

# John Lyon – Oldfield House

## Energy Statement



boom collective

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# Executive Summary and Introduction

This report has been produced by Boom Collective to support the planning application for The John Lyon School, Oldfield House.

The proposed scheme is to demolish the existing Oldfield House building (currently two stories) and build a new 4-storey Science, Technology, Engineering, Arts and Maths (STEAM) centre just to the north of the existing site.

The proposals for Oldfield House are in accordance with London Borough of Harrow policies, the Greater London Plan and all relevant Building Regulations.

The proposed development is considered to be a major development as defined by the London Plan document. Therefore the carbon reduction targets for the proposed new development are 35% reduction on Building Regulations 2013, in line with the most up to date Energy Assessment Guidance document dated October 2018.

In regards to meeting London Plan Energy Hierarchy, (lean, clean and green), the development will adapt a fabric first approach.

## Lean:

- High Standards of Insulation, targeting 20% improvement on Building Regulations
- High level of air tightness and minimal air leakage.
- High efficiency lighting appliances throughout, adopting LED technology and enhanced lighting controls.

## Clean:

- The development will be principally naturally ventilated, with mechanical extract ventilation in WC areas. It is proposed that these units will have efficient performance and controls to minimise energy use.
- Direct point of use electric heating with no distribution losses
- No combustible technologies within the building.

## Green:

- A Renewable Appraisal was undertaken at the early stages to establish the most appropriate solution considered in terms of technical, practical and economic viability. The appraisal concluded that a ground source heat pump should be used for heat generation.
- 20m<sup>2</sup> of PV panels will be provided on the inner south east facing roof

The proposed school development will comply with all criterion on Building Regulations Part L2A and based on the current Building Regulations carbon factors, shows a 35% improvement over the notional building.

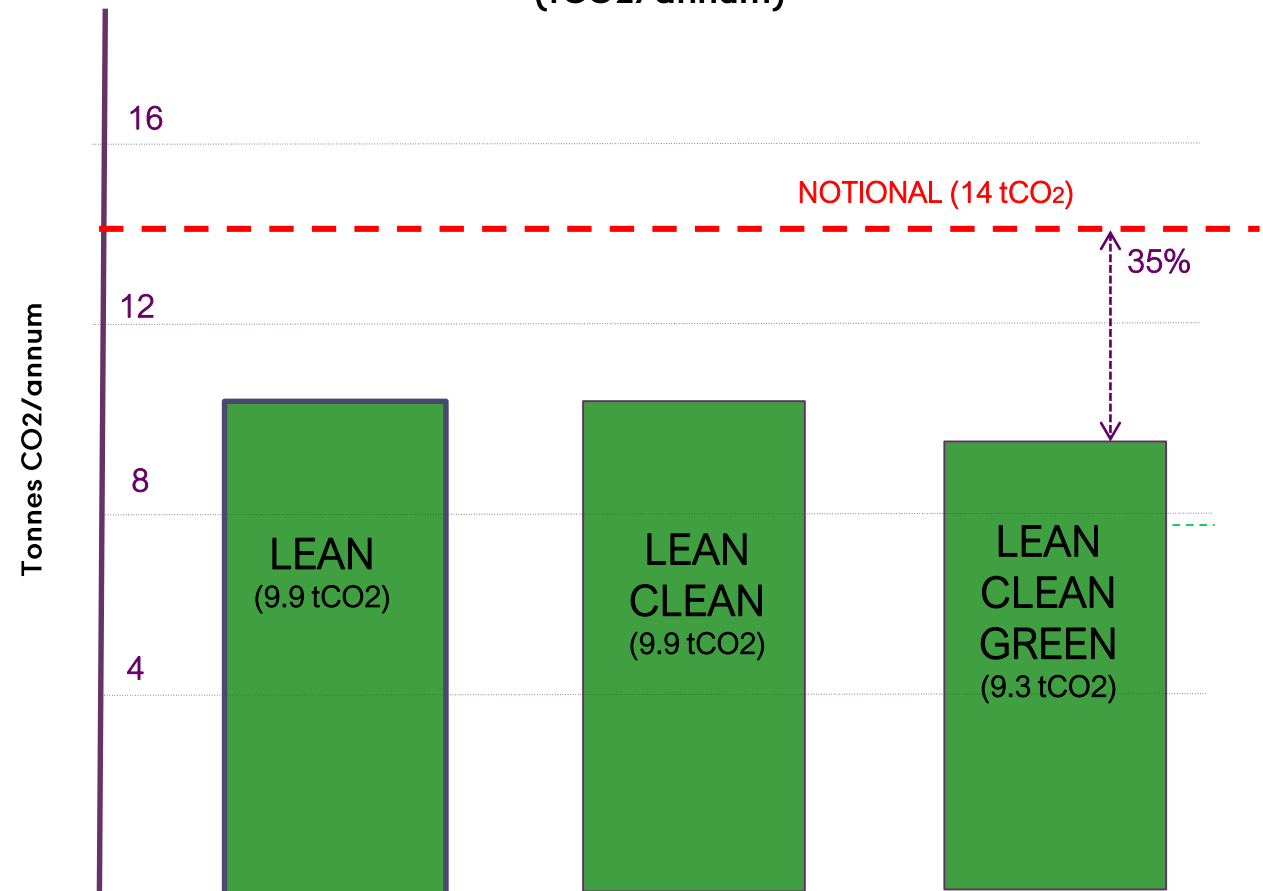
The carbon reduction has also been calculated using the new SAP 10 carbon conversion factors and a 50% reduction on Building Regulations 2013 is achieved, as well as 22% reduction in carbon emissions as a result of on-site renewables.

# Executive Summary and Introduction

	Regulated Carbon dioxide Savings	
	Tonnes CO2 per annum	% Reductions
Savings from Lean Measures	4.28	30.24%
Savings from Clean Measures	0.00	0%
Savings from Green Measures	0.74	5.22%
Cumulative Savings	5.02	35.47%

	(Tonnes CO2 per annum)	
	Regulated	Unregulated
Notional	14.268	15.85
Be Lean	9.878	15.85
Lean, Clean	9.878	15.85
Lean, Clean, Green	9.270	15.85

Energy Hierarchy and Targets (tCO2/annum)





# Planning Policy & Legislation

## National Planning Policy Framework

The National Planning Policy Framework sets out the Government's planning policies for England and details how these are expected to be applied. It sets out a structure for delivering sustainable development with particular relevance for energy and carbon issues.

## Building Regulations

Approved documents Part L 2013 (with 2016 amendments) are the most current Building Regulations in relation to Conservation of Power and Fuel. The 2013 revision to Part L of the Building Regulations was a key milestone towards the government's target for all new non-domestic buildings to be zero-carbon by 2019.

NOTE: this government ambition was abandoned in 2015 despite being widely supported by industry.

Following a long consultation period, the new carbon emission targets were published in November 2013 as a 9% aggregate improvement on the 2010 Part L targets for non-housing.

There are 4 parts to the Approved Document L:

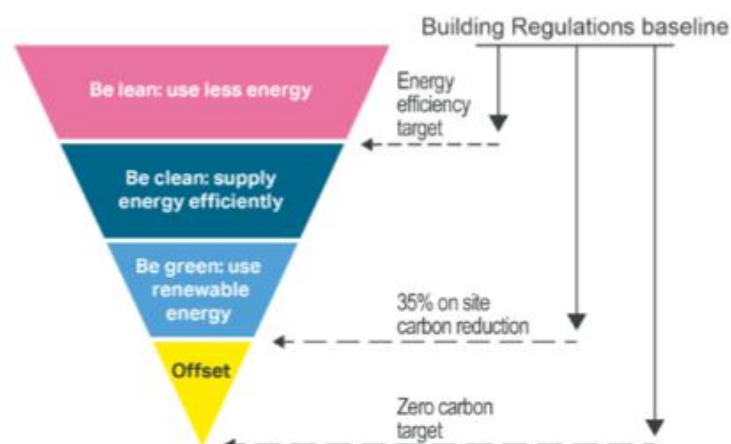
- Part L1A – Conservation of Fuel and Power (New Dwellings)
- Part L1B – Conservation of Fuel and Power (Existing Dwellings)
- Part L2A – Conservation of Fuel and Power (New buildings other than new dwellings)
- Part L1B – Conservation of Fuel and Power (Existing building other than existing dwellings)

The proposed development will be compliant with Building Regulations Part L2A,

## The Current London Plan (2017 fix)

Policy 5.2 Minimising Carbon Dioxide Emissions of the London Plan contains an energy hierarchy for minimising carbon dioxide emissions:

Be Lean : use less energy  
Be Clean : supply energy efficiently  
Be Green : use renewable energy



This hierarchy outlines a framework under which the GLA requires energy efficient building design to be approached. Firstly looking to reduce the energy consumption of a building through passive measures (be Lean), then supplying energy efficiently via building services (be Clean), and finally through the use of renewable energy technologies that supplement conventional fuels (be Green)

Policy 5.2 also outlines specific targets for carbon dioxide reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) calculated under the Building Regulations Part L.

Major development is defined as sites containing 10 or more dwellings, or non-domestic developments with a floor area of 1000m<sup>2</sup> or greater.

## Non - Residential Buildings:

Year	Improvement on 2010 Building Regulations
2010 - 2013	25%
2013 - 2016	40%
2016 - 2019	As per Building Regulations requirements
2019 - 2031	Zero Carbon

Policy 5.3 states that major development proposals should meet the minimum standards:

- minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
- avoiding internal overheating and contributing to the urban heat island effect
- efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
- minimising pollution (including noise, air and urban runoff)
- minimising the generation of waste and maximising reuse or recycling of avoiding impacts from natural hazards (including flooding)
- ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
- securing sustainable procurement of materials, using local supplies where feasible, and promoting and protecting biodiversity and green infrastructure.

# Planning Policy & Legislation

Policy 5.6 states that major development proposals should select energy systems in accordance with the following hierarchy:

1. Connection to existing heating or cooling networks;
2. Site wide CHP network;
3. Communal heating and cooling;

Policy 5.7 states that 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.

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.

Policy 5.9 states that major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

- Minimise internal heat generation through energy efficient design
- Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
- Manage the heat within the building through exposed internal thermal mass and high ceilings
- Passive ventilation
- Mechanical ventilation
- Active cooling systems (ensuring they are the lowest carbon options)

## Energy Planning- GLA Guidance

Policy 5.2 of the Current London Plan (2017 fix) requires each major development proposal to submit a detailed energy assessment.

Guidance documents:

- Energy Assessment Guidance (October 2018)
- Carbon Offset Funds (October 2018)
- GLA Carbon Emissions Reporting Spreadsheet (January 2019)

It should be noted that Energy Assessment Guidance document dated October 2018 states:

- **Demonstrate at least a 35% on-site reduction beyond Part L 2013 for non-residential development<sup>4</sup>.**

<sup>4</sup> The Mayor intends to introduce the zero carbon target for non-residential development when the new London Plan is published, expected in 2019.

## Harrow Core Strategy

### Core Policy CS1 – Responding to Climate Change

The Development Management Policies DPD and the Area Action Plan will compliment London Plan policies by establishing requirements for sustainable design and construction techniques that maximise the energy efficiency of new buildings, minimise the use of mains water, minimise carbon dioxide emissions in accordance with the London Plan energy hierarchy, and seek to promote and secure opportunities for decentralised energy, especially within the Harrow and Wealdstone Intensification Area, onsite renewable energy generation and urban greening.

## Harrow Development Management Policies

### Policy DM12 – Sustainable Design & Layout

The design and layout of development proposals should:

- utilise natural systems such as passive solar design and, wherever possible, incorporate high performing energy retention materials, to supplement the benefits of traditional measures such as insulation and double glazing;
- make provision for natural ventilation and shading to prevent internal overheating;
- incorporate techniques that enhance biodiversity, such as green roofs and green and,
- where relevant, the design and layout of buildings should incorporate measures to mitigate any significant noise or air pollution arising from the future use of the development.

Proposals that fail to take reasonable steps to secure a sustainable design and layout of development will be resisted.

### Policy DM13 – Decentralised Energy Systems

- Proposals for decentralised energy networks will be supported.
- Development proposals should connect to existing decentralised energy networks where feasible.

### Summary of Target

- 35% reduction on Building Regulations Part L2013

# Energy Strategy

The Environmental Engineering strategy options have been developed to provide a quality built environment, focusing on the comfort of the occupants as well as the Whole Life Cost (WLC) considerations of life cycle analysis, value for money, benefits to the environment, and their social impact.

