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Energy Report

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Contents

South west view of proposed development

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EXECUTIVE SUMMARY

The project consists of a proposed large extension and refurbishment of an existing school. This report describes how the scheme meets its objectives of reduced energy consumption and CO_2 emissions.

The approach adopted exceeds the requirements of Building Regulations (Part L 2010) and takes account of current guidance, particularly the Mayor's Energy Strategy as stated in the 'The London Plan: Spatial Development Strategy for Greater London July 2011'.

The Mayor's Energy Strategy encourages new developments to conserve energy using a defined energy hierarchy, which should be implemented in the following order:-

- Use less energy (be lean)
- Supply energy efficiently (be clean)
- Use renewable energy (be green)

Our analysis has consisted of:-

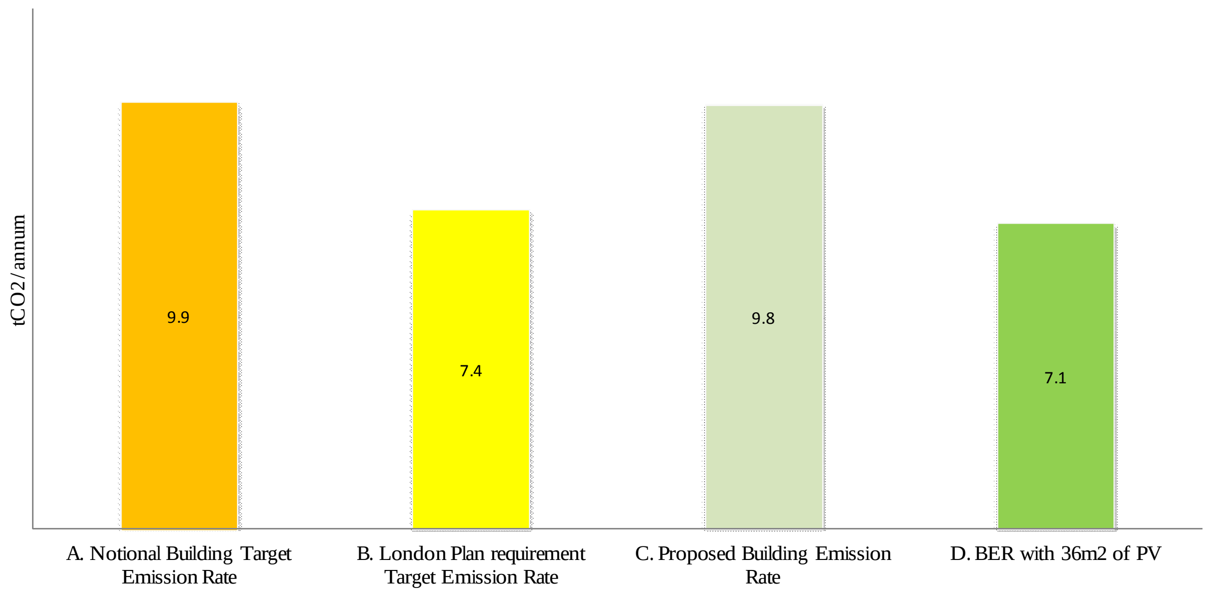
- Calculating the energy demand and the possible CO_2 emissions reductions that can be achieved in the development through employing energy reduction techniques demonstrated using standard approved methods and software modeling (DSM).
- Investigating the viability of CHP and district heating networks in the immediate area
- Investigating the viability of renewable energy technologies

In summary, this report confirms that the proposed development is responsible for 28% fewer CO_2 emissions than the 'notional' building due to passive design features and the application of renewable/low carbon technologies.

Opposite is a graphical representation of these reduction, and measures adopted are

- High levels of insulation and air tightness
- Natural ventilation generally, with heat recovery mechanical ventilation where necessary
- Solar photovoltaics for the school.

In addition we demonstrate that the improvements being made to the existing school will reduce carbon emissions from this element by around 19%.



CO2 REDUCTIONS USING PART L METHOD	CO2 (tonnes)	CO2 Reduction
A. Notional Building Target Emission Rate	9.9	
B. London Plan requirement Target Emission Rate	7.4	25%
C. Proposed Building Emission Rate	9.8	None
D. BER with 36m2 of PV	7.1	28%

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INTRODUCTION

An existing school is to be refurbished and extended. The extensions comprise a total useful floor area of approximately 600m2 and therefore are above the threshold of 500m2 at which the requirement for a formal sustainability statement is required.

This energy report contributes to the sustainability statement.

This report describes how the development achieves savings in energy and carbon dioxide emissions (CO_2) following a deliberately ordered strategy of measures to reduce energy consumption and using necessary energy efficiently. It is divided into two parts:-

- Measures applied to the existing building to reduce energy usage and improve occupant comfort
- Analysis of the proposed new extensions to demonstrate compliance with current requirements of planning and building regulations

With respect to the new build elements, this approach is informed by planning policy that is relevant to the location of the site. At a regional level, the guidance of the Greater London Authority is referenced, and as such the hierarchical approach of The London Plan 2011 and, in particular, the Mayor's Energy Strategy has been taken into account. The London Plan encourages the conservation of energy in buildings by a defined energy hierarchy which should be implemented in the following order:

1- Be lean- Use less energy, in particular by adopting sustainable design and construction measures

2- Be clean - Supply energy efficiently, in particular by prioritising decentralised energy generation

3- Be green- Use renewable energy

This hierarchy has been used in parallel with the requirements of current Building Regulations for the conservation of fuel and power (Part L2A: 2010), which set out specific benchmarks of performance for the basic building design.

Once these benchmarks have been reached the hierarchy is adopted. The structure of this report follows the ordered approach of the hierarchy, discussing compliance with Building Regulations and using less energy, supplying energy efficiently, and finally consideration of any effective renewable energy solutions applied to the residual requirement.

PLANNING POLICY CONTEXT

Local

Camden Council's core strategy document CS13 'Tackling climate change through promoting higher environmental standards' is interpreted by development policy DP22 'Promoting sustainable design & construction' which states:-

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and

b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.;

d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;

e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;

g) limiting run-off;

h) reducing water consumption;

i) reducing air pollution; and

j) not locating vulnerable uses in basements in flood-prone areas.

