Planning Application for the Aylesbury Estate Regeneration

Plot 18 Reserved Matters Application

Energy Statement

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Aylesbury Regeneration:
Plot 18 Reserved Matters Application

Energy Statement

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Table of Contents

Executive Summary

This Energy Statement has been prepared by AECOM to support the application for the discharge of Reserved Matters in relation to Development Parcel 18 (Plot 18).

Plot 18 is part of the wider Aylesbury Estate Regeneration Scheme which covers an area of 22.1 ha in Soutwark, and for which Outline Planning Permission (LPA ref: 13/AP/3844) was granted on 5th August 2015. A site plan is included in Section 1.

The Plot 18 site itself is 1.02 ha and consists of Subplot 18a (North Block) and Subplot 18b (South Block).

The North Block comprises the following uses:

- Residential Use (122 units)
- Community Facility (Library, Afterhours Facility, Stay and Play, Meeting Rooms, Creation Trust Office)
- Commercial Use

The South Block comprises the following uses:

- Health Centre
- Early Years Facility

This document sets out the CO_2 emissions savings predicted to be achieved as a result of applying an energy strategy at Plot 18 developed in accordance with that set out for the Outline Planning Application.

Policy Target

The planning target identified for the site is a 35% reduction in CO_2 emissions against Part L of Building Regulations 2013 Target Emission Rate (TER) in line with the London Plan 2015.

The Energy Hierachy

In line with the London Plan and GLA energy assessment guidance, the Energy Hierarchy has been adopted and the resulting CO_2 savings are set out in this report.

'Be Lean'

Energy efficiency measures were first assessed to reduce energy demand. Efficiency measures are included in the design are predicted to achieve a 15% reduction in CO_2 emissions compared to the baseline.

Measures include efficient fabric and 100% energy efficient LED lighting. A complete list of measures can be found in the 'Be Lean' section.

'Be Clean'

The feasibility of connecting to an existing or planned heat network was considered as part of the Site Wide Energy Strategy prepared by WSP dated November 2015. This document for Plot 18 does not repeat the study undertaken previously. In summary however, the Site Wide Energy Statement concluded that the Aylesbury Estate is of sufficient scale to allow for the inclusion of an Energy Centre with 60% of thermal demand supplied by CHP.

The energy strategy for Plot 18 is therefore to connect to the CHP-led district heating network, which is predicted to achieve a 19% reduction in emissions beyond the 'Be Lean' step.

The phased development of the Aylesbury Estate is such that Plot 18 will be constructed approximately 7 years before the Energy Centre is completed. When it is completed it will contribute to the 35% CO_2 emissions planning target. Until then temporary boiler plant will be used as the primary heating source.

'Be Green'

The aim for a 20% reduction in CO_2 emissions from renewable technologies in line with the Area Action Plan cannot be achieved bearing in mind constraints on technology selection (must be compatible with CHP); the site's loctaion in an urban area; and the limited level of available roofspace. However, photovoltaic panels are recommended, to be located on the available unshaded roof space.

Up to 200m^2 of roof area is suitable for photovoltaic panels. If a 21kWp PV array is installed, based on the assumed panel efficiency and inclination, this is predicted to generate 20MWh/yr. This would result in a 7% saving in CO_2 emissions beyond the 'Be Clean' step.

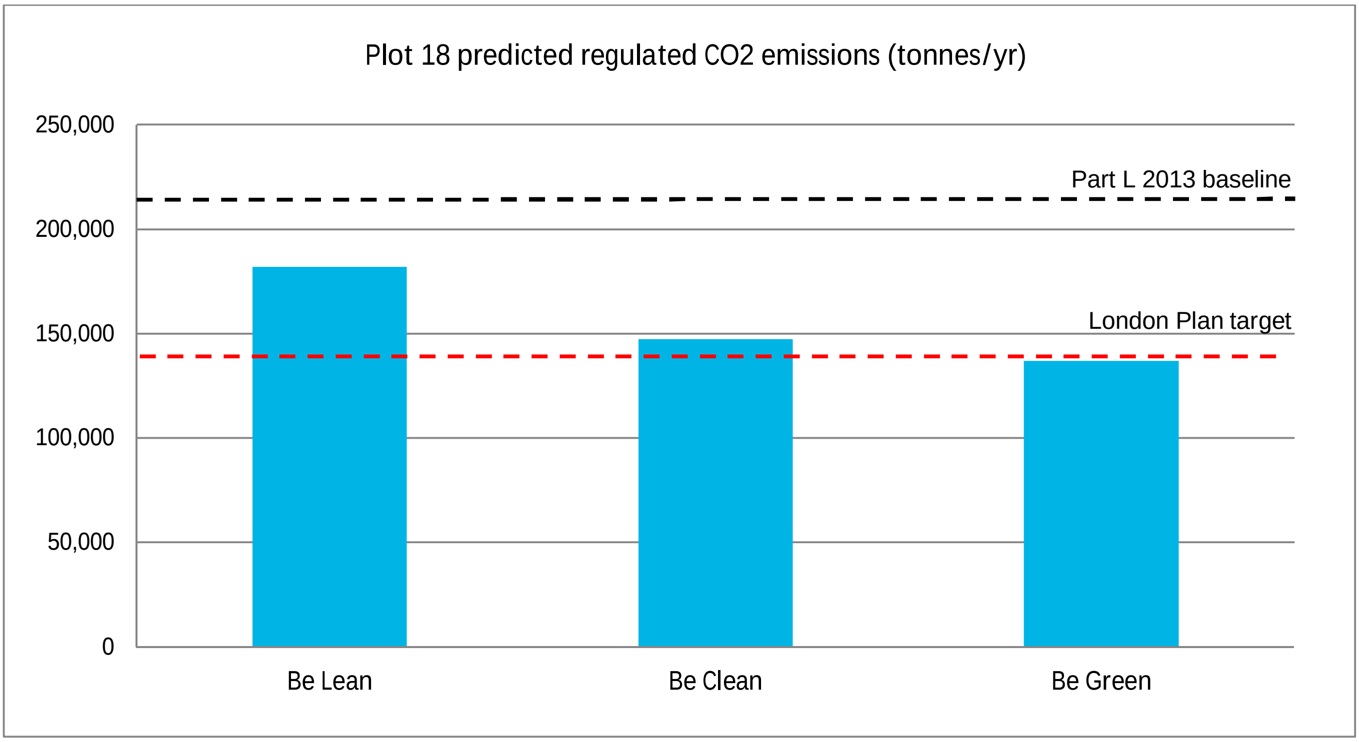
Results

Overall the adopted energy strategy is predicted to deliver the planning policy target saving of 35% in CO_2 emissions based on the modelling carried out, see Table 1 and Figure 1 below.

