Maria Fidelis site

Energy Statement

1st April 2019

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ISSUE HISTORY

Issue	Date	Description
1	28/03/19	Draft Planning
2	01/04/19	Draft Planning

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EXECUTIVE SUMMARY

The development on the Maria Fidelis site involves the creation of a new education centre for trade skills (CSC Building), the refurbishment of the existing school building for use as office space (Workspace Building), and the refurbishment of the Gym for community use (Multi-use Hall). The expected lifespan of all buildings is 10 years.

All three buildings are non-domestic. The new building is legislated under Part L2A of the Building Regulations and designed in accordance with the GLA's energy hierarchy. The existing buildings are legislated under Part L2B of the Building Regulations.

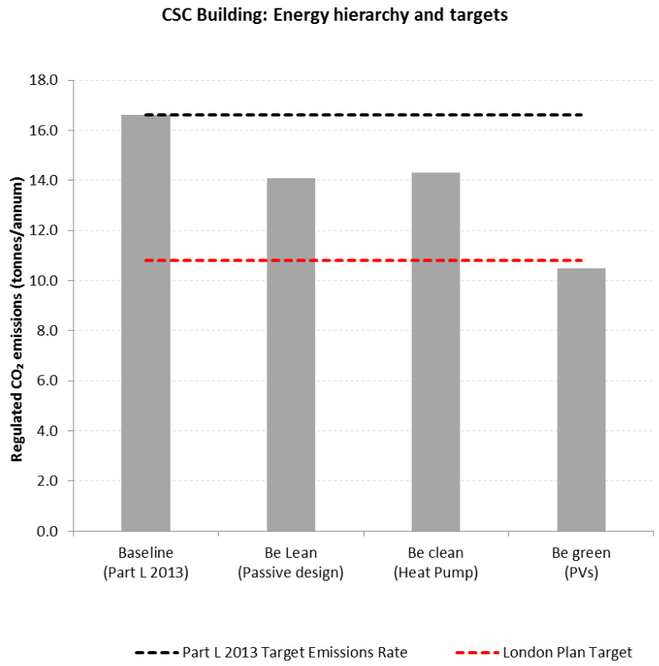
Passive measures are applied to the new building to reduce energy consumption as far as possible, given the site constraints. There is a nearby construction site which is a source of noise pollution. Considering the predicted noise levels, the acoustic consultant has advised that both the new and existing buildings will need to be mechanically ventilated and cooled.

We have carried out overheating modelling for the new building using a 2020 predicted weather file for London. This proves the proposed ventilation and cooling strategy will provide a comfortable internal environment for occupants.

District heating has not been considered due to the cost associated with extending the network, and the planned decarbonisation of the National grid preferring electrically driven heat sources.

Considering site constraints, future grid electrical carbon content, and the expected lifespan of the buildings, a strategy involving electric heat pumps and a PV array has been chosen for the CSC building. The predicted carbon emissions for each stage of the energy hierarchy are given in the following table. The new building meets the GLA's target of a 35 % reduction in carbon emissions.

Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)		
	CSC Building	**Saving from baseline %**
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.6	-
Be Lean - After energy demand reduction	14.1	15
Be Clean - After Heat pumps	14.3	14
Be Green - After PVs	10.5	37



