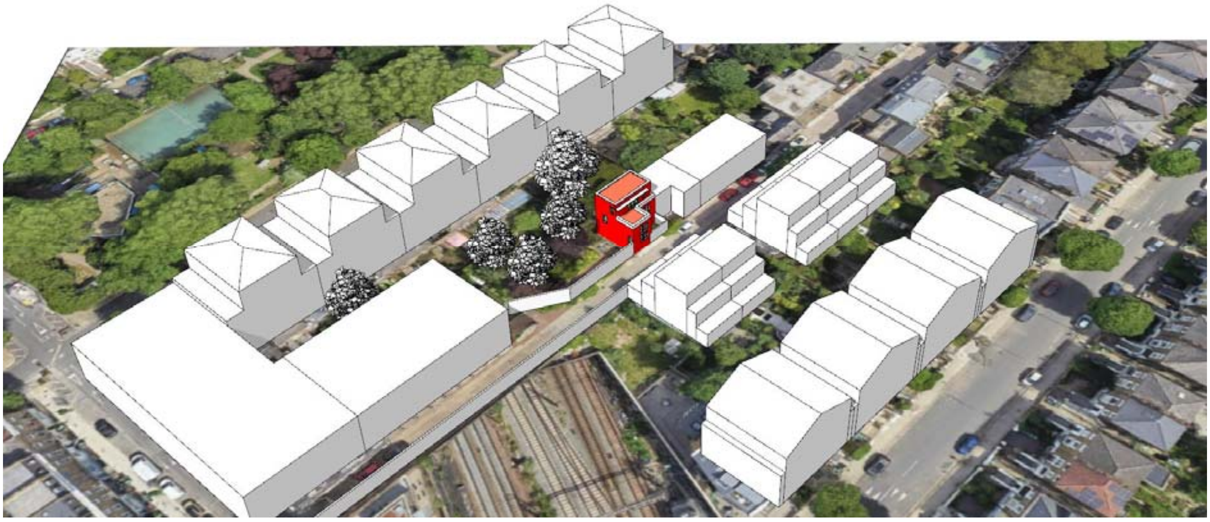

SUSTAINABILITY & ENERGY REPORT OF

13 Murray Mews, London

Abstract

This report seeks to confirm that the Proposed design for the above project complies with the Co2 reduction and the thermal performance recommendations set out in all the regulations that apply to this scheme, as well as to confirm the final energy consumption of the building using the Passivhaus Planning Package (PHPP).

Ymproving
A dedicated Passivhaus Consultancy

For:

Ivan Henshell

London

June 2023

Job No.: 230119

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Written: FC

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Table of Contents

SUMMARY

Francisco Cerezuela is appointed to review the proposed design for the above project to certify its compliance with the Co2 emission reduction and the thermal performance recommendations set out in all the policies listed below.

- National Planning Policy Framework
- London Plan
- Camden Local Plan policies CC1 CC2, and CC3
- Relevant Neighbourhood Plans
- Camden Planning Guidance on Sustainability
- Mayor's Sustainable Design and Construction SPG

Based on the information available and assumptions made, the results show indicate that it should be achievable to meet the Co2 emission reduction and the thermal performance recommendations; the final energy consumption, as established under the section 'PER demand' in the verification page, is also below 65.6 kWh/(m²a). This represents a 75% energy reduction when comparing the same building built to building regulations standards - Approved Document L, Conservation of fuel and power, Feb 2023.

The report indicates what building design and specification have been considered to meet the above results.

INTRODUCTION

Passive House buildings are characterised by particularly high levels of comfort with very low energy consumption. This is achieved primarily through the use of Passive House components (e.g. Passive House windows, insulation, heat recovery). From the outside, Passive House buildings do not differ from conventional buildings because "Passive House" means a standard and not a particular type of construction.