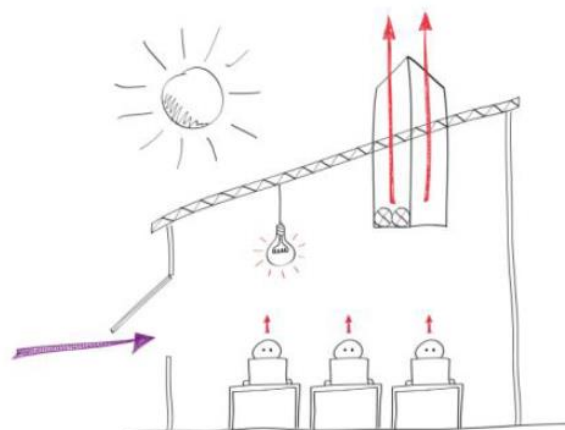
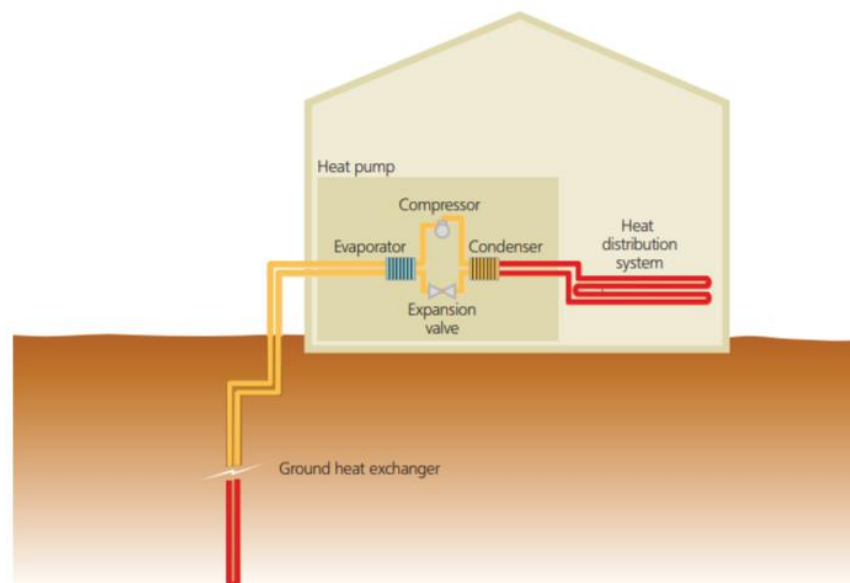
The thermal performance of the building fabric will exceed the current Building Regulations Approval Document Part L2 (2013) and provide an air tightness improvement from 10 to 5.0 m<sup>3</sup>/hr/m<sup>2</sup> of building fabric.

A low energy lighting strategy has been adapted, using light emitting diode (LED) technology and low energy fluorescent fittings. Presence detection control within circulation areas will also contribute to energy savings.

A fully naturally ventilated strategy is proposed, using the breathable building new NVHR 1100 units. This system implements displacement ventilation in summer and mixing ventilation in winter. It has significant energy savings over conventional ventilation approaches. The units are controlled to supply ventilation at the required rate, preventing over ventilation in the winter and encouraging higher ventilation rates in the summer.

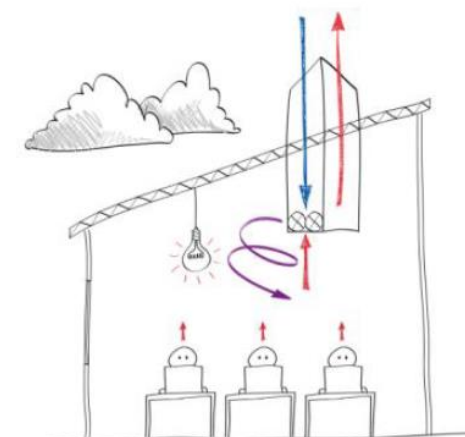
Hot water generation will be electric point of use, while high efficiency heating will be provided by ground source heat pumps located in the basement plant room. Early calculations indicate that approx. 25no. boreholes at 120m deep will be required to meet the heating demand for the school. The boreholes are to be in tandem with the structural piling configuration of the building, optimising cost and time.

Approximately 20m<sup>2</sup> of Photovoltaic panels will also be added to south easterly facing pitched roof, generating free electricity and offsetting some of the electrical draw of the heat pump.



### Breathing Buildings Summer Strategy

*Fans in the e-stack units can be used to boost displacement ventilation in the summer and avoid summer overheating.*



### Breathing Buildings Winter Strategy

*Mixing ventilation strategy used in the winter. E-stack units supply and mix fresh air at high level, to avoid cold draughts and the requirement for preheating.*



# Demand Reduction - Be Lean

## Building Fabric

The thermal performance of the building fabric will exceed the current 2013 Building Regulations Approval Document Part L2A (Non-domestic).

The limiting U values, Notional U values and proposed target U values are detailed in the table adjacent.

## Air Permeability

The primary improvements need to be made to the air tightness of the property and the thermal bridging. This will require additional effort in the detailing of typical junctions and interfaces, and addition policing and care taken on site.

## Glazing

The notional building against which the design is compared, assumes approx. an area of glazing that is approximately 20% of the floor area. So for a typical 20sqm room, the glazing associated with the apartment would be around 4sqm.

Large glazed modules will help to reduce the U-value of the glazing, as the complexity of the frame and its thermal bridging is the weak spot in the windows performance.

Of the glazing provision approximately 5% of the floor area will need to be openable in order to provide 4 air changes per hour required for purge (rapid) ventilation.

## Day lighting and low energy lighting

A low energy lighting strategy has been adapted, using light emitting diode (LED) technology and low energy fluorescent fittings.

Presence detection control will contribute to energy reduction throughout the communal areas.

WCs , store, plant & circulation = 5W/m<sup>2</sup>

Staff room & classrooms = 6 W/m<sup>2</sup>,

Stairs = 4 W/m<sup>2</sup>

Element	Non-Domestic Part L2A		
	Limiting U-values (W/m <sup>2</sup> .K)	Notional Building U-values (W/m <sup>2</sup> .K)	Target U-Values (W/m)
Walls	0.35	0.26	0.20
Roof	0.25	0.18	0.10
Floor	0.25	0.22	0.13
Windows	2.20	1.6	1.20 G= 0.4
Glazed doors	2.20	2.20	1.20
Opaque doors	2.20	2.20	1.60
Air tightness	10 m <sup>3</sup> /(m <sup>2</sup> .h) (@ 50 Pa)	5 m <sup>3</sup> /(m <sup>2</sup> .h) (@ 50 Pa)	5 m <sup>3</sup> /(m <sup>2</sup> .h) (@ 50 Pa)



# Overheating and Cooling

In line with the Mayor's cooling hierarchy the school development minimises internal heat generation through energy efficient design, for e.g. the use of LED lighting with daylight linking and presence detection will be extensive.

Consideration has been given to the suitable orientation of the building, along with the positioning and sizing of any glazing. Glazing ratios have been developed such that they look to optimise natural daylight without exposing occupied spaces to excessive levels of solar gain.

A fully naturally ventilated strategy is proposed, using the breathable building new NVHR 1100 units.

The window opening area has been carefully sized in line with Breathable buildings NVHR 1100 design criteria.

The e-stack NVHR system provides controlled natural ventilation for the classroom spaces. It implements displacement ventilation in summer and mixing ventilation in winter. This has significant energy savings over conventional ventilation approaches. The units are controlled to supply ventilation at the required rate, preventing over ventilation in the winter and encouraging higher ventilation rates in the summer.

The system installed in each room is designed to meet BB101 2018 summer overheating criteria as well as the BB93 noise limitations.



# Heating Infrastructure - Be Clean

The second step of the London Plan's energy hierarchy requires energy systems to be evaluated and designed considering the following:

- Connection to an existing heating or cooling network
- Site wide CHP network
- Communal Heating and Cooling

District Heating networks combine heat demands from different buildings resulting in a more even demand profile, with CHP capacity being shared between heat customers who require heat at different times of the day. This means larger and more efficient plant can run for longer operating hours and generate shorter economic paybacks.

The London Heat Map adjacent shows that there are no potential networks or existing district heating networks. The site is not located in an area identified with opportunity for decentralised energy.

In direct response to London Plan Policy 5.6;

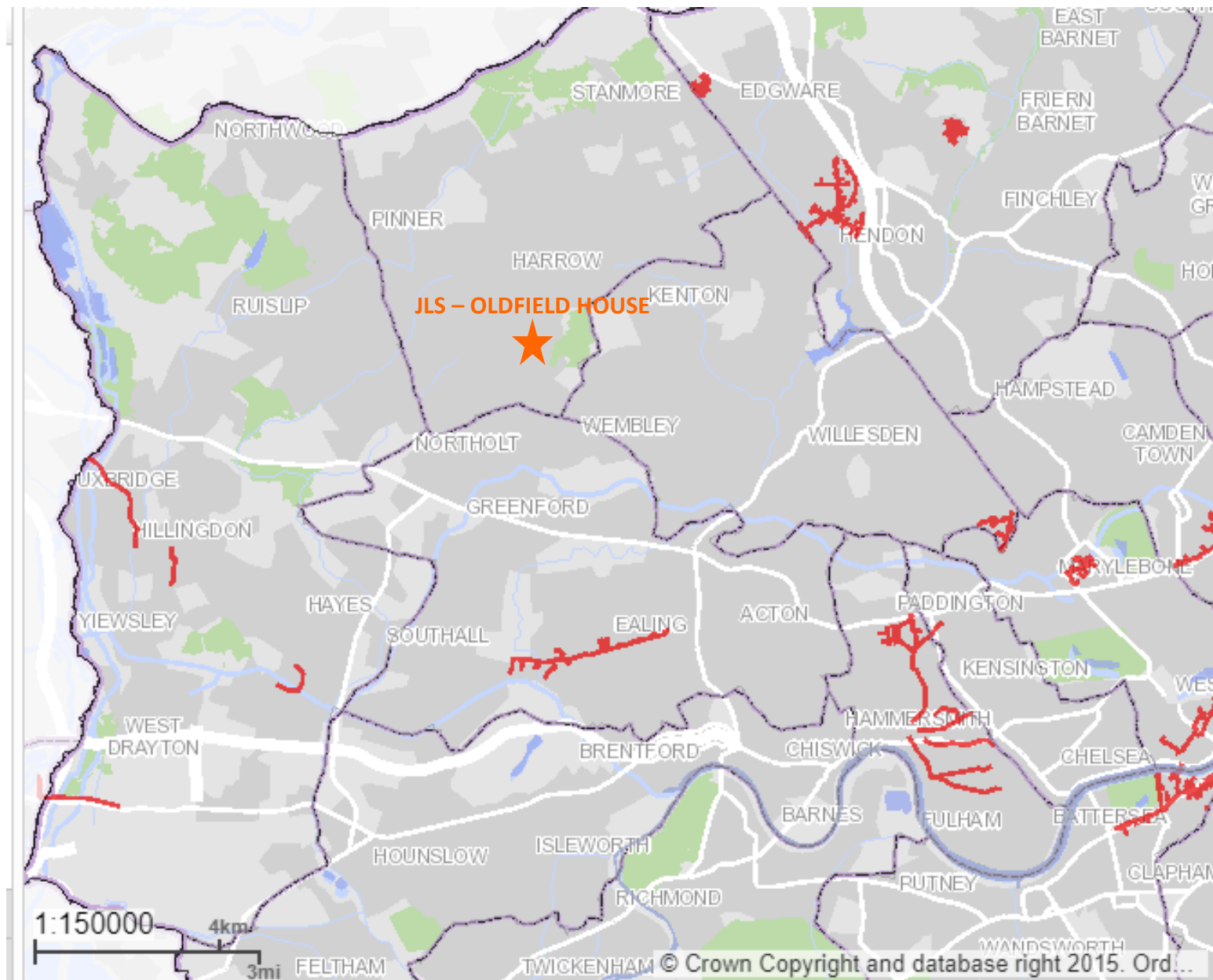
*(e) Connect to, or extend, existing decentralised heating, cooling or power networks in the vicinity of the site, unless a feasibility or viability assessment demonstrates that connection is not reasonably possible. - Not possible at Oldfield House.*

*(f) Evaluate the feasibility and viability of Combined Heat and Power (CHP) systems and, where appropriate, examine the feasibility of extending the system beyond the site boundary, where developments cannot immediately connect to an existing heating or cooling network; - Not possible at Oldfield House.*

Although CHP was given some consideration as a viable solution for the development, the low- carbon technology has been ruled out due to the following reasons;

- Air quality issues; emissions of nitrogen dioxide and particulate matter from a flue would be of local concern
- Site constraints, affordability and size of the plant area required for the CHP.

NOTE: The scheme will include for a heat exchanger in the plant room, allowing for the future connection to a district heating system.



# Renewable Energy – Be Green

The utilisation of the Lean and Clean approach allows the project to minimise the reliance on the fossil fuelled energy infrastructure. Once the energy use has been minimised, the CO2 emissions can be reduced further through de-carbonised supplies and onsite 'renewable energy' solutions – 'Being Green'.

A LZC technology Appraisal was undertaken and is contained within the Appendix.

In summary, it being an urban site, wind turbines are unlikely to be effective due to poor wind speed. The use of biofuels is prohibitive as London is subject to strict air quality measures. Fuel cells are not technically appropriate as the development will not generate high enough annual energy demand to make the technology feasible, and there is no source of waste heat for absorption chillers to make practical sense. Combined Heat & Power was considered, but again has significant air quality issues and generally works better with higher base loads.

A green approach of incorporating Low and Zero Carbon Technology has then been adopted via ground source heat pumps and PV panels.

# Renewable Energy – Be Green

## Ground Source Heat Pump (GSHP)

Ground source heat pumps (GSHPs) use pipes which are buried to extract heat from the ground. This heat can then be used to heat radiators, underfloor or warm air heating systems and hot water. For Oldfield House we are looking to use the GSHP for space heating only, this will look to maximise the efficiency of the system.

