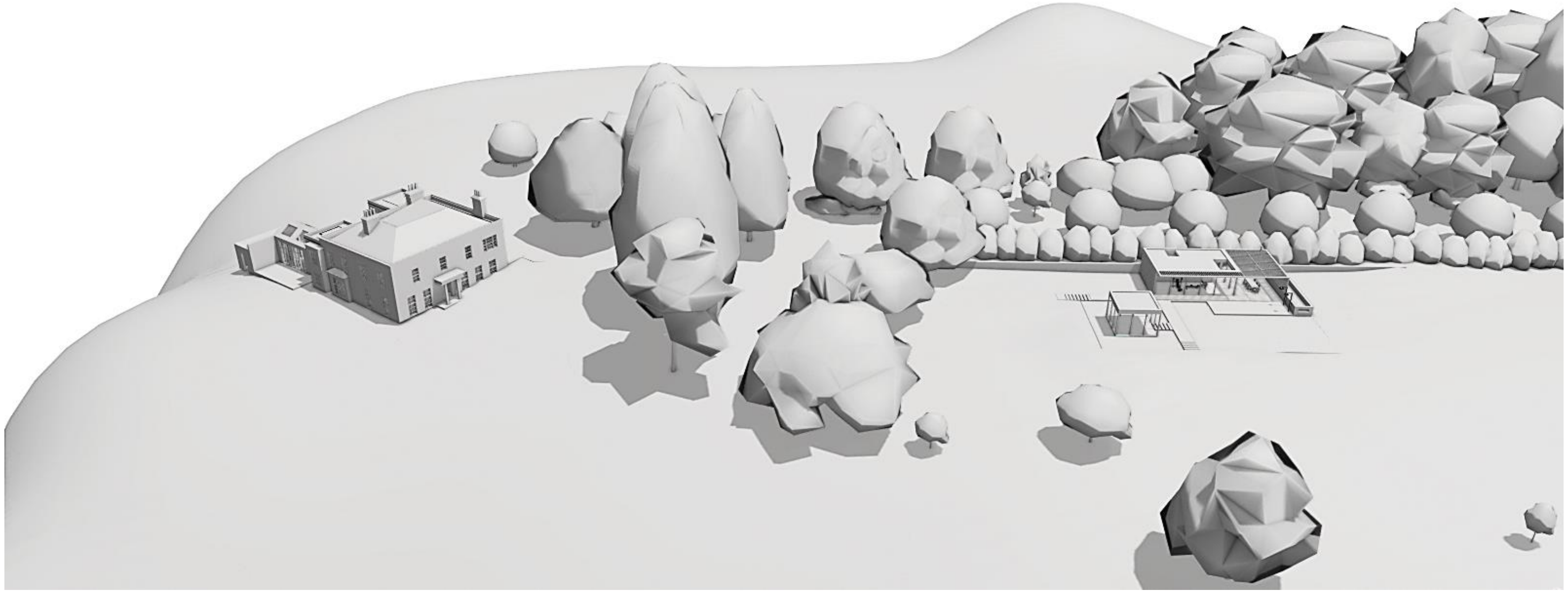

Munden Parva

Sustainability Assessment Study

Dec 2022

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Issue Details

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1.7 -For Information	12/2022	Sustainability Assessment Study	PS	IP

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Contents

1.0 Introduction

This report has been prepared from MWL to assess the sustainability performance of the proposed Munden Parva development sited in Dane End, Hertfordshire.

Munden Parva is a four-storey 18th Century detached Georgian dwelling formed of 10 bedrooms and 5 reception rooms. The Site includes pleasure gardens, a tennis court, ponds and a separate field for sheep grazing.

The proposed Site development involves the following works:

- Proposal of a new natural pool and associated pool house in place of existing tennis court (Figure 1).
- Installation of a ground source heat pump.
- Re-routing the primary driveway.