Regional

'The London Plan: Spatial Development Strategy for Greater London July 2011" states:-

Policy 5.1 - Climate change mitigation

- The Mayor seeks to achieve an overall reduction in London's carbon dioxide emissions of 60 per cent (below 1990 levels) by 2025. It is expected that the GLA Group, London boroughs and other organisations will contribute to meeting this strategic reduction target, and the GLA will monitor progress towards its achievement annually.

Policy 5.2 - Minimising carbon dioxide emissions

- Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

  1 Be lean: use less energy

  2 Be clean: supply energy efficiently

  3 Be green: use renewable energy

  The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

  Residential buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent (Code for Sustainable Homes level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

  Non-domestic buildings:

Year	Improvement on 2010 Building Regulations
2010 – 2013	25 per cent
2013 – 2016	40 per cent

2016 – 2019	As per building regulations requirements
2019 – 2031	Zero carbon

Policy 5.3-Sustainable design and construction

- The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.
- Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

Policy 5.9 - Overheating and cooling

- The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis
- Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

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

Applicant's responses to Planning Policies

As required by the local Authority, the applicant will undertake to meet the following sustainability targets:-

New build elements:-

- Achieve a BREEAM (Buildings Research Establishment Energy Assessment Method) rating of 'Very Good' when assessed against "BREEAM education 2008- SD 5051"
- Achieve a 25% reduction in regulated (ie Part L defined) emissions where compared against the minimum Part L2A 2010 standard (ie BER = <0.75 x TER)

Existing elements:-

- Demonstrate a minimum 20% reduction of regulated emissions with respect to the current building while improving the comfort of its occupants

We believe that BREEAM cannot be applied to the existing development and therefore do not propose to include it; however the principles defined in BREEAM will be applied wherever appropriate.

THE ENERGY HIERARCHY

Compliance with Building Regulations

New build elements (Part L2A)

National and regional energy strategies have to a large extent incorporated changes to Approved Document Part L insofar as the local targets require emission rates to meet or better those required by Part L. Therefore it is necessary to determine what the Part L (minimum) standard is before the application of energy reduction measures to the design.

The following section summarises the energy calculations undertaken in order to determine the Part L target emission rates (TER) to which the Planning requirements are applied. The TER is obtained by applying the design to a reference 'notional' building the characteristics of which are set by regulations. This should be considered as stage 'zero' of the energy hierarchy as described earlier and sets the benchmark for the worst performing, but legally permissible, development.

The school extensions are assessed under Part L2A using DSM (Simplified Building Energy Model).

The results that follow have been calculated using approved DSM software. Subsequent sections of this report shall demonstrate how the development, through the use of the hierarchy (lean, clean, green) meets the targets of both Part L and Planning.

The extensions have a treated floor area of approximately 605m^2 mainly at ground floor level with a small two story section located at the south east. The notional building used for comparison assumes the same basic characteristics; however it applies limits to the sizes of windows and other less well performing thermal elements. For reference, table 1 of the NCM modeling guide 2010 is reproduced below.

Table 1 Construction element U-values and thermal capacity for the Notional building

Exposed element	U-value (W/m²K)	Thermal capacity[6] (kJ/m²K)
Roofs[7] (irrespective of pitch)	0.18	21.8 (1.40 if metal clad)
Walls	0.26	88.3 (1.40 if metal clad)
Exposed floors and ground floors (subject to paragraph 33)	0.22	ivity
Windows, roof windows, and roof lights[8]	1.80	-
Vehicle access and similar large doors	1.50	2.1
Pedestrian doors and high usage entrance doors	2.20	54.6
Internal wall	1.80	8.8
Internal floor / ceiling	1.00	71.8 from above / 66.6 from below

Table 1 provides the notional building energy performance as produced by the approved modelling software.

NOTIONAL BUILDING				
Annual consumption	Gas Consumption	Elec Consumption	Carbon emissions	Carbon emissions
Usage	kWh	kWh	kg CO2/annum	kg CO2/m2
Space Heating	9444		1870	3.1
Space Cooling		0	0	0.0
DHW	15579		3085	5.1
Auxiliary		2771	1433	2.4
Lighting		8059	4166	6.9
	25023	10830	10553	17.4

Table 1- Notional Building energy usage

This represents an emission rate of **10.55 Tonnes per annum** and sets the target emission rate (TER) 17.4 $kgCO_2/m^2/year$, and with the notional building management and control features the revised TER is 16.3 $kgCO_2/m^2/year$.

The requirement is to target a reduction in emissions of 25% based upon Part L 2010

Therefore the revised TER is set as:

$$16.3 \times 0.75 = 12.2\ kgCO_2/m^2/year$$

Existing elements (Part L2B)

The proposed works invoke regulation 17D of the Building regulations:-

Consequential improvements to energy performance – Regulation 17D

(1) Paragraph (2) applies to an existing building with a total useful floor area over 1000 m^2 where the proposed building work consists of or includes–

(a) an extension;

(b) the initial provision of any fixed building services; or

(c) an increase to the installed capacity of any fixed building services.

(2) Subject to paragraph (3), where this paragraph applies, such work, if any, shall be carried out as is necessary to ensure that the building complies with the requirements of Part L of Schedule 1.

(3) Nothing in paragraph (2) requires work to be carried out if it is not technically, functionally or economically feasible.

-as clauses (a), (b) and (c) are all included.

Part L2B, section 6: Consequential Improvements, table 6 provides a list of improvements that should be considered. This is provided opposite for reference.

