair may be a lot longer.
B4/B5 replacement is calculated using the design life of the material and the design life of the building of 60 years. B5 refurbishment only refers to commercial buildings. For this the user must change the life of relevant materials to match refurbishment cycles.

C1 demolition is calculated for the totals based on standard RICS assumptions based on GIA in table 2a G501:G504. As for A5, no figure is needed for each row.
C2 uses a RICS calculation using a distance of 50km. Emissions are omitted in 2 situations. Firstly materials ticked in table 4 have no transport emissions for recycling according to EN15805 (This is mentioned in RICS). Secondly some timber EPDs give combined C1-C4 figures for 100% scenarios.
C3/C4 uses RICS factors in table 4. This has been grouped according to recycling, incineration or landfill, and 3 EPD types (col AU):
(1) where the EPD contains 3 scenarios with 100% info on each, the RICS proportions of these have been used. (2) where the EPD has just 1 scenario that matches those required, these are used. (3) Where data is missing or the scenario doesn't match, RICS estimates are used. The RICS figure for timber in landfill (which RICS requires also used for recycling) is high to allow for methane but all UK landfill sites are required to collect the methane. A revision of the RICS document is expected to change this. Therefore we have followed expert advice to use just the sequestered CO2.

D figures include reuse where the type has been selected in column U of the main table. Otherwise figures are taken from the EPD in the ratios determined by RICS in table 4. Missing figures are zero, therefore D can vary according to available information.