Table 1: Summary of predicted regulated CO2 emissions for Plot 18 at the Aylesbury Estate

	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	% reduction from baseline
Baseline (Part L 2013 TER)	214.4	-
Be Lean (After energy efficient measures)	182.1	15%
Be Clean (After connection to DHN)	147.5	16%
Be Green (After PV)	137.1	5%
TOTAL reduction from baseline	**77.3**	**36%**

Figure 1: Summary of predicted regulated CO_2 emissions compared to the planning policy target



1 Introduction

1.1 Background

This Energy Statement has been prepared by AECOM to support the application for the discharge of Reserved Matters in relation to Development Parcel 18 (Plot 18).

Plot 18 is part of the wider Aylesbury Estate Regeneration Scheme which covers an area of 22.1 ha, and for which there is Outline Planning Permission (LPA ref: 13/AP/3844) granted on 5th August 2015.

1.2 Plot 18 Proposed Development

The Plot 18 site itself is 1.02 ha and consists of Subplot 18a (North Block) and Subplot 18b (South Block). The North Block comprises the following uses:

- Residential Use (122 units)
- Community Facility (Library, Afterhours Facility, Stay and Play, Meeting Rooms, Creation Trust Office)
- Commercial Use

The South Block comprises the following uses:

- Health Centre
- Early Years Facility

The Energy strategy follows the methodology set out in the Aylesbury Estate Outline Energy Assessment and District Heating Study version 3.

1.3 Policy Context

The Plot 18 policy context is as follows:

Part L of the Building Regulations

The **TFEE** (Target Fabric Energy Efficiency kWh/m^2/yr) as calculated by SAP software. This effectively requires a minimum level of building fabric energy efficiency for compliance of the residential units and is detailed as thermal demand kWh/m^2/year.

The **TER** (Target Emission Rate kg/CO_2/m^2/yr) as calculated by SAP software (for residential units) or SBEM software (for the remaining elements of the development).

The Target Emissions Rate is a limit of kg CO_2 per m^2 based on regulated loads of building.

The London Plan 2015/16

Key policies within the London Plan relating to energy consumption and CO_2 emissions include;

Policy 5.2 Minimising CO_2 Emissions

Policy 5.3 Sustainable Design and Construction

Policy 5.5 Decentralised Energy Networks

Policy 5.6 Decentralised Energy in Development Proposals

Policy 5.7 Renewable Energy

Policy 5.9 Overheating and Cooling

The requirements detailed in the London Plan include;

Minimising carbon dioxide emissions in accordance with following energy hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

Achieve a 35% reduction on emissions against Part L of Building Regulations 2013.

Assess feasibility of connecting to existing heat network, if not feasible investigate practicality of including a CHP and a DHN. The feasibility of connecting to an existing heat network will be assessed and an outline given of potential CHP and related DHN network at the site. The feasibility on including on-site renewables should be carried out.

The potential risk of overheating and need for cooling should be mitigated.

Southwark Local Plan

Policy 3.4 – Energy efficiency

Policy 3.5 – Renewable energy

The requirements of Southwark Local Plan are similar to those detailed in London Plan in that energy efficiency is prioritised however policy requires a 10% contribution to energy demand from on-site renewables.

Aylesbury Area Action Plan

BH6: a 20% reduction in emissions from renewable source.

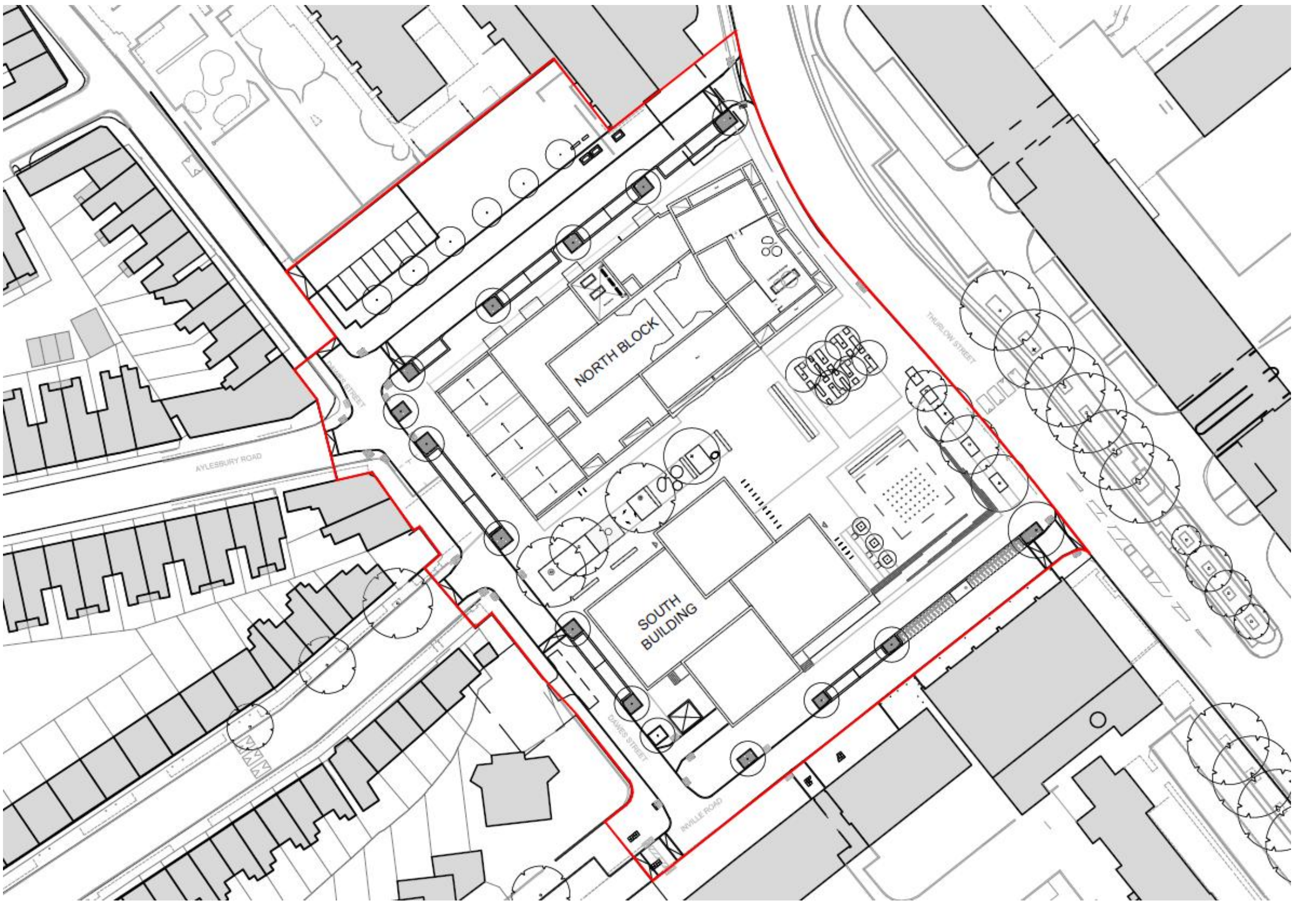
BH7: Sustainable Design and Construction