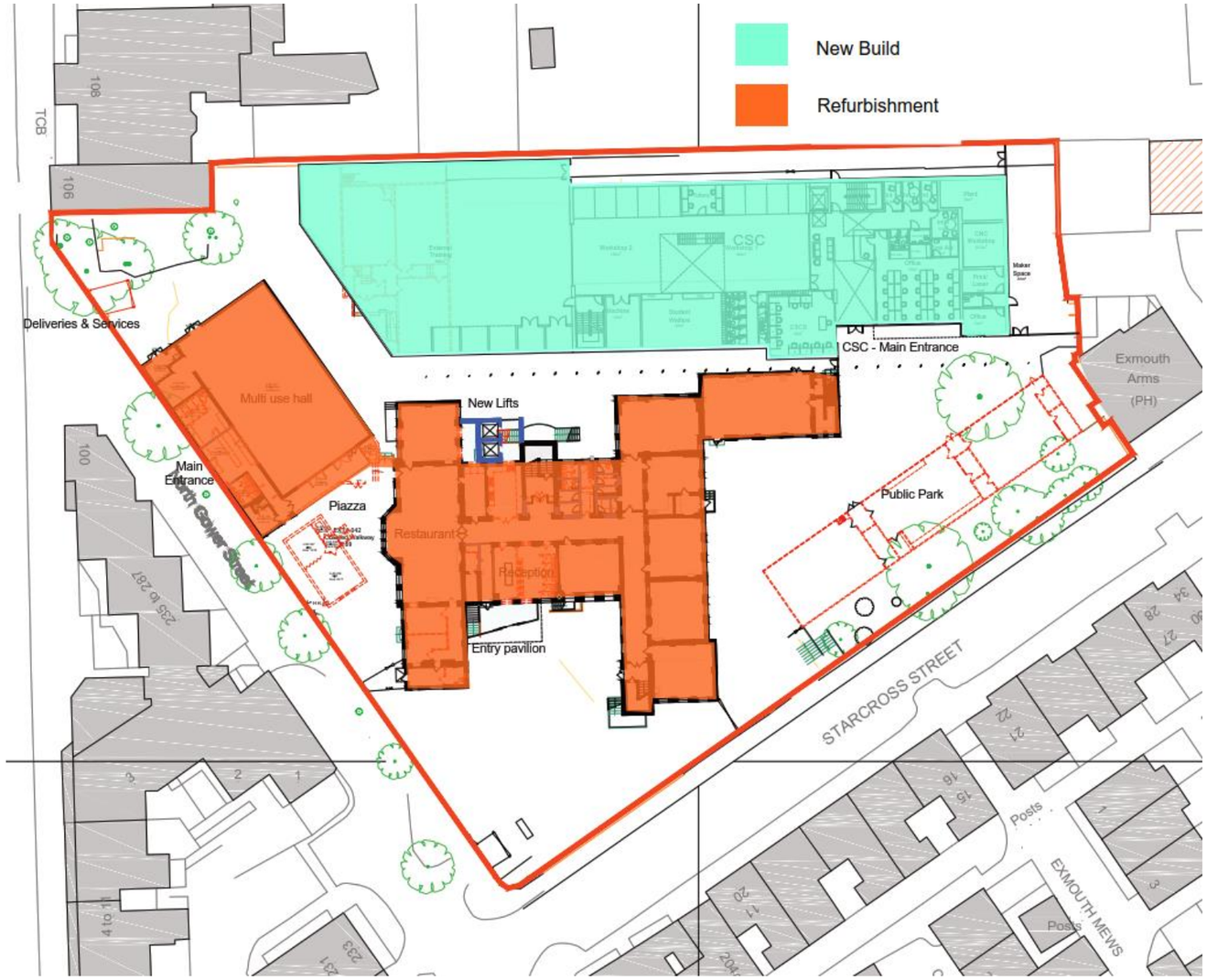
Introduction

Site context:
The site is located close to Euston station. It is bordered by residential, low traffic roads, to the West, South and East.

There is a construction site immediately beyond its Northern boundary. This is associated with the HS2 works in the area, and is predicted to exist for the next 5 years.

The new CSC building will be constructed close to the Northern boundary.

It is expected that the site will be redeveloped within the next 10 years as part of the ongoing HS2 works in the area. We have considered this as the predicted life span for the new CSC building when defining its energy strategy.