The Passive House Criteria were defined by the Passive House Institute 20 years ago. They precisely define the different requirements that a building must fulfil to achieve the highly efficient Passive House Standard. In addition to the Passive House Standard, the current document containing the Criteria also includes the EnerPHit Standard that was introduced in 2010 for building retrofits using Passive House components and the requirements for a PHI Low Energy Building, which were introduced in 2015.

Anyone buying or commissioning a house built to one of these three standards should always expressly demand a building in accordance with the definition set out by the Passive House Institute – preferably with certification. This will ensure legal certainty in case of conflict.

The Passivhaus Classic Criteria consist of two main parts besides the introduction: the actual Criteria and the "Technical regulations for building certification".

The key criteria for Passivhaus certification are:

- Heating energy target of 15kWh/m^2.yr
- Overheating limit of no more than 10% of the year at over 25^{ºC}
- Primary Energy consumption limit of ≤ 120 kWh/m²a
- Air Pressure Test Result n^{50} ≤ 0.6 h-1

The Passivhaus Low Energy Building Criteria consist of two main parts besides the introduction: the actual Criteria and the "Technical regulations for building certification".

The key criteria for Passivhaus certification are:

- Heating energy target of 30kWh/m^2.yr
- Overheating limit of no more than 10% of the year at over 25^{ºC}
- Primary Energy consumption limit of ≤ 135 kWh/m²a
- Air Pressure Test Result n^{50} ≤ 1.0 h-1

The **Passivhaus EnerPHit Criteria** consist of two main parts besides the introduction: the actual Criteria and the "Technical regulations for building certification".

The key criteria for Passivhaus certification are:

- Heating energy target of 25kWh/m^2.yr (20kWh/m^2.yr in London due to island heat effect)
- Component Method: ensuring all thermal envelope components and ventilation achieve specific values or lower
- Overheating limit of no more than 10% of the year at over 25^{ºC}
- Primary Energy consumption limit of ≤ 159 kWh/m²a
- Air Pressure Test Result n^{50} ≤ 1.0 h-1

The 15, 20, 25 and 30 kWh/m^2.yr heating energy target is based on the estimated number of kWh of annual heat demand for every m^2 of floor area.

As well as the space heating, Passivhaus limits all other energy use within the building to ensure the design of services and selection of equipment is energy efficient. These other energy sources include hot water heating, lighting, cooking, laundry, consumer electronics etc.

The energy demand is multiplied by factors to determine Primary Energy (PE) or Primary Energy Renewable (PER) values. Certification requires that PE or alternatively, the PER is lower than the targets shown above.

Primary Energy (PE) factors take into account the energy consumed at source, and all energy from extraction to use. For each unit of electricity used in the building an additional 1.6 units are consumed in fuel extraction, generation, distribution and conversion losses.

Passive House project planning is an important part of the planning for a building. The most important tool for this purpose is the Passive House Planning Package (PHPP). An energy consultant uses PHPP to calculate the building's energy balance and annual demands, as expressed above.

The PHPP model shows exactly which measures will have to be planned and implemented to achieve the Passive House Standard. For example, these may include the thickness of the thermal insulation and the quality of the windows and ventilation system.*

* Building Certification Guide by the Passive House Institute

https://passiv.de/downloads/03_building_certification_guide.pdf

MODELLING RESULTS

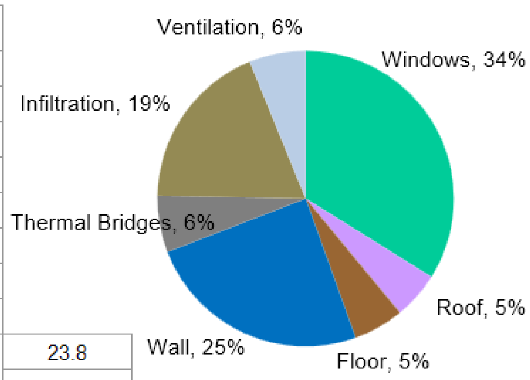
The design, as shown, will be able to limit the **heating and cooling energy demand** to less than **36.7 kWh/(m²a)** and the frequency of overheating to less than 2.6%, with the following assumptions based on the information received.

