ENVIRONMENTAL ASSESSMENT REPORT

ENERGY STATEMENT
INCLUDING RETRO-FITTING MEASURES TO REFURBISHED AREAS

DEVONSHIRE HOUSE SCHOOL
69 FITZJOHN´S AVENUE
LONDON, NW3 6PD

FIRST ISSUE 17TH MARCH 2015

QUALITY CONTROL- First Issue		
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1. EXECUTIVE SUMMARY

This Environmental statement outlines the specifications for maximising the environmental performance of Devonshire House School located at 69 Fitzjohn's Av, London NW3 6PD.

Devonshire House School is situated in the heart of Hampstead. The application site is located on a large 19th Century building currently in use as an independent preparatory school.

The proposed development consists of:

- An extension of the existing basement under the existing raised terrace;
- A new light well to the south of the building;
- The replacement of the non-original full width pitched roof rear extensions with a new glazed flat roofed extension.

The development aspires to maximise sustainable design features wherever possible by implementing a complete and integrated Environmental Strategy.

This strategy is developed to comply with the regional and local requirements Policies. Reference has been made to respond to CPG 3 Camden Planning Guidance adopted in September 2013 including a full Energy Assessment for minimum Energy Use and CO2 emissions reductions.

CPG 3 Camden Planning Guidance (dated September 2013) requires all developments to reduce their carbon dioxide emissions by following the steps in the energy hierarchy to reduce energy consumption.

This assessment demonstrates the aim to achieve the maximum possible CO2 emissions reductions when compared with Part L 2013 Building Regulations.

This reduction has been implemented following the Energy Hierarchy approach of 'be lean', 'be clean' and 'be green' as follows:

The main strategies for **ENERGY EFFICIENCY (BE LEAN)** beyond Part L requirements include:

- Passive design measures such as:
  - Efficient insulated building envelope beyond Part L 2013 requirements
  - Air tightness
  - Making the most of sunlight
  - Making the most of daylight
  - Preventing overheating
  - Reduced thermal bridging
  - Exposed thermal mass
  - External shading (automated external blinds)
  - Daylight harvesting
  - Materials with thermal properties
  - Natural Ventilation
  - Thermal buffers
  - Natural Cooling
  - Insulation
  - Thermal Performance
  - Highly efficient extract and supply fans for kitchen and toilets (Specific Fan Power)

- Efficient building services and controls such as:
  - A rated condensing boilers
  - Instantaneous DHW / Delivery efficiency 100% for toilets

- Luminous efficacy of 110 lm/w or better. / LOR of 85% or better.
- Weather compensation control (i.e., room by room)
- Local temperature control (i.e., room by room)
- Local time control (i.e., room by room)
- Photoelectric sensors and PIRs
- Sub metering HVAC.
- Lighting-sub metering

The proposed development has achieved a 2.67% CO2 emissions reductions by implementing the above energy efficiency measures.

The main strategy for **EFFICIENT SUPPLY OF ENERGY (BE CLEAN)** consists on replacing the existing boilers with a combination of a Combined Heat and Power (CHP) plant plus a highly efficient condensing boiler. Both using gas as main source of fuel.

The development has considered a **CHP** system as a way to reduce CO2 emissions and running costs. CHP technology is recommended for developments where there is a constant heat demand for most part of the year.

The proposed development has achieved 21.93% CO2 emissions reductions by applying an efficient supply of energy- be clean. This equates to a total reduction of 25.60% in CO2 emissions when compared with the baseline.

The strategy for this development has ruled out a district heating system for the following reason:

- The development is placed out of a planned district heating potential area as verified in the London Heat Map. The building will not be able to consider a connection heating system.

As the building is in a conservation area there is no opportunity to implement the USE OF RENEWABLE ENERGY- BE GREEN measures. No solar panels are feasible in this restricted areas.

Figures and tables below, show the CO2 emissions reductions following the Energy Hierarchy required by the CPG 3 Camden Planning Guidance.

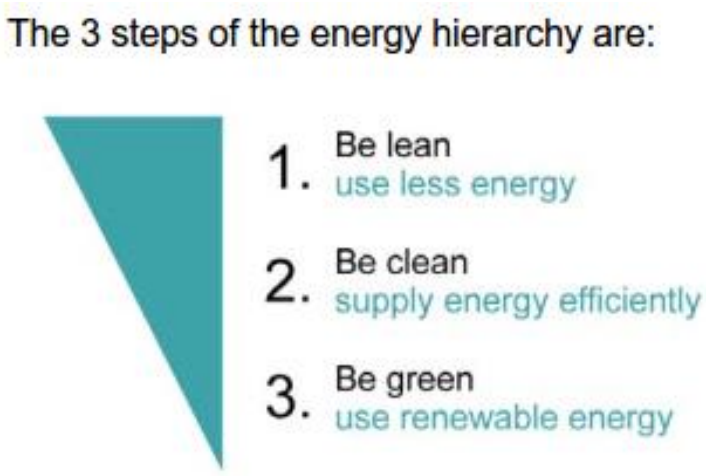


FIGURE 01 - CO2 EMISSIONS REDUCTION AFTER EACH STAGE OF THE ENERGY HIERARCHY

The Energy Hierarchy

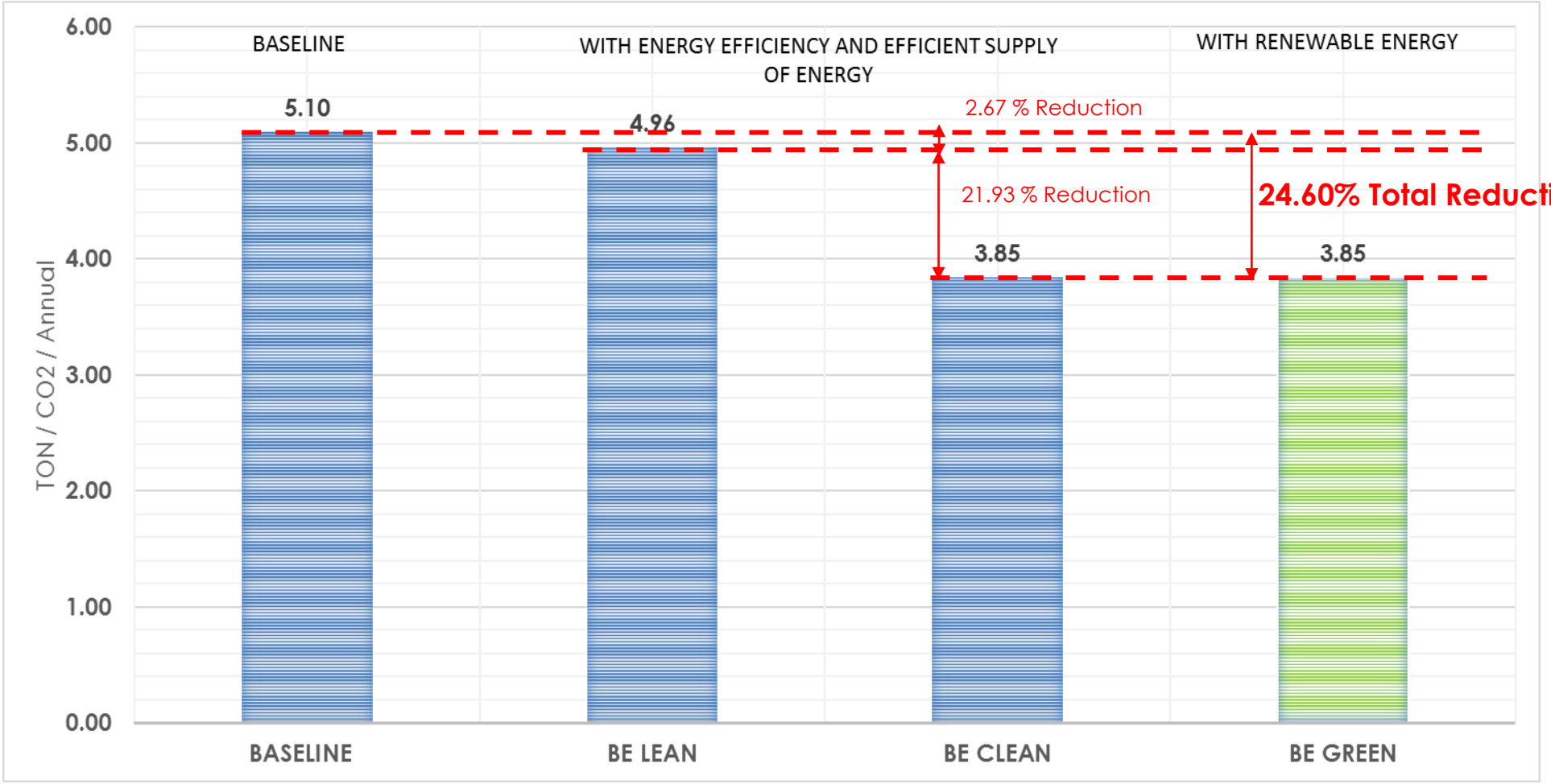


TABLE 01 – CARBON DIOXIDE EMISSIONS AFTER EACH STAGE OF THE ENERGY HIERARCHY

ID	ENERGY HIERARCHY	CARBON DIOXIDE EMISSIONS (Tonnes CO2 per annum)		TOTAL
		REGULATED	UNREGULATED	
A	BASELINE	5.10	14.51	19.61
B	BE LEAN	4.96	14.51	19.47
C	BE CLEAN	3.85	14.51	18.36
D	BE GREEN	3.85	14.51	18.36

TABLE 02 – REGULATED CARBON DIOXIDE SAVINGS FROM EACH STAGE OF THE ENERGY HIEREARCHY

ID	ENERGY HIERARCHY	REGULATED CARBON DIOXIDE SAVINGS	
		(Tonnes CO2 per annum)	(%)
A-B	BASELINE	0.00	0.00%
B-C	BE LEAN	0.14	2.67%
C-D	BE CLEAN	1.12	21.93%
D-E	BE GREEN	0.00	0.00%
A-D	**TOTAL CUMULATIVE SAVINGS**	**1.25**	**24.60%**
F	**TOTAL TARGET SAVINGS**	**1.25**	**24.60%**

Table 1 shows the total CO2 emissions in Tonnes per annum, including regulated and unregulated emissions.

