PROJECT REF: BS 1038
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52 – 53 Russel Square, London, WC1B 4HP

Energy Efficiency and Renewable Energy Plan

NORMAN BROMLEY
PARTNERSHIP

PROJECT REVISION SHEET

Revision No.	Date	Details	Changes	Author	Approved
P1	*21/12/17*	*For Comments*	*N/A*	*MD*	*MR*
P2	*19/06/18*	*For Comments*	*Incorporating Gerald Eve comments*	*MD*	*MR*

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1.0 EXECUTIVE SUMMARY

1.1 Section 106 Requirement

This statement has been prepared on behalf of the Applicant, in response to the requirements of the agreed Section 106 agreement for 52-53 Russell Square, London. This requirement relates to the provision of an Energy Efficiency and Renewable Energy Plan for the development prior to the change of use refurbishment.

1.2 Approach

This report demonstrates our intended approach to ensuring the proposed new school building achieves the energy and sustainability requirements and policies of the local authority as well as the current Building Regulations.

Our assessment methodology adopts the principles and procedures outlined within the Greater London Authority Energy Planning Document 2016 and consequently the key stages described therein have been fully incorporated within our calculation, review and reporting processes in delivering this report.

The calculations are based on assumed U values, internal gains and infiltration rates and have not been verified. The model has been produced in the absence of architectural sections and elevations and we are working from record drawings provided by the landlord with on-site check measurements, not a full measured survey.

Because the building is an existing listed building with limited proposed works to the structure and fabric, it does not need to satisfy the London Plan Energy criteria which would be required for a major new build development or large extension. We have however set out the estimated 'Baseline' calculation and the Step 2 – Energy Demand Reduction, however due to reasons detailed further in the report it has not been possible to incorporate any measures for Step 3 (Low Carbon Energy Supplies) or Step 4 (Renewable Energy).

1.3 Appraisals

The Proposed Development has been assessed to determine regulated energy requirements and associated CO_2 emissions.

1.4 Passive Design & Energy Efficiency Measures

The following passive design and energy efficiency measures will be implemented at the Proposed Development, including:

- New improved insulation to roof;
- Efficient low-energy LED lighting throughout the School. Lighting will be coupled to daylight and presence detection sensors to minimise unnecessary use;
- Insulated pipework and ductwork to any new or modified to minimise losses and gains.

These measures will achieve an approximate 44% improvement in carbon emissions when compared with the existing building with its current use as an office.

1.5 Infrastructure and Low-Carbon Supply of Energy

The potential for connecting onto an existing or planned heat network has been investigated however the London Heat Map does not identify an existing or proposed supply network close enough to the site.

The feasibility of using a combined, heat and power (CHP) for the School has also been investigated, however the School will not achieve the 5,000 hours per annum of simultaneous demand for heat and power required for CHP to be deemed feasible.

There is also limited space in the building plantroom to incorporate a CHP unit and installation of a flue would cause damage to the buildings historic fabric.

1.6 On-Site Renewable Energy Generation

Due to the Mansard roof style there is very limited useable roof space available, and suitable access has to be achieved for inspection and maintenance.

A large amount of the roof is shaded from chimney breast walls and parapet walls which would cause permanent shading of the modules, it would be possible to locate approximately 2 modules that would not be totally shaded however partial shading would still occur. When you weigh up the capital cost of providing a PV system against the pay back periods that would be achieved from such a small PV array with shading we would not recommend a PV system.

For these reasons PV panels are not considered a viable option for this property. For further details, please refer to the PV feasibility report submitted to satisfy Condition 6 of the planning conditions.

1.7 Carbon Reduction Target

By implementing the passive design and energy efficiency measures the buildings change of use refurbishment is predicted to achieve a 44% reduction in CO^2 emissions.

2.0 INTRODUCTION

This statement sets out the Energy Efficiency and Renewable Energy Plan for the change of use development of 52-53 Russell Square, London, referred to hereafter as the Plan. The Plan has been prepared on behalf of the Applicant, in response to the requirements of the agreed Section 106 Agreement for 52-53 Russell Square, London.