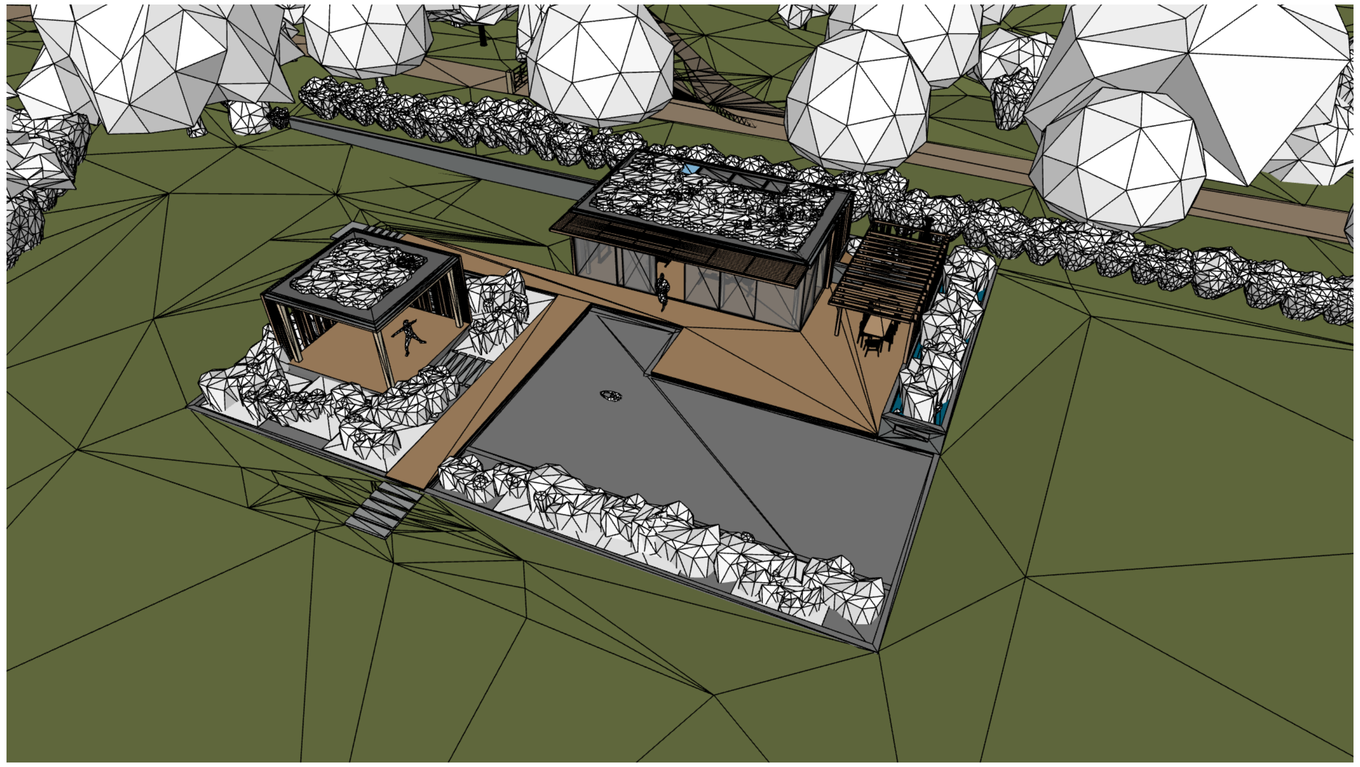


Figure 1. Proposed pool house, including outdoor yoga studio (left), gym studio (right) and natural swimming pool.

This document seeks to address the measures of sustainability and demonstrate the design intention in relation to the proposed interventions.

IES thermal modelling, under the new Part L 2021 Building Regulations, has been carried out for the proposed development.

2.0 Site Location and Development Proposal

Munden Parva is a 18th Century detached Georgian dwelling, sited in Dane End, Hertfordshire. Formerly the rectory of Little Munden, the property has been heightened and extended over the years, and today is formed of 10 bedrooms and 5 reception rooms laid over 4 floors. The property is well proportioned and enjoys expansive views out over the rolling landscape. Munden Parva is Grade II listed (list entry no. 1102264).

The Site includes well maintained pleasure gardens with planted terrace, a tennis court, ponds, and a separate field used for sheep grazing (Figure 2). To the north of the Site, ancillary buildings include general store and biomass outbuilding.

Figure 2. Illustration of the Munden Parva development; source: Google Maps

The proposed works include:

- Construction of a new natural pool and pool house in place of the existing tennis court including:
    - Dayroom, kitchen, and dining areas.
    - Gym area for rowing and cardio machines.
    - Outdoor yoga studio for two people.
    - A natural swimming pool.
- Re-routing the primary driveway.
- Installation of a ground source heat pump underneath the proposed new section of driveway.