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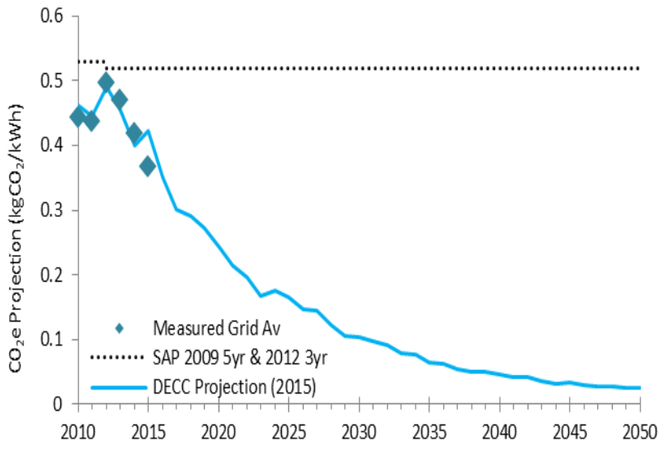
Carbon Context:
Buildings are where a large proportion of society's energy use is, and commensurably, carbon dioxide production.

Much of the energy used in buildings is delivered as electricity via the National Grid. The National Grid is in a long term process of decarbonisation, which is predominantly because of the closure of large coal fired power stations.

The trajectory of grid carbonisation is shown below – the dashed line indicates the "official" carbon content of the grid, which is much higher than the actual carbon content of the grid.

We think that a building's long term energy strategy should be considered in this context. This means that in the long term:

- Using grid supplied electricity is less carbon intensive
- Technologies which favour electricity as a fuel rather than gas are favoured

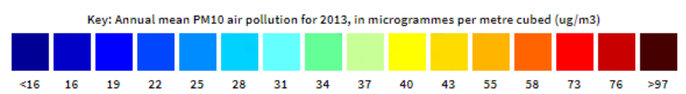


Noise pollution and Air quality:
The HS2 construction site is a source of noise pollution.

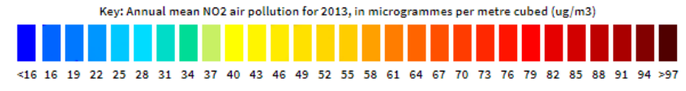
To maintain acceptable noise levels within the buildings, the acoustic consultant has advised that both the new and existing buildings will need to be mechanically ventilated and cooled.

The air pollution maps included in this section (sourced from the London air quality network by KCL) show the annual mean variation of nitrogen dioxide (NO_2) and fine particulate matter (PM10) in the borough of Camden.

Annual mean variation of PM10:



Annual mean variation of NO_2:



The table below defines the acceptable limits for annual average exposure to both NO_2 and PM10 above which constant exposure is detrimental to health, along with the observed value for the site.

	Air Quality Objective (Annual Mean)	Site Annual Mean
NO_2 concentrations ($\mu g/m^3$)	40	40
PM10 concentrations ($\mu g/m^3$)	40	25

The site is situated in an area with acceptable annual mean levels of both NO_2 and PM10.

Overheating – CSC building

CIBSE TM52 analysis has been completed for all of the mechanically cooled spaces in the CSC building. This is based on a 2020 predicted weather file for London, and central cooling plant sized to provide an output of 55kW.

The TM52 overheating criteria measure the operative temperature in each room and compares it to the maximum adaptive temperature (the maximum temperature at which an occupant is predicted to be comfortable).

The standard assesses the difference between these two temperatures against three criteria. These criteria can be described as follows:

Criterion 1 - How often over the year is the room too hot?
Criterion 2 - On the hottest day, by how much hotter is the room than acceptable and how long for?
Criterion 3 - By how much hotter is the room than acceptable on the worst hour of the year?

The values required to pass these criteria are as follows.

Criterion 1 - <3% of occupied hours to pass
Criterion 2 - <6°C.hrs to pass
Criterion 3 - <5°C to pass

By complying with the requirements of TM52 it is verified that the proposed ventilation and cooling strategy provides a comfortable internal environment for the occupants.