All developments must connect to CHP system, or be able to connect to CHP when it becomes available. A contribution to emissions reduction should be achieved through on-site renewables in line with London Plan and homes must achieve a Code Level 4. This is equivalent to a 19% improvement on Part L of Building Regulations 2013.

Site Wide Energy Strategy (WSP November 2015)

This is a core document, which in summary sets out how the Aylesbury Estate Regeneration Scheme will respond to the various planning policies summarised above.

Figure 2: Plot 18 site in context



2 Plot 18 Site Energy Demand: Baseline

2.1 Energy Modelling

In line with London Plan guidance the first stage in an energy assessment is to ascertain baseline site energy consumption and related emissions.

This was calculated using the following energy modelling:

- Modelling of a representative sample of residential units using SAP accredited software
- Modelling of the North Block community facility and commercial units in IES Virtual Environment software
- Modelling of South Block in IES Virtual Environment software.

Drawing from these results, a model has been created in Excel to predict the Plot 18 site CO_2 emissions and confirm that the whole site meets the CO_2 emissions improvement target compared to Part L.

2.2 North Block: Residential units baseline

SAP modelling has been carried out of typical floor (Sixth floor) therefore representing each unit type and orientation.

Figure 3: Sixth Floor used as typical for SAP models

The Sixth Floor consists of 8 units as follows:

1. 1B2P Top floor, North facing with 3 external walls (52.68m^2)
2. 2B3P Top floor, South facing with 3 external walls (67.82m^2)
3. 2B3P Top floor, South facing with 2 external walls (67.72m^2)
4. 1B2P Mid floor, North facing with 1 external wall (50.60m^2)
5. 2B4P Mid floor, North / East facing with 2 external walls (70.93m^2)
6. 1B2P Mid floor, East facing with 1 external wall (50.89m^2)
7. 2B4P Mid floor South / East facing with 2 external walls (70.93m^2)
8. 1B2P Mid floor South facing with 1 external wall (50.60m^2)

Landlord cores are unheated spaces and are therefore not included in Part L

The total baseline emissions for the 122 flats are presented in the table below. A sample SAP report is included in Appendix A.

Table 2: Baseline predicted CO2 emissions for Residential units

Residential units	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Baseline: **Part L 2013 TER**	67.9	81.5

2.3 North Block: community facility and commercial units SBEM baseline

SBEM calculations have been carried out of the North block community facility and commercial units to determine the Target Emissions Rate (TER) which is also the baseline.

The remaining spaces, such as landlord cores, refuse stores and bike stores are unheated space and are therefore not included in the Part L SBEM calculations.

The TER is based on the notional building, which is the same size, shape and activity as the actual building, but is elementally compliant with the requirements of NCM Modelling Guide 2013 in terms of fabric U-values, percentage opening areas, and plant efficiencies.

The calculations were carried out using the IES Virtual Environment suite of software, version 2015. A detailed room-by-room 3D model was created from the latest architectural floor plans, sections and elevations. Appropriate templates were applied to each room, details of the proposed plant added and the <VE Compliance> software used to predict the annual carbon emissions for the building.

The building model uses the National Calculation Methodology (NCM) standard activity schedules from the templates for a ‘Library, museum or gallery’ for the community centre areas, ‘Restaurant or public house’ for the shell & core cafe and ‘Retail and Office (retail)’ for the shell & core pharmacy.

NCM room activity were selected in each case as was appropriate to the room function.

The total baseline emissions for the community facility and commercial units are presented in Table 7 below. A sample of the BRUKL report is included in Appendix B.

Table 3: Baseline predicted CO_2 emissions for North Block community facility and commercial units

North block Community and Commercial	**CO_2 emissions (Tonnes CO_2 per annum)**	
	Regulated emissions	Unregulated emissions
Baseline: **Part L 2013 TER**	44.7	17.9

Figure 4: North Block community facility and commercial units modelled in SBEM

2.4 South Block SBEM baseline

SBEM calculations have been carried out of the South Block Health Centre and Early Years to determine the Target Emissions Rate (TER) which is also the baseline.

The South block consists of 4 floors, plus a basement. Figure 5 shows the ground floor layout.

The basement car park is an unheated space and is therefore not included in the Part L SBEM calculations.

Figure 5: South block ground floor layout

The calculation methodology is the same as described in the previous section 2.3. With regards to NCM activity schedules, the building uses the templates for a for a 'Primary Health Care Building' for the Health Centre and 'Primary or Secondary School' for the Early Years. NCM room activity were selected in each case as was appropriate to the room function.

The total baseline emissions for the South block are presented in the following Table. A sample of the BRUKL report is included in Appendix C.

Table 4:Baseline predicted CO_2 emissions for South Block

South Block Health centre and Early years	**CO_2 emissions (Tonnes CO_2 per annum)**	
	Regulated emissions	Unregulated emissions
Baseline: Part L 2013 TER	101.8	82.0

2.5 Total baseline results for Plot 18

The total predicted baseline emissions for Plot 18 are presented in the Table below..

Table 5: Plot 18 Baseline predicted CO_2 emissions

Baseline: Building Regulations Part L Compliant Development	**CO_2 emissions (Tonnes CO_2 per annum)**	
	Regulated emissions	Unregulated emissions
North Block: Residential	67.9	81.5
North Block: Community facility and commercial	44.7	17.9
South Block: Health centre & Early Years Facility	101.8	82.0
TOTAL PLOT 18	**214.4**	**181.4**

3 Be Lean: Use less energy

3.1 Approach

A number of efficiency measures have been incorporated in the design of the North and South blocks that goes beyond the specifications detailed for the notional building within Part L of Building Regulations.