3.0 Energy Design Performance

The energy performance and the carbon reduction for the proposed pool house have been assessed and maximised throughout the following measures:

Passive Design: The poolhouse has full height glazing openings to the south, east and west walls.

Energy Efficient Fabric: For the proposed poolhouse opaque elements will target excellent U-values and efficient windows will be proposed.

Ventilation Systems: The gym area is naturally ventilated, with local extract fans in the shower and WC areas.

Low and Zero Carbon Technologies: The poolhouse will be equipped with a ground source electric heat pump with high efficiency for the provision of space and hot water requirements.

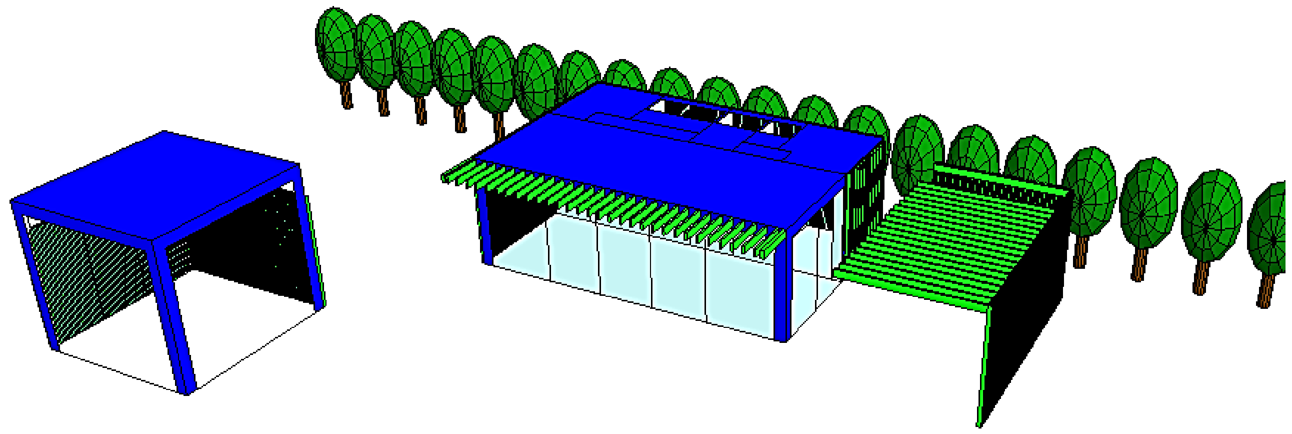
Renewable Technologies: No renewable sources are currently considered in this application.

Estate wide, the Client is keen for Munden Parva to be self-sufficient to help future proof site maintenance and running costs. In order to achieve net zero carbon on the estate, the use of renewable energy sources will be considered in the future.

Mechanical Cooling: Mechanical cooling will be provided for the poolhouse.

Methodology:

The IESVE dynamic software has been used for the SBEM calculation of the proposed poolhouse and the associated carbon emissions.



More details for the above are presented in the SBEM Results chapter.

4.0 Design Specifications

MWL has carried out SBEM calculations with the below listed fabric and system specifications.

Proposed Poolhouse:

Passive Design

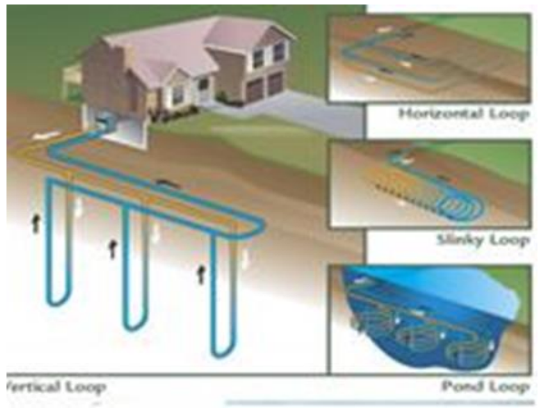
Building Element	Limiting Fabric Parameters Part L2 2021	Proposed Fabric Parameters
External Walls	0.26 W/m^2K	0.15 W/m^2K
Roofs	0.18 W/m^2K	0.12 W/m^2K
Ground floor	0.18 W/m^2K	0.12 W/m^2K
Windows: U-value/G-value	1.60 W/m^2K	1.20 W/m^2K / 25%
Rooflights: U-value/G-value	2.20 W/m^2K	1.20 W/m^2K / 25%
Air permeability	8.00 $m^3/m^2.h$ @ 50 Pa	5.00 $m^3/m^2.h$ @ 50 Pa
Ψ values (Thermal Bridging)	SBEM Default, Accredited Construction Details Not Used	