A ground source heat pump circulates a mixture of water and antifreeze around a loop of pipe, called a ground loop, which is buried in the ground. Heat from the ground is absorbed into the fluid and then passes through a heat exchanger into the heat pump. The ground stays at a fairly constant temperature under the surface, so the heat pump can be used throughout the year. The diagram on the right shows how the ground temperature becomes consistent as the depth increases, this is where the GSHPs will extract and reject heat to.

While GSHP do consume electrical energy, the useful energy output is several times the input. This is dependent on the coefficient of performance (CoP) of the unit and the operating conditions.

Ground source heat pumps are favorable for good localised air quality. The proposed ground source heat pumps will be located in the basement plant room, they run from 'clean' electricity therefore with no flues and no associated localized emissions.

### Close Loop Boreholes

It is proposed that closed loop boreholes are utilised. They tend to require between 20 and 40m of pipe per kW. The actual boreholes are usually 100 – 150mm in diameter Each borehole has at least one flow and return pipework, sometimes two.

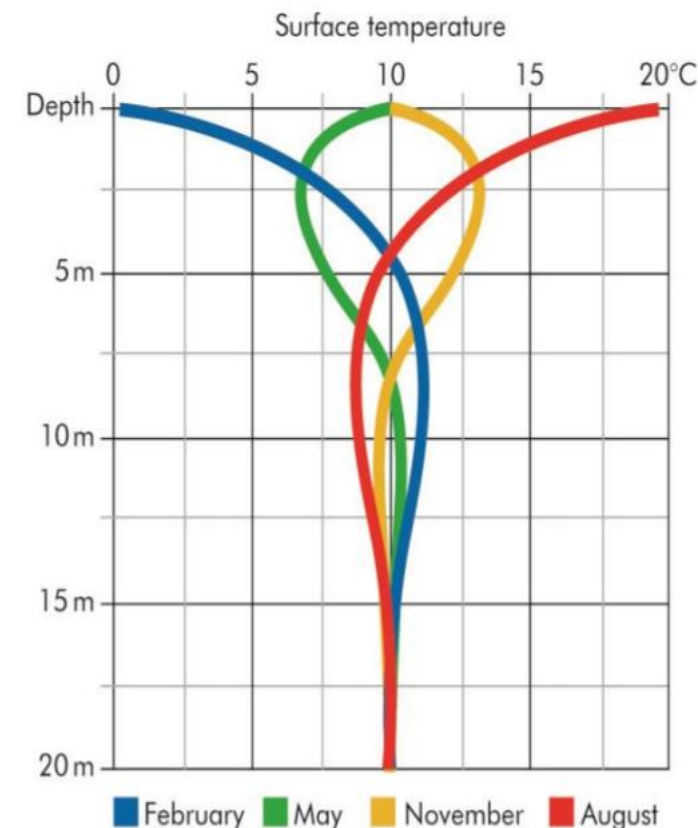
The table and points below outline the proposed GSHP selection and the system performance expected and assumed modelling criteria.

### System Outline

- 70kW GSHP (MSC certified – Space heating only)
- Point of use electric hot water heaters for Domestic Hot Water
- Boreholes / Energy Piles utilised, provision basis of approx. 25No. (150mm dia) 120m deep borehole, based on current geological understand of ground conditions (fairly typical London conditions). This will be developed in further detail going forwards.
- Ground Water Loop Temperatures Design: 0 – 7°C
- LTHW Flow Temperature: 35 °C
- Underfloor Heating throughout.

Modelling Inputs:  
SCOP (Heating) = 4.80

Modelling Outputs:  
Estimated heating energy = 0.9 kWh/m2



Floor	GSHP Model	Quantity	Peak Heating Output (kW)	Peak Electrical Input (kW)	Primary Input Temperature - Ground Loop (°C)	Primary Output Temperatures - LTHW (°C)
Basement	Vitocal 300-G	2	40.0	8.33	0 – 7	35



# Renewable Energy – Be Green

## Photovoltaic Panels

The proposed system should be on the inner south west facing roof. Whilst there is more south easterly facing roof available, it should be noted that PV panels will not be positioned here in keeping with the conservation area.

System Size = 3.8 kWp

Approximate Output = 3150 kWh

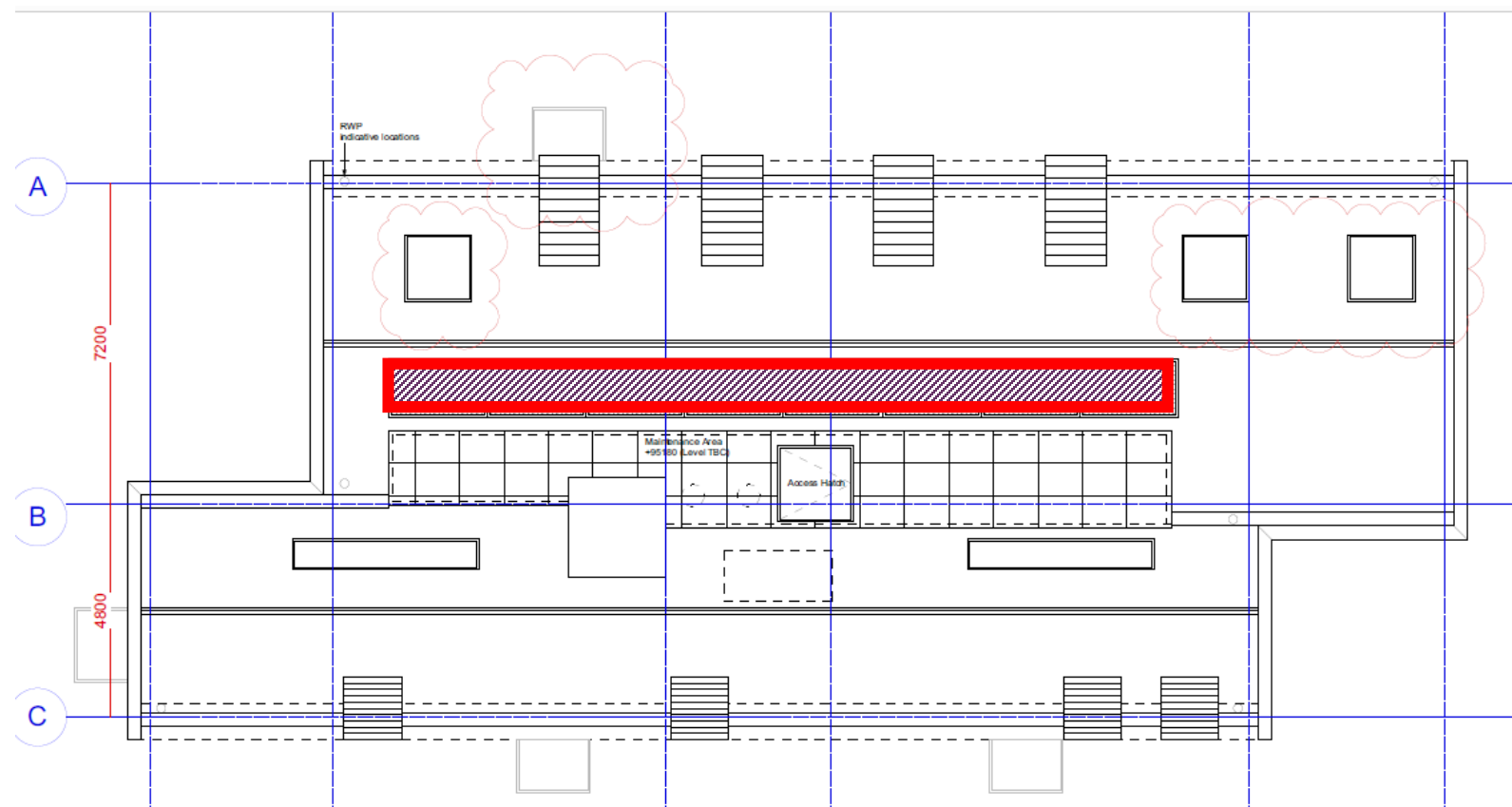
Approximate carbon savings = 1.6tCO<sub>2</sub>/annum

The above figures are based on the following assumptions;

- Electricity Carbon Factor = 0.519 kgCO<sub>2</sub>/kWh
- Output of PVs (kWh) is based on 850kWh/kWp

Refer to site map in appendix showing that there is no risk of shading from surrounding buildings.

NOTE: Both the PV panels and the Ground Source Heat Pump will be metered by a remote monitoring platform with daily readings for a period of 3 years after installation and when the equipment is turned on.



# Carbon Compliance

The calculation methodology for presenting carbon emission reduction draws on the approach set out by Policy 5.2 (Minimising Carbon Dioxide Emissions) of the London Plan and is amplified in the Harrow Development Management Policy.

It is a hierarchical approach with four sequential steps.

- Establish baseline (Part L compliance)
- Evaluate energy efficiency measures ('lean')
- Evaluate heating and cooling systems ('clean')
- Evaluate renewable energy technologies ('green')

SBEM (or Simplified Building Energy Model) is the approved methodology for calculating energy performance in non-domestic buildings. The energy calculations for the non-residential element have been undertaken using TAS software.

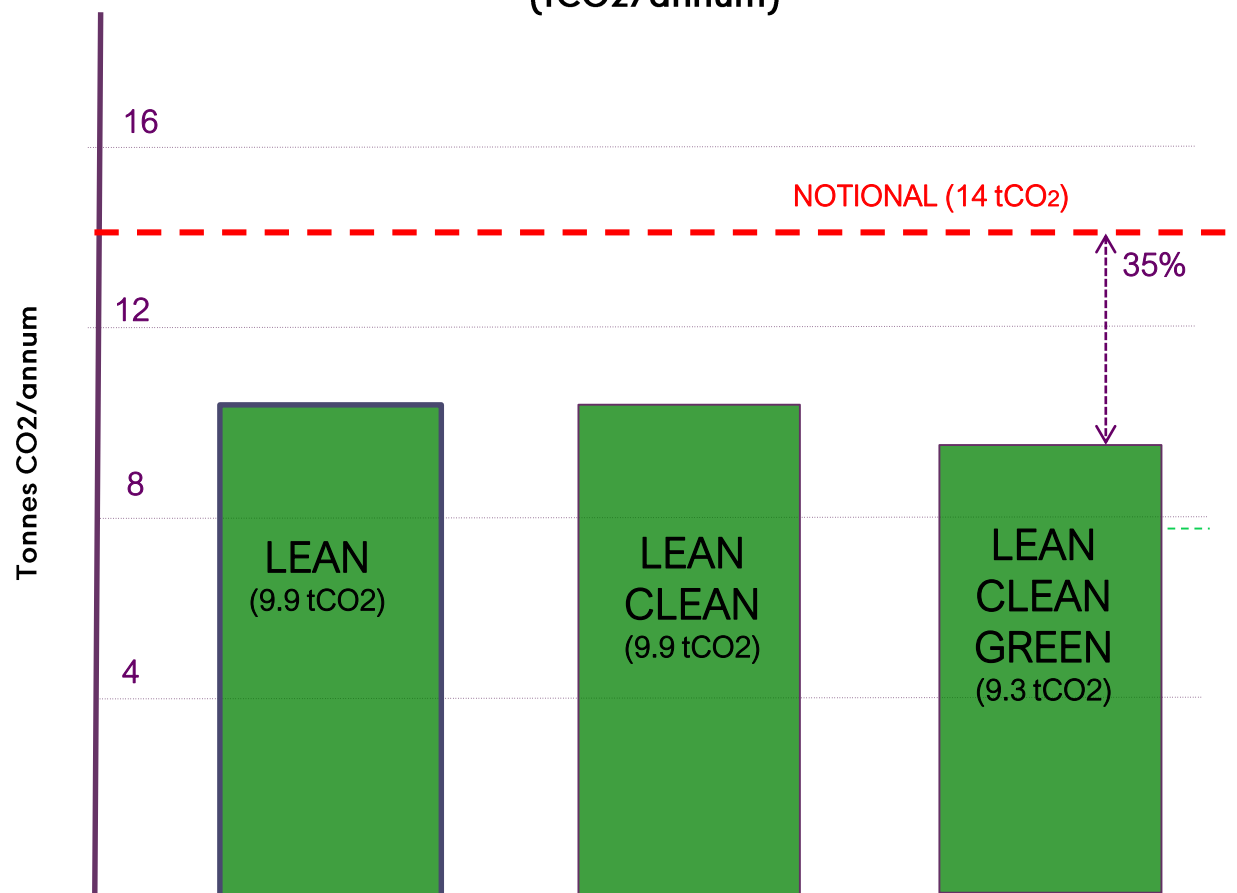
Full modelling report is contained within the Appendix.

A summary of our current proposals to reduce carbon for the development, in line with the calculation methodology outlined in the GLA Preparing Energy Assessments guidance is;

- Improved U values, air permeability = 5m3/m2.h, energy efficient lighting & controls – LEAN
- A fully naturally ventilated strategy is proposed using the breathable building new NVHR 1100 units, and mechanical extract in WC, Kiln/photography rooms, plant room and store – LEAN
- High performing GSHP to provide tempered air in the summer and winter months to all of the spaces. – GREEN
- 20m2 of PV panels (circa. 3.5kWp) will be provided on the inner south east facing roof. – GREEN

The Notional Building changes if the heat source changes. Therefore our proposed strategy shows a 38% improvement over the notional building – which is considered to have Building Regulations compliant U values, air permeability, lighting, ventilation and a gas boiler providing the heat.

