The Shed, Regis Road NW5

Energy Statement for Planning.

Job No: 2397
Issued: September 2017
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Contents

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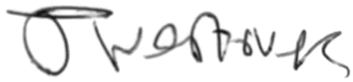
JW	29.09.17	
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1.0 Introduction

1.1 This report has been prepared in support of a planning application for the proposed refurbishment and extension of JML House in Regis Road, London. The proposal involves the regeneration of the existing building and the construction of a new third floor.

1.2 This report is in 2 sections. Section 1 looks at the policy requirements, the site and the proposals to analyse the potential areas for sustainable design. It then looks at ways in which those policy requirements of the Local Authority that relate to sustainability can be met.

1.3 This report is submitted to identify the most suitable sustainable solutions for the proposed development in broad terms. It is not intended to be a prescriptive route to compliance.

1.4 The report was prepared using guidance provided by the scheme Architect and is written in conjunction with the local authority's planning policies relating to sustainability and renewable energy as well as feedback received during the pre-planning process.

1.5 Our current understanding is that it is a policy requirement that the development will be required to achieve a 20% improvement over Part L2A, 2013 and a BREEAM "Excellent" rating through the implementation of the London Plan Energy Hierarchy of energy efficiency, decentralized energy and renewable energy technologies.

2.0 Policy Context

2.1 Recent changes have meant that previous Planning Policy Statements (PPS) have been replaced by a much simpler National Planning Policy Framework (NPPF)

2.2 The key statement in the NPPF refers to a "presumption in favour of sustainable development."

2.3 There is ongoing debate and analysis into the meaning and implications of this, since "sustainability" is a broad term, but for the purposes of this report, it is assumed that environmental sustainability and low ecological impact are to be given significant weight in the planning process.

2.4 The Local Authority uses the requirements of the latest London Plan and its own CPG 3 planning guidance for its sustainability policies.

2.5 Through discussion with the Architect, it has been established that the requirements here are:

- Proposed new building to achieve 20% improvement over the latest Building Regulations. (Part L 2013).
- Building to achieve a BREEAM 'Excellent' rating.

3.0 Development Proposal

3.1 Although full details of the proposal are described in other documents with the planning application, it is useful to look briefly at the site and the context here.