Services	Proposals
Space Heating	Ground source electric heat pump Efficiency = 400%
Space Cooling	SEER= 6.5
Hot Water	Ground source electric heat pump
Renewables – aiming at net zero carbon	None at the current stage
Ventilation	Natural Ventilation Local extract ventilation in shower and WC spaces
Lighting	LED Lights 100% Light Output Ratio

5.0 Low and Zero Carbon Technologies

This section of the report identifies the LZC technologies that are feasible for the Munden Parva development.

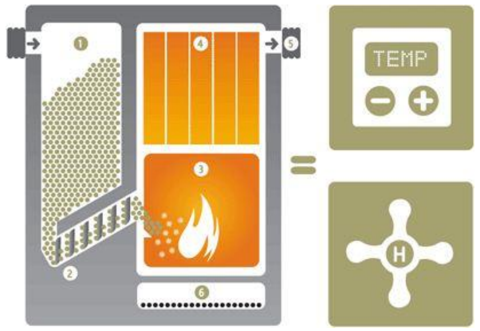
Ground Source Heat Pump



A Ground Source Heat Pump (GSHP) transfers energy from the ground to the building to provide space heating or pre-heating of domestic hot water. Unlike wind and solar heating, it requires an electrical input, however, the heat recovered is three to four times the required electrical input. Heat is transferred from the ground using a ground loop, which can either be within a vertical borehole arrangement or laid as coils in a horizontal trench. The heat pump works in the same way as a domestic refrigerator in reverse, by extracting heat from the borehole/trench to evaporate the refrigerant on the heat pump circuit. Heat is then input to the building as the refrigerant condenses.

Given that the Munden Parva site has a large area of land that could be used for the GSHP installation, this technology is feasible for the development

Biomass



Biomass boilers burn renewable fuel to generate hot water for direct use, or for heating purposes. The fuel they burn is renewable because it is in a constant carbon cycle. There are three main forms of biomass boilers available, namely those using wood chips as fuel, those using wood pellets as fuel and those using wood logs.

The operation and installation of Biomass requires additional plant space for the storage of solid fuel and design of access routes for delivery of fuel. A communal biomass boiler is already available feeding the space and hot water heating system of the Munden Marda dwelling and the neighbouring properties.

Photovoltaics (PV Panels)

Photovoltaic (PV) panels create electricity from solar radiation with efficiency ranging between 5 and 19%. PV modules generally require minimal maintenance, usually consisting of a visual inspection and associated electrical testing. They have no moving parts and an expected lifetime of over 30-40 years. Manufacturers typically offer a warranty on power output of 20-25 years. PV modules have no operating emissions and produce no noise, making them the most benign zero-carbon technology.

Given that the development owns a considerable large area of land, PVs is viable system to generate electricity for use on-site. The PV amount could be maximised as required to achieve the net zero carbon target.

6.0 Results

This section of the report presents the energy performance results for the proposed development with regard to the new Part L 2021 Building Regulations.

Proposed Poolhouse

The results of SBEM calculations for the proposed Poolhouse are illustrated in Figure 3, comparing the Target Emission Rate (TER) with the Building Emission Rate (BER) and in Figure 4 comparing the Target Primary Energy Rate (TPER) and the Building Primary Energy Rate (BPER).