2.1 Development Description

The scheme comprises of a refurbished building to incorporate a school split over 6 storeys with associated classrooms, group rooms, offices, laboratories and other ancillary spaces.

The existing building is used as an office and is Grade II listed.

2.2 Aim

The overriding aim of the energy strategy for the Development is to provide a low carbon development which has a flexible, future proofed energy supply strategy, as far as practically possible for a Grade II Listed Building.

The Plan sets out various measures to be adopted in the management of the Development with a view to satisfying the objectives of the energy strategy and reducing CO_2 emissions though (but not be limited to) the following:

- the incorporation of the measures set out in the Energy Statements submitted alongside the Application dated April 2017, 11 September 2017 and supplementary statements dated 28 July 2017 and 16 August 2017;
- details of how further reductions in the Developments CO_2 emissions from low or zero carbon technologies to be implemented on site. The Plan responds to the target reduction of at least 44% CO_2 emissions in relation to the Development compared to that of the existing baseline scheme of an office, using a combination of complementary low and zero carbon technologies as set out within Part 2.7 of the Section 106 Agreement;
- separate metering of all low and zero carbon technologies to enable the monitoring of energy and carbon emissions and savings;
- measures to secure a pre-implementation review by an appropriately qualified and recognised independent verification body certifying that the measures incorporated in the Plan are achievable in the Development and satisfy the aims and objectives of the Council's strategic policies on the reduction of carbon emissions contained within its Development Plan;
- include measures to secure a post construction review of the Development by an appropriately qualified and recognised independent verification body certifying that the measures incorporated in the Plan have been achieved in the Development and will be maintainable in the Development's future management and occupation; and identifying means of ensuring the provision of information to the Council and a mechanism for review and update as required from time-to-time.

2.3 Section 106 Operative Provisions

Part 4.3 of the 106 stipulates the following in relation to Energy Efficiency and Renewable Energy Plan:

On or prior to the Implementation Date to submit to the Council for approval the Energy Efficiency and Renewable Energy Plan.

Not to Implement nor permit Implementation until such time as the Council has approved the Energy Efficiency and Renewable Energy Plan as demonstrated by written notice to that effect.

Not to Occupy or permit Occupation of the Property until a satisfactory post-completion review has been submitted to and approved by the Council in writing confirming that the measures incorporated in the Energy Efficiency and Renewable Energy Plan as approved by the Council have been incorporated into the Property.

Following the Occupation Date the Owner shall not Occupy or permit Occupation of any part of the Development at any time when the Development is not being managed in accordance with the Energy Efficiency and Renewable Energy Plan as approved by the Council from time to time and shall not Occupy or permit Occupation of the Development otherwise than in accordance with the requirements of the Energy Efficiency and Renewable Energy Plan.

This Plan is submitted in response to these provisions.

3.0 APPROACH AND METHODOLOGY

3.1 Definitions and Limitations

Definitions

The following definitions should be understood throughout this statement:

- Energy Demand – the 'room-side' amount of energy which must be input to a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- Energy Requirement – the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- Regulated CO_2 Emissions – the CO_2 emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).

Limitations

The appraisals within this Statement are based on a baseline carbon dioxide emissions CO_2 using assumed U values, internal gains and infiltration rates that have not been verified of the existing office building. The calculations and model has been produced in the absence of architectural sections and elevations and the drawings are based on record drawings provided by the Landlord with on-site check measurements, not a full measured survey.

Energy Hierarchy

The London Plan Energy Hierarchy strategy provides an inclusive approach to energy use considering on site energy use, efficiency of energy supply and the use of sources of renewable energy.

The purpose of the energy hierarchy approach is to demonstrate that climate change mitigation measures form a fundamental part of the proposed scheme's design and evolution. Any measures taken forward must be demonstrated as appropriate and feasible in the context of the overall development.

Although this approach is not required for an existing building it has been adopted in this instance where possible.

There are 4 steps to the energy hierarchy process:

1. Design Criteria Building Regulations compliant building	2. 'Be Lean' Reduction by energy efficiency measures	3. 'Be Clean' Selection of low carbon energy supply strategy	4. 'Be Green' Renewable technologies

Step 1 – Design Criteria

As this is an existing building we have taken the baseline scheme as the existing buildings U values and fixed building services arrangement.