3.2 The plan below shows the proposed ground floor plan as provided to us by the scheme Architects.

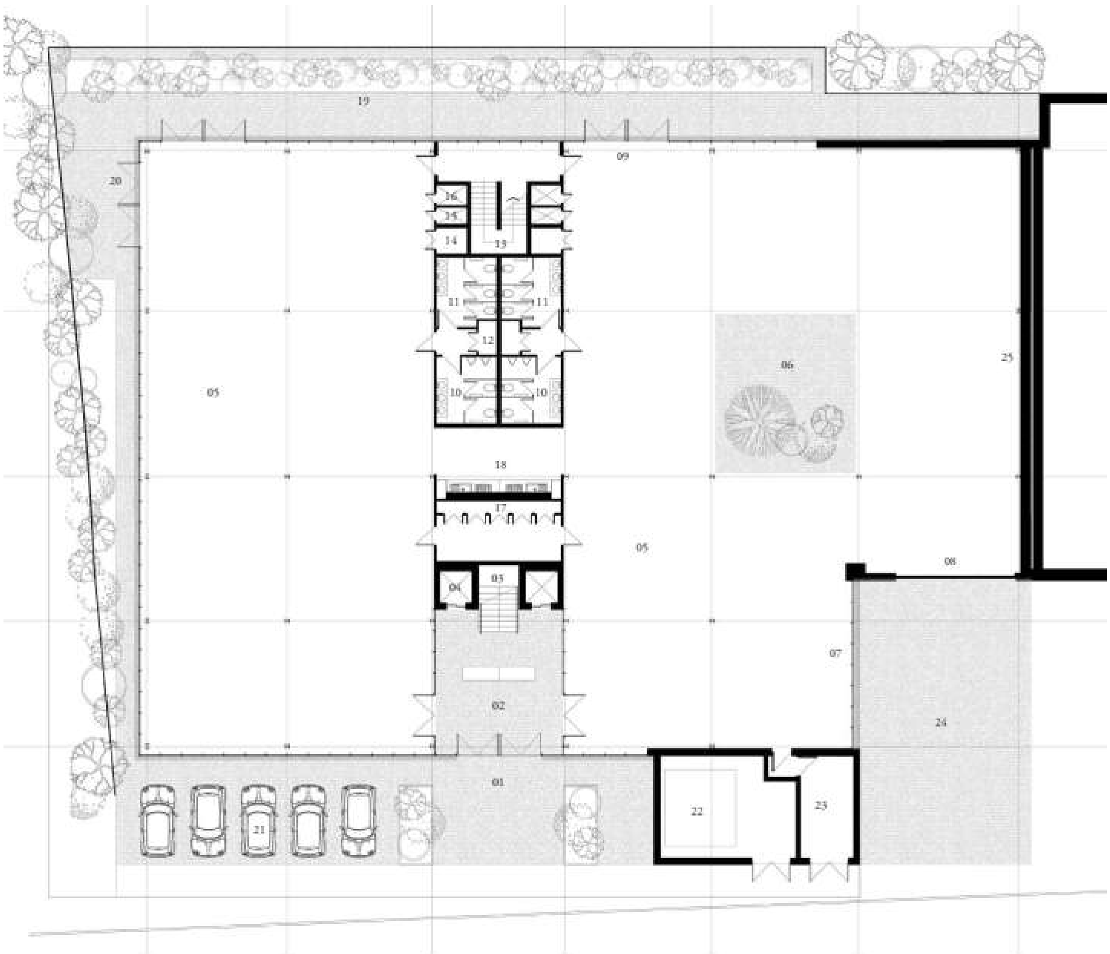

Figure 2 - "Street View" of the Site as Existing

3.3 The proposal involves the refurbishment of the existing ground, first and second floors, and the construction of a new third floor.

4.0 Energy Demand Calculations

4.1 Energy demand for new non-residential buildings in the UK is calculated using the Simplified Building Energy Model (SbEM).

4.2 SbEM is used to demonstrate compliance with Part L of the Building Regulations. Although not intended as a design tool, it is increasingly being used as such, in particular to ascertain likely CO_2 emissions for planning purposes.

4.3 We have used approved SbEM calculation tools, to make an initial assessment of the likely energy demand for the site.

4.4 SbEM give a number of useful output figures. The Dwelling Emission Rate (residential) or Building Emission Rate (commercial) and Target Emission Rate are used to show compliance with the carbon emissions requirements of Part L and local policy. The Primary Energy Demand meanwhile, gives a numerical prediction in kWh/yr of the energy consumption of the building.

4.5 For the purposes of this report, we are concerned primarily with a reduction in the CO_2 emissions and it is the DER/BER and TER figures from the calculations that we shall be using.

4.6 The DER, BER and TER are measured in Kg/C/m^2/yr. By multiplying this figure by the floor areas, we arrive at the total CO_2 emissions in Kg per year.

SbEM provide us with the predicted CO_2 emissions produced by energy uses which are covered by the Building Regulations (heating, cooling, ventilation and lighting).

5.0 SbEM Parameters.

5.1 Assumptions have also been made on the fabric and servicing parameters for the development. These are summarised below.

- External Walls - 0.18 W/m^2K
- Roof - 0.15 W/m^2K
- Semi-exposed walls - 0.20 W/m^2K
- Floor - 0.2 W/m^2K
- Windows - 1.1 W/m^2K
- Air tightness 5.00 $m^3/hr/m^2$ @50Pa
- LED lamps
- Doors- 1.4 W/m^2K
- Air Source Heat Pumps for hot water.
- Point of use electric heating.

6.0 Passive Measures

6.1 The design team for this site will adopt a “fabric first” approach to the build where possible, which has numerous advantages.