The proposed improvements as part of this submission are (cross referenced to table 6):-

Item	Proposal
1	Complete replacement of all heating plant including controls.
2	No cooling systems proposed
3	Complete replacement of all ventilation plant to L2A standards
4	Complete replacement of all lighting and provision of lighting controls
5	Metering generally in accordance with TM39
6	Upgrade of thermal elements as detailed elsewhere within this document
7	Complete replacement of glazing to L2A standards
8	Refer to renewable energy section elsewhere in this document
9	Not applicable- a new DEC/EPC will be generated by the works

Table 6 **Improvements that in ordinary circumstances are practical and economically feasible**

Items 1 to 7 will usually meet the economic feasibility criterion set out in paragraph 6.5. A shorter payback period is given in item 8 because such measures are likely to be more capital intensive or more risky than the others.

No.	Improvement measure
1	Upgrading heating systems more than 15 years old by the provision of new plant or improved controls
2	Upgrading cooling systems more than 15 years old by the provision of new plant or improved controls
3	Upgrading air-handling systems more than 15 years old by the provision of new plant or improved controls
4	Upgrading general lighting systems that have an average lamp efficacy of less than 40 lamp-lumens per circuit-watt and that serve areas greater than 100 m^2 by the provision of new luminaires or improved controls
5	Installing energy metering following the guidance given in CIBSE TM 39
6	Upgrading ***thermal elements*** which have U-values worse than those set out in column (a) of Table 5 following the guidance in paragraphs 5.12 and 5.13
7	Replacing existing windows, roof windows or rooflights (but excluding display windows) or doors (but excluding high-usage entrance doors) which have a U-value worse than 3.3 $W/m^2.K$ following the guidance in paragraphs 4.23 to 4.28
8	Increasing the on-site low and zero carbon (LZC) energy-generating systems if the existing on-site systems provide less than 10% of on-site energy demand, provided the increase would achieve a simple payback of 7 years or less
9	Measures specified in the Recommendations Report produced in parallel with a valid Energy Performance Certificate

Table 6 of approved document L2B

Step 1- Using less energy- 'Be lean'

Complying with the first stage of the energy hierarchy can be achieved by implementing 'passive' energy efficiency measures to reduce the demand for energy rather than meeting a larger demand with other sources. For this reason the Mayor's hierarchy looks to use less energy before incorporating energy efficient technologies, such as CHP, or deploying renewable energy technologies.

The design of the new building has incorporated the following energy saving measures:-

- The provision of high thermal performance by means of increased insulation and high performance window systems to reduce heat loss and minimize solar gain
- Specified construction techniques to reduce unwanted air infiltration, certified air-tight windows and post completion air-pressure testing to ensure compliance with design standards.
- Where used, mechanical ventilation systems will incorporate high efficiency heat recovery
- The use of natural ventilation techniques will combat summertime overheating
- Good levels of natural lighting
- Automatic lighting controls (daylight and presence detection) and low energy light fittings.

Table 3 below compares the target thermal insulation "U values" for the development with the Part L 2010 minimum standards:-

U-values (W/m^2K)	**Current building regulations minimum***	**Values for the proposed development**
Walls	0.35	0.26
Floors	0.25	0.22
Roofs	0.25	0.18
External doors	2.2	1.8
Windows & rooflights	2.2	1.8
Air permeability	$10m^3/m^2h$ at 50 Pa	$5m^3/m^2h$ at 50 Pa

*=Simplified area weighted averages

Table 3: Recommended U-values for the proposed building in comparison with the base case building

By the application of the improved building insulation levels, the calculations are revised thus:-

School results (DSM)

ACTUAL BUILDING USING DEFAULT GAS FIRED BOILER FOR DHW & SPACE HEATING				
Annual consumption	Gas Consumption	Elec Consumption	Carbon emissions	Carbon emissions
Usage	kWh	kWh	kg CO2/annum	kg CO2/m2
Space Heating	9414		1864	3.1
Space Cooling		0	0	0.0
DHW	15167		3003	5.0
Auxiliary		2456	1270	2.1
Lighting		7811	4038	6.7
	24581	10267	10175	16.8

Table 4- Actual Building energy usage

The resultant carbon emission rate is 10.17 Tonnes per annum or a BER of 16.8 $kgCO_2/m^2$/year, and with the building's management and control features the revised **BER is 16.2 $kgCO_2/m^2$/year**.

As can be seen, this alone does not meet the requirement of 12.2 and therefore further measures are required.

Existing building

As noted earlier, the requirement for consequential improvements means that (where financially and technically viable) the thermal elements should be upgraded in accordance with the table reproduced below:-

GUIDANCE ON THERMAL ELEMENTS **L2B**

Table 5 Upgrading retained thermal elements

Element[1]	U-value W/m².K	
	(a) Threshold	(b) Improved
Wall – cavity insulation	0.70	0.55[2]
Wall – external or internal insulation	0.70	0.30[3]
Floors[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

Notes:

1. 'Roof' includes the roof parts of dormer windows, and 'wall' includes the wall parts (cheeks) of dormer windows.
2. This applies only in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for 'wall – external or internal insulation'.
3. A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.
4. The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.
5. A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.
6. A lesser provision may be appropriate where meeting such a standard would create limitations on head room. In such cases, the depth of the insulation plus any required air gap should be at least to the depth of the rafters, and the thermal performance of the chosen insulant should be such as to achieve the best practicable U-value.
7. A lesser provision may be appropriate if there are particular problems associated with the load-bearing capacity of the frame or the upstand height.

The construction and estimated u-value associated with the existing building thermal elements are summarized in table 5 and table 6 below:-

Element	Construction	Estimated u-value
Walls	Cavity Wall with 25mm insulation	0.95
Ground floor	Concrete slab	0.65
Roofs	Slate roof. 25mm Insulation applied to internal ceiling (cold roof)	0.95
External doors	Solid wooden doors	3.0
Windows & rooflights	Single Glazed	5.7
Air permeability	$15m^3/m^2h$ at 50 Pa	

Table 5 – Existing building thermal elements

The proposed improvements are:-

Element	Improvement	Estimated u-value
Walls	None- though it should be noted that approximately 15% of the existing external walls will become internal walls following the construction of the extensions	0.95
Ground floor	None	0.65
Roofs	Roof replaced. Insulation line moved to provide 'warm roof'. 210mm of insulation added	0.18
External doors	Replaced with modern units	2.0
Windows & rooflights	Replaced with modern units	1.8
Air permeability	Air permeability estimated to be reduced to $10m^3/m^2h$ at 50 Pa due to the provision of new glazing and works to roof.	