The percentage of the improvement for regulated emissions when comparing the "baseline" towards the "be lean" stage. **The scheme achieves a 2.67% reduction in regulated CO2 Emissions.**

A further **21.93%** reduction is achieved after the "Be clean" and "Be green" stages. The combination of these strategies achieves an overall reduction of **24.60 %.**

Based on the above, the development meets the required GLA London Plan and Local Authority Planning requirements.

For further details on the above calculations as stated in the "Energy Assessment Example Tables" published by the Greater London Authority please refer to Tables 9no to 13no further below.

UNREGULATED EMISSIONS

Condition 10 issued by Camden Council also required "energy uses not covered by Building Regulations (un-regulated) should be also included and measures to reduce them should be demonstrated".

Based on the calculation done as per SBEM Part L 2013 the school extension's energy consumption for unregulated energy consumptions is expected to be 27.96 kWh/m2 per annum.

Measures to reduce the unregulated emissions which will be implemented to the school are:

- Use A+ and A rated appliances.
- Implement energy efficiency measures including
    - Turning off equipment when not in use
    - Install accessible switches to turn off all small power appliances when room is out of hours.

TABLE 3- ENERGY CONSUMPTION BY END USE FROM SBEM

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	30.18	30.81
Cooling	0	0
Auxiliary	1.22	0.55
Lighting	6.1	9.07
Hot water	36.42	33.4
Equipment*	27.96	27.96
TOTAL**	**73.92**	**73.84**

* 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.

2. INTRODUCTION

As outlined in the Sustainable, Design and Construction SPG (published in April 2014); from 6 April 2014 the Mayor will apply a 35 % carbon reduction target beyond Part L 2013 of the Building Regulations. This is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2013 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013-2016.

The 35% target is a flat percentage reduction across both residential and non-domestic buildings. The 35% target applies to Stage 1 applications received by the Mayor on or after 6 April 2014.

This report provides a review of the sustainability and efficiency benchmarks for the development and sets out targets for the development both in terms of sustainability and energy. Also included in this report is an overview of a number of sustainability and energy-efficiency technologies which are likely to be appropriate for the development.

The energy calculations presented in this report will need to be continually updated through the detailed design stages to reflect any changes. The energy analysis presented here should be treated as a pre-assessment based on the currently available data.

2.1 THE DEVELOPMENT

The building is located at 69 Fitzjohn's Ave, London, NW3 6PD. The proposed development consists of a school extension that is considered as a new building under Part L2a.

The proposed extension is greater than 100m2 and greater than 25% of the total useful floor area of the existing building. Therefore the work will be regarded as a new building and the guidance in Approved Document L2A is being followed. The new building consists of:

- Teaching staff room
- Lobby
- Replacement teaching room
- Dining hall

Some areas of the existing school will be refurbished including:

- Toilets,
- Catering
- Plant room

3. OVERVIEW OF ENVIRONMENTAL STANDARDS, TARGETS AND POLICIES.

This section provides an overview of the environmental rating schemes, mandatory regulations and policy documents applicable to the Devonshire House School extension development.

The mandatory environmental benchmarks include:

- Core Strategy Policy Tackling climate change through promoting higher environmental standards (adopted 2010)
- CPG 3 Camden Planning Guidance Sustainability (adopted September 2013)
- GLA London Plan (April 2014)

Core Strategy Policy CS13 Tackling climate change through promoting higher environmental standards (adopted 2010)

Core Strategy Policy CS13 (Tackling climate change through promoting higher environmental standards) expects development or alterations to existing buildings to include proportionate measures to be taken to improve their environmental sustainability where possible.

All buildings, whether being updated or refurbished, will to reduce their carbon emissions by making improvements to the existing buildings.

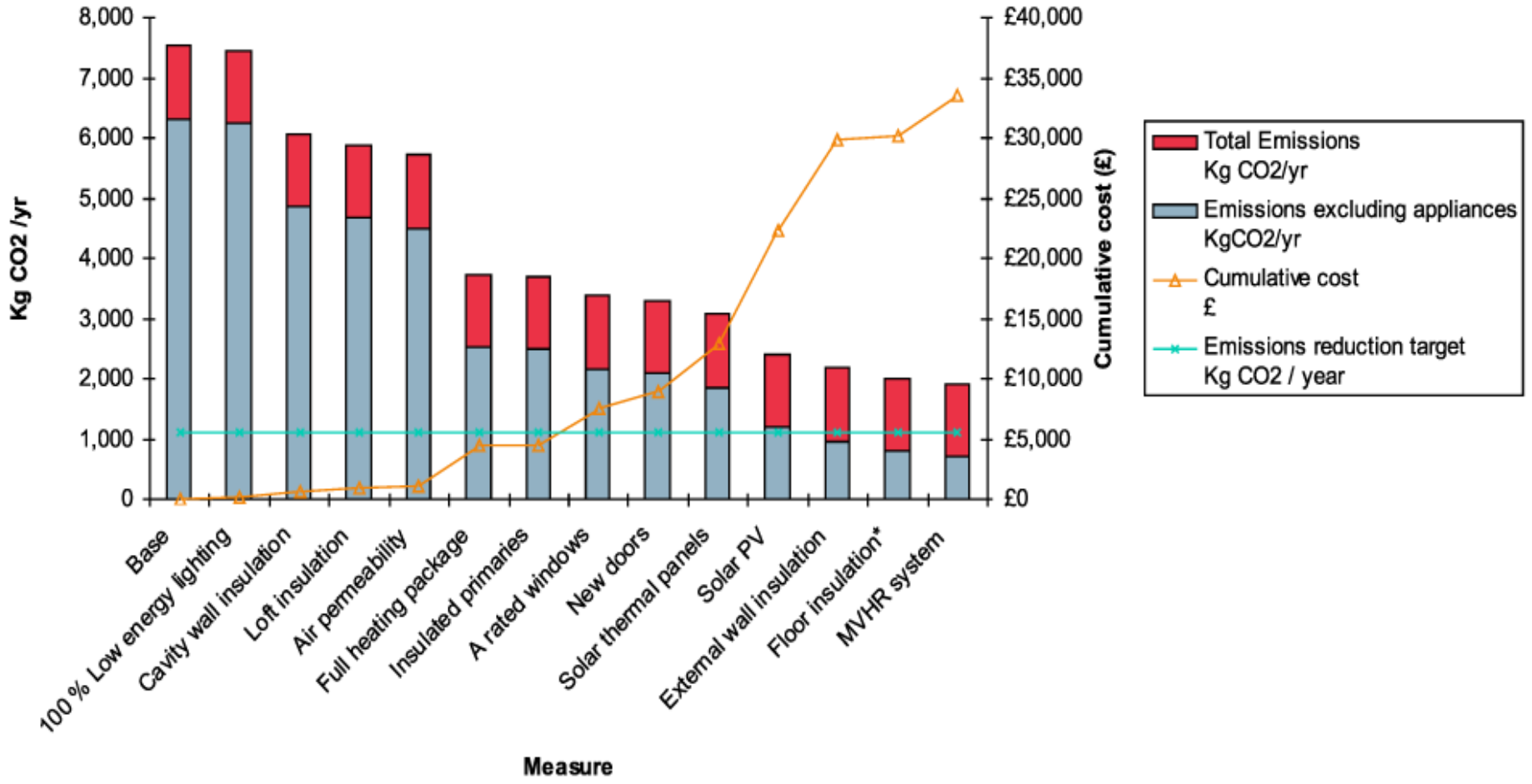
The 3 steps of the energy hierarchy (Be Lean, Be Clean, Be Green) should be followed in order to reduce energy consumption.

In terms of Be Lean (stage 1 of the hierarchy) it will be possible to introduce retro-fitting measures (including draught proofing, use of energy efficient lighting, insulation etc.).

Stage 2 (Be Clean) aims to ensure that developments have done all they can to obtain an efficient supply of energy through their design and operation. Stage 3 (Be Green) involves considering how renewable energy technologies can be used to further reduce the carbon dioxide emissions of a development. The Core Strategy, states that the development will be expected to achieve a 35% reduction in carbon dioxide emissions from on-site renewable energy generation, unless it can be demonstrated that such provision is not feasible. This could include the use of solar/thermal hot water panels, or photovoltaics (PVs).

As stated in the Policy, where even greater design flexibility is required, reasonable provision would be to use an approved calculation tool to demonstrate that the calculated CO2 emissions from the building and proposed extension are no greater than for the building plus a notional extension complying with the standards.

FIGURE 2 – IMPACT ON CARBON REDUCTION MEASURES FOR AN EXISTING BUILDING



ENERGY EFFICIENCY AND CO2 EMISSIONS REDUCTIONS INCLUDING RETRO FITTING MEASURES

APPROVED DOCUMENT PART L2 REQUIREMENTS

The proposed development and refurbished areas will need to comply with Approved Document Part L2 of Building Regulations.

LARGE EXTENSIONS

The proposed extension is both greater than 100m2, and greater than 25% of the total useful floor area of the existing building. Therefore, the work should be regarded as a new building and the guidance in Approved Document L2A followed.