	Proposed
Space Heating kWh/(m²a)	38.1
Heating load W/m²	22.2
Overheating %	3.3
PER kWh/(m²a)	65.6
Airtightness (ACH)	3.0
Opaque Fabric U-values W/(m²K)	
Wall	0.15
Floor	0.15
Roof	0.10
Window U-values W/(m²K)	1.00 (GBS)
MVHR efficiency (%)	85
MVHR Unit	Brink Flair 325

As shown in the below monthly energy balance, the windows and wall represent the more significant losses across all packages.

Monthly Method Heat Balance - kWh/(m².yr)

	Losses	Gains
Windows	26.3	
Roof	4.0	
Floor	4.3	
Wall	19.1	
	0.0	
	0.0	
Thermal Bridg	4.8	
Infiltration	14.4	
Ventilation	4.8	
Solar		23.8
Internal		15.6
Heating		38.1
Totals	***77.5***	***77.5***



- WARM PHPP Results Sheet

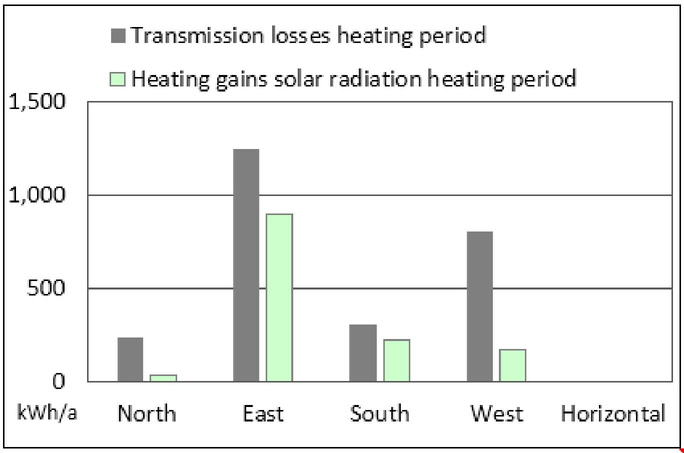
DESIGN ASSESSMENT and ASSUMPTIONS

ORIENTATION:

- DesignPH

The building is oriented in an East-West arrangement.

This arrangement is not ideal, resulting in more losses than solar gains through the vertical structural openings.



- PHPP Windows Sheet

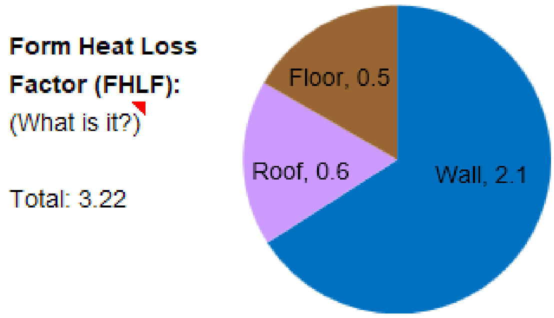
FORM:

The proposed scheme has a high form factor due to its small footprint and height.

The Heat loss form factor (HLFF) is defined as the ratio of heat loss area to treated floor area. Higher values make Passivhaus targets harder to achieve.

The typical range is 2 to 4, where 4 requires high-performing U-values on opaque elements, windows, MVHR units, etc.

This building has an HLFF of 3.22, sitting at the upper end of the range.