Table 6 – Proposed improvements to Existing building

EXISTING BUILDING				
Annual consumption	Gas Consumption	Elec Consumption	Carbon emissions	Carbon emissions
Usage	kWh	kWh	kg CO2/annum	kg CO2/m2
Space Heating	32909		6516	12.3
Space Cooling		0	0	0.0
DHW	4660		923	1.7
Auxiliary		3089	1597	3.0
Lighting		8686	4491	8.5
	37570	11776	13527	25.6

Table 7- Existing Building energy usage

The resultant carbon emission rate is 13.5 Tonnes per annum or a BER of 25.6 $kgCO_2/m^2/year$.

EXISTING BUILDING WITH IMPROVEMENTS				
Annual consumption	Gas Consumption	Elec Consumption	Carbon emissions	Carbon emissions
Usage	kWh	kWh	kg CO2/annum	kg CO2/m2
Space Heating	18594		3682	7.0
Space Cooling		0	0	0.0
DHW	4660		923	1.7
Auxiliary		3089	1597	3.0
Lighting		9226	4770	9.0
	23255	12315	10971	20.7

Table 8- Existing Building energy usage with upgraded roof and windows

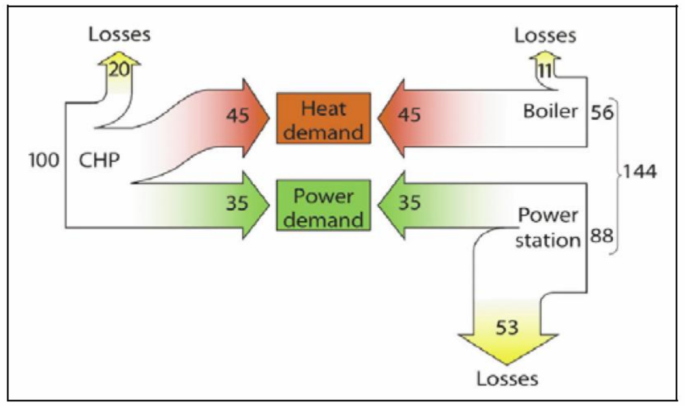
The resultant carbon emission rate is 10.9 Tonnes per annum or a BER of 20.7 kgCO2/m2/year, this represents a 19% improvement over the existing building emission.

Step 2: Supplying energy efficiently- 'Be clean'

Combined Heat and Power

Combined Heat and Power is a method by which electricity and heat are generated from a single fuel source, often gas. Electricity is generated in power stations that feed electricity into the National Grid. The heat generated as a byproduct of electricity generation in power stations is normally released to the atmosphere via cooling towers, whereas the heat from a CHP unit is harnessed for use in buildings.

In general, power plants operate with an electrical efficiency of between 35% and 40% (see below). The remaining energy input (up to 65%) produces thermal energy, which is lost to the atmosphere. CHP systems generate electricity locally and enable the use of the thermal by-product at the same time as the consumers are nearby. For good quality CHP, up to 90% of the input energy can be converted into useful energy, saving not only valuable energy resources but also potentially reducing CO2 emissions when compared with traditional electricity generation.



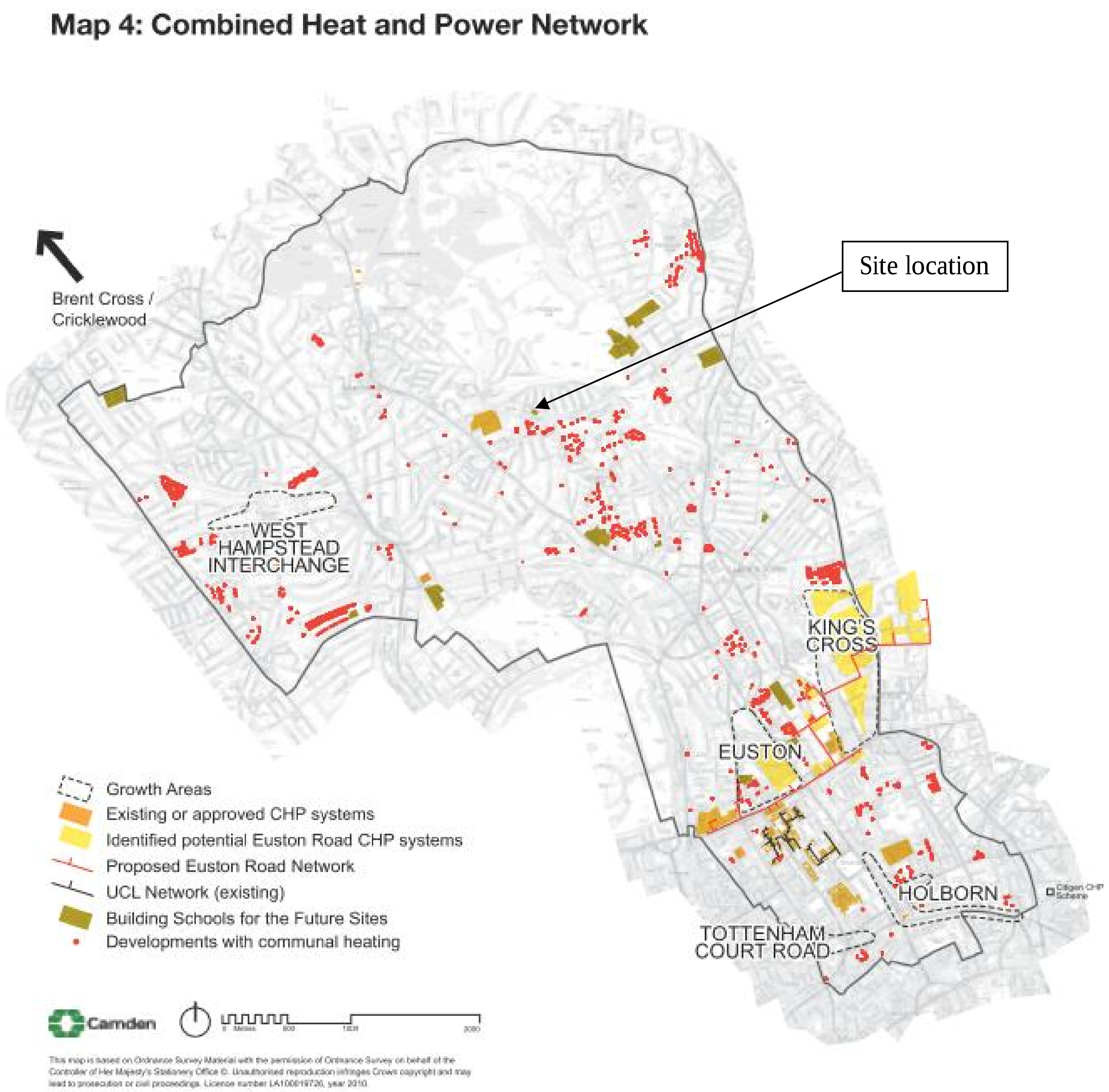
Energy flow of CHP compared to conventional provision of heat and power & typical small scale CHP engine located in plant room (Source: GPG388: Combined Heat and Power for Buildings, Action Energy).