REFURBISHED AREAS

For the existing elements reference will be made to Approved Document Part L2B.This document states that reasonable provision for the proposed extension will need to incorporate the following:

a) doors, windows, roof windows, roof lights and smoke vents that meet the standards.

b) newly constructed thermal elements that meet the standards.

c) existing opaque fabric which becomes a thermal element where previously it was not should be upgraded so that it meets the standards.

FIGURE 3- AERIAL VIEW OF THE EXISTING BUILDING AS EXISTING

Where fixed building services are provided or extended as part of constructing the extension, reasonable provision would be to following guidance and the modelling inputs used as part of this report:

a. Where the work involves the provision or extension of *controlled services*, reasonable provision would be demonstrated by following the guidance set out in the *Non-Domestic Building Services Compliance Guide*. It covers the following services:
   i. Heating and hot water systems (including insulation of pipes, ducts and vessels);
   ii. Mechanical ventilation;
   iii. Mechanical cooling/air-conditioning;
   iv. Fixed internal lighting;
   v. Renewable energy systems.
b. Provide new fixed building services that meet reasonable standards of efficiency, which in normal circumstances would be:
   i. An efficiency not less than set out in the *Non-Domestic Building Services Compliance Guide*.
   ii. An efficiency not less than that of the *controlled service* being replaced.
c. Provide new HVAC systems with appropriate controls to achieve reasonable standards of energy efficiency.
d. Demonstrate that reasonable provision of energy meters had been made for effective monitoring of the performance of newly installed plant.
e. Demonstrate that relevant information has been recorded in a new log book or incorporated into an update of the existing one.
f. If a renewable energy generator such as a wind turbine or photovoltaic array is being replaced, the new system should have an electrical output that is not less than the original installation.
g. When replacing a heating appliance, consideration should be given to connecting to any existing local heat networks. If the work involves pipework changes, considerations should be given to providing capped of connections to facilitate subsequent connection to a planned local heat network.
h. The aim for buildings as a whole is to enable building occupiers to assign at least 90 per cent of the estimated annual energy consumption of each fuel to the various end-use categories (heating, lighting, etc.).

FIGURE 3 – SMART ENERGY METERING

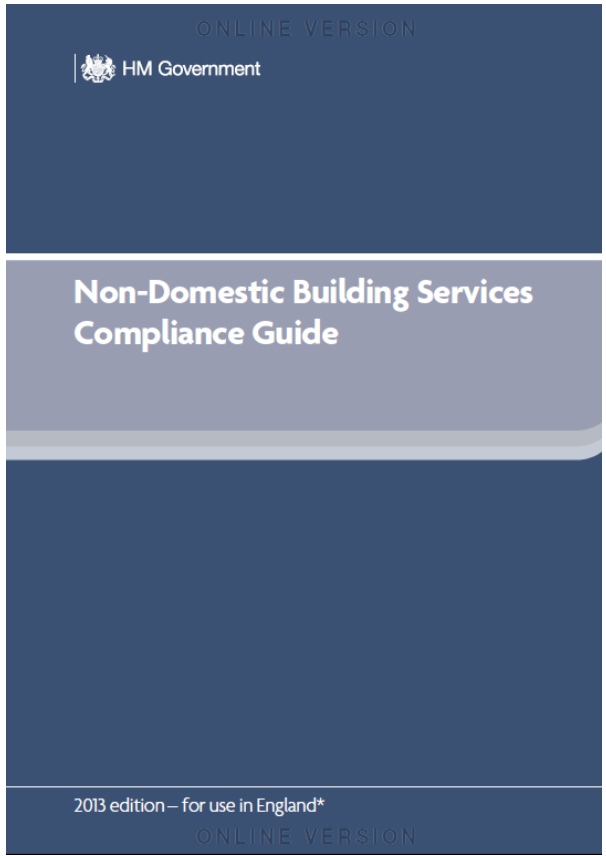
Display ENERGY Metering has the potential to engage students and teachers to reduce energy consumption.

SOURCE: WIRELESS ENERGY METER
http://www.gadgetireland.com/http-//www-gadgetireland-com/green-energy-/-energy-saving-meter/prod_469.html

i. Reasonable provision of energy meters in existing buildings would be to install energy metering systems in the building service systems. In addition to this:
-Meters should be provided to enable the performance of any renewable energy system provided as part of the works to be separately monitored;

-In buildings with a total useful floor area greater than 1000 m2, the metering system should enable automatic meter reading and data collection;

-The metering provisions should be designed such as to facilitate the benchmarking of energy performance.



RENOVATION OF RETAINED THERMAL ELEMENTS

For the purposes of this renovation of a thermal element through:

a. the provision of a new layer means either of the following activities:
   i. Cladding or rendering the external surface of the thermal element; or
   ii. Dry-lining the internal surface of a thermal element.

b. the replacement of an existing layer means either of the following activities:
   i. Stripping down the element to expose the basic structural components (brick, block work, timber/metal frame, joists, rafters, etc.) and then rebuilding to achieve all the necessary performance requirements.
   ii. Replacing the water proof membrane on a flat roof.

TABLE 04 – 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.

CPG 3 Camden Planning Guidance Sustainability (adopted September 2013)

Energy Efficiency: new buildings key message - All new developments are to be designed to minimise carbon dioxide emissions. The most cost-effective ways to minimise energy demand are through good design and high levels of insulations and air tightness.

Policy *5.2 Minimising carbon dioxide emissions of the* Draft:
Replacement London Plan introduces a carbon dioxide reduction target for new development to make a 25% improvement on the current 2010 Building Regulations:

- 2010-2013 25 per cent
- 2013-2016 40 per cent
- 2016-2031 Zero carbon

The following standards focus on improving a building's fabric to achieve best practice U-values over and above current Building Regulations. The Council considers that the standards below are feasible in all but exceptional circumstances to meet the new London Plan targets and the Energy Saving Trust (EST) guidance on energy efficiency to achieve Level 4 of the Code for Sustainable Homes. There are other ways to reduce the energy efficiency of a building as set out in the first part of this section.

The table below generally relates to residential developments, however the building fabric standards are also applicable to commercial developments. For all developments a balance will need to be reached between the need to retain heat, the heat generated within a development and the need to remove excess heat.

TABLE 05 – CPG STANDARDS VS PROPOSED DEVELOPMENT

BUILDING ELEMENT	CAMPDEN CPG REQUIREMENTS	PROPOSED DEVELOPMENT	PERCENTAGE OF IMPROVEMENT
External wall	0.20	0.18	10%
Roof	0.13	0.13	Matches requirement
Floor	0.20	0.18	10%
Windows	1.50 British Fenestration Rating Council band B or better	1.45	3.33%
Doors	1.00 (solid) 1.50 (glazed)	1.45	3.33% (glazed)
Air tightness	3.00 (m3/h.m2 at 50 Pa)	3.00	0
Proportion of energy efficient lighting	100%	100%	0
CfSH	Developments should achieve 50% of the un-weighted credits in the Energy category (See section 8 on sustainability assessment tools for more details relating to the Code for Sustainable Homes).	Not applicable	Not applicable
BREEAM	Developments will be expected to achieve 60% of the un-weighted credits in the Energy category of their BREEAM assessment. (See section 8 on sustainability assessment tools for more details relating to BREEAM.	Not applicable	Not applicable

Camden Planning Guidance 3 Sustainability states the following in relation to the content of the Energy Statement:

"An energy statement is to set out how a development has been designed to follow the steps in the energy hierarchy. It should demonstrate how the proposed measures are appropriate and viable to the context of the development.

Baseline energy demand and carbon dioxide emissions

Calculate the baseline energy demand of the development and the corresponding carbon dioxide emissions arising from the development. You should clearly show the methodology used. See below for more guidance on how to calculate the baseline demand and carbon dioxide emissions.

Reduce the demand for energy

Describe the design measures which are proposed to maximise the energy efficiency of the development. See sections 2 and 3 for guidance on how to ensure your development is as energy efficient as possible.

Supply energy efficiently

Describe how your development has considered further reducing carbon dioxide emissions by sourcing energy efficiently e.g. through the use of decentralised energy, such as combined heat and power systems. See section 4 for guidance on decentralised energy network and combined heat and power.

Calculate the energy use and the corresponding carbon emissions from the development having applied the first two stages of the energy hierarchy.

Use renewable energy

Describe how your development has considered using renewable energy technologies to further reduce carbon dioxide emissions. See section 5 for more guidance on renewable energy.

Calculate the remaining energy use and the corresponding carbon emissions from the development having applied all three stages of the energy hierarchy.

Conclusion

A concluding section should be provided outlining the contribution of each set of measures, technology or combination of technologies towards meeting the relevant targets set out in this guidance and providing recommendations as to which approach is most suitable for the site. Where it has not been possible to reach the targets, a clear explanation should be provided."

GLA London Plan (Adopted April 2014)

- Policy 5.1 – Climate Change Mitigation
- Policy 5.2 – Minimising CO2 emissions
    - As outlined in the Sustainable, Design and Construction SPG (to be published in April 2014), from 6 April 2014 the Mayor will apply a **35% carbon reduction target beyond Part L 2013 of the Building Regulations** - this is deemed to be broadly equivalent to the 40 per cent target beyond Part L 2013 of the Building Regulations, as specified in Policy 5.2 of the London Plan for 2013-2016
    - All applications received from the 6 July 2014 will be assessed against the 35 per cent reduction target beyond Part L 2013 of the Building Regulations
- Policy 5.7 – Renewable Energy
    - There is a presumption that all major development proposals will seek to reduce carbon dioxide emissions **by at least 20 per cent** through the use of on-site renewable energy generation wherever feasible.
    - The Mayor encourages the use of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost effective carbon dioxide emissions savings for a development proposal.