Energy Hierarchy and Targets (tCO2/annum)



	(Tonnes CO2 per annum)	
	Regulated	Unregulated
Notional	14.268	15.85
Be Lean	9.878	15.85
Lean, Clean	9.878	15.85
Lean, Clean, Green	9.270	15.85

Savings from	Regulated Carbon dioxide Savings	
	Tonnes CO2 per annum	% Reductions
Lean Measures	4.28	30.24%
Clean Measures	0.00	0%
Green Measures	0.74	5.22%
Cumulative Savings	5.02	35.47%

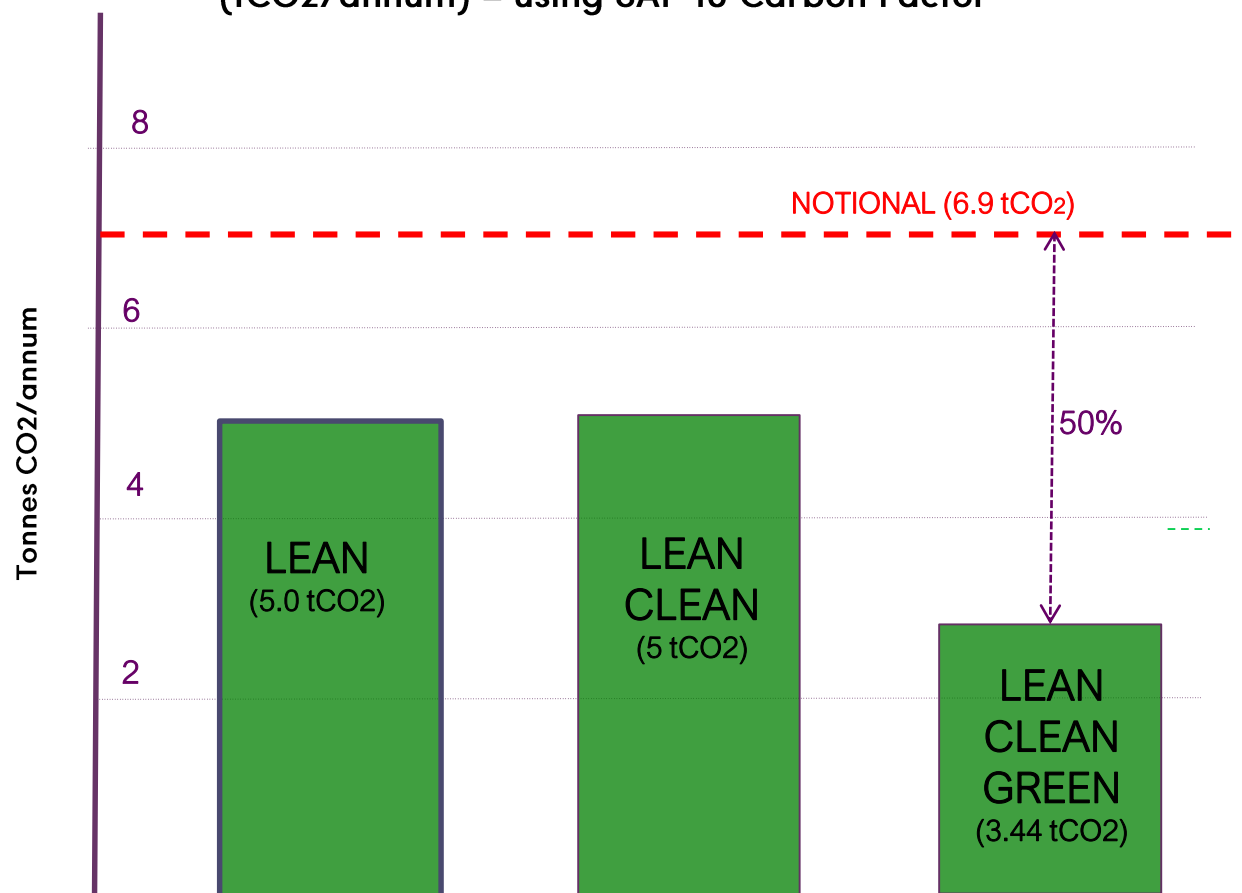
# Building Compliance – with SAP 10 Carbon Factors

From January 2019, planning applicants are encouraged to use updated (SAP 10) carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements but with the outputs manually converted for the SAP 10 emission factors.

## Carbon Factors

	Emissions kgCO <sub>2</sub> per kWh	
	SAP 2012	SAP 10
Mains Gas	0.216	<b>0.210</b>
Electricity	0.519	<b>0.233</b>

Energy Hierarchy and Targets (tCO<sub>2</sub>/annum) – using SAP 10 Carbon Factor



	(Tonnes CO <sub>2</sub> per annum)	
	Regulated	Unregulated
Notional	6.87	15.85
Be Lean	4.96	15.85
Lean, Clean	4.96	15.85
Lean, Clean, Green	3.44	15.85

Savings from	Regulated Carbon dioxide Savings	
	Tonnes CO <sub>2</sub> per annum	% Reductions
Lean Measures	1.91	28%
Clean Measures	0.00	0%
Green Measures	1.52	22%
Cumulative Savings	5.02	50%


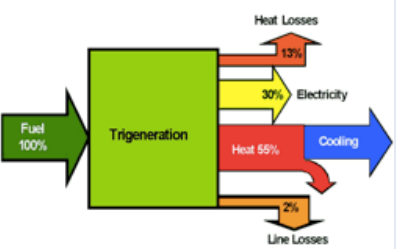
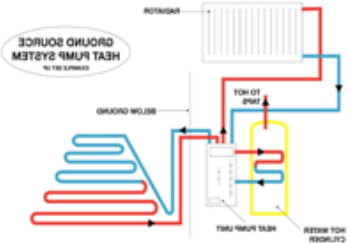

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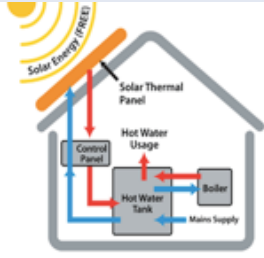


# Appendix

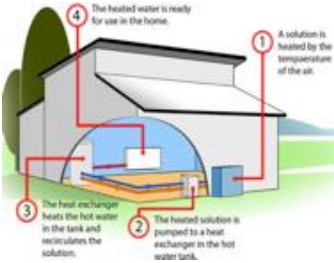
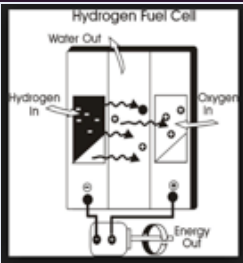


# Renewables and LZCT Appraisal

Renewable Technology	Advantages	Disadvantages	Viable Option
Combined Heat and Power (CHP) 	<ul style="list-style-type: none"> <li>Heat and power generation – efficient way to generate heat</li> <li>Tried and tested technology</li> <li>Suitable for projects with high heating and hot water loads</li> </ul>	<ul style="list-style-type: none"> <li>Modulating decreases performance</li> <li>Higher Nox emissions than condensing boiler</li> <li>No RHI tariff</li> </ul> <p><b>DECIDING FACTOR:</b></p> <ul style="list-style-type: none"> <li>Significant impact on the local air quality, in an area where it is already a concern</li> <li>Flues required</li> <li>Affordability</li> </ul>	N
Tri-generation 	<ul style="list-style-type: none"> <li>Waste heat drives absorption chiller in summer months</li> <li>Provides low carbon cooling (depending on source of waste heat)</li> <li>Chillers are quiet</li> </ul>	<ul style="list-style-type: none"> <li>Requires source of waste heat usually from industrial process</li> <li>Large plant space required for absorption chiller</li> <li>Large amount of heat rejection</li> <li>Still requires conventional chillers for peak cooling load</li> <li>No RHI payments</li> </ul>	N
Ground Source Heat Pump 	<ul style="list-style-type: none"> <li>Can provide steady and consistent heating and cooling</li> <li>RHI available</li> </ul>	<ul style="list-style-type: none"> <li>Large area of land required</li> <li>Run off electricity – high carbon factor</li> <li>High capital cost</li> <li>Costs associated with exploratory bore holes required</li> </ul> <p><b>DECIDING FACTOR:</b></p> <ul style="list-style-type: none"> <li>Carbon savings and significant RHI to be gained makes payback attractive</li> </ul>	Y
Biomass 	<ul style="list-style-type: none"> <li>Carbon neutral</li> <li>Economic alternative to fossil fuels</li> <li>RHIs available</li> </ul>	<ul style="list-style-type: none"> <li>Large storage areas required with access for deliveries</li> <li>Source of wood pellets</li> <li>Slower start up time compared with fossil fuels</li> <li>Reliability of fuel source</li> </ul> <p><b>DECIDING FACTOR:</b></p> <ul style="list-style-type: none"> <li>Not acceptable by Planning</li> </ul>	N

# Renewables and LZCT Appraisal

Renewable Technology	Advantages	Disadvantages	Viable Option
Wind Turbine 	<ul style="list-style-type: none"> <li>• Zero carbon technology</li> <li>• FITs available</li> <li>• Turbulent wind speed at urban sites</li> <li>• Recorded output typically lower than manufacturer's data</li> <li>• Area of natural beauty - Planning permission very unlikely</li> </ul>	<ul style="list-style-type: none"> <li>• Recorded output typically lower than manufacturer's data</li> <li>• Planning permission difficult</li> <li>• Noisy, especially with gearbox</li> </ul> <p><b>DECIDING FACTOR:</b></p> <ul style="list-style-type: none"> <li>- Not acceptable by Planning</li> </ul>	<p><b>N</b></p>
Photovoltaics (PV) 	<ul style="list-style-type: none"> <li>• Zero carbon technology (PV)</li> <li>• Tried and tested technology</li> <li>• Can be integrated/replace building fabric providing cost savings</li> <li>• Simple technology with no moving parts – minimal maintenance</li> <li>• FITs available</li> </ul>	<ul style="list-style-type: none"> <li>• Obstructions (shading etc.) effects productivity</li> <li>• Best results produced in direct sunlight mostly over summer, south facing – do we have a south facing roof?</li> <li>• Needs to be carefully integrated amongst rooflights and drainage requirements</li> <li>• Require large areas for significant production</li> </ul>	<p><b>Y</b></p>
Home PV battery 	<ul style="list-style-type: none"> <li>• Enhances PV technology and allows greater control, efficiency and reliability</li> <li>• Tried and tested technology</li> <li>• Simple technology with no moving parts – minimal maintenance</li> <li>• Waives the requirement for a G59 connection with the electricity grid</li> </ul>	<ul style="list-style-type: none"> <li>• Requires Space</li> </ul>	<p><b>Y</b></p>
Solar thermal Panels 	<ul style="list-style-type: none"> <li>• Tried and tested technology</li> <li>• Can be integrated into the building fabric</li> <li>• RHIs available</li> </ul>	<ul style="list-style-type: none"> <li>• Not compatible with CHP system</li> <li>• Pumps use electricity</li> <li>• Obstructions effect productivity</li> </ul> <p><b>DECIDING FACTOR:</b></p> <ul style="list-style-type: none"> <li>- More carbon savings from PV panels</li> </ul>	<p><b>Y</b></p>

# Renewables and LZCT Appraisal

Renewable Technology	Advantages	Disadvantages	Viable Option
<p>Air Source Heat Pump</p> 	<ul style="list-style-type: none"> <li>• RHI available</li> <li>• Minimum maintenance</li> <li>• No deliveries</li> <li>• Underfloor heating is ideal so not to take up floor space</li> <li>• Minimal spatial requirements</li> </ul>	<ul style="list-style-type: none"> <li>• Not a zero carbon technology as it uses some electricity to run the pump</li> <li>• Best matched to underfloor heating</li> <li>• Alternative means of heating water required for summer months</li> <li>• Aesthetics should be considered</li> </ul> <p>DECIDING FACTOR: - External plant required and potential issues with noise</p>	<p>Y</p>
<p>Fuel Cell</p> 	<ul style="list-style-type: none"> <li>• More efficient cogeneration method than CHP</li> <li>• Research grants may be available</li> </ul>	<ul style="list-style-type: none"> <li>• Newly adopted technology – only two installations in UK</li> <li>• Suited to development with significant heat and electricity demand</li> <li>• Requires large plant space</li> </ul> <p>DECIDING FACTOR: - Heating and electricity demand too low</p>	<p>N</p>
<p>Wood burning Stove</p> 	<ul style="list-style-type: none"> <li>• Carbon neutral</li> <li>• Economic alternative to fossil fuels</li> <li>• Aesthetically pleasing centre point in a living space</li> <li>• Come in various sizes, colours and finishes</li> <li>• Give a warm and cosy atmosphere</li> <li>• RHIs available (only if back boiler)</li> </ul>	<ul style="list-style-type: none"> <li>• Flue/chimney required</li> <li>• Storage areas required</li> <li>• Slower start up time compared with fossil fuels</li> </ul> <p>DECIDING FACTOR: - Chimney required – Air Quality</p>	<p>N</p>
<p>Anaerobic Digester</p> 	<ul style="list-style-type: none"> <li>• It turns waste into a resource</li> <li>• You can use waste by-products to generate energy and reduce your waste disposal costs.</li> <li>• It can be used in combination with a combined heat and power plant to generate both electricity and heat.</li> </ul>	<ul style="list-style-type: none"> <li>• Works best on a larger scale</li> <li>• Requires Planning permission</li> <li>• Would need community buy in</li> </ul> <p>DECIDING FACTOR: - Not suited to small scale jobs.</p>	<p>N</p>





**Key:**

- Vehicular Access
- Pedestrian Access
- Existing Walls
- Trees (Cat B)
- Site Boundary
- Existing Oldfield House Footprint
- Proposed Oldfield House Footprint
- Affected Trees (Cat C)
- Proposed Mechanical and PH Plant Room

Rev	Date	Drawn	Comment

**Client**  
John Lyon School

**Job**  
New Oldfield House  
Middle Rd, Harrow HA2 0HN

**Stage 3**      FOR DISCUSSION

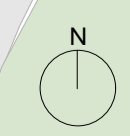
**Drawing Title**  
Proposed Site Plan UG

Date of First Issue	Issued	Checked
02.07.2018	TC	WH

Drawn	Scale
ZGM	1:300 @ A1    1:600 @ A3

**Drawing No.**      **Revision**  
988B\_CLTH\_1001\_SK\_190219

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## JOHN LYON SCHOOL – OLDFIELD HOUSE

### PART L2A - ENERGY ASSESSMENT



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It is important to note that with any modelling exercise there are assumptions and approximations that have to be made. As far as possible, details of all assumptions made, and approximations used are supplied as part of the report. These should be read carefully.