The risk of overheating will also be reduced via the following measures:

- Internal heat gains minimised by using low energy lighting
- Glazing with a low g-value will be specified to reduce solar gains
- Solar gain is controlled by installing internal blinds in occupied spaces
- Local temperature control provided in all occupied spaces

For a space to pass the TM52 analysis, it needs to pass at least 2 out of the 3 criterion.

The table below documents in detail the outcome of the TM 52 analysis, and confirms all spaces passed.

Room Name	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Office	48.4	0.4	5	2	-
Interview room 1	48.4	0	0	0	-
Interview room 2	48.4	0	0	0	-
Interview room 3	48.4	0	0	0	-
Interview room 4	48.4	0	0	0	-
Interview room 5	48.4	0	0	0	-
Student Welfare	48.4	0	0	0	-
CSCS	48.4	0	0	0	-
Tutors	48.4	0	0	0	-
First Aid	48.4	0	0	0	-
Workshop Ground floor	48.4	0	0	0	-
Classroom 4	48.4	0.5	5	2	-
Classroom 3	48.4	0.6	5	2	-
Classroom 2	48.4	2.1	10	3	2
Workshop First floor	48.4	0	0	0	-
Staff	48.4	0.7	4	1	-
Classroom 1	48.4	1.2	7	2	2
Tutors	48.4	0	0	0	-

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Heat networks

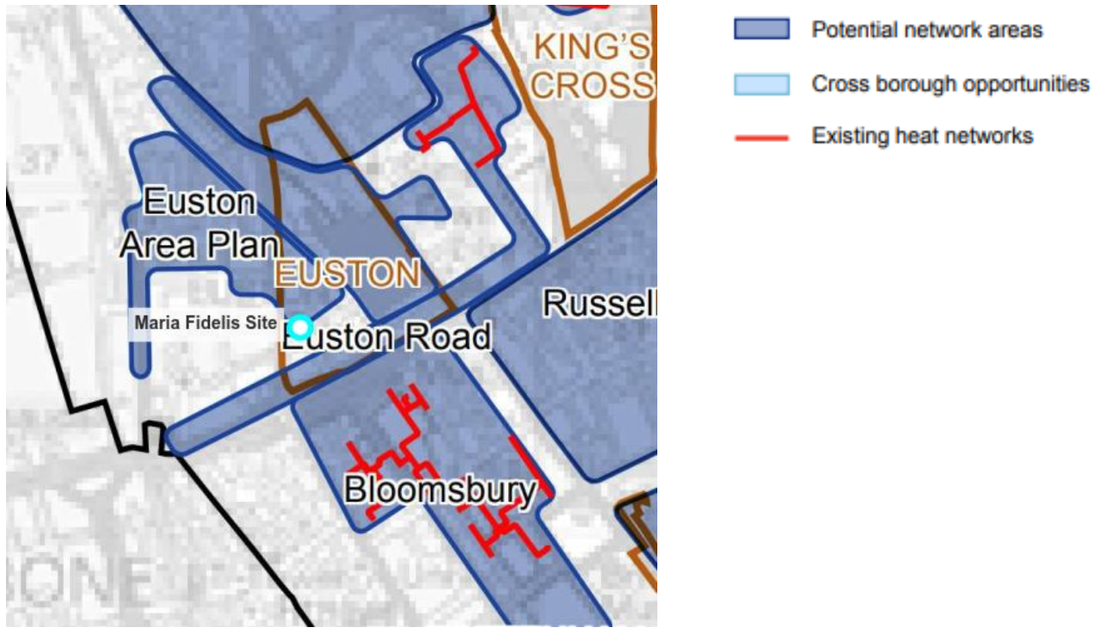
On review of Camden's Energy networks map the nearest existing heat network is located South of Euston road, around 500 meters away from the Maria fidelis site. The site is not located in an area which requires the design to consider future heat networks.