6.2 Passive measures such as glazing, orientation, insulation, reduction of thermal bridging, biodiversity etc. are generally more cost effective ways to reduce energy use than “active” measures, such as renewable technologies.

6.3 Passive measures generally have much less embodied Carbon, since on the whole they are design considerations rather than “bolt-on” extras.

6.4 Passive measures proposed for this site include:

- Increased U Values above Building regulations backstop values.
- Using high quality, sustainably sourced materials with good “Green Guide” ratings where possible.
- Supplying low-energy lighting inside and outside.

6.5 These measures combined will reduce the energy demand considerably (although it is not possible to quantify exactly), help occupants live a more sustainable lifestyle, and comply with the Local Authority's vision for new developments in the Borough.

7.0 Energy Strategy

7.1 The London Energy Hierarchy gives a systematic approach to reducing emissions. It asks developers to consider carbon reductions in the following order:

- passive design (Be Lean)
- community heating for heating and cooling (Be Clean)
- renewable technologies (Be Green)

7.2 Passive design has already been dealt with in the assumptions used above. The results of this are given later in the report.

7.3 The next stages of the analysis are to determine the viability of district and communal heating and then the most appropriate renewable strategy for the site. Increased investment and heavier regulation have meant that a reasonably wide range of technologies is now available to help meet carbon reduction targets. Each technology is suitable for different applications, and many can usually be discounted quite early in the process for reasons outside the control of the design team.

7.4 The following sections are an analysis of the available technologies using the hierarchy above.

8.0 CHP & District Heating

8.1 A Combined Heat and Power approach to the site would take the form of a centralised communal plant. To our knowledge there is no existing district heating network to the site.

8.2 According to London Plan guidance, Communal CHP is not considered to be a suitable solution for the development because it is not likely to have a simultaneous demand for heat and power in excess of 5,000 hours per annum. Also, a predicted low demand for hot water at the development and the fact that the heavily glazed nature of the building will mean that cooling is prioritised over heating are additional reasons why CHP is unsuitable in this instance.

8.3 The site lies outside of any existing district heating networks and also is not within any areas identified as "opportunity areas", shown in purple on the London Heat Map extract shown below. District heating is therefore not considered viable.

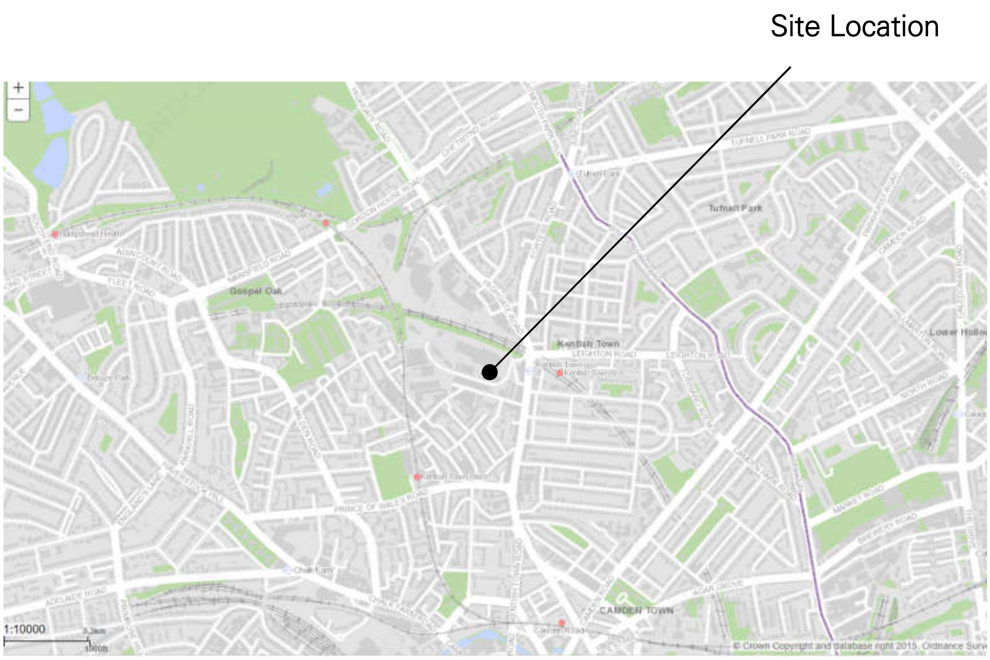

Figure 4 - London Heat Map © Crown Copyright and PointX, 2017

9.0 Technologies Considered

9.1 The following table gives a summary of the alternative technologies that are considered in more detail, and a brief outline of the benefits and disadvantages associated with them.