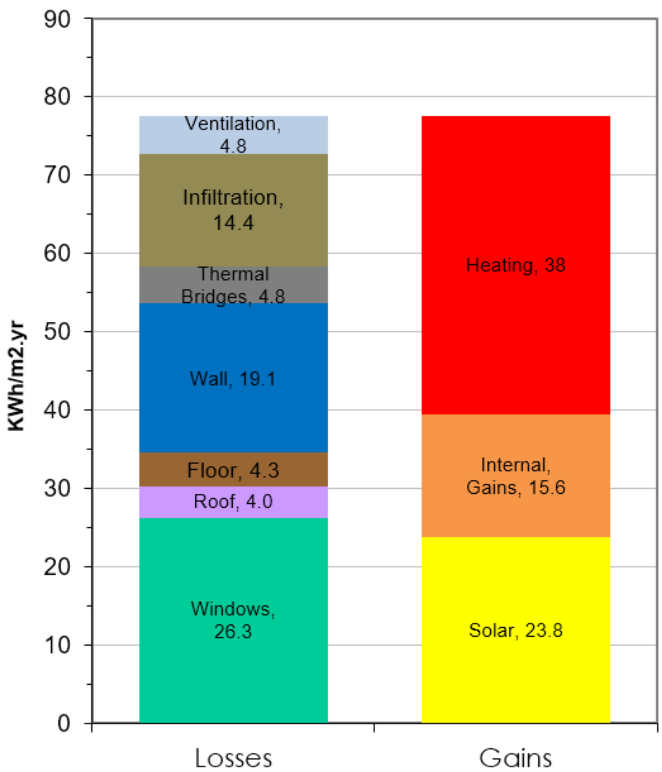
- WARM PHPP Results Sheet

<u>WINDOWS:</u>

The windows are a critical package on any project, as they usually represent the central point for transmission losses, offset by the solar heat gains they allow to pass through.

	Proposed
Heating Load (W/m^2)	22.2
Solar Gains (%)	29.8
Energy Losses (%)	30.7
Glazing/TFA Ratio	23.1

The above metrics are within the expected range for a building-orientated East-West.



- WARM PHPP Results Sheet

COMPLEX JUNCTION:

There are a few complex junctions in the project where attention to detail is required to overcome potential issues such as thermal bridging and airtightness.

Due to the construction system used, the airtightness and thermal bridging strategy seem very robust and well-suited to delivering such an ambitious design.

OVERHEATING:

Overheating is defined as the internal temperature being above 25^{o}C.

The approximate time in the year during which this occurs is 3.3%, assuming standard PHPP occupancy and gains. PHPP simulates the building as a whole, so it cannot identify overheating risks for single rooms.

This project: 3 %	
% of hours in a year over 25 degrees C	**Assessment**
0 - 2 %	Excellent
2 - 5 %	Good
5 - 10 %	Acceptable (certification criteria)
10 - 15 %	Poor
> 15 %	Catastrophic

- WARM PHPP Results Sheet

U-VALUES:

The calculations of all the opaque elements (floor, wall, roof) or fabric u-values have been carefully considered according to the methodology of BR443 "Conventions for U-Value calculations" and BS 6946 and BS 5250 via PHPP.

Assembly no.	Building assembly description	Interior insulation?
01ud	**Wall**	

Heat transmission resistance [m²K/W]

Orientation of building element	**2-Wall**	interior R_{si}	0.13
Adjacent to	**3-Ventilated**	exterior R_{se}:	0.13

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plasterboard	**0.130**					**13**
Knauf ThermRoll 32 / timber frame	**0.032**	**timber frame**	**0.130**			**140**
Sheating board	**0.130**					**9**
Rocksill slab	**0.034**					**100**

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
85%	**15.0%**		**26.2** cm

U-value supplement [ ] W/(m²K)

U-value: **0.150** W/(m²K)

Assembly no. 02ud — Floor — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element	3-Floor
Adjacent to	2-Ground
interior R_{si}	0.17
exterior R_{se}	0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Screed	1.150					65
RC slab	1.350					150
Thermal Rockfloor	0.038					130
Thermal Rockfloor	0.038					100

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			44.5 cm

U-value supplement W/(m²K)

U-value: 0.156 W/(m²K)

- PHPP Components Sheet

Assembly no. 03ud — Roof — Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element	1-Roof
Adjacent to	1-Outdoor air
interior R_{si}	0.10
exterior R_{se}	0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Plasterboard	0.190					15
Unventilated	0.280	Service battens	0.130			45
Plywood	0.130					18
Hardrock Multi-fix	0.039					185
Hardrock Multi-fix	0.039					185
EPDM	0.250					18