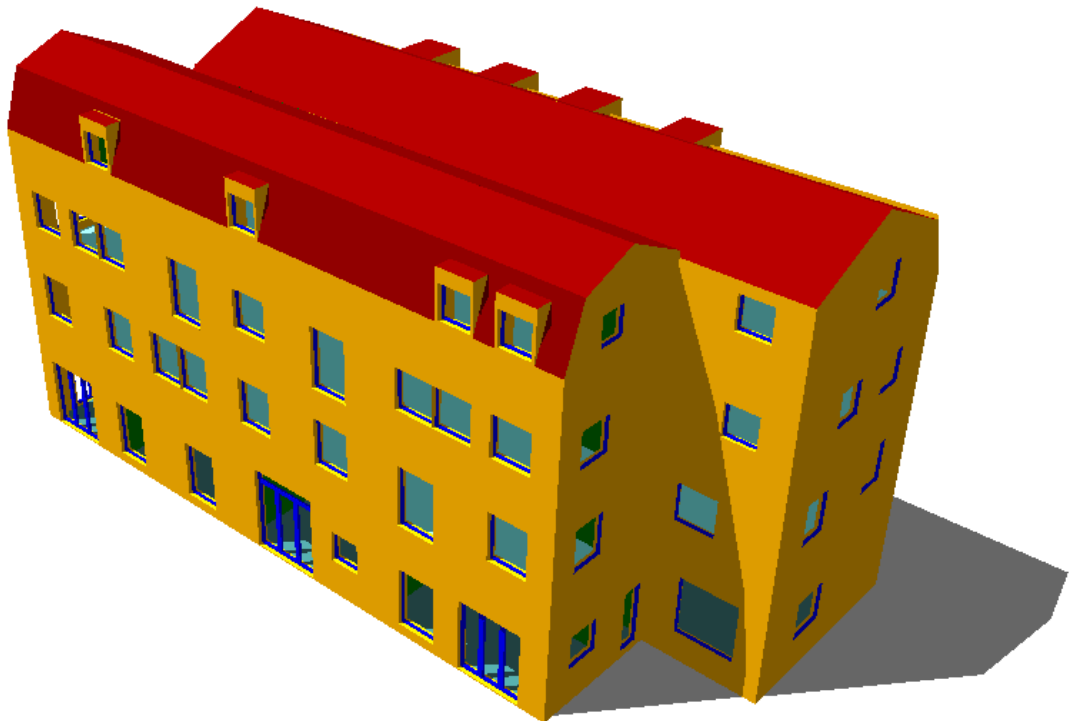
All results are based on the output from computer modelling software and should be taken as an indication of the likely final situation, but these conditions cannot be guaranteed.

## **1. THE MODEL**

The building was modelled using TAS 9.4.1 dynamic thermal modelling software written by EDSL Ltd.

### **1.1. GEOMETRY**

The following images are taken of the 3D model and attempt to show the full geometry. As with any modelling exercise, some approximations have to be made, but care has been taken to ensure the scale and internal dimensions of the model are as close as practicable to the design drawings, and that glazing areas etc. are accurately represented.



**Figure 1. Image of the model from the South-East**

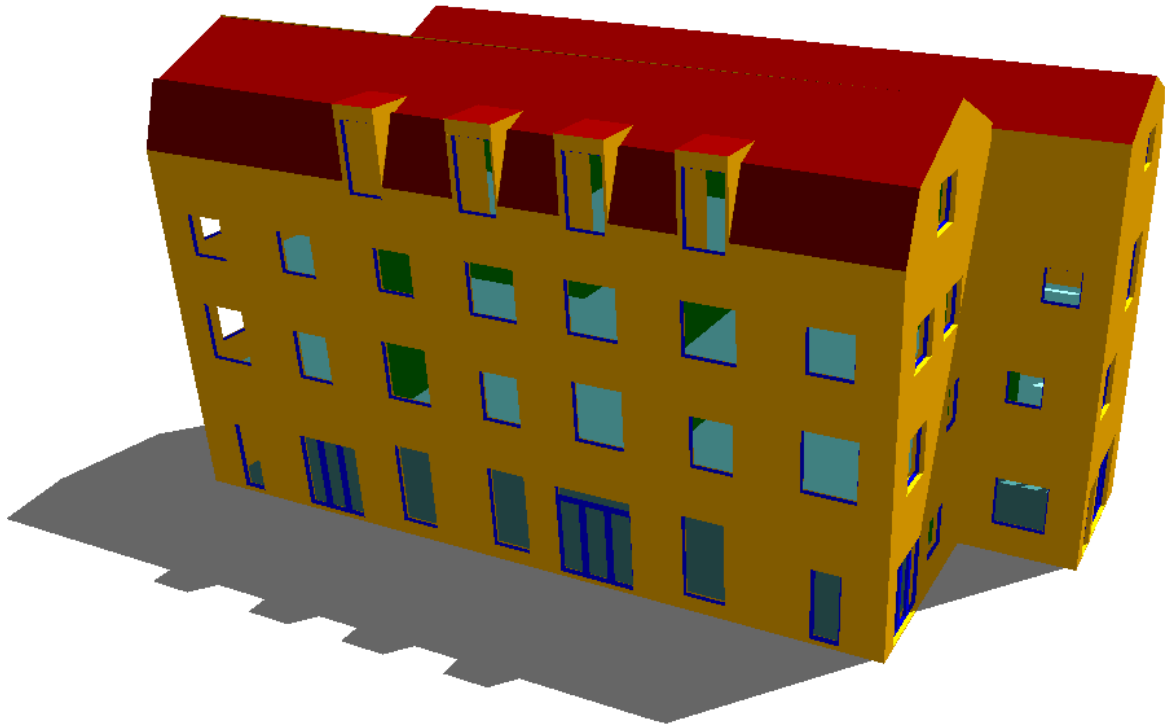


Figure 2. Image of the model from the North-West

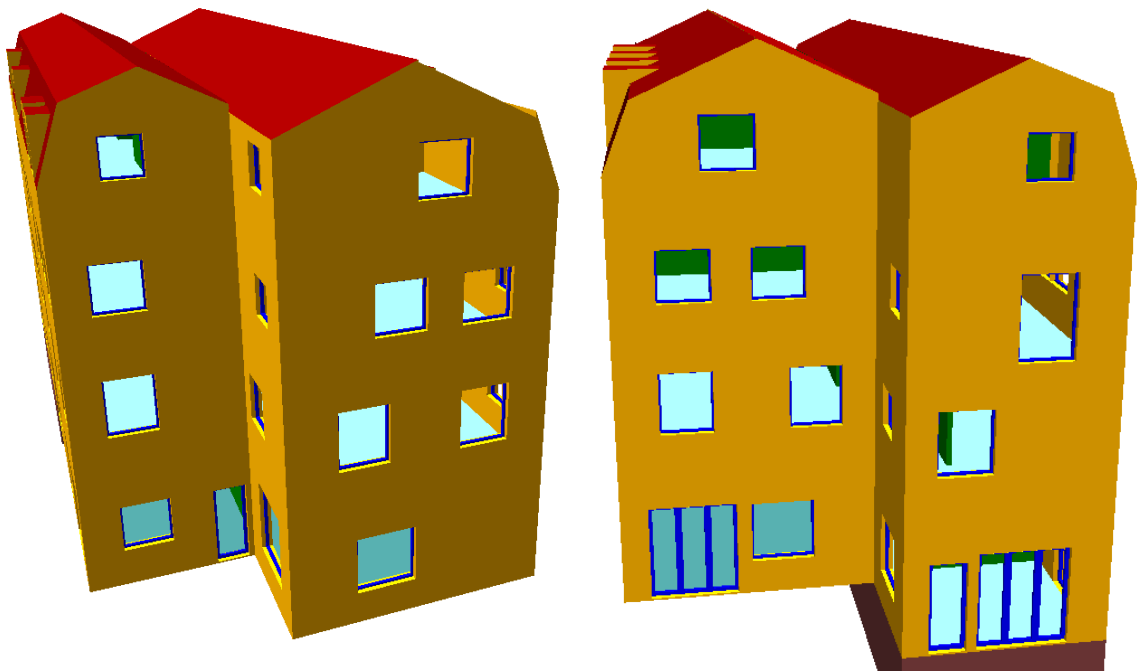


Figure 3. Image of the model from the East and West





## 1.2. ZONE LAYOUTS

The zoning for this building has been colour coded to reflect the usage assumed for each space:

Colour	NCM Profile	NCM Description
Cyan	D1_Edu_Teaching_v5.2.7	Teaching areas which include classrooms and corridors providing access to and between classrooms. People Density 0.55 pers/m2. Lux level 280
Orange	D1_Edu_HighDensIT_v5.2.7	High density desk based work space with correspondingly dense IT. People Density 0.2183099 pers/m2. Lux level 300 Lux.
Light Green	D1_Edu_WkshpSS_v5.2.7	A teaching area for practical non-science classes (eg woodwork, metalwork). For practical science based teaching spaces use "laboratory" and for non practical teaching spaces use "classroom/meeting room". People Density 0.06325926 pers/m2. Lux level 500 Lux.
Yellow	D1_Edu_Circulation_v5.2.7	For all circulation areas such as corridors and stairways. People Density 0.11 pers/m2. Lux level 100 Lux.
Blue	D1_Edu_Office_v5.2.7	Areas to perform management, office and administration work separated from standard customer/public areas. It can include internal corridors providing access to the office spaces, tea making facilities or kitchenettes within the office space and staff lounges. People Density 0.103 pers/m2. Lux level 400 Lux.
Purple	D1_Edu_Reception_v5.2.7	The area in a building which is used for entry from the outside or other building storeys. People Density 0.1155 pers/m2. Lux level 200 Lux. Display Lighting 9 W/m2.
Pink	D1_Edu_Toilet_v5.2.7	Any toilet areas. People Density 0.11 pers/m2. Lux level 200 Lux.
Green	D1_Edu_Plant_v5.2.7	Areas containing the main HVAC equipment for the building eg: boilers/air conditioning plant. People Density 0.11 pers/m2. Lux level 200 Lux.

Note the North angle has been taken from the dwg drawings with Elevation 2 facing SE.