Technology	Technically Feasible	Strengths	Weaknesses
Solar Thermal Panels (ST)	✓	Trusted technology with large variety of products and installers	Low CO_2 reduction when replacing gas
Photovoltaic Panels (PV)	✓	High CO_2 reduction due to high emissions factor of electricity. Feed In Tariffs	High capital cost. Need sufficient roof space
Biomass boiler	✓	Considered carbon neutral – scores well in CO_2 reduction	Storage space required. Cost and reliability of fuel. Logistics of supply.
Ground Source Heat Pump	✗	Generally reliable technology, with reasonable offset.	Ground condition dependant. High capital cost where space is limited
Air Source Heat Pump	✓	Tried and tested technology. Low capital cost.	Debatable performance figures. Noise, aesthetic and vibration issues
Exhaust Air Heat Pump	✓	Better reliability and performance than ASHP. No external plant.	Need large internal area.
Wind Turbine	✓	"Fit and forget". Generally acceptable to public eye.	Unreliable source of energy. Low relative CO_2 reduction

Solar Thermal Panels

Figure 4: Evacuated Tube Solar Thermal Collectors (Creative Commons License)

9.2 Solar thermal collectors use radiant energy from the sun to heat water pumped through tubes mounted on the roof. They are an established technology and widely used. As a result, capital costs are comparatively lower than other solutions. There are two main types, evacuated tube (Fig.4) and flat plate (Fig 5). Evacuated tube panels are less aesthetically pleasing, but produce more heat per square metre.

Figure 5: Flat Plate Solar Thermal Collector (©http://www.inbalance-energy.co.uk)

9.3 Thermal energy is difficult to store effectively and therefore much of the heat produced is often wasted. Another main disadvantage is that solar thermal systems only work effectively in the summer months when there is significant solar radiation. This is, of course when there is lowest demand for heating, and so if the energy cannot be stored or used elsewhere, it is likely to be wasted.

9.4 Since they are replacing gas, rather than electricity, solar thermal systems also have a much lower ability to reduce CO2 emissions for a given size of panel when compared to PV, and in this instance, the primary goal is to achieve the 35% reduction in emissions with a limited amount of roof space on which to site the panels.

9.5 Although solar thermal panels are often used as a renewable technology, and represent a cost-effective means of reducing emissions where space is available, they are not considered the most suitable for this site.

Photovoltaic Cells (PV)

Figure 6: Roof Mounted Photovoltaic Panels (Creative Commons License)

9.6 Photovoltaic panels convert energy from solar radiation into electricity using a semiconductor material such as silicon. There is now a huge range of panels available, divided primarily into roof-integrated (where the panel forms the roof covering) and roof-mounted (where the panel sits over the tile as shown in Fig. 6)

9.7 PV panels can also be classified by the type of semiconductor used. Polycrystalline panels are the cheaper option, but have reduced efficiency over the more expensive monocrystalline. Hybrid panels which comprise a mono crystalline cell with a thin amorphous layer are now becoming more popular, but remain the most expensive option.

9.8 While PV was until recently considered much more costly than other solutions, growing demand as well as Government incentives (through the Feed-In Tariff scheme which guarantee a certain financial ROI for a period of 25 years) have meant that PV is now a much more economical solution.

9.9 A further advantage of PV over solar thermal is the versatility of panel sizes, which means the production can be sized more accurately to reflect demand. In a situation such as this, where roof space is limited, this is considered to be a key advantage and PV is the favoured technology in this instance.