4. ENERGY STATEMENT.

The objective of the energy assessment is to demonstrate the effectiveness of the energy strategies incorporated into the proposed development and to assess the opportunities for adding on-site renewable energy systems to the development.

4.1 METHODOLOGY

For this assessment the development was analysed using Integrated Environmental Solutions (IES-VE), via Apache Dynamic Simulation software and the Simplified Building Energy Model (SBEM) which follows Part L 2013 requirements. This software version for Part L 2013 has been approved by the BRE.

The building geometry and layout information has been taken from the architect drawings.

This study has been made in order to predict the most accurate building emissions rate (BER) and the target emissions rate (TER).

4.2 DETAILED SPECIFICATIONS FOR EACH STAGE OF THE ASSESSMENT

Tables 5no to 7no below, show the values and services that were used for the assessment at the 3 stages of the Energy Hierarchy.

INTEGRATED ENVIRONMENTAL SOLUTIONS

4.3 ENERGY & CO2 EMMISSIONS MODELLING & DATA INPUTS

The information has been taken directly from digital files provided by the Design Team.

FIGURE 04 – BIRD EYE VIEW OF THE SITE AS EXISTING LOOKING NORTH

5. PART L2A SBEM SPECIFICATIONS – AS PROPOSED

TABLE 06 - PART L2A SBEM SPECIFICATIONS- BUILDING ENVELOPE – MODELLING & DATA INPUTS

ELEMENT	U-VALUES (W/m2K)/ AIR PERMEABILITY	FURTHER INFORMATION
External Wall Type 1 (basement)	0.18 W/m2k	8mm external rendering, 85mm polyurethane board, 95mm brickwork, 12.5mm plasterboard
External Wall Type 2 (GF)	0.18 W/m2k	8mm external rendering, 85mm polyurethane board, 95mm steel, 12.5mm plasterboard
Internal Partitions	-	13mm plasterboard, 5mm mineral wool, 13mm plasterboard
Ground Floor	0.18 W/m2k	300mm reinforced concrete slab, 100mm PUR insulation, 70mm screed, floor finish variable
Roof	0.13 W/m2k	250mm CLT Panel, 4mm vapour barrier, 150mm PUR Insulation, 2x 5mm layers of high performance bitumen roofing felt
Ceiling	-	50mm flooring screed, 150mm concrete dense, 400mm services void, 15mm ceiling tile
Windows /Glazed Doors	1.45 W/m2k	Double glazed, timber aluminium composite – G value 0.28 and LT value of 0.6 or better GF TEACHING ROOM and GF LOBBY G value 0.28 and LT value of 0.6 or better , Automated external blinds - Required to comply with Criterion 3 of Part L2A* Other rooms G value 0.65 and LT value of 0.6
Skylights	1.65 W/m2k	Double glazed, timber aluminium composite – GF TEACHING ROOM, GF LOBBY, G value 0.28 and LT value of 0.6 or better, Automated external blinds - Required to comply with Criterion 3 of Part L2A* Other rooms G value 0.65 and LT value of 0.6
Thermal bridging	-----	Accredited Construction Details to be followed.
Air permeability	3.0 m^3/hm^2@50Pa	-----

TABLE 07 - PART L2A SBEM SPECIFICATIONS- BUILDING SERVICES – MODELLING & DATA INPUTS

ELEMENT	VALUES / SYSTEM TYPE	FURTHER INFORMATION
Electric Power Factor	> 0.95	-----
Cooling	None	Natural Ventilation.
Space Heating	Central Heating using water, Floor Heating	**Be lean:** Natural Gas, Heating Seasonal Efficiency 91% / Delivery efficiency 97%. **Be clean:** Gas Boilers + CHP
Controls		**Be Lean and Be Clean:** Local time control (i.e., room by room) Optimum start/stop control Local temperature control (i.e., room by room) Weather compensation control (i.e., room by room)
Sub metering HVAC	Yes	Provision for metering but no alarm for out of range values.
Heat Emitters	Yes	Under floor heating

TABLE 08 - PART L2A SBEM SPECIFICATIONS- BUILDING SERVICES – MODELLING & DATA INPUTS (CONTINUED)

ELEMENT	SYSTSEM TYPE	FURTHER INFORMATION
Domestic Hot Water	Instantaneous to toilets. CHP+Gas boiler to kitchen	• Instantaneous DHW / Delivery efficiency 100% (toilets only) • Storage tank 180 litres (proportionally to a 1000 litre tank for the whole building) • Insulation Thickness: 150 mm • Storage losses 0.005 kWh/(l * day) • Distribution losses 4 W/m • Pump power 50W • Loop length 18m • Timed secondary circulation
Lighting	LEDs	Luminous efficacy of 110 lm/w or better. / LOR of 85% or better.
Lighting control	------	• Manual switching - General • All rooms will have manual retroactive switches to switch off lighting levels. Store / WC's, shall have automatic Absence/Presence Detection. • All rooms will be controlled with daylight dimming and absence detection control systems as set out in the requirements of BB90.
Lighting-sub metering	------	Lighting systems have provision for metering. Lighting systems metering warns of "out-of-range" values.

ELEMENT	SYSTSEM TYPE	FURTHER INFORMATION
Ventilation	Natural Ventilation + Mechanical Ventilation in toilets and catering.	Generally, natural ventilation Supply and extract mechanical ventilation to toilets. Extract rate 6 l/s/ wc Supply rate 8 l/s/person. Extract rate to catering area 60 l/s (intermittent) SFP for kitchen extract maximum 0.6 W/l.s SFP for toilets maximum 0.40 W/l.s
Renewables	------	N/A

6. PART L2A SBEM RESULTS – AS PROPOSED

TABLE 09 - SBEM RESULTS – CRITERION 1 – FOLLOWING THE LONDON PLAN ENERGY HIERARCHY

BASE CASE COMPLIES WITH PART L2A CRITERION 1? **BASELINE**	**YES**	**TER: 18.7 kgCO2/m2/year** **BER: 18.2 kgCO2/m2/year*** *THE BASE CASE FOR THE BUILDING AS DESIGNED DOES COMPLY WITH CRITERION 1.
COMPLIES WITH PART L2A CRITERION 1? **BE LEAN / BE CLEAN**	**YES**	**TER: 18.7 kgCO2/m2/year** **BER: 14.1 kgCO2/m2/year*** *THE BE CLEAN / BE GREEN STAGES ACHIEVE A 23.18 % REDUCTION, AS THE PROPERTY FALLS WITHIN THE FITZJOHNS NETHERHALL CONSERVATION AREA BE GREEN STAGE 3 IS NOT FEASIBLE.

TABLE 10 - SBEM RESULTS – CRITERION 2, 3, 4 & 5

COMPLIES WITH PART L2A CRITERION 2?	**YES**	THE PERFORMANCE OF THE BUILDING FABRIC AND THE BUILDING SERVICES AS DESIGNED, COMPLIES WITH REASONABLE OVERALL STANDARDS OF ENERGY EFFICIENCY.
COMPLIES WITH PART L2A CRITERION 3?	**YES**	COMPLIES WITH PART L2A CRITERION 3 WITH: - GF TEACHING ROOM, GF LOBBY, G VALUE 0.28 AND LT VALUE OF 0.6 OR BETTER , PLUS AUTOMATED EXTERNAL BLINDS
CAN COMPLY WITH PART L2A CRITERION 4?	**SEPARATE SUBMISSION**	THE PERFORMANCE OF THE BUILDING, AS BUILT, SHOULD BE CONSISTENT WITH THE BER.
CAN COMPLY WITH PART L2A CRITERION 5?	**SEPARATE SUBMISSION**	THE NECESSARY PROVISION FOR ENABLING ENERGY-EFFICIENT OPERATION OF THE BUILDING SHOULD BE IN PLACE.

7. ENERGY AND CO2 EMISSIONS RESULTS

7.1 REGULATORY MINIMUM

The Target Emissions Rate (maximum allowable CO_2 emissions under Building Regulations Part L2A 2013) has been calculated using an approved calculation methodology such as SBEM as this is a non-domestic building.

As mentioned before, SBEM calculations have been carried out in line with current GLA guidance. The **total Target Emissions Rate** using gas boilers as a baseline **is 5.10 tonnes of CO2/ year.**

The following sections give a summary of the energy benchmarks applying the two stages of the energy hierarchy:

- BE LEAN: With energy efficiency
- BE CLEAN: With energy efficiency and efficient supply of energy (if applicable)
- BE GREEN: N/A as the property falls within the Fitzjohn's Nether hall Conservation Area.

(BASELINE)

Baseline stage demonstrates the base case in which this analysis has been performed and compared with at the other 3 stages (Be lean, Be clean, Be green) Table 11, below, shows the different results in the different elements of the development.

TABLE 11 – ENERGY DEMAND AND CO2 EMISSIONS BROKEN DOWN BY USE. BASELINE

	BASELINE	
	A. ENERGY EFFICIENCY	
	TOTAL ENERGY DEMAND (kWh/year)	ASSOCIATED TOTAL CO2 (KgCO2/year)
HOT WATER	9,108.18	1,967.37
SPACE HEATING	8,401.89	1,814.81
LIGHTING	2,473.39	1,283.69
AUXILIARY	149.99	77.84
COOLING	0.00	0.00
TOTAL + REGULATED ONLY	**20,133.44**	**5,143.71**
APPLIANCES / NON-REGULATED ENERGY	7,624.69	3,941.97
TOTAL (REGULATED + UNREGULATED)	27,758.13	9,085.67

7.3 DEMAND REDUCTION (BE LEAN)

The guidance requires that details in the energy assessment of the demand reduction measures specific to the development are provided, for example enhanced U-values (W/m2K), air tightness, efficient services and lighting. Please refer to tables 6no to 8no for further details.