In summary, the measures included in the design are:

- High performance building fabric
- Improved air tightness
- 100% low energy LED lighting
- Efficient fans and pump controls

3.2 North Block: Residential units

The following fabric and building services specifications has been used for the residential units in SAP:

Table 6: SAP fabric specification

Building Element	Plot 18 Residential units
Exposed Floors [W/m²K]	0.16
Roof [W/m²K]	0.12
Terraced Roof [W/m²K]	0.12
Walls to Core (Lift Shaft et al) [W/m²K]	0.15
Walls to Corridors [W/m²K]	0.15
Party walls [W/m²K]	0.00
External Wall / Rainscreen Cladding [W/m²K]	0.15
Windows [W/m²K]	1.2
g-value	0.5
Apartment Entrance Doors [W/m²K]	1.2
Thermal bridging y-value	0.13
Air Permeability [m³/hm²]	3

Table 7: SAP building services specification

MEP Element	Plot 18 Residential units
Mechanical Ventilation	MVHR
SFP [w/l]	0.42
Heat Exchange Efficiency [%]	91
Boiler efficiency [%]	91
Water heating	Plate heat exchanger
Lighting	100% Low Energy

Figure 6: Example of residential MVHR

Applying these measures results in an estimated saving of 4.6 tonnes CO_2/year for the Residential Units, equivalent to a 1.6% saving of the regulated emissions.

Table 8: Predicted CO_2 annual emissions after applying energy efficiency measures to Residential units

Residential units	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Baseline	67.9	81.5
Be Lean	63.3	81.5
% reduction	1.6%	-

3.3 North Block: community facility and commercial units

The following fabric and building services specifications has been used for the community facility and commercial units units in IES:

Table 9: North Block IES fabric specification

Building Element	Plot 18 Residential units
Exposed Floors [W/m²K]	0.16
Roof [W/m²K]	0.12
External Wall / Rainscreen Cladding [W/m²K]	0.15
Windows [W/m²K]	1.2
g-value	0.4
Apartment Entrance Doors [W/m²K]	1.2
Air Permeability [m³/hm²]	3

Table 10: North Block IES building services specification

MEP Element	Plot 18 Residential units
Llighting average efficiency	90lm/W with 95% LOR
Lighting metering with out of range values	Yes
Lighting control	Daylight dimming and occupancy control to suit space
Boiler efficiency	91
Ventilation heat recovery efficiency	65-80% depending on particular unit
Ventilation SFP	1.8-1.9W/l/s depending on particulat unit
Air Handling Unit CEN clasifcation	Class L2
Ductwork CEN classification	Class D
Chiller cooling SEER	5.0
Pump control type	Variable speed with multiple pressure sensors

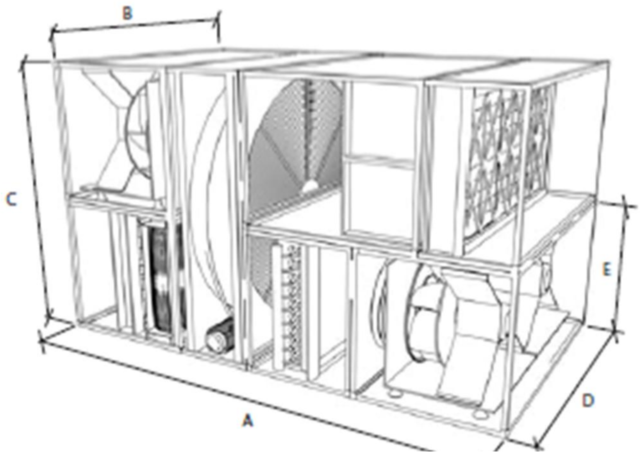
Applying these measures results in an estimated saving of 5.6 tonnes CO_2/year for the North Block community facility and commercial units, equivalent to a 12.5% saving of the regulated emissions.

Table 11: Predicted CO_2 annual emissions after applying energy efficiency measures to North Block community facility and commercial units

North Block community facility and commercial units	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Baseline	44.7	17.9
Be Lean	39.1	17.9
% reduction	12.5%	-

Figure 7: Example of ductwork being pressure tested

Figure 8: Diagram of AHU with thermal wheel



3.4 South Block: Health centre and Early Years Facility

The following fabric and building services specifications has been used for the South Block in IES:

Table 12: South Block IES fabric specification

Building Element	Plot 18 Residential units
Exposed Floors [W/m²K]	0.18
Roof [W/m²K]	0.13
External Wall / Rainscreen Cladding [W/m²K]	0.18
Windows [W/m²K]	1.4
g-value	0.4
Entrance Doors [W/m²K]	2.2
Air Permeability [m³/hm²]	3

Table 13: South Block IES building services specification

MEP Element	Plot 18 Residential units
Llighting average efficiency	90lm/W with 95% LOR
Lighting metering with out of range values	Yes
Lighting control	Daylight dimming and occupancy control to suit space
Boiler efficiency	91
Ventilation heat recovery efficiency	65-80% depending on particular unit
Ventilation SFP	1.8-1.9W/l/s depending on particulat unit
Air Handling Unit CEN clasifcation	Class L2
Ductwork CEN classification	Class D
Chiller cooling SEER	6.0
Pump control type	Variable speed with multiple pressure sensors

Applying these measures results in an estimated saving of 22.1 tonnes CO_2/year for the North Block community facility and commercial units, equivalent to a 21.7% saving of the regulated emissions.

Table 14: Predicted CO_2 annual emissions after applying energy efficiency measures to North Block community facility and commercial units

North Block community facility and commercial units	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Baseline	101.8	82.0
Be Lean	79.7	82.0
% reduction	21.7%	-

Figure 9: Example of an energy efficient air cooled chiller

3.5 Total 'Be Lean' results for Plot 18

The total predicted 'Be Lean' emissions for Plot 18 are presented in theTable below. The total 'Be Lean' saving is 32.3 tonnes CO_2/year for Plot 18 equivalent to a 15.1%

Table 15: Plot 18 'Be Lean' predicted CO_2 emissions

Baseline: Building Regulations Part L Compliant Development	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Baseline:	214.4	181.4
Be Lean	182.1	181.4
% reduction	15%	-

4 Be Clean: Supply energy efficiently

4.1 Decentralised energy heirarchy

Following the application of efficiency measures (Be Lean) the next step is to consider which technologies can provide further improvement in CO_2 emissions. The recommended hierarchy is;

1. Connection to existing heat networks
2. Allow for connection to planned networks
3. Include a site wide heat network

4.2 Aylesbury Estate Outline Planning

The Aylesbury Masterplan Outline Planning application was granted permission on 5th August 2015. This included an Energy Assessment and District Heating Study – version 3, carried out by which includes a study on heat networks.