Micro CHP systems can be sized and installed to suit individual buildings and run in a similar fashion to a traditional gas fired boiler. Alternatively larger scale systems operated as a standalone entity can be used to provide heat and power to the local neighbourhood.

Buildings that are best suited as candidates for their own CHP system are those with high all year heating demand, generally for the provision of hot water such as hotels, hospitals and industrial premises together with a reasonably consistent base electrical load. Dwellings and schools are not included in this group; schools are closed for extended periods each year and dwellings typically use more electricity at off-peak times. Due to this, integrated CHP is not considered viable for the development.

District heating

Camden Council is keen to encourage district heating and there are a number of sites within the Borough benefitting from this. Core Strategy CS13 includes a helpful heat map which is included here for reference:-



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It is noted that a district heating scheme is under development with heat being provided by the combined heat and power system located at the Royal Free Hospital.

At the time of writing very little information on this scheme is available in the public domain and the potential to connect this site to it in unknown.

Therefore, it is proposed at this time to include suitable buried pipework terminating at one end in the main plant room with the other in an easily accessible location or chamber close to the site boundary as part of the scheme.

This will allow connection should:-

(i) -it transpire following further investigation that it is already available

or

(ii) -district heating be extended to this location from the source identified or any other source

All further calculations, etc within this report shall assume that the school generates its own heat.

Step 3: Using renewable energy- 'Be Green'

The London Plan 2011 provides the following guidance for the use of renewable energy:-

POLICY 5.7 RENEWABLE ENERGY

Strategic

A. *The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.*

Planning decisions

B. *Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.*

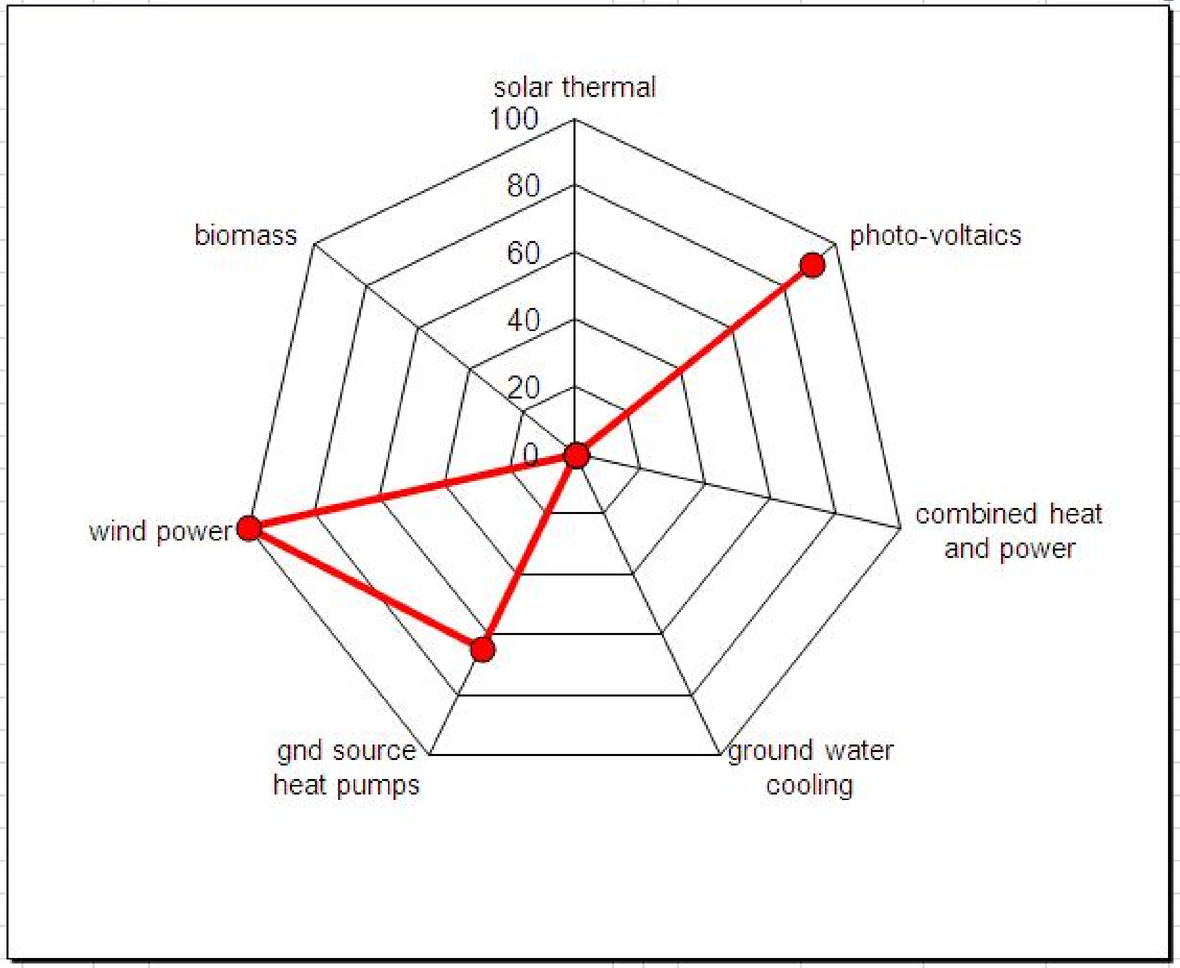
Before further analysis is done, the London Renewable Toolkit offers a flowchart intended to provide the prospective developer a simple method of determining the viability of the above technologies for a given site. This flowchart has been formalised in a tool (TM38) developed by CIBSE. Using the information provided in the specifications and knowledge of the site, the output of this tool is shown opposite.