Step 2 – 'Be Lean' – Reduction by Energy Efficiency Measures

Apply energy demand reduction measures specific to the scheme such as enhanced building fabric to deliver reduced heat loss, heat gain and improved air permeability.

Other measures include improved efficiency of fixed building services beyond that of the statutory requirements.

Step 3 – 'Be Clean' – Selection of low carbon energy supply strategy

Once demand for energy has been minimised it should be demonstrated that the use of a low carbon energy supply has been explored through the order of preference of the following options:

1 - Connection to an existing heat distribution network
Investigate the potential for connecting onto an existing heat network referencing the London Heat Map and contacting local heat network operators.

2 - Connection to a planned heat distribution network
Investigate the potential for connecting onto a planned heat network referencing the London Heat Map and local energy master plans.

3 - Site wide heating networks - Where multiple buildings are proposed or where the building density is sufficient, a communal heating system should be adopted with all buildings/uses within a development normally connected into a single site wide heating network, thus facilitating future connection to decentralised energy networks.

4 - Combined heat and power (CHP) – Consider the appropriateness of CHP for the development. Typically CHP is deemed feasible where there is a simultaneous demand for heat and power in excess of 5,000 hours per annum.

Step 4 – 'Be Green' – Renewable Energy Technologies

Subject to the 'Be Lean and Be Clean' principles being appropriately satisfied and demonstrated accordingly, consideration should be made to feasible renewable energy technologies.

Figure 2 provides a graphical representation of the London Plan Energy Hierarchy.

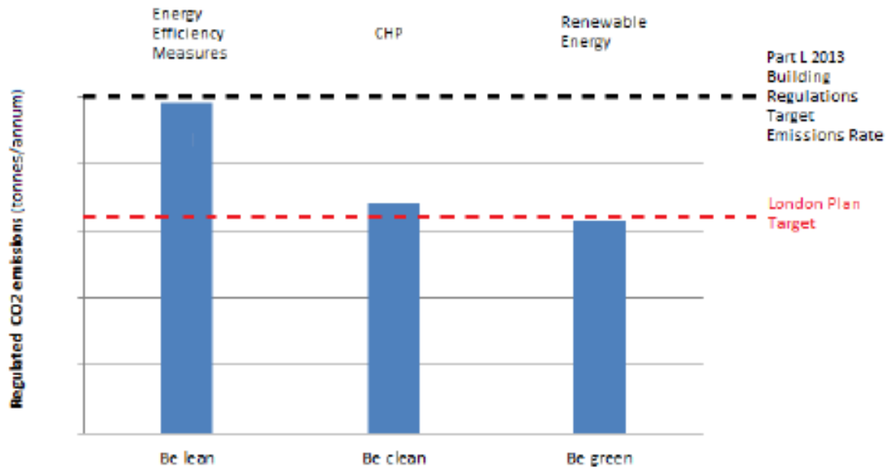

Figure 2 – 'Be Lean, Be Clean and Be Green' Diagram, London Plan

4.0 PRE-IMPLEMENTATION DESIGN STAGE REVIEW - BASELINE SCHEME

As the building is existing we have taken the existing construction and fixed services as the baseline scheme.

Building fabric details

U Values	Existing	Units
Wall	1.715	W/m2K
Roof	2.65	W/m2K
Floor	0.5	W/m2K
Windows	2.2	W/m2K
Infiltration	0.25	(Air Permeability of 3m³/h/m² @50Pa)

Fixed Building Services

Service	
Lighting Luminaire	70 lm/circuit watt
Lighting Occupancy control	No
Lighting presence detections	No
Heating / Hot Water	Efficiency 91%
Variable speed control of pumps	Yes
Heat Recovery Ventilation SFP	1.9 W/l/s
Heat Recovery Efficiency	70%
Zonal Extract Ventilation SFP	0.5 W/l/s
Local Supply or Extract Ventilation SFP	0.3 W/l/s
Ventilation demand control	Yes

Based upon the building inputs detailed above, the SBEM calculation has identified the following baseline CO_2 emissions:

Notional Building Emissions	59 $kgCO_2/m^2$

4.1 Be Lean

The following sections outline considerations of the passive design and energy efficiency measures that will be implemented within the Development.