This detailed energy statement for Plot 18 does not repeat the Outline Energy Assessment, which was accepted. In summary however, the Outline Energy Assessment concluded that a connection to an existing or planned heat network is not feasible.

It also concluded that the Aylesbury Estate is of sufficient scale to allow for the inclusion of an Energy Centre with 60% of thermal demand supplied by CHP.

Figure 10: Example of CHP units

Figure 11: Example of Condensing boilers

The energy strategy for Plot 18 is therefore to connect to the sitewide Energy Centre via a district heating network (DHN) and benefit from the low carbon heat source supplied by gas fired CHP and gas fired Condensing boilers.

4.3 Plot 18 connection to Aylesbury Estate DHN

Plot 18 development will be connected to the Aylesbury Estate district heating network (DHN) to assist in meeting the targeted 35% reduction of CO_2 from Part L 2013 as required by planning.

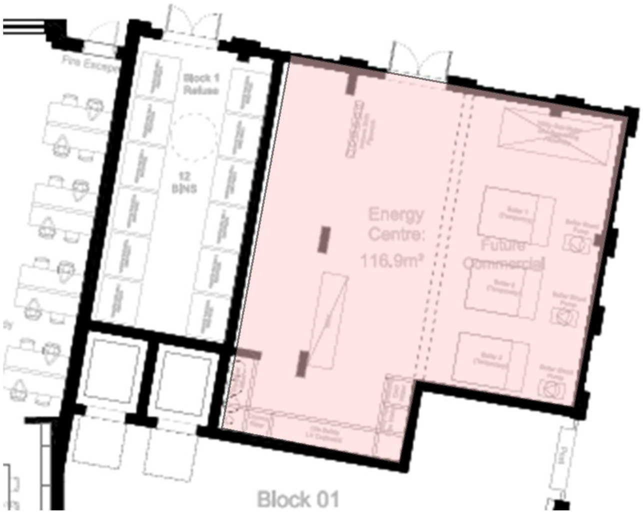
The phased development of the Aylesbury Estate is such that Plot 18 will be constructed approximately 7 years before the Energy Centre is completed.

During the period before Plot 18 can be connected to the district heating network, it will be heated by temporary boilers located at ground floor in the North block.

The boilers will supply heating to a plate heat exchangers serving the North Block and the South Block.

When the Energy Centre is completed, these plate heat exchangers will be connected to the district heating network and the boiler plant will be removed.

Figure 12: Location of Heating plantroom in North Block and serving North and South block



4.4 Performance of Energy Centre plant

The predicted performance of the Energy Centre heating plant will be as follows:

Table 16: Energy Centre heating performance

Energy Centre criteria	Performance
Gas Boiler efficiency	90.8%
Boiler Thermal contribution	40%
CHP Efficiency	86%
Heat to power ratio	1.26
CHP Heat efficiency	46%
CHP Electrical efficiency	38%
Distribution loss factor	7.8%

Connecting to the proposed district heating system (CHP and gas-fired boilers) results in an estimated saving of 34.6 tonnes CO_2/year for the new Plot 18 development. This is equivalent to a 19% saving compared to the 'Be Lean' step.

Table 17: Predicted regulated CO_2 emissions before and after connecting to a decentralised energy supply [Tonnes CO2/yr]

Baseline: Building Regulations Part L Compliant Development	**CO_2 emissions (Tonnes CO_2 per annum)**	
	Regulated emissions	Unregulated emissions
Be Lean	182.1	181.4
Be Clean	147.5	181.4
% reduction	19%	-

5 Be Green: Renewable Energy Technologies

5.1 Heading

In line with Policy 5.7 renewable energy technologies have been considered to provide a reduction in carbon dioxide emissions with a target of 20%.

The following technologies have been evaluated to assess their suitability to for Plot 18:

- Biomass Heating
- Ground and Air Source Heating
- Wind turbines
- Solar Thermal
- Solar Photovoltaics

5.2 Biomass Heating

Biomass as a fuel source for the Energy Centre boilers was considered at the Outline Planning stage as part the Energy Assesment. The assessment did not recommend this technology due to additional air quality concerns involved when including this technology in an urban area.

Biomass as a fuel for the Energy Centre CHP was also considered in the Outline Energy Assessment, however a larger scale of plant is required before this is suitable. In addition to this, fuel storage and delivery were also considered likely to hamper the development.

Figure 13: Typical Biomass boiler plant

Figure 14: Pellet form biomass fuel

5.3 Ground and Air Source Heat Pumps

The feasibility of closed loop Ground / Air Source Heat Pump has been considered for Plot 18. Whilst a ground / air source heat pump system is not a wholly a renewable energy source, as it requires electricity, there can be a saving in primary energy compared to producing heat using a boiler. For a Ground Source Heat Pump (GSHP) the limiting factors are the rate at which energy can continue to be drawn out of the ground without a gradual degradation in temperature over time and the low grade temperature at which heat can be delivered to the building. An advantage of a GSHP is the ability to provide highly efficient cooling as well as heating.

It is considered that a GSHP would be in competition with the CHP-led district heating scheme which is proposed for meeting the heating and hot water base load.

Figure 15: Typical water to water heat pump for GSHP

5.4 Wind turbines

The feasibility of wind turbines has been considered for Plot 18. The energy output of a wind turbine is extremely sensitive to wind speed and wind characteristics. When deciding on potential areas where a wind turbine can be located, checks need to be carried out on average wind speeds and wind directions up and downstream of the turbine, to ensure that it is free from obstructions.

Two other rules of thumb for locating turbines are to locate the turbine hub so that it is:

a. twice the height of any adjacent obstruction, or

b. a horizontal distance of 10 times the height of the nearest obstruction away from the obstruction

Building-mounted or micro wind turbines are still relatively unproven in urban locations where wind regimes are very unpredictable and there is uncertainty about what can realistically be assumed in terms of their annual electrical output. Early examples notably generated significantly less electricity than was predicted by manufacturers of the turbines.