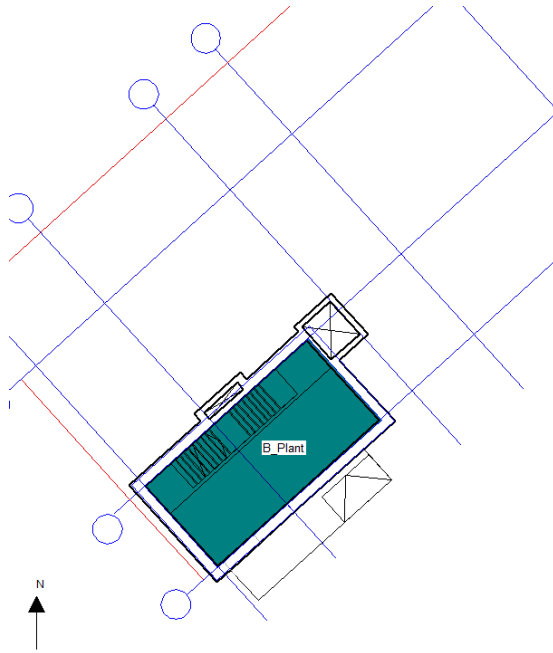


Figure 4. Basement zone layout



Figure 5. Ground floor zone layout

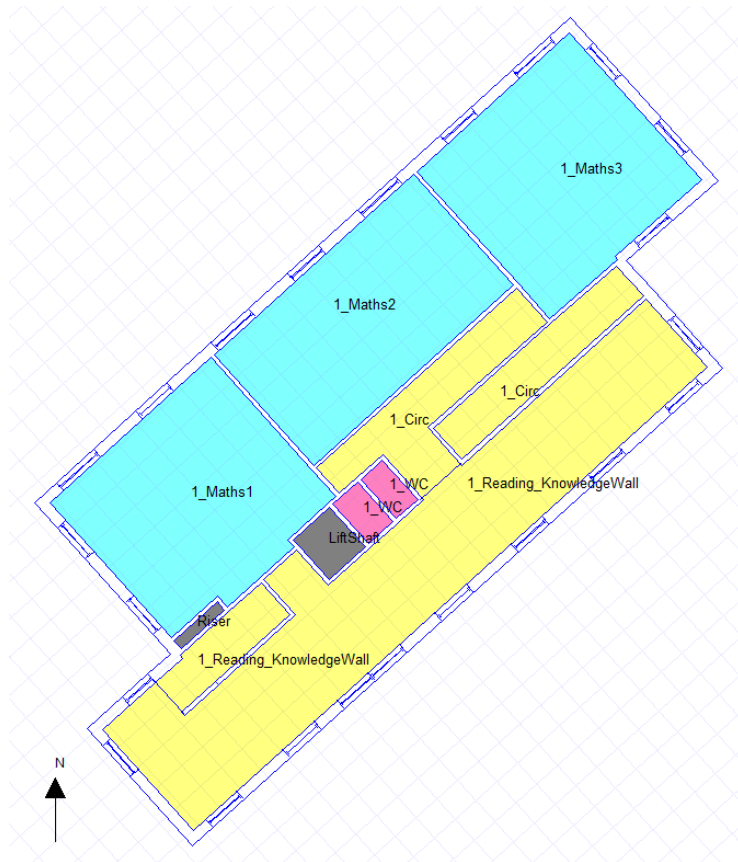


Figure 6. First floor zone layout

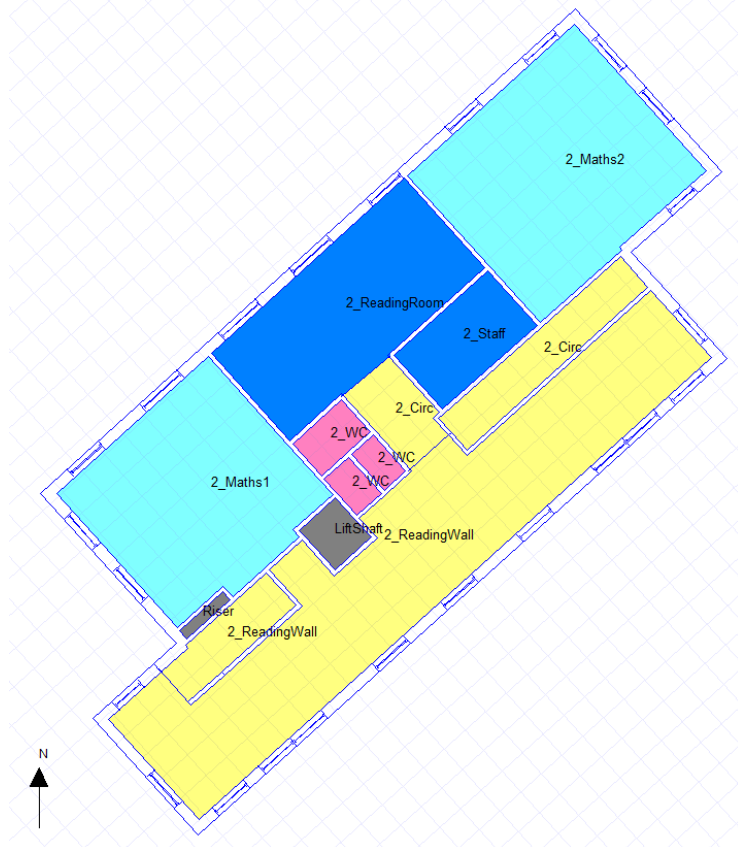
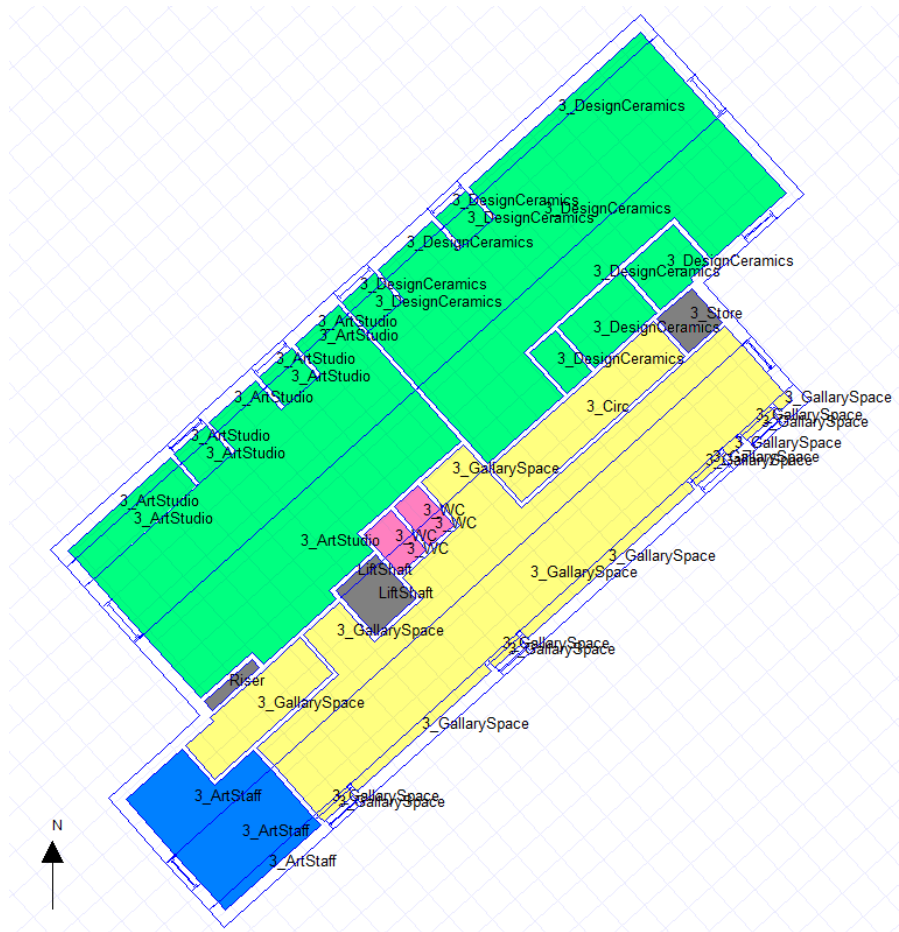


Figure 7. Second floor zone layout



**Figure 8. Third floor zone layout**

NB this zone layout for the third floor appears to have more divides to the spaces, but these are null lines required to model the roof shapes. The model assumes that there is no loft space about the occupied rooms i.e. the rooms extend up to the roof.

### 1.3. BUILDING ELEMENTS

Building Element	U-Value (W/m <sup>2</sup> K)	g-value	Notes
External Walls	0.2	n/a	Brick wall with cavity insulation and internally finished with plaster board
Ground floor	0.13	n/a	Concrete ground bearing ground & basement slab
Roof	0.1	n/a	Slate roof with 'traditional build-up'
Windows (inc frame)	1.2	0.4	Double glazing with solar control
Internal floors	n/a	n/a	Concrete slabs between level



## 1.4. INTERNAL GAINS

The weather file used for this exercise CIBSE London TRY

### 1.4.1 Solar

Solar gains are calculated automatically by the modelling software based on the orientation of the building, the transmission coefficients of the glazing and the solar angles.

### 1.4.2 Occupancy and Equipment gains

The following gains are provided within the NCM database for use assessing education buildings including schools. These are standard profiles and are not editable. Section 1.2 above indicates which spaces have been allocated to each profile.

	NCM Profile	Peak Occupancy (W/m <sup>2</sup> )	Peak Equipment (W/m <sup>2</sup> )	Hours of peak operation (weekdays)
	D1_Edu_Teaching_v5.2.7	38.6	4.7	7am-6pm
	D1_Edu_HighDensIT_v5.2.7	16.0	30	7am-6pm
	D1_Edu_WkshpSS_v5.2.7	4.3	6.2	7am-7pm
	D1_Edu_Circulation_v5.2.7	7.7	2.0	7am-7pm
	D1_Edu_Office_v5.2.7	7.5	11.9	7am-6pm
	D1_Edu_Reception_v5.2.7	9.9	5.6	9am-5pm
	D1_Edu_Toilet_v5.2.7	7.7	5.0	7am-7pm
	D1_Edu_Plant_v5.2.7	0.09	50.5	9am-5pm

### 1.4.3 Lighting gains and controls

The following information on lighting gains and controls was provided and used for this assessment:

Space Type	lighting power density (W/m <sup>2</sup> )	Daylight linking and dimming	Occupancy sensing
Circulation / Lobby / Locker Lobby	5	No	AUTO-ON-OFF
Society Room	5	No	AUTO-ON-OFF
Staff Room	6	Yes	AUTO-ON-OFF
ICT	6	Yes	AUTO-ON-OFF
STEAM / Classroom	6	Yes	AUTO-ON-OFF
General Classroom	6	Yes	AUTO-ON-OFF
WCs	5	No	AUTO-ON-OFF
Stairs	4	No	AUTO-ON-OFF
Store	5	No	AUTO-ON-OFF
Kiln + photography	5	No	AUTO-ON-OFF





Gallery	6	Yes	AUTO-ON-OFF
Reading room/walls	6	Yes	AUTO-ON-OFF
Plant	5	No	AUTO-ON-OFF

## 1.5. HEATING AND VENTILATION

### 1.5.1 Infiltration

The air tightness target for this project is  $5\text{m}^3/\text{m}^2/\text{hr}@50\text{Pa}$ .  
(Note that the Notional building will use  $3\text{m}^3/\text{m}^2/\text{hr}@50\text{Pa}$ )

### 1.5.2 HVAC Systems

#### Heating system type and efficiency:

Ground Source Heat Pump system running on grid electricity with

- seasonal COP of **4.8**
- Distribution efficiency **90%**

#### DHW system type and efficiency:

Direct electric at point of use with

- **100%** generation efficiency
- **100%** distribution efficiency

#### Ventilation plan:

**NVHR** – applies to all classroom spaces including ICT and art studios

- Fan power = **0.13 W/l/s**
- No heat recovery
- Demand control based on occupancy

**Extract only** – applies to all WCs, Kiln/photography rooms, plant room and store

- Fan power = **0.3 W/l/s**

**Natural Ventilation** – applies to all circulation spaces, staff rooms, reading spaces and gallery plus locker room



## 2. RESULTS

### Part L2A 2013 Lean/Clean/Green

For the GLA the model needs to assess a tiered approach, showing that Part L2A is passed using good passive design in the first instance (Lean), then improving the technology used to meet the buildings demands (Clean), and lastly any renewables are taken into account (Green).

### 2.1. BE LEAN

The guidance states that the 'Lean' iteration should be run with gas boilers to provide space heating and DHW, with 91% efficiency and 10% distribution losses. See below:

- 8.8. If the final heating proposal is to be low carbon or renewable energy, gas boilers must still be assumed for the purposes of the 'be lean' element of the hierarchy. In this case the gas boiler performance must be assumed to be equal with Part L notional values for boiler efficiency and controls in order to only show the

<sup>17</sup> The FEES is the maximum energy demand for the dwelling.

<sup>18</sup> From the inside looking out.

<sup>19</sup> The Target CO<sub>2</sub> Emissions Rate is the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of kgCO<sub>2</sub> per m<sup>2</sup> of floor area per year.

performance of the energy efficiency measures that will be installed. Higher efficiencies should only be used if gas boilers will be part of the final strategy (i.e. after the 'be clean' and 'be green' tiers of the hierarchy have also been addressed), in which case the gross efficiency of the gas boiler model to be specified can be used.

#### Figure 9. Extract from GLA Energy Assessment Guidance

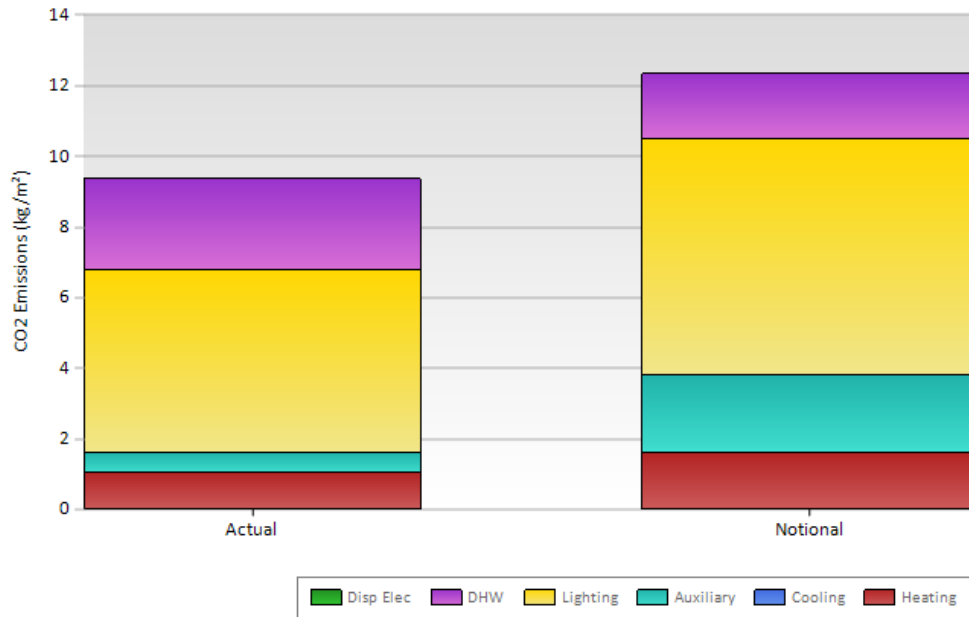
The Lean case therefore uses gas boilers for space heating and DHW.