Passive Design Measures

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most effective and robust measures for reducing CO2 emissions as the performance of the solutions, for example wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, we can be confident that the benefits of the measures will continue at a similar level for the duration of their installation.

To further reduce the CO_2 emissions associated with the scheme, the following measures have been applied to exceed the standards used as part of the baseline scheme:

1. New insulation to roof
2. Replacement of lighting with high efficiency luminaires
3. Inclusion of lighting controls including daylight / presence sensors in classrooms / offices and PIR's to corridors and WC's.
4. We are generally adapting and extending the existing heating plant therefore providing a building management system to existing plant may not be possible and if it is very costly. The only building wide system is the VRF system which currently has local control therefore a BMS system would offer no advantage. Section 106 paragraph 2.7e states a Building Management System (BMS) is provided however for the reasons given above this has not been included within the scheme.
5. New digital check meters are specified for all distribution boards (section 106 paragraph 2.7d) however separate metering of lighting and power services will not be possible as the strategy is to retain the existing distribution boards.

Building Fabric Details

U Values	Proposed	Units
Wall	1.715	W/m2K
Roof	0.18	W/m2K
Floor	0.5	W/m2K
Windows	2.2	W/m2K
Infiltration	0.25	(Air Permeability of 3m³/h/m² @50Pa)

Fixed Building Services

Service	
Lighting Luminaire	100 lm/circuit watt
Lighting Occupancy control	Yes
Lighting presence detections	Yes
Heating / Hot Water	Efficiency 91%
Variable speed control of pumps	Yes
Heat Recovery Ventilation SFP	1.9 W/l/s
Heat Recovery Efficiency	70%
Zonal Extract Ventilation SFP	0.5 W/l/s
Local Supply or Extract Ventilation SFP	0.3 W/l/s
Ventilation demand control	Yes

Based upon the building inputs detailed above, the SBEM calculation has identified the following "Be Lean" CO_2 emissions:

Notional building emissions	59 $kgCO_2/m^2$
Building emissions rate	25.96 $kgCO_2/m^2$
% emissions improvement	44

4.2 Be Clean

The following sections detail considerations of the infrastructure and low-carbon energy supply measures that have been considered, and those which will be implemented at the Proposed Development.

4.2.1 - Connection to an Existing Heat Distribution Network

The potential for connecting onto an existing heat network has been investigated and the London Heat Map does not identify supply network close enough to the site (section 106, paragraph 2.7f).

4.2.2 - Connection to a Planned Heat Distribution Network
The potential for connecting onto a planned heat network has been investigated and the London Heat Map does not identify a proposed supply network close enough to the site (section 106, paragraph 2.7f).

4.2.3 - Combined Heat and Power (CHP)
The development as a school will not achieve the 5,000 hours per annum of simultaneous demand for heat and power required for CHP to be deemed feasible.

There is also limited space in the building plantroom to incorporate a CHP unit and the installation of a flue would cause damage to the building's historic fabric.

4.3 Be Green

The following sections outline considerations of the renewable energy generation measures that have been considered, and those which will be implemented within the Development:

The energy efficient measures undertaken as part of the "be lean" design are sufficient to achieve Part L2A 2013 compliance and to achieve the 35% CO_2 reduction required for The London Plan.

The following renewable energy technologies have been investigated and discounted:-

- Wind Turbines
- Photovoltaics
- Solar Water Heating
- Ground Source Heat Pump
- Air Source Heat Pump

4.3.1 - Wind Turbines
Wind turbines exploit a natural resource to generate electricity, which can be used to serve the building with any excess exported and sold to the electricity provider.

However, wind turbines must be cited to operate in an undisturbed air flow. Considering the proximity of adjacent buildings, the wind turbine would have to be mounted at some height, and require a suitable support structure, both highly visible. Due to the property's listed status, this technology is not considered a feasible option.