This shows, following the completion of a simple checklist which renewable technologies are worth considering for a particular development. The closer to the outside of the 'web' the point is, the more viable it possibly is.

The tool is only an indication and some technologies may be included or discounted as they come under more scrutiny.

Building Information	
Type	**educational buildings**
Location	**urban**
Exposure	**normal**

Ranking	
Cost Effectiveness:	3
Carbon Savings:	3
Marketing / Image:	3
Technology Risk:	3



Output of CIBSE TM38 renewables selector tool

Solar Thermal

Due to extended periods of non-occupancy and relatively small domestic hot water usage, solar thermal is not considered viable for the school.

Wind turbine

While the TM38 tool suggested that a wind turbine is *technically* viable for this site this option has been discounted as not suitable for the site due to unacceptable noise generation and an imposing appearance in a generally residential area.

Air or Ground Heat Pump Source Heating and Cooling

The school and dwellings will be designed to be naturally ventilated and passively cooled; no extensive cooling systems are anticipated within the development.

Ground or air source heating, in order to be efficient relies on the use of low temperature heating systems such as underfloor heating which are ideally left running continuously with setback temperatures being applied during periods of non-occupancy. While underfloor heating is proposed for the new build elements it is not financially viable to fit underfloor heating in the existing school. Even if it was, due to the higher levels of heating required due to the older construction (ie more infiltration and generally higher u-values than current standards allow) it is unlikely that the low output of underfloor heating systems would be enough to meet the heating requirement.

Therefore, to keep the systems simple it is intended for the development to run with high temperature heating systems (with weather compensation) with local mixing to produce low temperature underfloor heating circuits. The incorporation of heat pumps would considerably complicate the installations as well as requiring much greater space allocated to plant.

It is also arguable that the addition of twin circuits and plant would, due to the embodied carbon required to manufacture and install them, have a greater carbon footprint than several years worth of small savings in running emissions.

These technologies will not be pursued.

Solar Photovoltaic

The electrical usage profiles for schools that are closed during the peak generation months (ie over the summer holidays) do not match well with the electrical output of solar photovoltaic installation.

However, though it is preferable that the energy generated is used at the point of generation neither Part L of the Building Regulations or current planning policy require this to be the case. Indeed the way Part L deals with onsite generation is to assume that all electricity is imported and all generated electricity is exported with the net result contributing to the sites BER (building emission rate).

Two areas which are suitable for the inclusion of solar photovoltaic panels have been identified, these being:-

- The south facing roof of the new building to the southeast of the site (approximately 45m2 of PV)
- The roof of the existing hall building (approximately 36m2 of PV)

While it is technically feasible in other areas, there are a number of issues which prevent this from being adopted in greater quantities:-

- In order to provide the good levels of daylighting and provide passive ventilation to combat summer overheating many of the flat roofs are fitted with fixed or openable rooflights. This breaks up the usable area for the installation of an efficient array.
- The suitable flat roofs are at low level and therefore susceptible to vandalism.

This has the following effect on the carbon emissions of the building as designed:-

ACTUAL BUILDING WITH PV				
Annual consumption	Gas Consumption	Elec Consumption	Carbon emissions	Carbon emissions
Usage	kWh	kWh	kg CO2/annum	kg CO2/m2
Space Heating	9414		1864	3.1
Space Cooling		0	0	0.0
DHW	15167		3003	5.0
Auxiliary		2456	1270	2.1
Lighting		7811	4038	6.7
Displaced electricity (PV)		-5203	-2752	-4.5
	24581	5064	7423	12.3
Building Emission Rate	11.7	kg CO2/m2/annum		

Table 9- Actual Building energy usage

These show that the PV array will save 7.42 Tonnes of carbon emissions per annum and reduce the BER to 11.7 $kgCO_2/m^2/year$, a reduction on TER of 28.4% and exceeding the requirements.