Utilisation of a local district heating network has not been considered for the following reasons:

- The relativity short predicted life span of the new and existing buildings
- Cost to extend the network
- Electric heat sources are preferred, considering the planned decarbonisation of the National grid

Rather than investing in an extension to the network, which could potentially become redundant in 10 year's time, we proposed a combined VRF heating and cooling system is installed. The Peak winter heating load of 50kW falls within maximum duty required for cooling, so no additional heat pump plant is required

The cost saved from not extending the network / installing a separate wet heating system, can be spent on good quality, high efficiency VRF electric heat pumps. These could be re-used on other projects if the site is re developed as planned.



Be Lean - Passive design - CSC

Our approach is to reduce the energy demand of the new building as far as possible through passive /energy efficient measures. They are easy to incorporate and provide the largest reduction in a buildings energy load for their cost

Building fabric:
A high specification building fabric will minimise both heat loss in the summer and heat gain in the winter. The fabric will also be sealed well, preventing uncontrolled airflow with its associated heat loss or gain.

	Part L2A Minimum standard	NCM Notional Building	Proposed Standard
Roof	0.25 W/m^{2}K	0.18 W/m^{2}K	0.18 W/m^{2}K
Wall	0.30 W/m^{2}K	0.26 W/m^{2}K	0.15 W/m^{2}K
Floor	0.25 W/m^{2}K	0.22 W/m^{2}K	0.15 W/m^{2}K
Openings	2.2W/m^{2}K	1.6W/m^{2}K	1.5 W/m^{2}K
Air permeability	10 m^3/m^{2}h	3 m^3/m^{2}h	3 m^3/m^{2}h *
Glazing G value			0.4 (general)
Glazing light transmission			65% (general)

Artificial lighting and daylight:
High efficiency LED light fittings will be specified throughout.

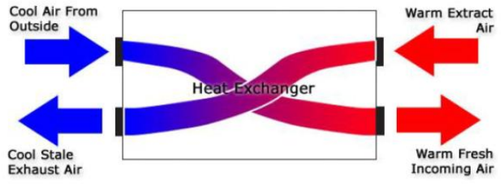
Artificial lighting will be daylight controlled so that it is only used when there is inadequate daylight. Absence detection throughout will ensure unoccupied spaces are unlit.

The First floor Workshop area will receive good levels of natural light due to the North facing windows at high level. The orientation of the windows naturally controls glare, as the space will not receive direct sunlight.

South and East facing windows throughout the building will be provided with internal blinds to control glare and solar heat gain.

Mechanical ventilation with heat recovery:
A fully mechanically ventilated strategy offers the opportunity for extensive heat recovery, leading to lower heating demands as indicated by the diagram below.

Fresh air is only delivered to spaces where necessary to maintain internal air quality, by modulating fan speed based on C02 level. This reduces the annual energy consumption of the ventilation system.



Efficient controls
Simple controls will also be utilised to minimise the energy use of the heating system. These include:

- Timeclock for the entire building
- Thermostatic heating control local to each space
- WC fans (boost) on occupancy control

Be Clean - Alternative technologies - CSC

The following systems will be specified to further reduce energy demand and the associated carbon emissions.

Heating system – Electrically driven VRF heat pump

- The average efficiency of a VRF heat pump system is 350%, compared to 90% for a wet heating system powered by gas boilers.
- Current measurements from the National grid shown that the annual carbon emissions associated with the production of electricity are nearly the same as the emissions for a gas powered system.
- Based on this, we predicted that using VRF heat pumps instead of gas boilers will reduce the carbon emissions associated with heating by a factor of 2.5.

Domestic hot water production via local electric units:

- Hot water is heated instantaneously local to the application.
- This avoids standing losses, and additional energy demand due to recirculation pumping.