4.3.2 - Photovoltaics
Photovoltaic (PV) panels produce electrical energy which can also be used to serve the building, with any excess exported to the electricity provider. For further details, please refer to the PV feasibility report submitted to satisfy Condition 6 of the planning conditions.

Due to the Mansard roof style there is very limited useable roof space available, and suitable access has to be achieved for inspection and maintenance.

The maximum number of photovoltaic (PV) modules that could be installed to the flat roof is limited to two due to the automatic openable vent (AOV) and the zone at each end of the roof where modules cannot be installed due to shading.

In our opinion a maximum of two modules could be installed however access for installation and ongoing maintenance would be difficult due to the space restrictions.

Similarly, it is likely that even if photovoltaic modules were installed, they would be visible from Russell Square, and therefore have a negative and harmful impact on the Grade II listed building and wider conservation area.

A further reason for discounting the use of a photovoltaic installation is due to the high capital costs associated with the pay back periods that would be achieved with only two modules. The estimated supply and install cost would be in the region of £3,000.00 + VAT with a payback period predicted to be in excess of 25 years.

On this basis, we do not consider PV panels to be appropriate in this instance. Accordingly, details of PV panels have not been provided (Condition 6ii).

4.3.3 - Solar Water Heating
A solar water heating system could be used in conjunction with a conventional gas boiler system and a dual element hot water cylinder.

Similar to the use of PV panels though, there is very limited roof space available for the citing of panels. To compound this, the hot water demand within this building will be very modest, so solar hot water technology would make only a limited contribution to the reduction in $C0_2$ emissions. As a result it is not considered an appropriate option for this property.

4.3.4 - Ground Source Heat Pumps
A ground source heat pump would require some form of ground pipework loop, either at a shallow depth or throughout the height of a borehole, to extract usable energy from the ground. This building has virtually no available land for the installation of either. For that reason this technology is not considered remotely viable for this building.

4.3.5 - Biomass Boilers
A biomass boiler could be introduced at this building to provide a heat source for the central heating system. However, there is very limited space for fuel storage, thereby necessitating frequent deliveries to what is a very busy part of London.

Furthermore, and considering the city centre location and given the Grade II nature of the property, there would be considerable concern over the height of the chimney required to ensure compliance with the Clean Air Act Memorandum.

For these reasons the introduction of a biomass boiler is not considered viable for this building.

4.3.6 - Air Source Heat Pumps
The proposals are to retain the existing air source heat pump units and internal heating and cooling units to serve the classrooms.

The heat pump utilises energy from the external air and converts this energy to either heating or cooling energy for the building. The system is admittedly less efficient than a ground source heat pump, with relatively greater variation in that COP as external condition fluctuate.

However, the technology will make a significant contribution to reducing carbon emissions associated with this building, particularly when compared to the alternative heat source such as a gas fired boiler.

Finally the technology has already been discretely incorporated into this building, and therefore has been shown to be viable for use here.

Based on the above the SBEM Calculation has not changed following the Step 2 – 'Be Lean' – Reduction by Energy Efficiency Measures.

5.0 CONCLUSION

Following the assessment methodology set out by the London Plan we have identified a number of measures to improve energy efficiency and limit CO_2 emissions for the proposed French School Building.

The table below provides a summary of the improvements achieved at each step of the energy hierarchy approach:

	Regulated Carbon Dioxide Emissions (Tonnes CO_2/Annum)	CO_2 Emissions Reduction (%)
Savings from Energy Demand Reduction	25.96	44
Savings from Low Carbon Energy Supply	0	0
Savings from Renewable Energy	0	0
Total Cumulative Savings	25.96	44
Total Target Savings	25.96	44

The building's change of use from an office to a school combined with the energy saving proposed is predicted to achieve reduced CO_2 omissions of 44 %.

A post construction review will be provided to ensure the Contractor has completed the installation based on the design and the requirements set out within this report (section 106, paragraph 2.7h and 2.7i). The Contractor will produce fully operation and maintenance manuals and as built drawings which shall indicate all low energy measures installed.