UNREGULATED LOADS

Policy 5.2 D(a) of the London Plan requires:-

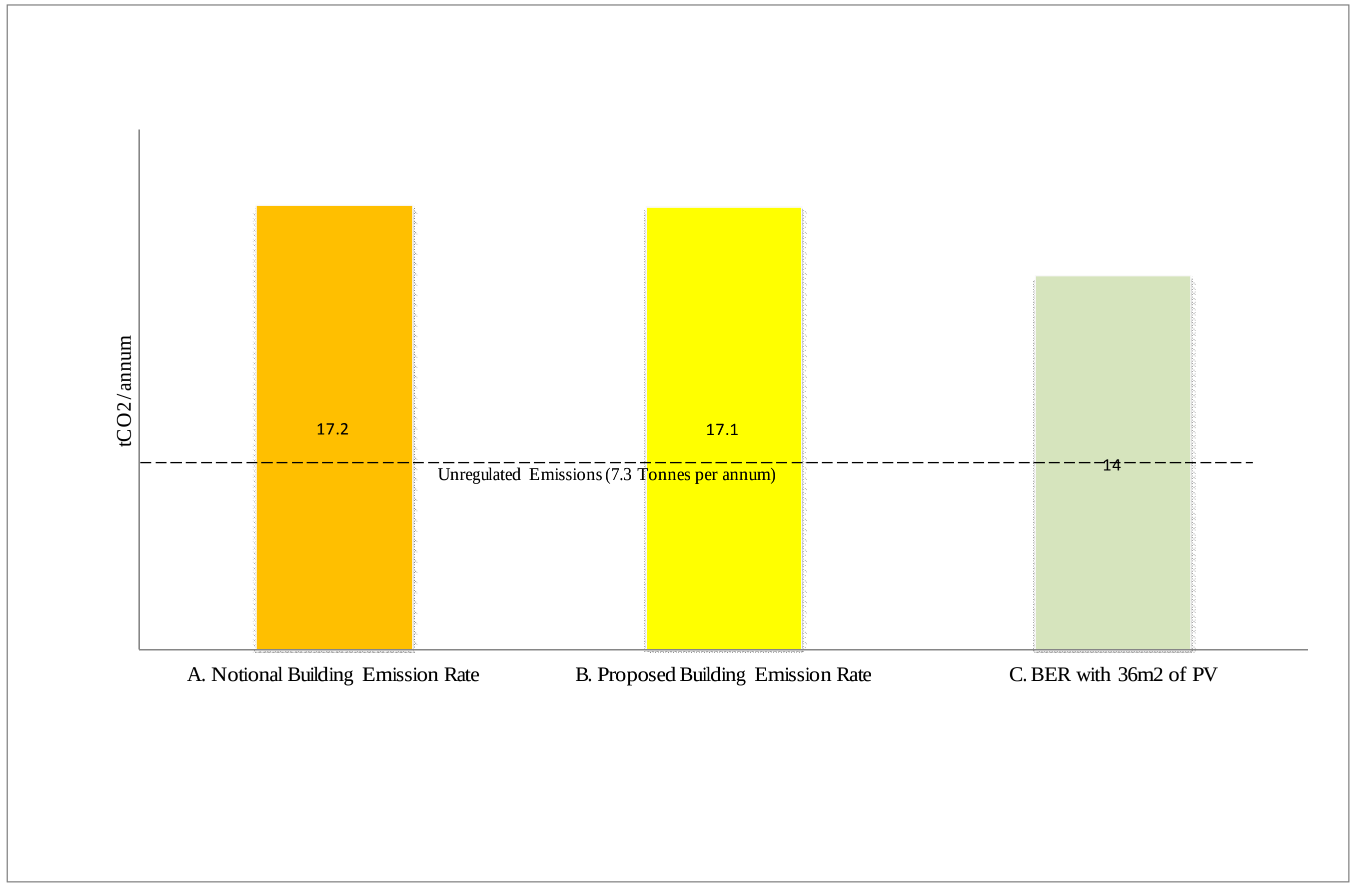
"calculation of the energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy"

The table below shows the school DSM calculation with unregulated loads (as defined by the NCM database) included:-

NOTIONAL BUILDING WITH UNREGULATED LOADS				
Annual consumption	Gas Consumption	Elec Consumption	Carbon emissions	Carbon emissions
Usage	kWh	kWh	kg CO2/annum	kg CO2/m2
Space Heating	9444		1870	3.1
Space Cooling		0	0	0.0
DHW	15579		3085	5.1
Auxiliary		2771	1433	2.4
Lighting		8059	4166	6.9
Equipment		14097	7288	12.0
	25023	24926	17841	29.5
Target Emission Rate	35.7	kg CO2/m2/annum		

Table 9- Notional Building energy usage with unregulated loads

As can be seen, these contribute 35.7 kg CO2/m2/ annum (17.8 Tonnes), the effect of which is summarized in the chart opposite.



The BREEAM schemes deal more directly with appliances and ongoing energy management. Therefore the reports relating to these should be referenced for further information.

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CONCLUSIONS

Energy assessments of the proposed development & the refurbished elements have been carried out.

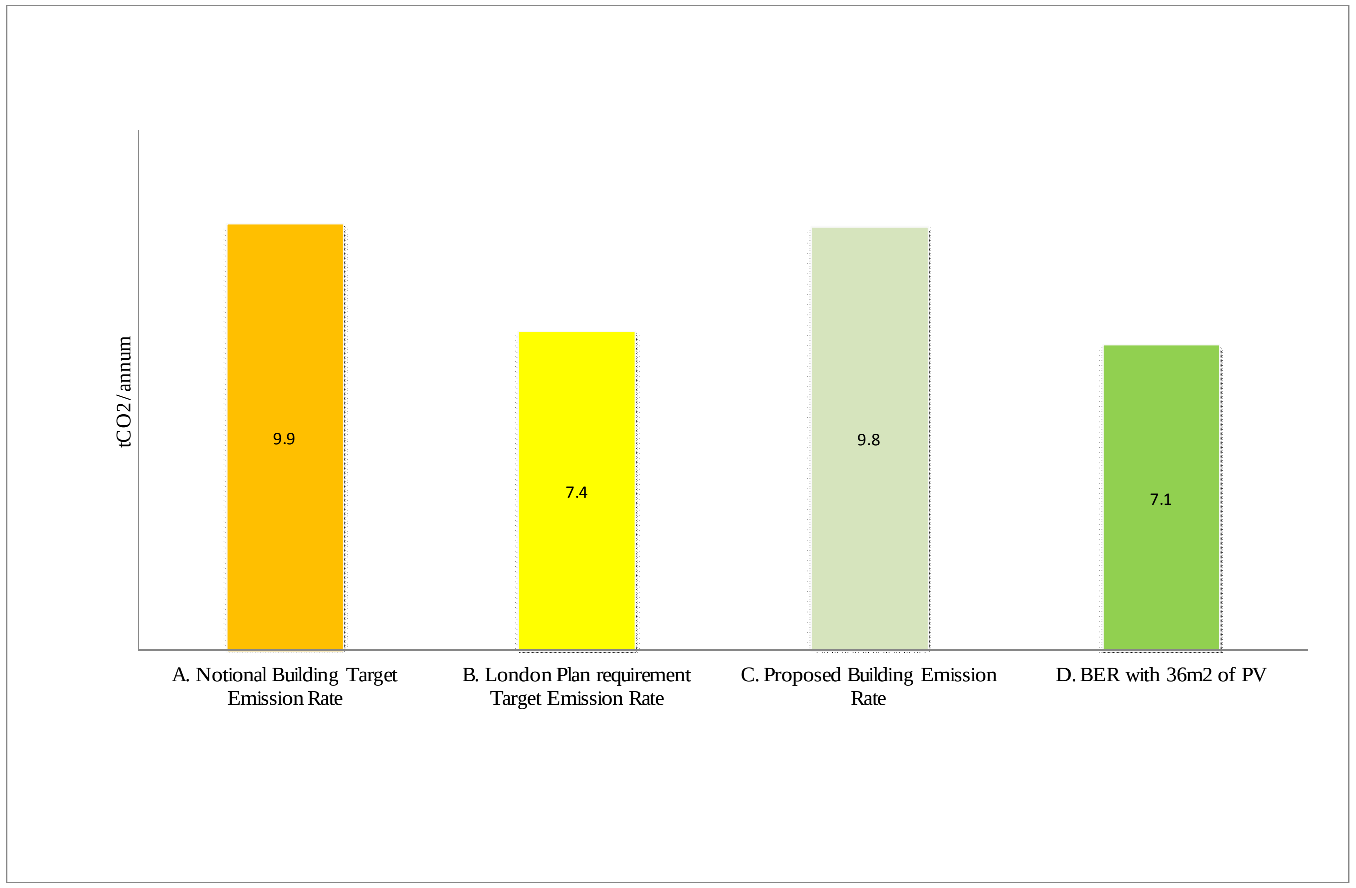
Various passive energy reduction measures have been presented. These have been supplemented with solar photovoltaic panels to further reduce the emissions rate to below the target set by the London Plan.