TABLE 12 – ENERGY DEMAND AND CO2 EMISSIONS BROKEN DOWN BY USE. BE LEAN

	BE LEAN	
	A. ENERGY EFFICIENCY	
	TOTAL ENERGY DEMAND (kWh/year)	ASSOCIATED TOTAL CO2 (KgCO2/year)
HOT WATER	9,931.73	2,145.25
SPACE HEATING	8,230.09	1,777.70
LIGHTING	1,663.47	863.34
AUXILIARY	332.69	172.67
COOLING	0.00	0.00
TOTAL + REGULATED ONLY	20,157.98	4,958.96
APPLIANCES / NON-REGULATED ENERGY	7,624.69	3,941.97
TOTAL (REGULATED + UNREGULATED)	27,782.68	8,900.93

After applying the demand reduction measure, the combined CO2 emissions reduction of the building extension at this stage of the Energy Hierarchy is 1.50 Tonnes of CO2 per annum. This achieves a percentage of reduction 2.67%.

7.4 HEATING INFRASTRUCTURE (BE CLEAN)

CENTRALIZED PLANT

A new highly efficient plant is being considered to replace the existing boilers for the rest of the building. This will minimize distribution losses and provide an efficient distribution of energy where it is required. The new system will be sized to meet the heat demand of the existing school plus the extension.

CHP

CHP technology is recommended for developments where there is a high demand for heat for most part of the year. This can be seen in building types such as hotels, hospitals, leisure centres with swimming pools or some mixed use developments.

For educational developments it can be only successfully used when there is a constant heat demand. In this case the school has a kitchen and catering area which will have a demand for DHW, even in summer months.

The CHP and a gas boiler have been sized to be used in combination of the existing school. Meaning that the new proposed extension will be a positive improvement to the building as a whole. For further details refer to Appendix B.

FIGURE 05 – COMBINED HEAT AND POWER PLANT (CHP) LOAD TRACKER XRGI 6

TABLE 13 – COMBINED HEAT AND POWER PLANT (CHP) LOAD TRACKER XRGI 6 DATA SHEET

POWER UNIT	XRGI 6
Noise Level	49 Db(A)
Dimensions (L x W x H)	92 x 64 x 96 cm
Weight	440 kg
Service Interval	10,000 hours
Power Output (modulating)	2.5 - 6 Kw
Electrical Efficiency	64%
Overall Efficiency	93%
Fuel	Natural gas, Propane, Butane
Natural Gas Consumption	Max. 2.1 m3/h
Fuel Supply Pressure	5 - 65 mbar
Emission Levels	CO < 150 mg/Nm3 NOX < 350 mg/Nm3
Heat Distributor	Q40
Generator	4 pole asynchronous
Voltage	400 V, 3 phase
Current	12:00 AM

TABLE 14 – ENERGY DEMAND AND CO2 EMISSIONS BROKEN DOWN BY USE. BE CLEAN

	BE CLEAN	
	A. ENERGY EFFICIENCY	
	TOTAL ENERGY DEMAND (kWh/year)	ASSOCIATED TOTAL CO2 (KgCO2/year)
HOT WATER	12,050.61	2,602.93
SPACE HEATING	9,380.88	2,026.27
LIGHTING	1,660.74	863.34
AUXILIARY	332.69	172.67
COOLING	0.00	0.00
TOTAL + REGULATED ONLY	23,424.93	5,665.21
APPLIANCES / NON-REGULATED ENERGY	7,624.69	3,941.97
TOTAL (REGULATED + UNREGULATED)	31,049.62	9,607.18

After applying the efficient supply of energy- be clean measures, the CO2 emissions reduction of the building extension at this stage of the Energy Hierarchy is 1.12 Tonnes of CO2 per annum. This achieves a percentage of reduction 21.93%.

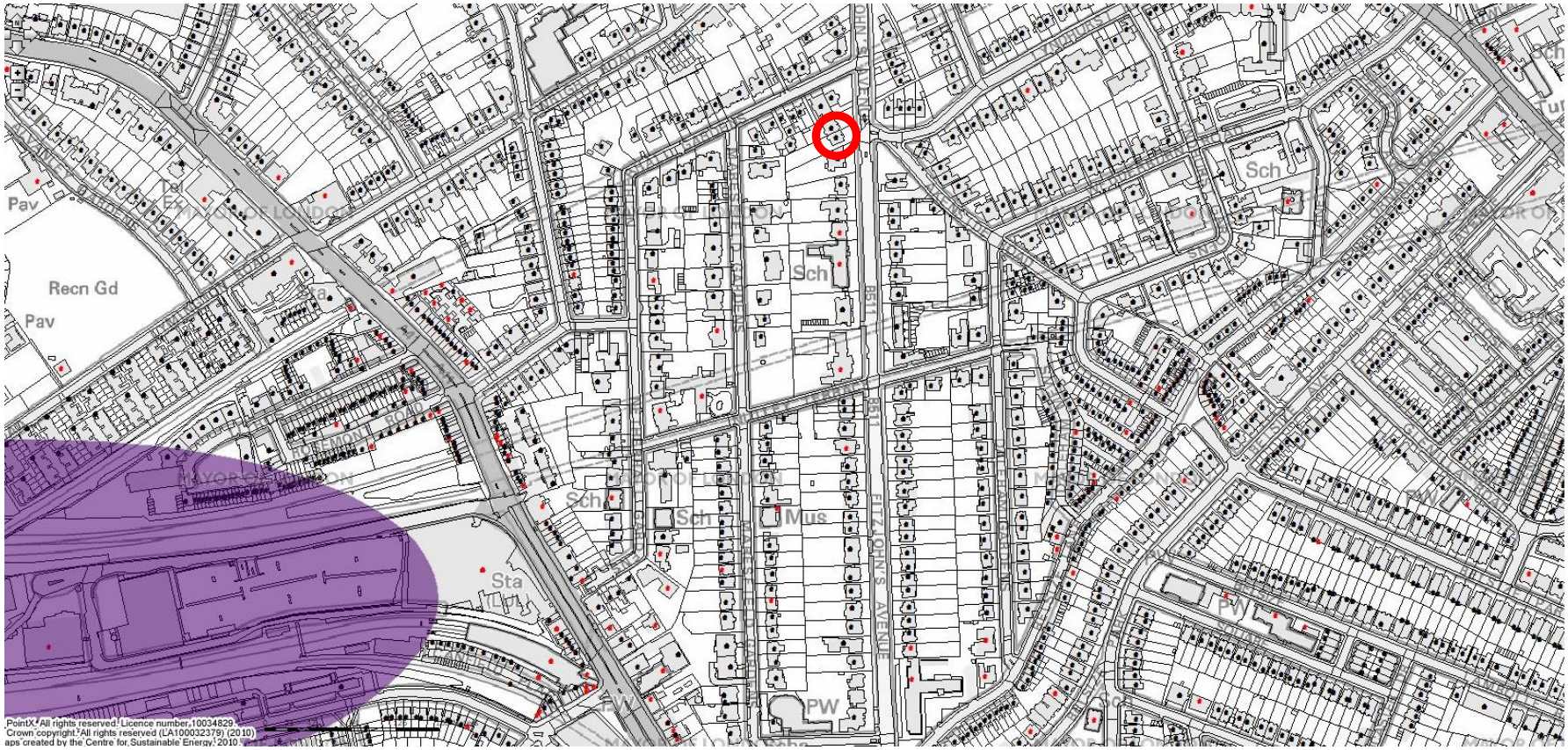
If the be lean carbon emission savings are added to the equation, the proposed development has a combined reduction of 24.60% when compared to the baseline.

CONNECTION TO AREA WIDE LOW CARBON HEAT DISTRIBUTION NETWORK

As stated in the London Plan, the development should connect to a heat distribution network (if available) in order to contribute to the use of surplus of heating.

As part of this study, it was investigated if there is a heat distribution network already planned or if there is a project to build one. The school is located where there is no opportunity to be connected to a heat distribution network. This can be seen in the London Heat Map (www.londonheatmap.org.uk), Figure 6no below:

FIGURE 06 – LONDON HEAT MAP WITH SITE LOCATION IN RED AND PLANNED HEAT DISTRIBUTION NETWORK SHOWN IN PURPLE



7.5 RENEWABLE ENERGY (BE GREEN).

Applicants should provide calculations to demonstrate that their chosen system or systems will reduce CO2 emissions from residual regulated emissions once CO2 savings from demand reduction measures and energy efficient supply including CHP have been discounted from the baseline regulated emissions.

TABLE 15 – ENERGY DEMAND AND CO2 EMISSIONS BROKEN DOWN BY USE. BE GREEN

	A. ENERGY EFFICIENCY	
	TOTAL ENERGY DEMAND (kWh/year)	ASSOCIATED TOTAL CO2 (KgCO2/year)
HOT WATER	12,050.61	2,602.93
SPACE HEATING	9,380.88	2,026.27
LIGHTING	1,660.74	863.34
AUXILIARY	332.69	172.67
COOLING	0.00	0.00
TOTAL + REGULATED ONLY	23,424.93	5,665.21
APPLIANCES / NON-REGULATED ENERGY	7,624.69	3,941.97
TOTAL (REGULATED + UNREGULATED)	31,049.62	9,607.18

As the building is in a conservation area there is no opportunity to implement the USE OF RENEWABLE ENERGY- BE GREEN measures. No solar panels are feasible in this restricted areas.