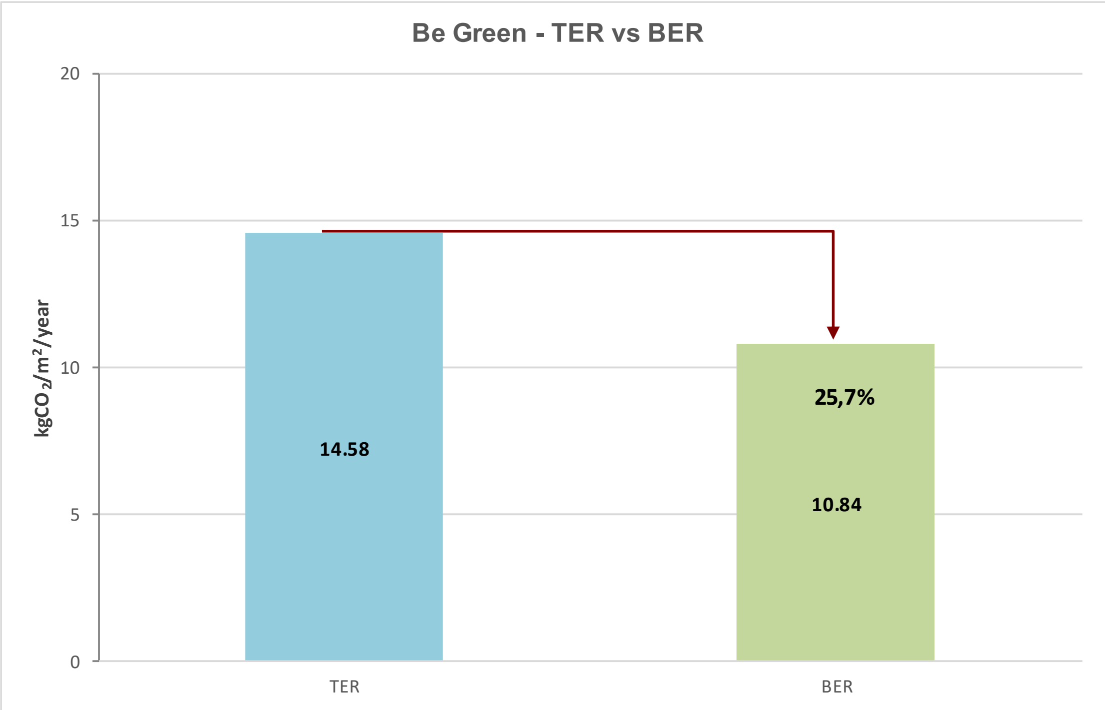


Figure 3. Proposed Poolhouse – TER vs BER

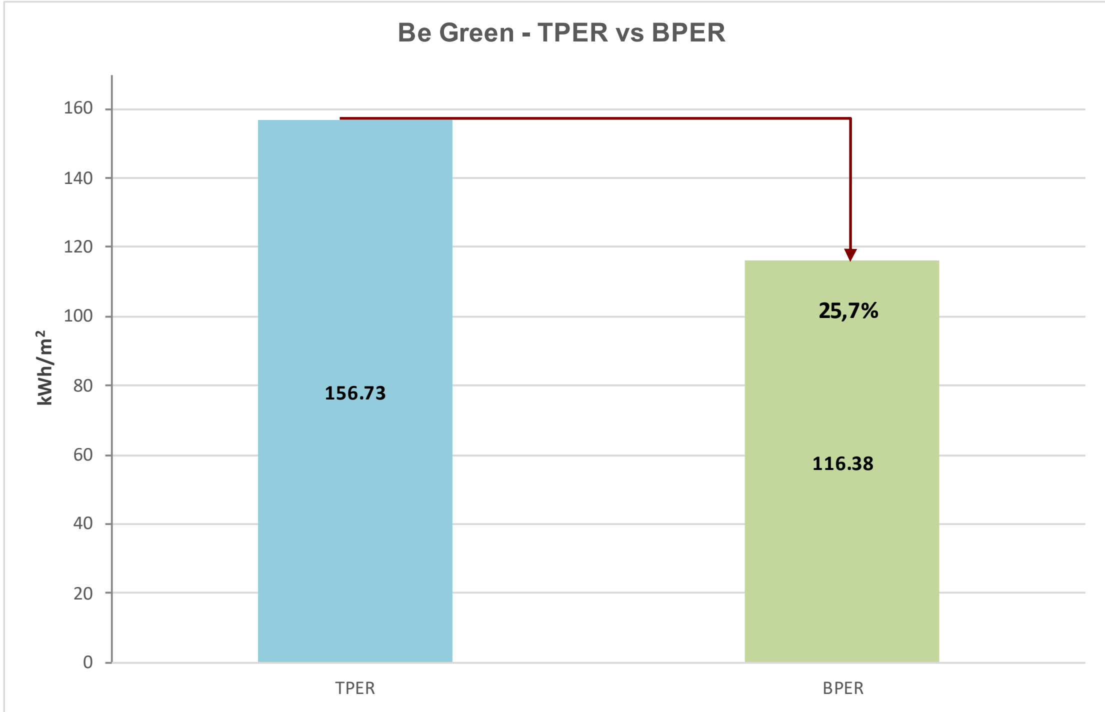


Figure 4. Proposed Poolhouse – TPER vs BPER

The generated SBEM results, given in Appendix A, highlight the need to further mitigate the increased solar gains in the Gym Area, as the large glazing area may lead to overheating risk during warm sunny days. The selected low G-value of 0.25 in combination with shading devises or design solutions, such as brise soleil, may effectively balance the solar gain throughout the seasons.