The following tables and charts present these reductions in terms of :-

a) The new build element

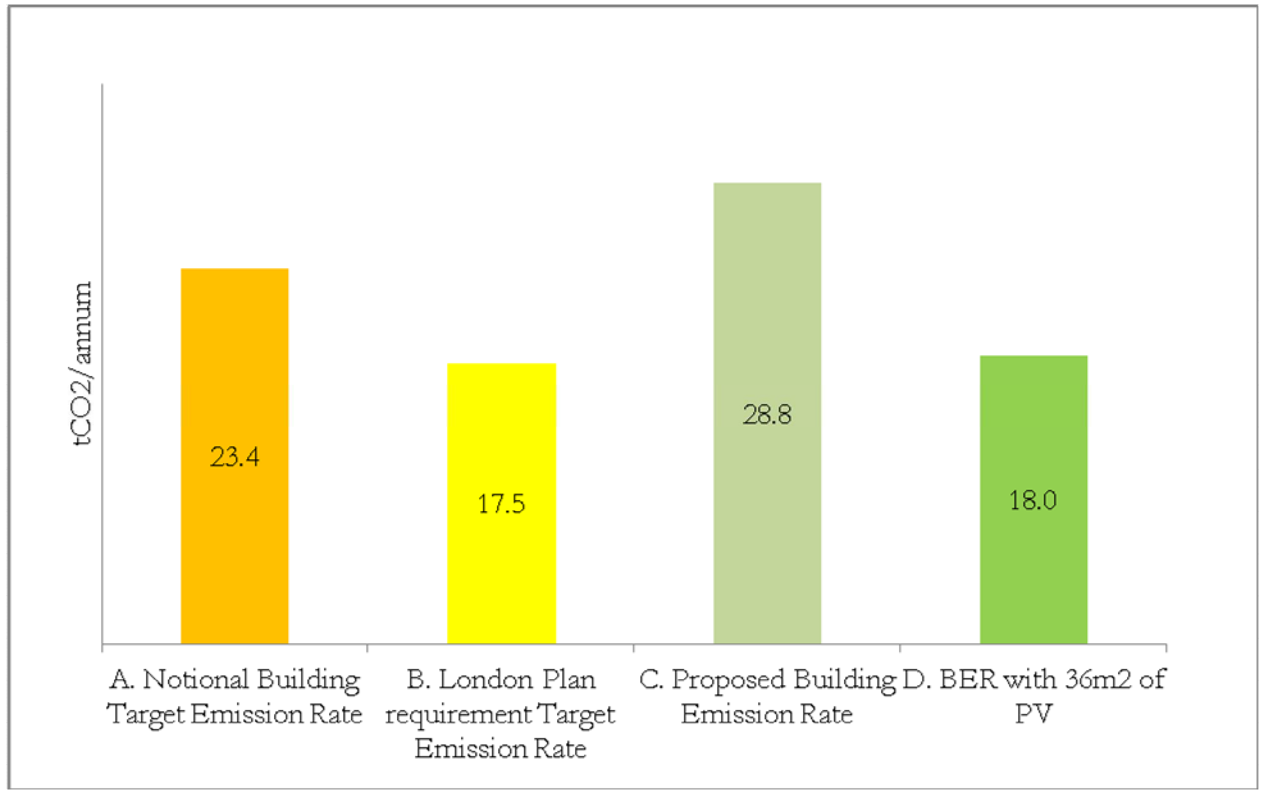
b) The entire site including the existing building

SUMMARY DATA–NEW BUILD ENERGY PERFORMANCE



CO2 REDUCTIONS USING PART L METHOD	CO2 (tonnes)	CO2 Reduction
A. Notional Building Target Emission Rate	9.9	
B. London Plan requirement Target Emission Rate	7.4	25%
C. Proposed Building Emission Rate	9.8	None
D. BER with 36m2 of PV	7.1	28%

SUMMARY DATA–ENTIRE DEVELOPMENT ENERGY PERFORMANCE



ENTIRE BUILDING CO2 REDUCTIONS USING PART L METHOD	CO2 (tonnes)	CO2 Reduction
A. Notional Building Target Emission Rate	23.4	
B. London Plan requirement Target Emission Rate	17.5	25%
C. Proposed Building Emission Rate	28.8	None
D. BER with 36m2 of PV	18.0	23%

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