After applying the demand reduction measure, the combined CO2 emissions reduction of the development at this stage of the Energy Hierarchy is 0 Tonnes of CO2 per annum. This achieves a combined percentage of reduction equivalent to the previous stage of the hierarchy of 24.60%.
Therefore the total CO2 emissions reduction after the 3no stages of the Energy Hierarchy for the building extension is 24.60%.

7 CONCLUSION

This Energy Statement outlines the specifications for maximising the environmental performance of the proposed development located at Devonshire House School, 69 Fitzjohn's Av, London NW3 6PD.

The development aspires to maximise sustainable design features wherever possible by implementing a complete Environmental Strategy. This strategy is developed to comply with the regional and local requirements Policies.

In line with The London Plan (2013) and Camden Council requirements, this strategy has been written and produced to illustrate savings in terms of CO2 for the proposed development. **This assessment demonstrates the aim to achieve the maximum possible CO2 emissions reductions when compared with Part L 2013 Building Regulations.**

The baseline emissions for the development have been assessed in accordance with section 6.2 of the Energy Planning GLA guidance.

The proposed development has achieved a 2.67% CO2 emissions reductions by implementing the ENERGY EFFICIENCY – (BE LEAN) measures.

The main strategy for **EFFICIENT SUPPLY OF ENERGY (BE CLEAN)** consists on replacing the existing boilers with a combination of a Combined Heat and Power (CHP) plant plus a highly efficient condensing boiler. Both using gas as main source of fuel.

The proposed development has achieved 21.93% CO2 emissions reductions by applying an efficient supply of energy. This equates to a total reduction of 25.60% in CO2 emissions when compared with the baseline.

The strategy for this development has ruled out a district heating system for the following reason:

- The development is placed out of a planned district heating potential area as verified in the London Heat Map. The building will not be able to consider a connection heating system.

As the building is in a conservation area there is no opportunity to implement the USE OF RENEWABLE ENERGY- BE GREEN measures. No solar panels are feasible in this restricted areas.

- The Final 2010 baseline emissions equate to **5.10 Tonnes/CO2/year**
- Demand Reduction measures (Be Lean) reduce **2.67% or 0.14 Tonnes CO2 / year.**
- Heating Infrastructure (Be Clean) reduce **21.93% or 1.12 Tonnes CO2 / year.**
- Renewable Energy (Be Green) reduce **0.00% or 0.00 Tonnes CO2 / year.**

The combined reductions in all 3no stages of the Energy Hierarchy from the Part L 2013 baseline equate to **24.60% CO2 emissions.**

7.1 SUMMARY OF CO2 EMISSIONS REDUCTIONS

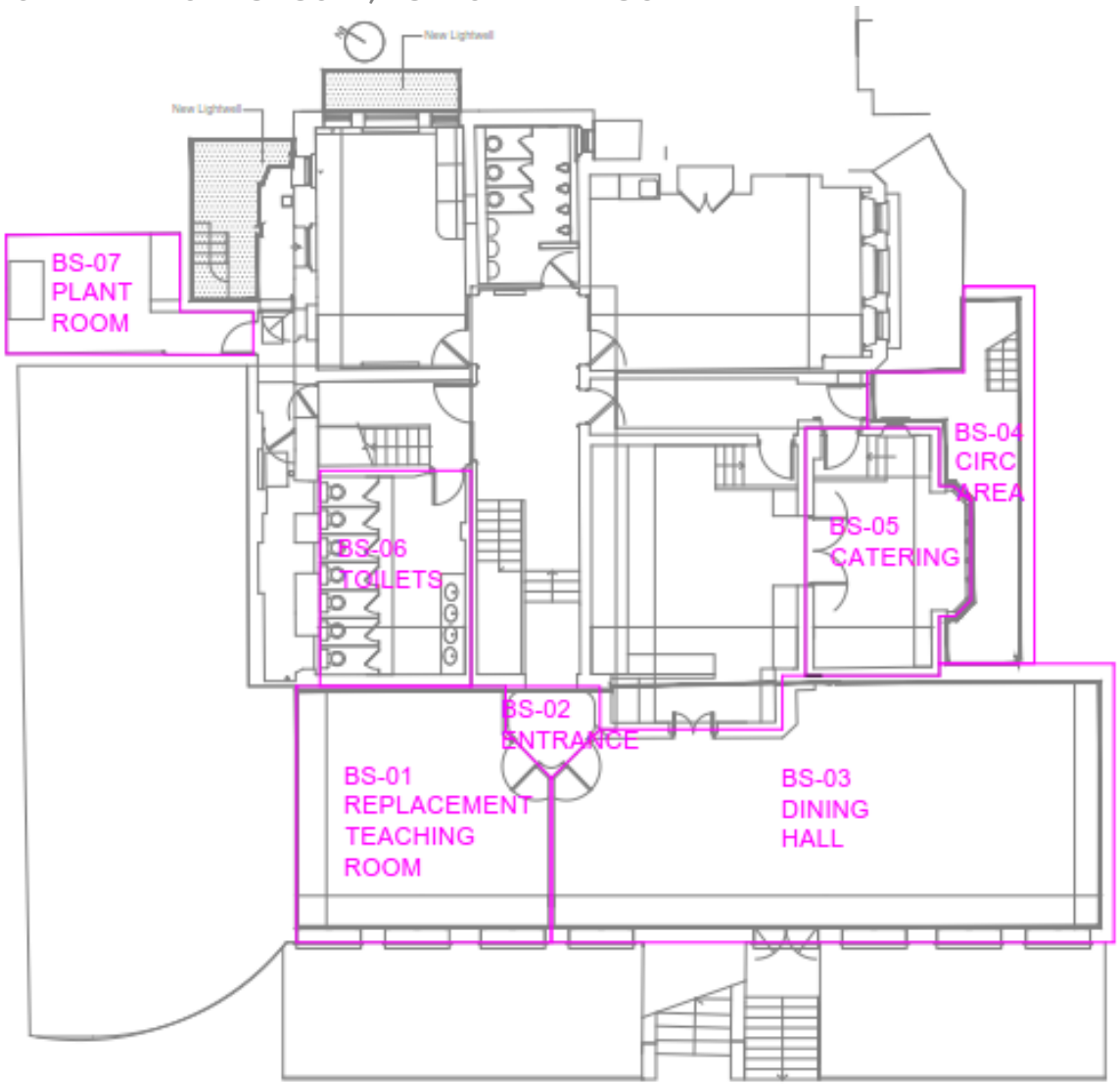
The following tables show the CO2 emissions reductions starting with the target emissions rate followed by the three stages of the energy hierarchy.

TABLE 16 – BUILDING EMISSIONS RATE

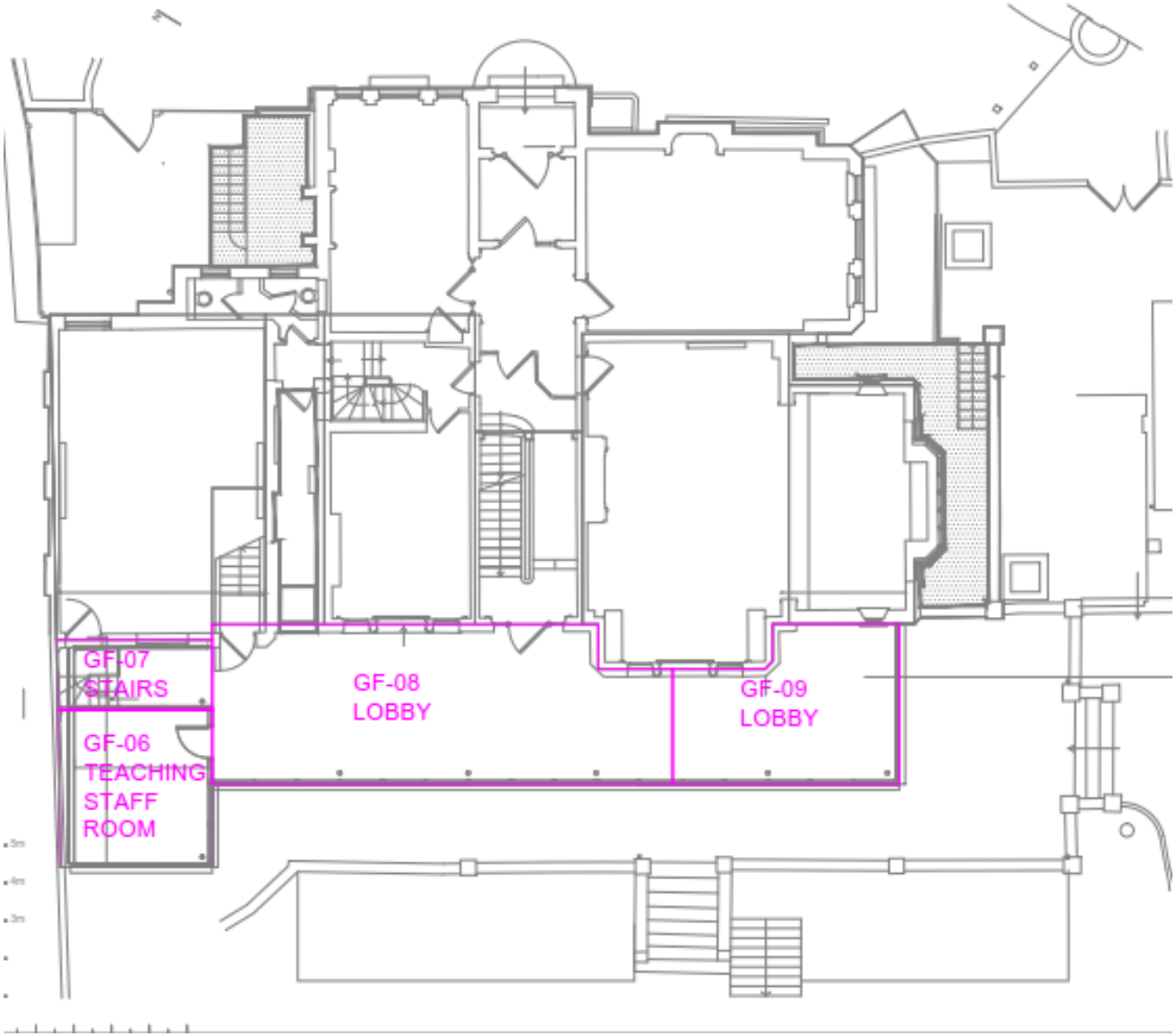
	CO2 EMISSIONS (kgCO2/m2/year)
TARGET EMISSIONS RATE	18.7
"INTERIM" DWELLING / BUILDING EMISSIONS RATE (with energy efficiency)	18.2
"INTERIM" DWELLING / BUILDING EMISSIONS RATE (with energy efficiency and efficient supply of energy)	14.1
"FINAL" DWELLING / BUILDING EMISSIONS RATE (with energy efficiency, efficient supply of energy and renewable energy technologies)	14.1
% CO2 REDUCTION BELOW TER	24.60