Given the constraints of Plot 18 and the unproven nature of building mounted wird turbines this technology is not considered suitable for this development.

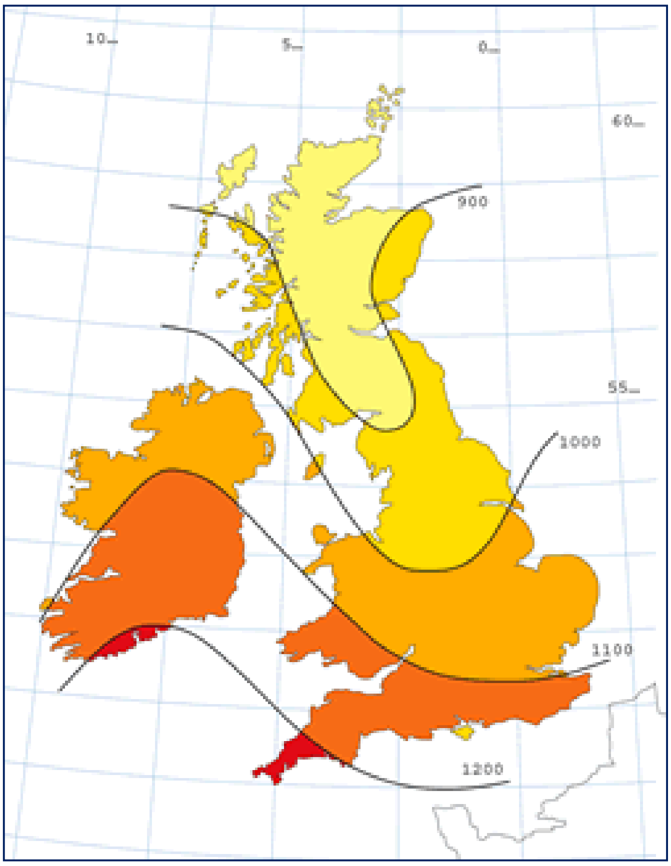
Figure 16: Wind turnine

5.5 Solar thermal

A solar thermal hot water (STHW) system generates hot water from solar energy, they consist of two main types - flat panels and evacuated tubes. Flat panels often cost less but will usually have a lower energy yield than evacuated tubes.

The map below shows that London receives an average to high amount of solar radiation compared to the rest of the UK. Panels should be orientated between south-east and south-west and with an inclination between 30-40 degrees to optimise the output.

Figure 17: UK solar radiation



The viability of STHW panels to supply hot water has been reviewed and it is considered that there will be competition to supply hot water to the site with the proposed CHP-led district heating scheme; which is higher up in the London Plan Energy Hierarchy. STHW is therefore not being considered for this development.

5.6 Solar Photovoltaic

Photovoltaic (PV) panels generate electricity from sunlight. Maximum energy yield will occur when the panels are orientated between south-east and south-west and tilted at 30° to the horizontal. Once installed, the panels have no running costs apart from occasional maintenance to keep the panel surface clean.

Figure 18: Typical PV installation

PV is a renewable technology that is complimentary to CHP. The electricity demand for Plot 18 is likely to be such that electricity generated by CHP and PV is rarely exported. The potential to use PV to generate electricity for the new development has been assessed and it is considered it is suitable for Plot 18.

The North Block roof at level 15 and at level 6 is the most suitable location as they are not overshadowed by other buildings and are roofs that can be accessed for maintenance.

The PV panels will be tilted on a frame at 30° to the horizontal and due to the orientation of the building the panels will face South-East (128° from North).

With the panels positioned in this way, a 21kWp system is required to reduce CO_2 emissions by the required 10.1 tonnes CO_2/ year.

The PV arrays will have a total panel area of approximately 102m^2, based on a 20% efficient PV panel. This required a roof area of approximately 200m^2, once the panels are spaced out to prevent overshadowing each other and to provide maintenance access.

Inverters will be located at roof level for each PV array. There will be one PV array at level 15 roof and two separate PV arrays at level 7 roof.

The PV system will feed into the North Block landlord LV panel, however for the purposes of reporting, this energy statement attributes the saving to the North Block community facility and commercial units.

Table 18: PV system performance

PV system	Performance
Number of panels	64
Panel efficiency	20.4%
Panel area	1.6m^2
Total panel area	102m^2
Panel nominal output	327W
Electirical output	21 kWp
Inclination from horizontal	30 degrees
Orientation from North	128 degrees
kWh generated electricity	20 MWh/yr

Incpororating PV to the roof of the North Block results in an estimated saving of 10.4 tonnes CO_2/year for the new Plot 18 development. This is equivalent to a 7.1% saving compared to the 'Be Clean' step.

Table 19: Predicted regulated CO_2 emissions before and after connecting renewable energy technologies

Baseline: Part L 2013	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Be Clean	147.5	181.4
Be Green	137.1	181.4
% reduction	7.1%	-

The aim for a 20% reduction in CO_2 emissions from renewable energy technologies in line with the Area Action Plant will not be achieved given the location of the site within an urban area and limited level of available roof space/