7.0 Conclusion

The proposed sustainability assessment study follows the best practice approach to reduce the carbon emissions for the proposed poolhouse in the Munden Parva development.

For the proposed poolhouse, the SBEM methodology (Part L 2021) is followed utilising the IES VE software and passive design measures have been incorporated such as low u-values, low air leakage and low thermal bridging.

The development's sustainable design standards are integral to the proposal; these include supplying heating and domestic hot water via a ground source heat pump for the proposed poolhouse.

According to the generated results, the proposed development meets both the carbon emission targets and primary energy targets set out in Part L 2021.

Appendix A presents the SBEM results for the Munden Parva poolhouse. Estate wide, the Client is keen for Munden Parva to be self-sufficient to help future proof site maintenance and running costs. In order to achieve net zero carbon on the estate, the use of additional renewable energy sources will be considered in the future.

8.0 Appendix A – SBEM Results

BRUKL Output Document

Compliance with England Building Regulations Part L 2021

Project name

Munden_Parva_SBEM_BE GREEN

As designed

Date: Wed Dec 07 18:13:02 2022

Administrative information

Building Details

Address: Dane End, Hertfordshire,

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.c.0

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.17

BRUKL compliance module version: v6.1.c.0

Certifier details

Name: MWL

Telephone number: 020 8446 9696

Address: Lymehouse Studios, 30-31 Lyme St, London, NW1 0EE

Foundation area [m²]: 74.25

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	14.58	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.84	
Target primary energy rate (TPER), $kWh/m^2.annum$	156.73	
Building primary energy rate (BPER), $kWh/m^2.annum$	116.38	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	WN000002_W1
Floors	0.18	0.12	0.12	WN000002_F
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.12	WN000002_C
Windows** and roof windows	1.6	1.2	1.2	WN000002_W1_O0
Rooflights***	2.2	1.7	1.7	WC000000_C_O0
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

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

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

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

^ For fire doors, limiting U-value is 1.8 W/m²K

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

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- 1a. Gr HP_Nat Vent_Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	6.5	-	1.1	-
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

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

2- 1. Gr HP_Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

3- 2. Gr HP_E

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

4- 0. DHW

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

1- SYST0001-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.001
Standard value	N/A	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

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

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

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

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Gym_Area	120	-	-
Kitchenette	120	-	-
Storage3	120	-	-
Storage1	120	-	-
Lobby	120	-	-
Storage2	120	-	-
Shower Room	120	-	-
WC	120	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Gym_Area	YES (+253.1%)	NO
Kitchenette	NO (-45.9%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	45.4	45.4
External area [m²]	201	201
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	4
Average conductance [W/K]	80.84	60.18
Average U-value [W/m²K]	0.4	0.3
Alpha value* [%]	33.79	53.25

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	17.46	20.52
Cooling	2.92	2.41
Auxiliary	13.85	22.78
Lighting	5.66	6.81
Hot water	37.18	52.91
Equipment*	7.93	7.93
TOTAL**	**77.07**	**105.44**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	298.95	242.04
Primary energy [kWh/m²]	116.38	156.73
Total emissions [kg/m²]	10.84	14.58

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Fan coil systems, [HS] GSHP/WSHP, [HFT] Electricity, [CFT] Electricity										
	Actual	179.5	84.5	13.9	4.4	19.5	3.58	5.38	4	6.5
	Notional	153.9	57.2	16.2	3.6	7.7	2.64	4.4	----	----
[ST] Central heating using water: radiators, [HS] GSHP/WSHP, [HFT] Electricity, [CFT] Electricity										
	Actual	325.1	21.7	24	0	1.6	3.76	0	4	0
	Notional	290.9	24.4	30.6	0	1	2.64	0	----	----
[ST] Central heating using water: radiators, [HS] GSHP/WSHP, [HFT] Electricity, [CFT] Electricity										
	Actual	345.9	65.9	25.6	0	4	3.76	0	4	0
	Notional	254.4	30.3	26.8	0	4.3	2.64	0	----	----

Key to terms

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