APPENDIX A – ENERGY AND CO2 EMISSIONS ZONES AS PROPOSED

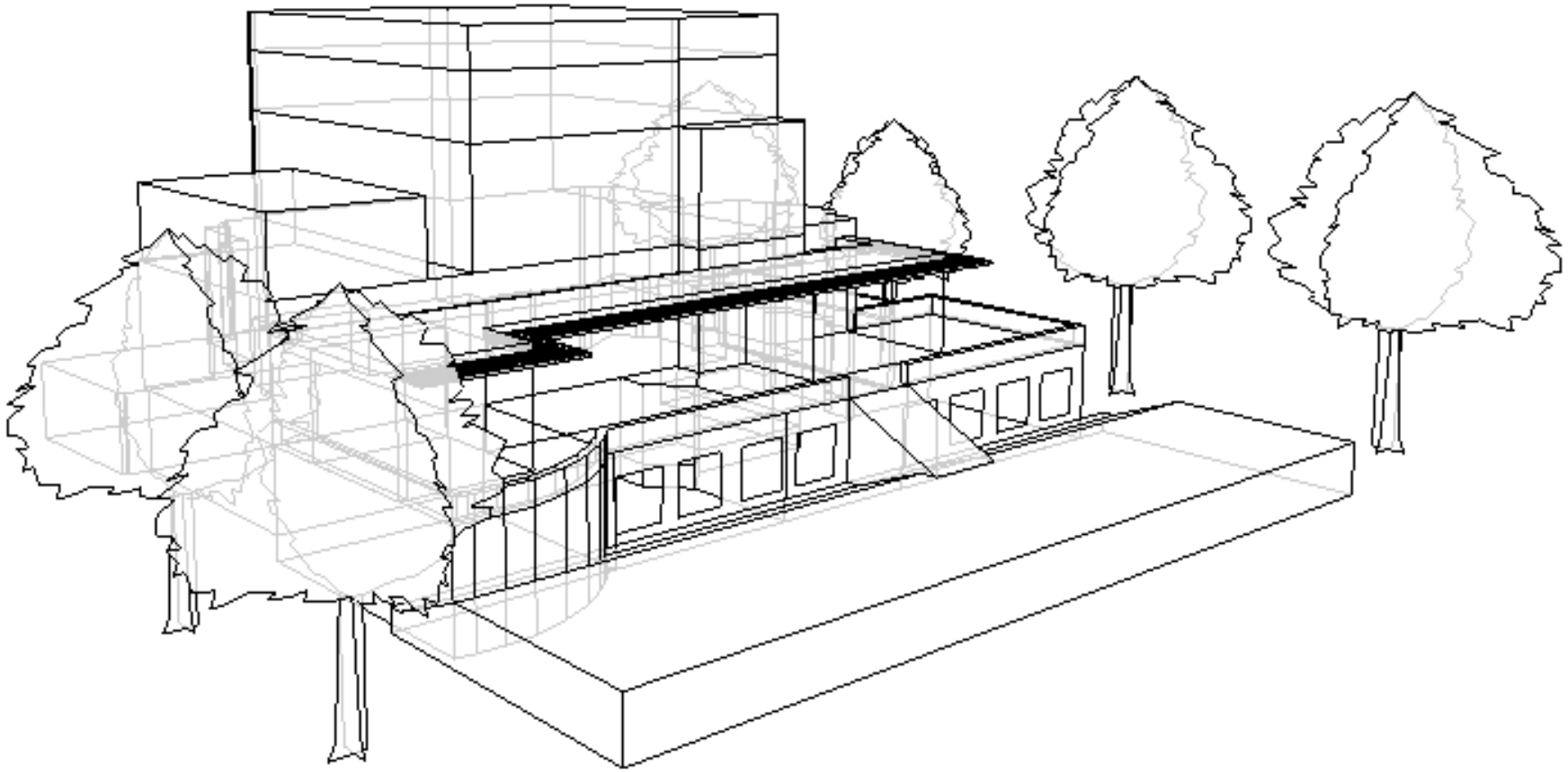
BASEMENT - AS PROPOSED, ZONES IN PINK OUTLINE



GF - AS PROPOSED, ZONES IN PINK OUTLINE



3D VIEW OF THE BUILDING AS PROPOSED



APPENDIX B- DEVONSHIRE HOUSE SCHOOL SAV SYSTEMS LOAD TRACKER CHP COMBINED REDUCTIONS

SAV/CHP/107264/Ian Green/12 Feb 2015
Devonshire House School
LoadTracker CHP (XRGI 6G) -
CRA (Carbon Reduction Assessment)

Please note that the results presented in this assessment are specific to XRGI 6G LoadTracker modulating

Number of CHP units at 6 kWe	1
Recommended heat storage vessel	1,000 ltr per CHP
Type of usage	School
Data reference	Email from Zeynep Korzay @ Crawford and Gray on 11 Feb 2015

1.0 Summary of Usage:

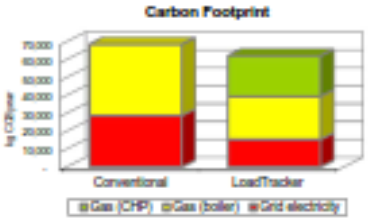
Annual electricity consumption	55,390 kWh
Electricity price (without CCL)	13.19 p/kWh
Annual gas consumption	184,131 kWh
Gas price (without CCL)	3.48 p/kWh

1.1 CO2 Emission Factors used:

- For grid electricity = 0.519 kg/kWh
- For grid displaced electricity = 0.519 kg/kWh
- For gas = 0.216 kg/kWh

2.0 Carbon Footprint of Project User Centre:

CO_2 (conv)	68,520 kg CO_2 pa (a)
CO_2 (CHP)	62,061 kg CO_2 pa (b)
Net reduction	6,458 kg CO_2 pa



By introducing a CHP, a reduction of 6.5 tonnes of CO_2 emissions (6,458/68,520 = 9%) could be expected relative to a conventional mains supply/gas boiler system.

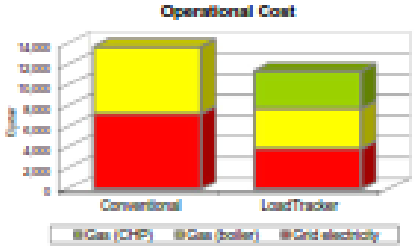
Notes:

(a) = (electricity consumption x 0.519) + (gas consumption x 0.216)
=(55,390 kWh x 0.519) + (184,131 kWh x 0.216) = 68,520 CO_2 pa
(b) = (CHP gas consumption x 0.216) + (supporting boiler gas consumption x 0.216) + (electricity consumption x 0.519) - (CHP electricity production x 0.519)
=(104,709 kWh x 0.216) + (111,475 kWh x 0.216) + (55,390 kWh x 0.519) - (25,755 kWh x 0.519) = 62,061) kg CO_2 pa

3.0 Cost Savings:

Comparisons are shown between the operational costs of a conventional system (mains supply/gas boiler) and 1 x LoadTracker 6G CHP unit.

	Conv.	CHP
Electricity	£7,306 (c)	£3,905 (d)
Gas (Boiler)	£6,408 (e)	£3,879 (f)
Gas (CHP)	0	£3,644 (g)
Total	£13,714	£11,428



The use of LoadTracker CHP would result in annual savings of £13,714 - £11,428 = £2,286 pa relative to a conventional mains supply/boiler system.