Biomass

9.10 Biomass as a term relates to the conversion of bio fuel (generally wood chips or pellets) into heat energy. It is considered to be a carbon neutral energy source, as the emissions released through the combustion process are offset by those sequestered during the growing life of the fuel source.

9.11 Biomass installations for domestic use can either be a communal system (Fig 7) with a centralised boiler and storage unit, or individual boilers within each property.

9.12 The advantage of a centralised system is that there is only one boiler, so there is a lower capital cost, and fewer opportunities for breakdown.

Figure 7: Communal Biomass Installation (Author's Own Image)

9.13 As a practical solution, there are some issues with its use:

- Where the system is communal, a large storage area is needed.
- In communal systems, heat is wasted in distribution networks
- If the system is individual, the space for storage and plant needs to be available at dwelling level.
- There can be issues with reliability of the boilers, and also of supply of fuel.
- There are still comparatively few UK suppliers, meaning capital costs are relatively high, and maintenance contracts can be uncompetitive

9.14 Although biomass is considered a carbon neutral fuel source, and so for very low carbon schemes, it remains the best source of heat energy, for a project such as this, without zero-carbon aspirations, it is not considered suitable.

9.15 For the reasons given, biomass is not considered to be the best solution for this project.

Ground Source Heat Pump

9.16 Ground Source Heat Pumps use latent warmth stored in the ground using a buried loop of pipework externally, and a heat condenser within the dwelling.

9.17 The sealed loop system, usually filled with water and glycol, works at high pressure, and uses mains electricity to drive a vapour compression cycle process, which increases the "Coefficient of Performance" (the ratio of primary energy in to energy out) to around 3:1. This means that for every unit of electricity put into the system, around 3 units are output.

9.18 Ground Source Heat Pumps require a reasonably large area of ground for the buried pipework (unless they are vertically bored), and have a comparatively high capital cost. However, this capital cost is offset by relatively short payback periods, generally considered to be between 10 and 15 years.

9.19 Like all heat pump systems, the delivered heat is low-level, and so the dwellings need to be very well insulated and airtight for the pump to work effectively. Underfloor Heating is preferable to radiators.

9.20 As the external plant is buried, there is very little aesthetic implication. The heat exchange plant can be stored internally (fig. 8), and is of modest size. However it does require an area of land for the collection pipes to be buried, which does not exist on this site.

9.21 Therefore Ground Source Heat Pumps are not considered to be technically feasible on this site.

Fig 8: Ground Source Heat Pump (Source: Internet)

Air Source Heat Pumps

9.22 Air source heat pumps (ASHPs) operate using the same principles as the underground alternative, but draw thermal energy from the air rather than the ground. ASHPs work by extracting heat from the air and turning it into usable domestic heating. There are two main types of ASHP systems: air-to-air systems provide warm air, which is circulated to heat the building; and air-to-water systems which heat water to provide heating to a building through radiators or an underfloor system.

9.23 The heat pump itself comprises a compressor and two heat exchangers that extract heat from ambient air. Unlike the GSHP, the ASHP requires considerably less external space to install (and the pump is usually sited externally or can be located in the roof space. Accordingly, installation costs are kept to a minimum.

9.24 Although usually powered by electricity, the ASHP has a coefficient of performance (CoP) ranging between 3 and 4, meaning for every unit of energy put in, the pump will output between 3 and 4 units. However the CoP of an Air Source Heat Pump declines with a reduction in air temperature, unlike the GSHP that has a relatively stable heat source.

9.25 Air to water heat pumps produce hot water that is at a lower temperature than standard boiler systems, which makes it most efficient when supplying low temperature systems such as under floor heating. Optimising the system to generate higher temperatures reduces the CoP meaning the economic and energy benefits may be affected.

Fig 9: Air Source Heat Pump (Source: Internet)

9.26 External ASHP’s require a box such as the one shown in Fig.9 to be mounted on the outside of the building. These are reasonably unsightly, but more importantly can create significant noise.

9.27 However, ASHPs are widely used as part of a renewables solution for commercial buildings in the UK and require minimal maintenance.