The result predicted is a **31%** reduction against the TER as shown below:



**Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target**

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	11.7
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	11.7
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	8.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission



	<i>Actual</i>	<i>Notional</i>
Heating (kgCO <sub>2</sub> /m <sup>2</sup> )	1.02	1.59
Cooling (kgCO <sub>2</sub> /m <sup>2</sup> )	0.00	0.00
Auxiliary (kgCO <sub>2</sub> /m <sup>2</sup> )	0.58	2.21
Lighting (kgCO <sub>2</sub> /m <sup>2</sup> )	5.19	6.67
DHW (kgCO <sub>2</sub> /m <sup>2</sup> )	2.57	1.88
Displaced Electricity (kgCO <sub>2</sub> /m <sup>2</sup> )	0.00	0.00
<i>Equipment (kgCO<sub>2</sub>/m<sup>2</sup>) *</i>	12.96	12.96
<b>Total (kgCO<sub>2</sub>/m<sup>2</sup>)</b>	<b>9.36</b>	<b>12.34</b>
Total Floor Area (m <sup>2</sup> )	1192.79	1192.79



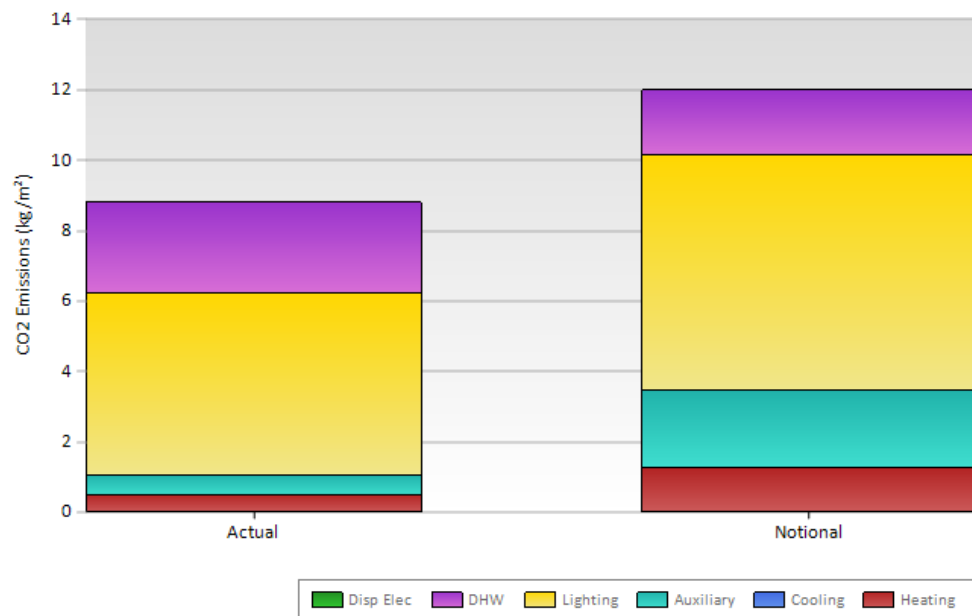
## 2.2. BE CLEAN

For this case, the Ground Source Heat Pipe (GSHP) system to provide space heating was included.

The result predicted is a **27%** reduction against the TER as shown below:

### Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	12
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	12
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	8.8
Are emissions from the building less than or equal to the target?	BER <= TER
Are as built details the same as used in the BER calculations?	Separate submission



	<i>Actual</i>	<i>Notional</i>
Heating (kgCO <sub>2</sub> /m <sup>2</sup> )	0.45	1.25
Cooling (kgCO <sub>2</sub> /m <sup>2</sup> )	0.00	0.00
Auxiliary (kgCO <sub>2</sub> /m <sup>2</sup> )	0.58	2.21
Lighting (kgCO <sub>2</sub> /m <sup>2</sup> )	5.19	6.67
DHW (kgCO <sub>2</sub> /m <sup>2</sup> )	2.57	1.88
Displaced Electricity (kgCO <sub>2</sub> /m <sup>2</sup> )	0.00	0.00
<i>Equipment (kgCO<sub>2</sub>/m<sup>2</sup>) *</i>	<i>12.96</i>	<i>12.96</i>
<b>Total (kgCO<sub>2</sub>/m<sup>2</sup>)</b>	<b>8.80</b>	<b>12.01</b>
Total Floor Area (m <sup>2</sup> )	1192.79	1192.79



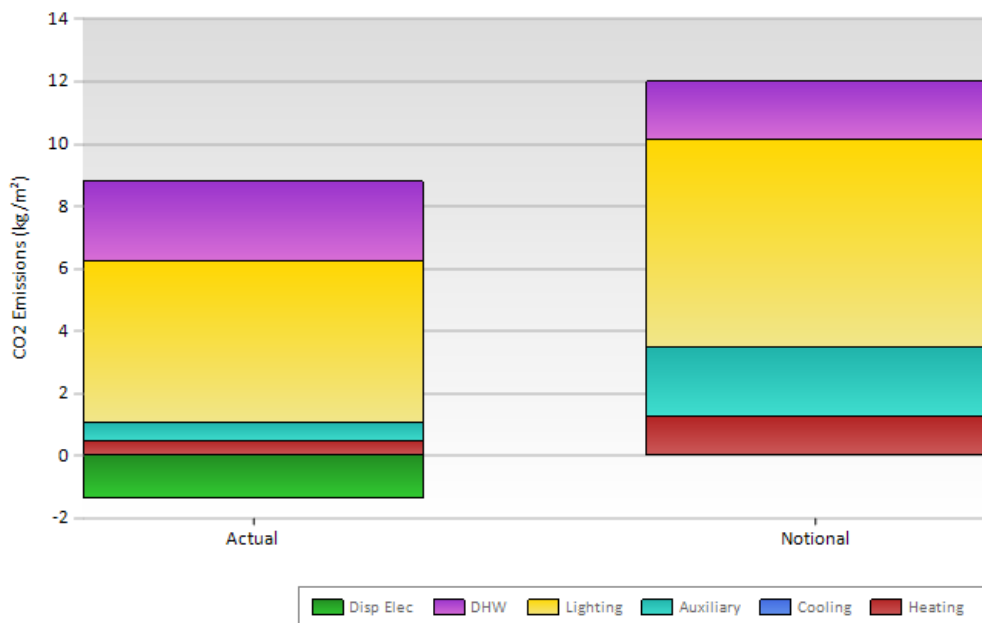
### 2.3. BE GREEN

For this case **20m<sup>2</sup>** of PV was added to the SE facing sloped roof with a generation efficiency of **20%**.

The result predicted is a **38%** reduction against the TER as shown below:

**Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target**

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	12
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	12
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	7.4
Are emissions from the building less than or equal to the target?	BER <= TER
Are as built details the same as used in the BER calculations?	Separate submission



	<i>Actual</i>	<i>Notional</i>
Heating (kgCO <sub>2</sub> /m <sup>2</sup> )	0.45	1.25
Cooling (kgCO <sub>2</sub> /m <sup>2</sup> )	0.00	0.00
Auxiliary (kgCO <sub>2</sub> /m <sup>2</sup> )	0.58	2.21
Lighting (kgCO <sub>2</sub> /m <sup>2</sup> )	5.19	6.67
DHW (kgCO <sub>2</sub> /m <sup>2</sup> )	2.57	1.88
Displaced Electricity (kgCO <sub>2</sub> /m <sup>2</sup> )	-1.37	0.00
<i>Equipment (kgCO<sub>2</sub>/m<sup>2</sup>) *</i>	<i>12.96</i>	<i>12.96</i>
<b>Total (kgCO<sub>2</sub>/m<sup>2</sup>)</b>	<b>7.42</b>	<b>12.01</b>
Total Floor Area (m <sup>2</sup> )	1192.79	1192.79





## 2.4. CARBON COMPARISON

Extracting the loads and multiplying by the carbon factors given for each fuel type provides the following analysis:

Fuel type	Fuel Carbon Factor (kgCO <sub>2</sub> /kWh)	
	SAP 2012	SAP 10
Natural Gas	0.216	0.210
Grid Electricity	0.519	0.233
Fuel oil	0.319	0.298

### Energy Use

	Baseline (Notional)	Lean	Clean	Green
Space heating (Kwh)	7.35	4.73	0.9	0.9
Fuel type	Natural Gas	Natural Gas	Electric	Electric
DHW (kWh)	5.88	6.21	5.08	5.08
Fuel Type	Fuel Oil	Electricity	Electricity	Electricity
Lighting (Kwh)	13.18	10.26	10.26	10.26
Auxiliary (kWh)	4.36	1.15	1.15	1.15
PV (kWh)				-2.64

CO <sub>2</sub> using SAP 2012 Carbon Factors				
	Baseline (Notional)	Lean	Clean	Green
Space heating	1.59	1.02	0.47	0.47
DHW	1.27	1.34	2.64	2.64
Lighting	6.84	5.32	5.32	5.32
Auxiliary	2.26	0.60	0.60	0.60
PV				-1.37
	<b>11.96</b>	<b>8.28</b>	<b>9.03</b>	<b>7.66</b>
		<b>31%</b>	<b>25%*</b>	<b>36%*</b>

\* These reduction percentages don't exactly match those quoted in the sections above because these are based on the TER for the Lean case, and this target changes for the Clean and Green cases when the DHW changes to direct electric.

CO <sub>2</sub> using SAP 10 Carbon Factors				
	Baseline (Notional)	Lean	Clean	Green
Space heating	1.54	0.99	0.21	0.21
DHW	1.23	1.30	1.18	1.18
Lighting	3.07	2.39	2.39	2.39
Auxiliary	1.02	0.27	0.27	0.27
PV				-0.62
	<b>6.87</b>	<b>4.96</b>	<b>4.05</b>	<b>3.44</b>
		<b>28%</b>	<b>41%</b>	<b>50%</b>

# BRUKL Output Document



Compliance with England Building Regulations Part L 2013

## Project name

**JLS - Oldfield School**

As designed

Date: Thu Apr 11 15:28:19 2019

## Administrative information

### Building Details

Address: ,

### Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.4

BRUKL compliance check version: v5.6.a.1

### Owner Details

Name:

Telephone number:

Address: , ,

### Certifier details

Name:

Telephone number:

Address: , ,

## Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	11.7
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	11.7
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	8.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

### Building fabric

Element	U <sub>a</sub> -Limit	U <sub>a</sub> -Calc	U <sub>i</sub> -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.26	Basement Walls
Floor	0.25	0.13	0.13	Ground Floor
Roof	0.25	0.1	0.1	Roof
Windows***, roof windows, and rooflights	2.2	1.2	1.2	Door_Triple_2800
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
U <sub>a</sub> -Limit = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)] U <sub>a</sub> -Calc = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)] U <sub>i</sub> -Calc = Calculated maximum individual element U-values [W/(m <sup>2</sup> K)]				
* 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 <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa	10	5

## Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

### 1- Extract Only (8 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	0.91	-	-	-	-
<b>Standard value</b>	0.91*	N/A	N/A	N/A	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* 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.					

### 2- Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	0.91	-	-	-	-
<b>Standard value</b>	0.91*	N/A	N/A	N/A	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* 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.					