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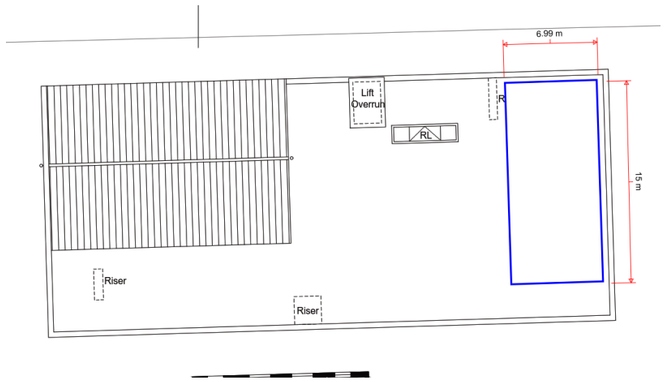
Be Green - Renewable energy - CSC

To meet the 35% reduction mandated by the London Plan, a 100m2 PV array is required.

This will be located on the North East corner of the CSC building's roof as indicatively indicated below



Energy strategy - CSC

The CSC building has been modelled and assessed based on the National Calculation Methodology (NCM), using minimum performance values from Part L 2013 of the Building Regulations.

The specific tool used was the VE Compliance module of IES VE. The associated BRUKL documents are included as part of the Planning submission.

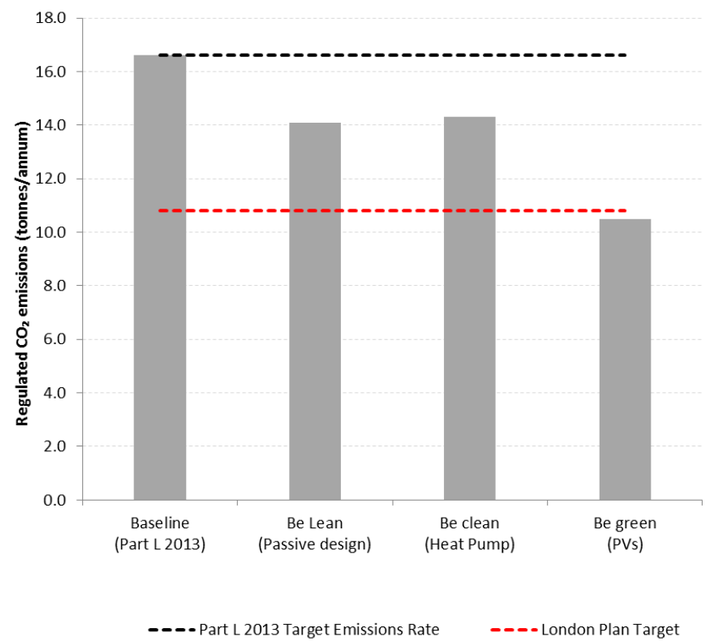
The results of the carbon emissions modelling are illustrated in the following graph and table for each stage of the energy hierarchy.

The results indicate that introducing the electrically driven heat pump system to provide heating (Be Clean) in place of gas powered boilers, increases the overall carbon emissions slightly.

This is because NCM modelling considers out dated carbon factors for electricity and gas, as discussed in the Introduction section of this report. The carbon intensity of the grid today is around 205 gC02/kWh - less than half of the Part L value NCM considers.

Considering this, providing heating via the VRF heat pump system is a positive move in terms of reducing regulated carbon emissions for the new building.

CSC Building: Energy hierarchy and targets



Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)		
	CSC Building	**Saving from baseline %**
Baseline: Part L 2013 of the Building Regulations Compliant Development	16.6	-
After energy demand reduction- Be Lean	14.1	85
After heat pumps – Be Clean	14.3	86
After PVs (renewable energy) – Be Green	10.5	63

Energy strategy – Workspace Building

The works to the existing school building come under the remit of Part L2B 'Conservation of Fuel and Power in Existing Buildings other than Dwellings', which is a complex set of regulations setting out requirements for improving energy efficiency in existing buildings.

The provision of a new cooling system triggers consequential improvements. This means that 10% of the construction budget for the refurbishment needs to be spent on improvement measures relating to energy efficiency.

The following measures will be incorporated into the scheme:

- Install new high efficiency LED light fittings
- New lighting controls to provide daylight dimming and absence detection
- All windows to be secondary glazed to reduce heat loss, and therefore the annual energy consumption of the heating system.

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