9.28 Air Source Heat Pumps can therefore be considered to be suitable for this scheme

Exhaust Air Heat Pump

9.29 An alternative is the exhaust air heat pump (EAHP), a variant on the technology described above.

9.30 These systems work essentially in the same way to an ASHP, combined with a Mechanical Ventilation and Heat Recovery system (MVHR). Warm stale air is extracted from the dwelling and any warmth in the air is extracted using a heat exchanger in the heat pump circuit.

9.31 This heat energy is used to provide heating and hot water to the dwelling, while the cold air is expelled, usually at a temperature of around 0ºC. Fig. 10 gives a graphical representation of this process.

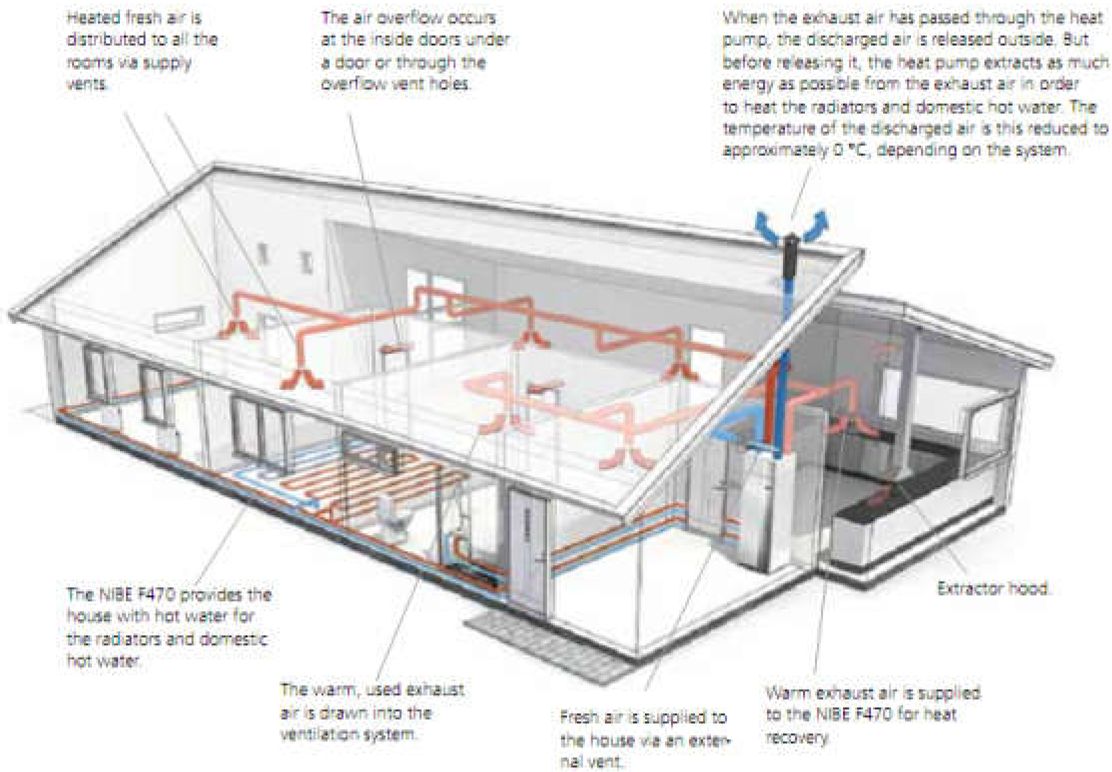

Fig 10. The Workings of an Exhaust Heat Pump System © Nibe

9.32 As with ASHPs, EAHPs supply low temperature water for heating (ideally in a well-insulated airtight fabric with underfloor heating) and DHW. Any shortfall in the production from exhaust air is met with an electric immersion.

9.33 The advantage of an exhaust air system over a "standard" ASHP is essentially that all of the technology is contained internally, and so there is no visual or audible intrusion into neighbouring properties.