Notes:

(c) = 55,390 kWh x 0.1319 £/kWh = £7,306

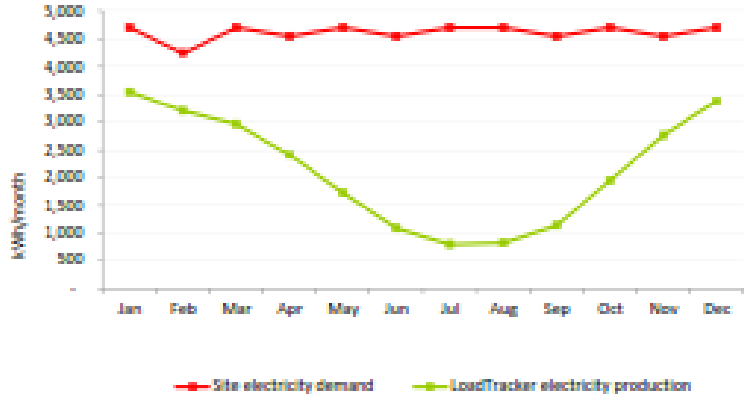
(d) = Assessed by LoadTracker programme

(e) = 184,131 kWh x 0.0348 £/kWh = £6,408

(f) = Assessed by LoadTracker programme

(g) = Assessed by LoadTracker programme

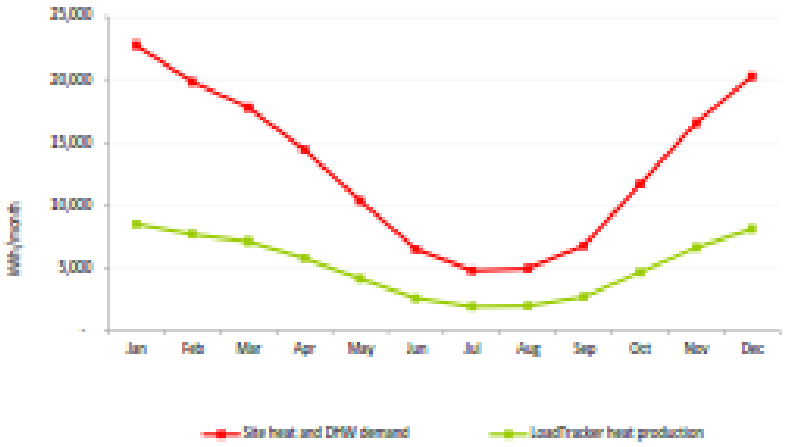
4.0 LoadTracker CHP Contribution to Electrical Needs of User Centre



CHP accounts for 25,755 kWh / 55,390 kWh = 47% of electricity requirements of the User Centre.

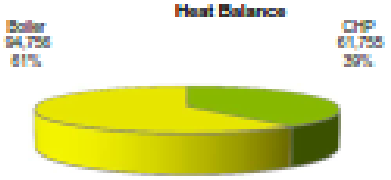
5.0 LoadTracker CHP Contribution to Heat Needs of User Centre

The CHP LoadTracker units can maintain a similar profile for heat production, as shown below:



6.0 Heat Balance for User Centre

Heat consumption by User Centre	156,511 kWh (h)
Heat production (CHP)	61,755 kWh (i)
Heat production (boiler)	94,756 kWh (j)
Consumption by boiler	111,478 kWh (k)



It can be seen that CHP account for 61,755 kWh/156,511 kWh = 39% of heat requirements of the user centre.

Notes:

(h) = 184,131 kWh @ 85% (assumed boiler efficiency) = 156,511 kWh

(i) = Assessed by LoadTracker programme, to give max possible CHP usage

(j) = Net difference (h) - (i)

(k) = Heat production (j) factored up assuming 85% efficiency = 94,756/0.85

Appendix

CCL = Climate Change Levy. Exemption from this is granted to projects containing good quality CHP.

Site Electricity Consumption (given by customer):

3. ELECTRICAL DEMAND
Electricity consumption in kWh *(annual or monthly)*
If annual [kWh]:
45,144 kWh/year, based on Display Energy Certificate (DEC), issued in 2009. Plus 10,245.33 kWh/year as calculated using SBEM for the extension only = **55,389.33 kWh/year**

Site Electricity Demand (given by customer):

5. GAS CONSUPTION FOR HEATING AND HOT WATER PRODUCTION [kWh] *(annual or monthly)*
If annual [kWh]:
168,036 kWh / year (based on DEC issued in 2009). Plus 16,094.75 kWh/year as calculated using SBEM for the extension only = **184,130.75 kWh/year.**

Notes:

Boiler efficiency @ 85%
DHW share assumed 20%

APPENDIX C- SBEM BRUKL REPORTS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Devonshire House School - be lean

As designed

Date: Wed Feb 18 23:20:55 2015

Administrative information

Building Details

Address: 69 Fitzjohns Av, London, NW3 6PD

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.2

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.2

BRUKL compliance check version: v5.2.b.1

Owner Details

Name: Devonshire House School

Telephone number: Phone

Address: 69 Fitzjohns Av, London, NW3 6PD

Certifier details

Name: Xavier Valladares

Telephone number: 0 203 051 6264

Address: ECOstudio XV, 2nd Floor 145-157 St John St, London, EC1V 4PY

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

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.7
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.7
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	18.2
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

Values which do not meet standards in the 2013 Non-Domestic Building Services Compliance Guide are displayed in red.

2.a 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	BS010000:Surf[2]
Floor	0.25	0.18	0.18	BS010000:Surf[0]
Roof	0.25	0.13	0.13	BS010000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.39	1.6	GF060001:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = 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	3

2.b 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- Gas boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- Gas boiler-DHW-intantaneous

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.005
Standard value	0.9*	N/A

* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
BS-01 REPL TEACHING ROOM	94	-	-	192
BS-02 ENTRANCE	-	110	-	11
BS-03- DINING HALL	-	110	-	216
GF-06-TEACHING ROOM STAFF	94	-	-	96
GF-06-TEACHING ROOM STAFF	94	-	-	64
GF-08-LOBBY	-	110	25	173
GF-09-LOBBY	-	110	25	91
BS-04 CIRCULATION FIN	-	110	-	41
BS-05 CATERING	-	110	-	73

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?
BS-01 REPL TEACHING ROOM	NO (-86%)	NO
BS-03- DINING HALL	NO (-85.7%)	NO
GF-06-TEACHING ROOM STAFF	N/A	N/A
GF-06-TEACHING ROOM STAFF	NO (-23.3%)	NO
GF-08-LOBBY	NO (-66.2%)	NO
GF-09-LOBBY	NO (-83.3%)	NO
BS-05 CATERING	NO (-98.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	272.7	272.7
External area [m²]	676.2	676.2
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	319.56	295.33
Average U-value [W/m²K]	0.47	0.44
Alpha value* [%]	10	10

* 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
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
100	**D1 Non-residential Inst.: Education**
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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/m²]

	Actual	Notional
Heating	30.18	30.81
Cooling	0	0
Auxiliary	1.22	0.55
Lighting	6.1	9.07
Hot water	36.42	33.4
Equipment*	27.96	27.96
TOTAL**	**73.92**	**73.84**

* 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/m²]

	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/m²]	88.22	95.63
Primary energy* [kWh/m²]	103.72	107.14
Total emissions [kg/m²]	18.2	18.7

* 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] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	88.2	0	30.2	0	0.6	0.81	0	0.91	0
	Notional	95.6	0	30.8	0	0.6	0.86	0	----	----

Key to terms

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

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	GF060000:Surf[3]
Floor	0.2	0.18	BS010000:Surf[0]
Roof	0.15	0.13	BS010000:Surf[1]
Windows, roof windows, and rooflights	1.5	1.16	GF060001:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = 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	3

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Devonshire House School - be clean

As designed

Date: Wed Feb 18 23:40:48 2015

Administrative information

Building Details

Address: 69 Fitzjohns Av, London, NW3 6PD

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.2

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.2

BRUKL compliance check version: v5.2.b.1

Owner Details

Name: Devonshire House School

Telephone number: Phone

Address: 69 Fitzjohns Av, London, NW3 6PD

Certifier details

Name: Xavier Valladares

Telephone number: 0 203 051 6264

Address: ECOstudio XV, 2nd Floor 145-157 St John St, London, EC1V 4PY

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

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.7
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.7
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	14.1
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

Values which do not meet standards in the 2013 Non-Domestic Building Services Compliance Guide are displayed in red.

2.a 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	BS010000:Surf[2]
Floor	0.25	0.18	0.18	BS010000:Surf[0]
Roof	0.25	0.13	0.13	BS010000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.39	1.6	GF060001:Surf[3]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = 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	3

2.b 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	>0.95

1- Gas boiler

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0	0	1
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

"No HWS in project, or hot water is provided by HVAC system"

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	129	0.29
Standard value	105	0.2

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
BS-01 REPL TEACHING ROOM	94	-	-	192
BS-02 ENTRANCE	-	110	-	11
BS-03- DINING HALL	-	110	-	216
GF-06-TEACHING ROOM STAFF	94	-	-	96
GF-06-TEACHING ROOM STAFF	94	-	-	64
GF-08-LOBBY	-	110	25	173
GF-09-LOBBY	-	110	25	91
BS-04 CIRCULATION FIN	-	110	-	41
BS-05 CATERING	-	110	-	73

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?
BS-01 REPL TEACHING ROOM	NO (-86%)	NO
BS-03- DINING HALL	NO (-85.7%)	NO
GF-06-TEACHING ROOM STAFF	N/A	N/A
GF-06-TEACHING ROOM STAFF	NO (-23.3%)	NO
GF-08-LOBBY	NO (-66.2%)	NO
GF-09-LOBBY	NO (-83.3%)	NO
BS-05 CATERING	NO (-98.7%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the 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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	272.7	272.7
External area [m²]	676.2	676.2
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	319.56	295.33
Average U-value [W/m²K]	0.47	0.44
Alpha value* [%]	10	10

* 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
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
100	**D1 Non-residential Inst.: Education**
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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/m²]

	Actual	Notional
Heating	34.4	30.81
Cooling	0	0
Auxiliary	1.22	0.55
Lighting	6.1	9.07
Hot water	44.19	33.4
Equipment*	27.96	27.96
TOTAL**	**73.3**	**73.84**

* 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/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	12.6	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	88.22	95.63
Primary energy* [kWh/m²]	79.1	107.14
Total emissions [kg/m²]	14.1	18.7

* 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
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