### 3- NVHR (10 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	0.91	-	-	0.13	-
<b>Standard value</b>	0.91*	N/A	N/A	1.1^	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* 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.					
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

### 1- Gas boiler

	Water heating efficiency	Storage loss factor [kWh/litre per day]
<b>This building</b>	0.91	0
<b>Standard value</b>	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

## Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
	A	B	C	D	E	F	G	H	I	Zone	Standard	
<b>Standard value</b>	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
G_STEAM Studio	-	-	-	-	0.1	-	-	-	-	-	N/A	

Zone name	SFP [W/(l/s)]									HR efficiency		
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
G_Classroom		-	-	-	-	0.1	-	-	-	-	-	N/A
1_Maths1		-	-	-	-	0.1	-	-	-	-	-	N/A
1_Maths2		-	-	-	-	0.1	-	-	-	-	-	N/A
1_Maths3		-	-	-	-	0.1	-	-	-	-	-	N/A
2_Maths1		-	-	-	-	0.1	-	-	-	-	-	N/A
2_Maths2		-	-	-	-	0.1	-	-	-	-	-	N/A
G_Acc_WC		0.3	-	-	-	-	-	-	-	-	-	N/A
G_WC		0.3	-	-	-	-	-	-	-	-	-	N/A
1_WC		0.3	-	-	-	-	-	-	-	-	-	N/A
2_WC		0.3	-	-	-	-	-	-	-	-	-	N/A
3_WC		0.3	-	-	-	-	-	-	-	-	-	N/A
G_ICT		-	-	-	-	0.1	-	-	-	-	-	N/A
3_Store		0.3	-	-	-	-	-	-	-	-	-	N/A
3_ArtStudio		-	-	-	-	0.1	-	-	-	-	-	N/A
3_DesignCeramics		-	-	-	-	0.1	-	-	-	-	-	N/A
B_Plant		0.3	-	-	-	-	-	-	-	-	-	N/A
3_PhotographyKiln		0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
G_Lobby		-	-	-	128
G_LockerLobby		-	-	-	116
G_Stair_E		-	-	-	33
1_Reading_KnowledgeWall		-	-	-	573
1_Circ		-	-	-	123
2_ReadingWall		-	-	-	596
2_Circ		-	-	-	82
3_GallerySpace		-	-	-	509
3_Circ		-	-	-	43
G_StaffRoom		-	-	-	132
2_Staff		-	-	-	71
2_ReadingRoom		-	-	-	240
3_ArtStaff		-	-	-	104
G_STEAM Studio		-	-	-	413
G_Classroom		-	-	-	341
1_Maths1		-	-	-	315
1_Maths2		-	-	-	308
1_Maths3		-	-	-	314
2_Maths1		-	-	-	298
2_Maths2		-	-	-	344
G_Acc_WC		-	-	-	17
G_WC		-	-	-	25

General lighting and display lighting		Luminous efficacy [lm/W]			
Zone name		Luminaire	Lamp	Display lamp	General lighting [W]
	Standard value	60	60	22	
1_WC		-	-	-	21
2_WC		-	-	-	38
3_WC		-	-	-	19
G_ICT		-	-	-	295
3_Store		-	-	-	9
3_ArtStudio		-	-	-	454
3_DesignCeramics		-	-	-	477
G_SocietyRoom		-	-	22	262
B_Plant		-	-	-	236
3_PhotographyKiln		-	-	-	63

### 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?
G_StaffRoom	NO (-47%)	NO
2_Staff	N/A	N/A
2_ReadingRoom	NO (-67%)	NO
3_ArtStaff	NO (-95%)	NO
G_STEAM Studio	NO (-34%)	NO
G_Classroom	NO (-64%)	NO
1_Maths1	NO (-66%)	NO
1_Maths2	NO (-60%)	NO
1_Maths3	NO (-70%)	NO
2_Maths1	NO (-71%)	NO
2_Maths2	NO (-79%)	NO
G_ICT	NO (-54%)	NO
3_ArtStudio	NO (-81%)	NO
3_DesignCeramics	NO (-83%)	NO
G_SocietyRoom	NO (-30%)	NO
3_PhotographyKiln	N/A	N/A

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

Separate submission

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

Separate submission

### EPBD (Recast): Consideration of alternative energy systems

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



## Technical Data Sheet (Actual vs. Notional Building)

### Building Global Parameters

	Actual	Notional
Area [m <sup>2</sup> ]	1193	1193
External area [m <sup>2</sup> ]	1907	1907
Weather	LON	LON
Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa]	5	3
Average conductance [W/K]	584	1005
Average U-value [W/m <sup>2</sup> K]	0.31	0.53
Alpha value* [%]	14.92	14.92

\* 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 Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
C2 Residential Institutions: Universities and colleges
C2A Secure Residential Institutions
Residential spaces
D1 Non-residential Institutions: Community/Day Centre
D1 Non-residential Institutions: Libraries, Museums, and Galleries
<b>100 D1 Non-residential Institutions: Education</b>
D1 Non-residential Institutions: Primary Health Care Building
D1 Non-residential Institutions: Crown and County Courts
D2 General Assembly and Leisure, Night Clubs, and Theatres
Others: Passenger terminals
Others: Emergency services
Others: Miscellaneous 24hr activities
Others: Car Parks 24 hrs
Others: Stand alone utility block

### Energy Consumption by End Use [kWh/m<sup>2</sup>]

	Actual	Notional
Heating	4.73	7.35
Cooling	0	0
Auxiliary	1.13	4.36
Lighting	10.26	13.18
Hot water	6.21	5.88
Equipment*	25.6	25.6
<b>TOTAL**</b>	<b>22.33</b>	<b>30.77</b>

\* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

### Energy Production by Technology [kWh/m<sup>2</sup>]

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

### Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	14.69	22.82
Primary energy* [kWh/m <sup>2</sup> ]	47.43	68.65
Total emissions [kg/m <sup>2</sup> ]	8.1	11.7

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

<b>HVAC Systems Performance</b>										
<b>System Type</b>	<b>Heat dem MJ/m2</b>	<b>Cool dem MJ/m2</b>	<b>Heat con kWh/m2</b>	<b>Cool con kWh/m2</b>	<b>Aux con kWh/m2</b>	<b>Heat SSEFF</b>	<b>Cool SSEER</b>	<b>Heat gen SEFF</b>	<b>Cool gen SEER</b>	
<b>[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity</b>										
<b>Actual</b>	4.4	0	1.5	0	1	0.82	0	0.91	0	
<b>Notional</b>	5.2	0	1.8	0	1.2	0.82	0	----	----	
<b>[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity</b>										
<b>Actual</b>	19.3	0	6.6	0	1.1	0.82	0	0.91	0	
<b>Notional</b>	39.5	0	13.4	0	1.2	0.82	0	----	----	
<b>[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity</b>										
<b>Actual</b>	12.1	0	4.1	0	1.3	0.82	0	0.91	0	
<b>Notional</b>	10.8	0	3.7	0	8.1	0.82	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 Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

### Building fabric

Element	U <sub>i-Typ</sub>	U <sub>i-Min</sub>	Surface where the minimum value occurs*
Wall	0.23	0.2	External Wall
Floor	0.2	0.13	Ground Floor
Roof	0.15	0.09	PV_panel-pane
Windows, roof windows, and rooflights	1.5	1.2	WinH_1500*3000
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U <sub>i-Typ</sub> = Typical individual element U-values [W/(m <sup>2</sup> K)]		U <sub>i-Min</sub> = Minimum individual element U-values [W/(m <sup>2</sup> K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa	5	5

# BRUKL Output Document



Compliance with England Building Regulations Part L 2013

## Project name

**JLS - Oldfield School**

As designed

Date: Tue Apr 09 17:55:56 2019

## Administrative information

### Building Details

Address: ,

### Certification tool

Calculation engine: TAS

Calculation engine version: "v9.4.4"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.4.4

BRUKL compliance check version: v5.6.a.1

### Owner Details

Name:

Telephone number:

Address: , ,

### Certifier details

Name:

Telephone number:

Address: , ,

## Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum	12
Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	12
Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum	7.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

### Building fabric

Element	U <sub>a</sub> -Limit	U <sub>a</sub> -Calc	U <sub>i</sub> -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.26	Basement Walls
Floor	0.25	0.13	0.13	Ground Floor
Roof	0.25	0.1	0.1	Roof
Windows***, roof windows, and rooflights	2.2	1.2	1.2	Door_Triple_2800
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project
U <sub>a</sub> -Limit = Limiting area-weighted average U-values [W/(m <sup>2</sup> K)] U <sub>a</sub> -Calc = Calculated area-weighted average U-values [W/(m <sup>2</sup> K)] U <sub>i</sub> -Calc = Calculated maximum individual element U-values [W/(m <sup>2</sup> K)]				
* 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 <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa	10	5

## Building services

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

<b>Whole building lighting automatic monitoring &amp; targeting with alarms for out-of-range values</b>	YES
<b>Whole building electric power factor achieved by power factor correction</b>	>0.95

### 1- Extract Only (8 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	4.8	-	-	-	-
<b>Standard value</b>	0.91*	N/A	N/A	N/A	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* 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.					

### 2- Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	4.8	-	-	-	-
<b>Standard value</b>	0.91*	N/A	N/A	N/A	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* 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.					

### 3- NVHR (10 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
<b>This system</b>	4.8	-	-	0.13	-
<b>Standard value</b>	0.91*	N/A	N/A	1.1^	N/A
<b>Automatic monitoring &amp; targeting with alarms for out-of-range values for this HVAC system</b>					YES
* 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.					
^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.					

### 1- Direct Electric

	Water heating efficiency	Storage loss factor [kWh/litre per day]
<b>This building</b>	1	0
<b>Standard value</b>	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"

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
<b>Standard value</b>	60	60	22	
G_Lobby	-	-	-	128
G_LockerLobby	-	-	-	116
G_Stair_E	-	-	-	33
1_Reading_KnowledgeWall	-	-	-	573
1_Circ	-	-	-	123
2_ReadingWall	-	-	-	596
2_Circ	-	-	-	82

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
		60	60	22	
3_GallerySpace		-	-	-	509
3_Circ		-	-	-	43
G_StaffRoom		-	-	-	132
2_Staff		-	-	-	71
2_ReadingRoom		-	-	-	240
3_ArtStaff		-	-	-	104
G_STEAM Studio		-	-	-	413
G_Classroom		-	-	-	341
1_Maths1		-	-	-	315
1_Maths2		-	-	-	308
1_Maths3		-	-	-	314
2_Maths1		-	-	-	298
2_Maths2		-	-	-	344
G_Acc_WC		-	-	-	17
G_WC		-	-	-	25
1_WC		-	-	-	21
2_WC		-	-	-	38
3_WC		-	-	-	19
G_ICT		-	-	-	295
3_Store		-	-	-	9
3_ArtStudio		-	-	-	454
3_DesignCeramics		-	-	-	477
G_SocietyRoom		-	-	22	262
B_Plant		-	-	-	236
3_PhotographyKiln		-	-	-	63

**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?
G_StaffRoom	NO (-47%)	NO
2_Staff	N/A	N/A
2_ReadingRoom	NO (-67%)	NO
3_ArtStaff	NO (-95%)	NO
G_STEAM Studio	NO (-34%)	NO
G_Classroom	NO (-64%)	NO
1_Maths1	NO (-66%)	NO
1_Maths2	NO (-60%)	NO
1_Maths3	NO (-70%)	NO
2_Maths1	NO (-71%)	NO
2_Maths2	NO (-79%)	NO
G_ICT	NO (-54%)	NO
3_ArtStudio	NO (-81%)	NO
3_DesignCeramics	NO (-83%)	NO
G_SocietyRoom	NO (-30%)	NO



Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3_PhotographyKiln	N/A	N/A

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

Separate submission

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

Separate submission

#### EPBD (Recast): Consideration of alternative energy systems

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

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

	Actual	Notional
Area [m <sup>2</sup> ]	1193	1193
External area [m <sup>2</sup> ]	1907	1907
Weather	LON	LON
Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa]	5	3
Average conductance [W/K]	584	1005
Average U-value [W/m <sup>2</sup> K]	0.31	0.53
Alpha value* [%]	14.92	14.92

\* 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 Institutions: Hospitals and Care Homes
C2 Residential Institutions: Residential schools
C2 Residential Institutions: Universities and colleges
C2A Secure Residential Institutions
Residential spaces
D1 Non-residential Institutions: Community/Day Centre
D1 Non-residential Institutions: Libraries, Museums, and Galleries
<b>100 D1 Non-residential Institutions: Education</b>
D1 Non-residential Institutions: Primary Health Care Building
D1 Non-residential Institutions: Crown and County Courts
D2 General Assembly and Leisure, Night Clubs, and Theatres
Others: Passenger terminals
Others: Emergency services
Others: Miscellaneous 24hr activities
Others: Car Parks 24 hrs
Others: Stand alone utility block

## Energy Consumption by End Use [kWh/m<sup>2</sup>]

	Actual	Notional
Heating	0.9	2.48
Cooling	0	0
Auxiliary	1.15	4.36
Lighting	10.26	13.18
Hot water	5.08	5.88
Equipment*	25.6	25.6
<b>TOTAL**</b>	<b>17.38</b>	<b>25.9</b>

\* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

## Energy Production by Technology [kWh/m<sup>2</sup>]

	Actual	Notional
Photovoltaic systems	2.64	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

## Energy & CO<sub>2</sub> Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m <sup>2</sup> ]	14.69	22.82
Primary energy* [kWh/m <sup>2</sup> ]	52.03	66.39
Total emissions [kg/m <sup>2</sup> ]	7.4	12

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

<b>HVAC Systems Performance</b>										
<b>System Type</b>	<b>Heat dem MJ/m2</b>	<b>Cool dem MJ/m2</b>	<b>Heat con kWh/m2</b>	<b>Cool con kWh/m2</b>	<b>Aux con kWh/m2</b>	<b>Heat SSEFF</b>	<b>Cool SSEER</b>	<b>Heat gen SEFF</b>	<b>Cool gen SEER</b>	
<b>[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity</b>										
<b>Actual</b>	4.4	0	0.3	0	1.2	4.32	0	4.8	0	
<b>Notional</b>	5.2	0	0.6	0	1.2	2.43	0	----	----	
<b>[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity</b>										
<b>Actual</b>	19.3	0	1.2	0	1.1	4.32	0	4.8	0	
<b>Notional</b>	39.5	0	4.5	0	1.2	2.43	0	----	----	
<b>[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity</b>										
<b>Actual</b>	12.1	0	0.8	0	1.3	4.32	0	4.8	0	
<b>Notional</b>	10.8	0	1.2	0	8.1	2.43	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 Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

### Building fabric

Element	U <sub>i-Typ</sub>	U <sub>i-Min</sub>	Surface where the minimum value occurs*
Wall	0.23	0.2	External Wall
Floor	0.2	0.13	Ground Floor
Roof	0.15	0.09	PV_panel-pane
Windows, roof windows, and rooflights	1.5	1.2	WinH_1500*3000
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
U <sub>i-Typ</sub> = Typical individual element U-values [W/(m <sup>2</sup> K)]		U <sub>i-Min</sub> = Minimum individual element U-values [W/(m <sup>2</sup> K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa	5	5