9.34 The systems are cost effective, and although they are a comparatively recent development, the research carried out so far seems to show that their performance is living up to the predictions in terms of energy reduction.

9.35 Although an EAHP system is considered suitable in many respects, as a standalone system, they are not considered suitable for this scheme.

Small-scale Wind Turbine

9.36 Micro wind turbines (roof-mounted) work best in exposed locations, without turbulence caused by large obstacles such as buildings and trees. They tend not to work very well in urban situations where wind comes from several directions and there are significant obstacles in the way. Most rooftops get an average annual wind speed of no more than 2 or 3 metres per second, and as the turbines do not generate power at less than 3 or 4 m/s, it would be sitting idle for much of the time.

9.37 The proposed development is in an urban location and so any wind turbine installed would very likely produce an unacceptably low output. Research into the effectiveness of urban micro turbines is suggesting that the predicted financial and carbon ROIs are not being met. The current thinking is that wind turbines are much better suited to large-scale, offshore applications. Micro wind turbines are not considered suitable for this development.

Fig 11. Micro Wind Turbine Example *© Creative Commons License*

10.0 Renewable Selection

10.1 Having assessed the options for renewable technologies, this report recommends that PV panels and Air Source Heat Pumps are installed, in conjunction with a highly insulated fabric to achieve the requirements for the dwellings.

10.2 The current calculations show that 24kWp of PV is required to achieve the energy reduction.

10.3 Using a Sharp 240W panel, this means that a total of 100 panels would be needed. It is proposed that the panels be installed on the roof and are oriented south where feasible.

10.4 This size of PV array would be expected to produce approximately 17,650 kWh of electricity per year and could expect to reduce emissions by approximately 9,315 kg/CO2 per annum.[1]

10.5 It is beyond the scope of this report to actually design the system but an initial appraisal of the available roof space suggests that this level of PV is feasible.

[1] info.cat.org.uk, 2017

11.0 Be Lean, Be Clean, Be Green

11.0 The London Plan specifies this hierarchy when dealing with carbon reduction.

11.1 "Be Lean" refers to reducing energy demand through passive means - this has been explained earlier in the report.

11.2 "Be Clean" refers to CHP and low carbon heat generation, again dealt with in full within the report.

11.3 "Be Green" refers to supplying the remaining energy requirements with renewable technology where possible. This is to be achieved with the use of Air Source Heat Pumps as detailed.

11.4 It is considered helpful to show the reduction in emissions at each stage of this process in tabular form. These are given below.

Proposed Building		
Stage	Emissions ($kgCO_2/m^2.yr$)	% reduction
Baseline (building regulations Part L 2013 compliance)	19.3	
Be lean	17.4	9.8
Be clean	17.4	9.8
Be green	15.4	20.2

12.0 Summary of Results

12.1 The following table gives a summary of the results of the analysis, with the addition of PV and Air Source Heat Pumps.

12.2 The table gives the percentage reduction between DER or BER and TER, showing the level of improvement over the requirements of Part L2a.

	Low-Carbon Technology	TER	DER/BER	% Improvement on Regulated Emissions
New Building	PV and CHP	19.3	15.4	**20.2%**

12.3 The addition of CHP and ASHPs therefore gives an area-weighted improvement over Part L2a of over 20% thus complying with the relevant policy.

Preliminary SbEM (BRUKL) Calculations

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

The Shed

As designed

Date: Thu Sep 28 10:24:07 2017

Administrative information

Building Details

Address: Regis Road, LONDON, NW5 3EG

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: Design Database

Interface to calculation engine version: v26.06.00.05

BRUKL compliance check version: v5.3.a.0

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: Robert Elliot Diamond

Telephone number: 01206 224 270

Address: Ingleton Wood LLP, 874 The Cresent, Colchester, CO4 9YQ

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	19.3
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	19.3
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	17.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	GROUND Wall 1
Floor	0.25	0.2	0.2	GROUND Exposed Floor 1
Roof	0.25	0.15	0.15	THIRD Exposed Roof 1
Windows***, roof windows, and rooflights	2.2	1.1	1.7	GROUND Door 1
Personnel doors	2.2	1.4	1.4	GROUND Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** 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.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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