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
85%	15.0%		46.6 cm

U-value supplement W/(m²K)

U-value: 0.099 W/(m²K)

- PHPP Components Sheet

THERMAL BRIDGES:

A thermal bridge is an element or location with less insulation or reduced insulation performance than the adjacent areas of the thermal envelope. This means the element or location provides a path of least resistance (a "bridge") for heat to move through the building envelope.*

* Elrond Burrell

The current model shows 4.8 kWh/(m²a), representing a 7% allowance for thermal bridges added by the No. 2 SVPs, the perimeter wall-to-floor, wall-to-roof junction, etc.

Thermal bridge inputs

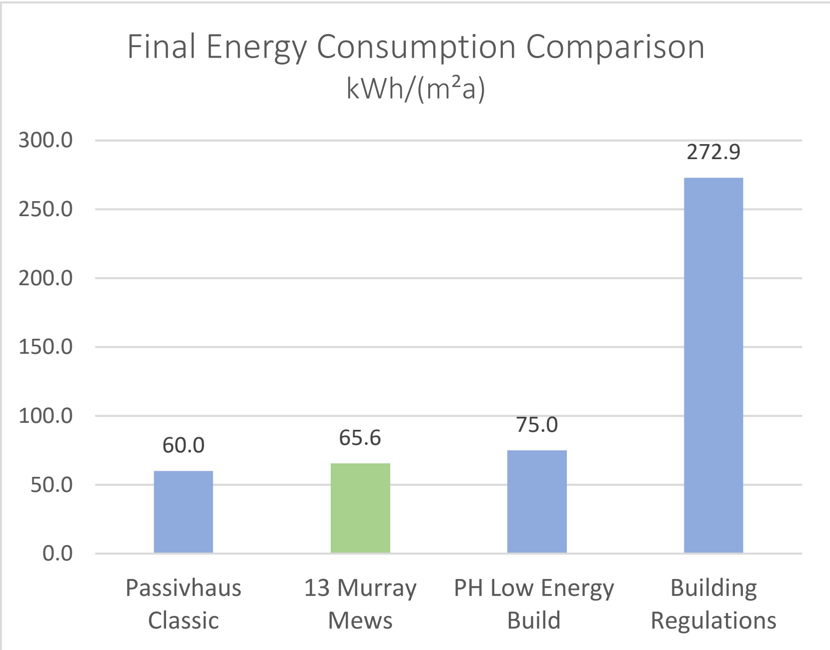
No.	Thermal bridge - denomination	Group No.	Assigned to group	Quantity	x (	Length [m]	-	Subtraction length [m]	)=	Length ℓ [m]	User determined psi value [W/(mK)]
1	SVPs	15	Thermal bridges Ambient	2	x (	9.37	-		) =	18.73	0.163
2	Wall-to-Ground Junction	16	Perimeter thermal bridges	1	x (	35.74	-		) =	35.74	0.080
3	Wall-to-Roof Junction	15	Thermal bridges Ambient	1	x (	60.06	-		) =	60.06	0.050

- PHPP Areas Sheet

CONCLUSIONS

The analysis undertaken using a Passivhaus Planning Package (PHPP) to assess the Proposed construction of the scheme has shown the ability of this to achieve a final energy consumption of 65.6 kWh/(m²a) and Co2eq* emissions of 25.3 kg/(m²a). This represents a 75% energy reduction when comparing the same building built to building regulations standards - Approved Document L, Conservation of fuel and power, Feb 2023.

To achieve the above results, the building makes use of a high level of insulation on the floor, wall and roof, triple-glazed windows and doors, a low level of airtightness to make the mechanical ventilation with heat recovery (MVHR) work effectively, optimised thermal bridge junctions, and a heat pump to provide all the energy along with the photovoltaic panels.



APPENDIX

The building has been modelled using SketchUp 2021 and DesignPH 2.0.09, including the neighbouring building and trees, to account for the correct solar gains and shading across the year.