Figure 19: Site layout and Indicative PV area

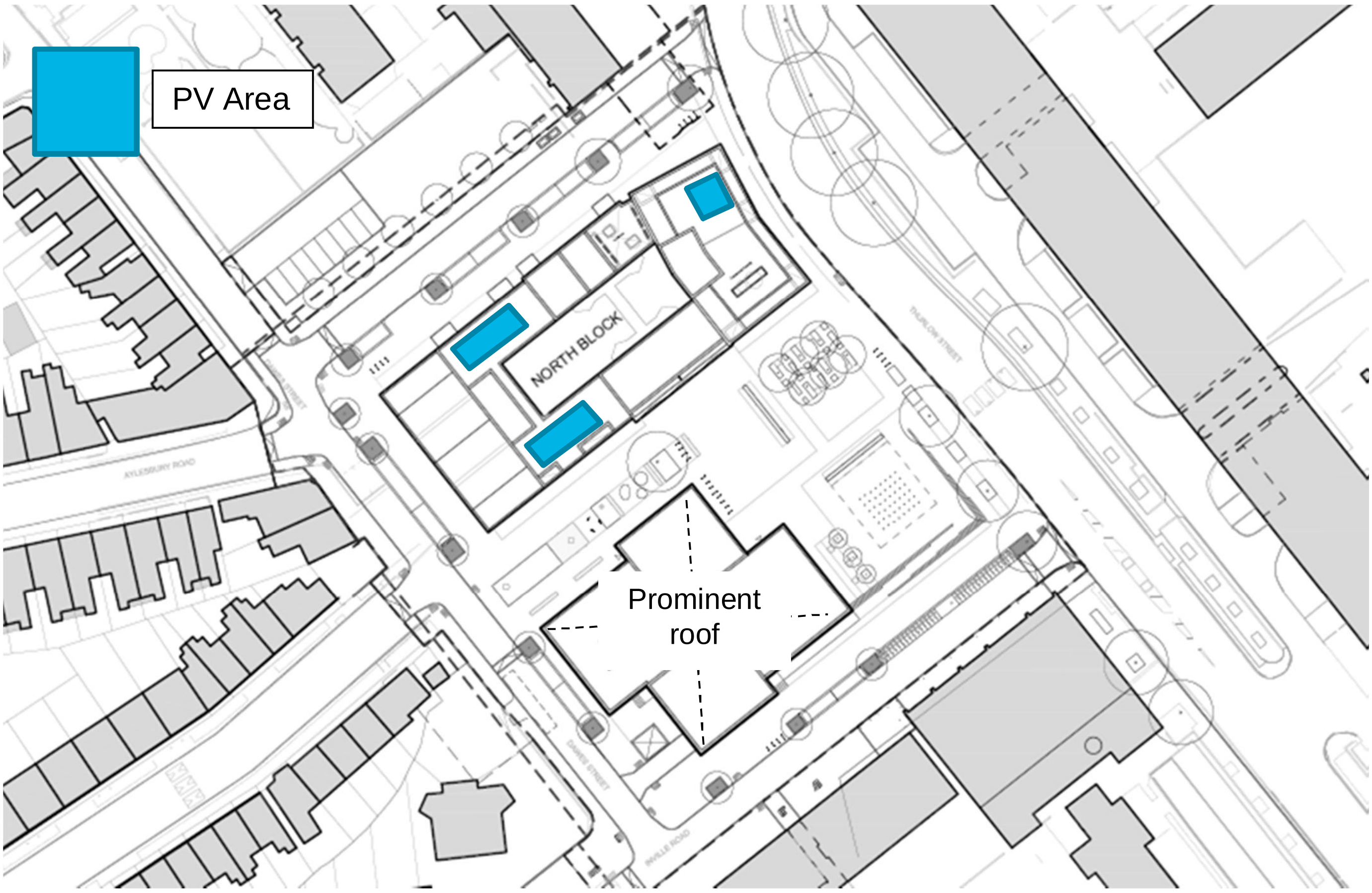
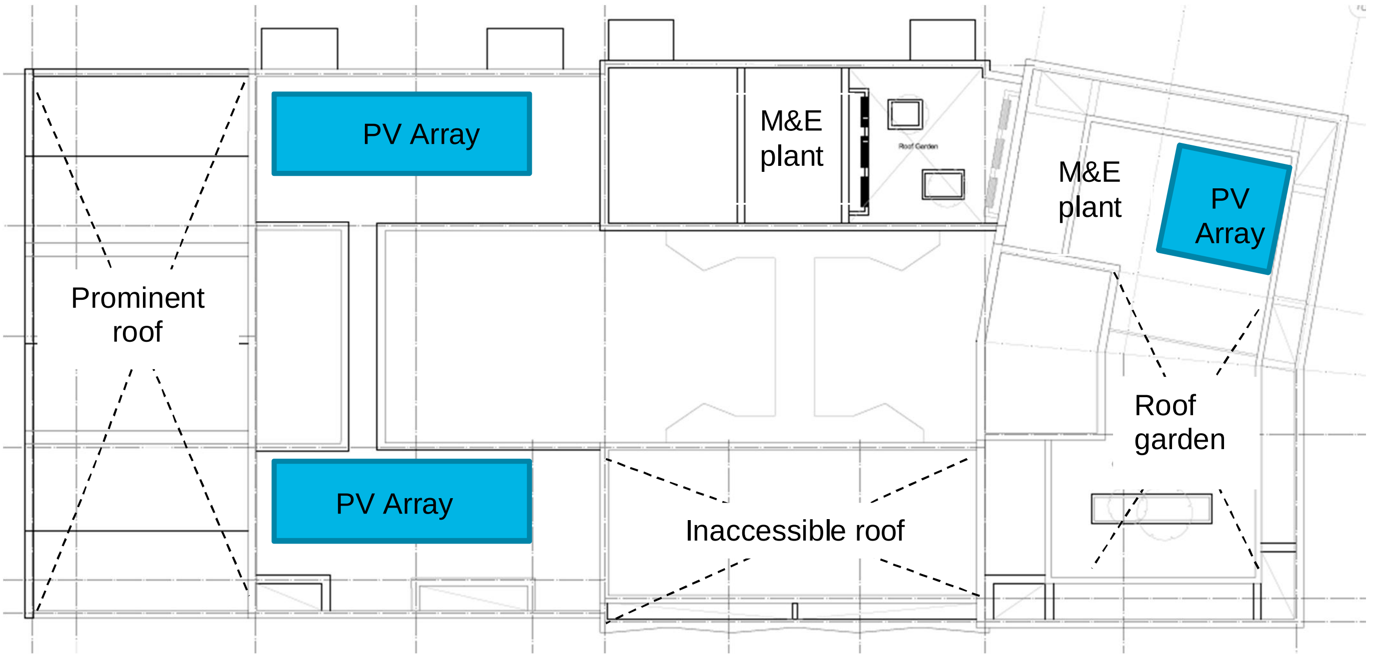


Figure 20: North Block roof with indicative PV area



5.7 BREEAM

For credits under the BREEAM assessment it is necessary for several key aspects to be discussed in relation to the chosen technology, which for Plot 18 is PV.

Energy generated

The final array design will be confirmed at a later stage, but will most likely consist of around 64 panels, connected to a number of inverters. The energy generated each year is calculated in IES to be 20MWh.

Payback

PV systems under 5MW capacity are currently supported by the UK Feed-In Tarriff; although this is currently under review and may be reduced in the near future. The main benefits come from offsetting electrical use on-site, thus saving on electrical bills.