1- HVAC 1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	5.5	-	-	-
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Default DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
GROUND	-	-	-	-	-	-	-	-	-	-	N/A
FIRST	-	-	-	-	-	-	-	-	-	-	N/A
SECOND	-	-	-	-	-	-	-	-	-	-	N/A
THIRD	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
GROUND	87	-	-	6720
FIRST	87	-	-	6552
SECOND	87	-	-	6552
THIRD	87	-	-	6840

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GROUND	YES (+0%)	YES
FIRST	YES (+0%)	YES
SECOND	YES (+0%)	YES
THIRD	YES (+0%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	4444	4444
External area [m^2]	4162	4162
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	1798.86	925.6
Average U-value [W/m^2K]	0.43	0.22
Alpha value* [%]	12.9	5.98

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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/m^2]

	Actual	Notional
Heating	2.48	2.37
Cooling	9.15	8.26
Auxiliary	0	0
Lighting	19.09	25.45
Hot water	2.89	3.34
Equipment*	42.19	42.19
TOTAL**	**33.61**	**39.41**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	183.63	127.7
Primary energy* [kWh/m^2]	103.19	111.65
Total emissions [kg/m^2]	17.4	19.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	48.1	135.5	2.5	9.2	0	5.4	4.11	5.5	5.5
	Notional	20.7	107	2.4	8.3	0	2.43	3.6	----	----

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U_{i-Typ}	U_{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.18	GROUND Wall 1
Floor	0.2	0.2	GROUND Exposed Floor 1
Roof	0.15	0.15	THIRD Exposed Roof 1
Windows, roof windows, and rooflights	1.5	1.1	GROUND Window 1 (1)
Personnel doors	1.5	1.4	GROUND Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

U_{i-Typ} = Typical individual element U-values [W/(m²K)]

U_{i-Min} = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

The Shed

As designed

Date: Thu Sep 28 10:17:02 2017

Administrative information

Building Details

Address: Regis Road, LONDON, NW5 3EG

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: Design Database

Interface to calculation engine version: v26.06.00.05

BRUKL compliance check version: v5.3.a.0

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: Robert Elliot Diamond

Telephone number: 01206 224 270

Address: Ingleton Wood LLP, 874 The Cresent, Colchester, CO4 9YQ

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	19.3
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	19.3
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	15.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	GROUND Wall 1
Floor	0.25	0.2	0.2	GROUND Exposed Floor 1
Roof	0.25	0.15	0.15	THIRD Exposed Roof 1
Windows***, roof windows, and rooflights	2.2	1.1	1.7	GROUND Door 1
Personnel doors	2.2	1.4	1.4	GROUND Door 1 (Personnel Door)
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** 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.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

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

1- HVAC 1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.5	5.5	-	-	-
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Default DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
GROUND	-	-	-	-	-	-	-	-	-	-	N/A
FIRST	-	-	-	-	-	-	-	-	-	-	N/A
SECOND	-	-	-	-	-	-	-	-	-	-	N/A
THIRD	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
GROUND	87	-	-	6720
FIRST	87	-	-	6552
SECOND	87	-	-	6552
THIRD	87	-	-	6840

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GROUND	YES (+0%)	YES
FIRST	YES (+0%)	YES
SECOND	YES (+0%)	YES
THIRD	YES (+0%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	4444	4444
External area [m^2]	4162	4162
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	1798.86	925.6
Average U-value [W/m^2K]	0.43	0.22
Alpha value* [%]	12.9	5.98

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 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/m^2]

	Actual	Notional
Heating	2.48	2.37
Cooling	9.15	8.26
Auxiliary	0	0
Lighting	19.09	25.45
Hot water	2.89	3.34
Equipment*	42.19	42.19
TOTAL**	**33.61**	**39.41**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	3.97	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	183.63	127.7
Primary energy* [kWh/m^2]	103.19	111.65
Total emissions [kg/m^2]	15.4	19.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

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