Table 20: Simple payback calculation

Simple payback model		Source
System size	21kWp	Site information
Annual generation	20 MWh	IES calculation
CAPEX	£25,200	£1,200 per kWp based on industry knowledge of PV costs
FIT income	£810	4.05 p/kWh proposed rate from January 2018
Energy Saving benefit	£2000	10p/kWh assuming all energy is used on site
Simple payback	9 years	Calculation: CAPEX / Annual benefit

Land use and local planning requirements

The proposed PV system will be roof mounted, so will not be using any additional land. Similarly this also means that the scheme will come under permitted development rights, provided certain conditions are met to minimise visual impact.

Noise

Photovoltaic panels produce no noise during operation. Inverters however may do; though these will be located away from both internal building inhabitants and any external noise receivers.

Feasibility of exporting electricity

Although the system will have the cability of exporting electrical power to the grid, the main financial benefit comes from using the power on site. During times of very low demand, power will be exported and a grid connection application will be required before the system is complete via the G59 connection procedure. Under the Feed-In Tarriff an export meter will be required to measure the exact volume exported and receive an export rate of 4.05p/kWh based on completion in January 2018.

Table 21: Summary of BREEAM Key Aspects

BREEAM Key Aspect	Comments
Energy generated	Estimated to 20 MWh per year
Payback	Simple payback estimated to be 9 years
Land use	N/A (Roof mounted)
Local planning requirements	Permitted development
Noise	Minimal noise impact
Feasibility of exporting electricity	Minimal electricity expected to be exported subject to grid connection agreement with DNO
Life cycle costs / impact in terms of emissions	Emissions arise from manufacture and installation – zero emissions during operation. Overal emissions expcted to be significantly lower than equivalent amount of grid electricity.
Any grants available	Yes, currently supported under UK Feed-In tariff
Technology appropriate to the site and energy dwemand for development	Yes – roof space is maximised with minimal visual impact and majority of energy generated will be used on site
Reasons for excluding other technologies	Refer to Section 5.6

6 Results

6.1 Energy Efficiency Measures

The recommended strategy for achieveing the London Plan targets for Plot 18 is a combination of 'Be Lean', 'Be Clean', and 'Be Green' measures. A range of efficiency measures have been detailed that are predicted to deliver a 15.1% saving in CO_2 emissions.

It is proposed to connect to the Aylesbuty Estate CHP-led district heating network, which although is not planned to be completed until 7 years after the completion of Plot 18, it will then contribute to the target CO_2 emission savings. It is predicted to reduce emissions by 19% from the 'Be Lean' step.

Finally up to 200m^2 of roofspace has been considered feasible for the inclusion of photovoltaic which reduces emissions by 7.1% from the 'Be Lean' step.

The total reduction in predicted regulated emissions is 36%. The proposed scheme for Plot 18 therefore in line with the Site Wide Energy Strategy (WSP Novermber 2015) which includes meeting the London Plan target for CO_2 emissions reductions compared to Part L and this was achieved by following the London Plan Energy Hierarchy.

Table 22: Estimated CO2 emissions for the site from adopting an energy efficient approach

	CO_2 emissions (Tonnes CO_2 per annum)	
	Regulated emissions	Unregulated emissions
Baseline: Part L 2013	214.4	181.4
Be Lean: Energy Efficiency Measures	182.1	181.4
Be Clean: Connection to CHP led district heating	147.5	181.4
Be Green: Incorporation of renewable energy	137.1	181.4

Table 23: Estimated regulated CO_2 emissions savings at each step in the GLA heirachy

	Regulated Carbon Dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy efficiency measures	32.3	15.1
Savings from CHP led district heating	34.6	19.0
Savings from renewable energy	10.4	7.1
Total cumulative savings	**77.3**	**36.0**
Total target savings	**75.0**	**35**
Annual surplus	**2.3**	**-**

Appendix A: Sample SAP outputs

Output at Step 2 – Be Clean

SAP Worksheet
Design - Draft

NHER

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Dr Eric Roberts	Assessor number	3679
Client		Last modified	13/04/2016
Address	L6-Flat3 North Block, Aylesbury, London, EC1		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		66.60	(1a)	x	2.60	(2a)	=	173.16	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	66.60	(4)						
Dwelling volume							(3a) + (3b) + (3c) + (3d)...(3n) =	173.16	(5)

2. Ventilation rate

				m³ per hour	
Number of chimneys		0	x 40 =	0	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		0	x 10 =	0	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	0	÷ (5) =	0.00	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		3.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.15	(18)
Number of sides on which the dwelling is sheltered		3	(19)
Shelter factor	1 - [0.075 x (19)] =	0.78	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.12	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2													
	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4													
	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m													
	0.15	0.15	0.14	0.13	0.12	0.11	0.11	0.11	0.12	0.12	0.13	0.14	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	0.50	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	63.70	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (22b)m + (23b) x [1 - (23c) ÷ 100]

0.33	0.33	0.32	0.31	0.31	0.29	0.29	0.29	0.30	0.31	0.31	0.32	(24a)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)

0.33	0.33	0.32	0.31	0.31	0.29	0.29	0.29	0.30	0.31	0.31	0.32	(25)

URN: Flat3 v2 version 1
NHER Plan Assessor version 6.1.2
SAP version 9.92

Appendix B: North Block BRUKL reports

Output at Step 3 – Be Green

BRUKL Output Document

Compliance with England Building Regulations Part L 2013

HM Government

Project name

2016_04_05 - North Block Part L

As designed

Date: Fri Apr 15 12:19:33 2016

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	39.5
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	39.5
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	24.4
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	00000000:Surf[2]
Floor	0.25	0.16	0.16	00000000:Surf[0]
Roof	0.25	0.12	0.12	00000000:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.16	1.2	00000000:Surf[4]
Personnel doors	2.2	1.2	1.2	0000000E:Surf[2]
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

Appendix C: South Block BRUKL reports

Output at Step 2 – Be Clean

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Aylesbury South Building

As designed

Date: Mon Apr 11 12:27:12 2016

Administrative information

Building Details

Address: Aylesbury South Building, Aylesbury, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: David Pierce

Telephone number: 01223 275725

Address: 3A Clifton Court, Cambridge, CB1 7BN

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

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	23.2
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	23.2
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	17.7
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 the building services should achieve reasonable overall standards of energy efficiency

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

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	RM00003C:Surf[2]
Floor	0.25	0.18	0.18	RM000042:Surf[10]
Roof	0.25	0.13	0.13	RM00005D:Surf[13]
Windows***, roof windows, and rooflights	2.2	1.4	1.4	RM00003C:Surf[0]
Personnel doors	2.2	2.2	2.2	12000004:Surf[4]
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
m³/(h.m²) at 50 Pa	10	3