Greenwood Place Resource Centre
Energy Statement

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EXPLANATORY NOTES RELATING TO REVISION I

A full planning application for the Greenwood Estate development was submitted to Camden Council's planning department in 2013 and planning approval was granted on 18 June 2014. The development included a community centre building and a separate residential block along with some public realm works.

Since the original planning approval was granted the Highgate Road Residential Block development has been sold by the client meaning it is no longer under control of the current design team. As a result the planning conditions have been altered in order to separate the conditions for the community building and the residential building.

Additionally a value engineering exercise was undertaken resulting in a number of design changes, notably the removal of the lower ground hydrotherapy unit in the Greenwood Place Resource Centre.

An Energy and Sustainability statement was included in the original planning submission bundle.

The previous revision to this Energy Statement, prepared by Synergy Consulting Engineers, sought to confirm that the original planning conditions set out by Camden Council regarding the community building are met in line with the current building regulations as indicated by TGA in the previous revision of the energy statement and excluded the residential development from all calculations.

This revision of the energy statement, which is provided in support of an amended Greenwood Estate planning application, includes amendments arising from the omission of the hydrotherapy unit from the Greenwood Place Resource Centre and the removal of any reference to the residential Highgate Road development.

The principles set out in Camden Council's planning policies have been followed. These policydocuments have been listed in the body of the report.

Energy consumption and carbon reduction results for Greenwood Place Resource Centre have been obtained from calculations undertaken using the National Calculation Methodology. Improvement over Building Regulations Part L, as expressed in this energy statement and earlier versions, are based upon the Building Regulations 2013.

1.0 INTRODUCTION

1.1 PREAMBLE

A team of construction professionals are developing proposals for the demolition of a number of single storey buildings in Greenwood Place and the construction of a new Community Centre building.

A planning application was submitted and approved for this scheme in 2013. This revision of the Energy Statement seeks to confirm that the planning conditions set out by Camden Council are met in line with the current building regulations following a number of design changes, most notably the removal of the lower ground hydrotherapy unit. This statement also removes any reference to the residential building to reflect the change in the planning conditions.

1.2 CAMDEN COUNCIL PLANNING POLICIES

All new building developments in the London Borough of Camden are required to meet minimum standards relating to sustainability, energy efficiency and carbon reduction. This is inline with London wide and national aspirations set by the London Mayor and the UK Government.

In the London Borough of Camden area, sustainability, energy efficiency and carbon reduction all feature in the planning process. Planning guidance on these matters is set out in the Local Development Framework and, in particular, in the following inter-related policy documents:

- CPG3 - Sustainability
- CS13 - Tackling Climate Change Through Promoting Higher Environmental
- Standards
- DP22 - Promoting Sustainable Design and Construction
- DP23 - Water
- CS16 - Improving Camden's Health and Wellbeing
- DP32 - Air Quality & Camden's Clear Zone

The formulation of a viable servicing strategy and energy plan for this project, as defined in this Energy Statement, takes into account guidance contained in the above listed documentation.

The planning condition specified by the London Borough of Camden's planning department relating to reduction of carbon emission reductions for the development is stated below:

'Prior to commencement of any part of the development, (excluding demolition and enabling works) the applicant and/or developer shall submit to the local planning authority for approval an Energy Efficiency and Renewable Energy Plan setting out a package of measures to achieve target carbon emission reduction levels of 25.16% for the community centre and 32.65% for the residential building of the development. The Plan shall contain mechanisms for monitoring, review and further approval by the local planning authority, and shall include an Air Quality Assessment for any CHP system proposed for inclusion. The development shall at all times proceed in accordance with such Plan as will have been approved.'

Following the sale of the residential development it has been agreed with the London Borough of Camden's planning department that the current design team are not required to fulfil the condition relating to the residential building.

1.3 THE ENERGY HIERARCHY

It is now customary to consider energy supply and energy efficiency in buildings in a three tier process known as an 'Energy Hierarchy'.

The Energy Hierarchy:

1. Be Lean – *Design and construct a new building to consume less energy*
2. Be Clean – *Deliver and consume energy efficiently*
3. Be Green – *Deliver some or all of the required energy from renewable sources.*

The importance of the 'Energy Hierarchy' is in its drive to ensure that new buildings are designed and constructed to consume only the minimum amount of energy in the first instance.

After this first objective in the hierarchy has been defined, the design of the energy generation and delivery systems can be considered.

The final step in the energy planning process is to identify how much of the buildings energy needs can be met from renewable energy sources.

1.4 CAVEAT

The energy consumption analysis and results, which underpin the recommendations included in this Energy Statement, have been derived by applying the National Calculation Methodology (NCM). This methodology is embedded in the SBEM and SAP calculation procedures. The energy consumption for the completed buildings may differ from the predictions given by SBEM and SAP.

1.5 THIS REPORT

The purpose of this report is to set out design strategies and performance targets relating to energy conservation, energy efficiency and energy supply, which have been embodied into the development proposals and will be carried forward into the detail design and construction phases of the project.

In the first instance, the information contained in this report will enable the local authority Planning Team to consider and understand the adopted measures and features, relating to energy, that have been incorporated into the development proposals thus far.

The emphasis in this report is on energy consumption and carbon reduction. Other issues, which come under the general heading of 'sustainability', will be covered in a separate document.

2.0 DEVELOPMENT PROPOSALS

2.1 PROJECT DESCRIPTION

Greenwood Place Resource Centre comprises a 3200m^2, 4-storey day centre building including an accessible roof garden area. This building is to be designed to theBRE BREEAM ‘Excellent’ rating with the building achieving at least 60% of the un-weighted energy credits.

The following section of this report describes the strategies that have been adopted, firstly to reduce the energy demand imposed by the new buildings to comply with Part L 2013 of the Building Regulations and secondly to identify the principal mode of energy delivery.

Finally, the provision of renewable energy systems is described.

2.2 GREENWOOD PLACE COMMUNITY CENTRE

Reduce Energy Demands

This building is designed to incorporate effective use of passive, internal climate moderating, features where achievable. This will result in less reliance of building engineering systems and hence reduced energy consumption. In a number of areas it was necessary to introduce mechanical ventilation and cooling due to acoustic constraints and to mitigate overheating.

Passive features that have been included:

- Natural ventilation in summertime to maintain comfortable internal temperature conditions
- Background supplementary mechanical ventilation with heat recovery
- Good day lighting in interior spaces
- Night time ventilation/cooling, coupled with exposed concrete room surfaces in the occupied spaces
- Effective use of winter sunshine on southern elevations
- Effective shading strategies to prevent unwanted solar heat admission in the summertime

The building envelope is to comprise highly insulated elements with improved u-values over minimum statutory standards. The building will be highly air-tight, preventing uncontrolled and wasteful air infiltration.

U values and air permeability standard, adopted for this project, are those values identified in CPG3 and are considered to be current best practice.

Good construction detailing will identify and address the issue of ‘cold bridging’ which now accounts for a significant proportion of the conducted heat losses through a building envelope.

A green roof feature is to be incorporated onto part of the roof area.

Efficient Energy Generation and Delivery

Thermal energy will be delivered to the community centre building by a central combined heat and power plant (CHP) supported by high efficiency gas-fired condensing boilers.

Electricity, generated by the CHP unit, will be supplied to the building along with grid derived electricity. Surplus electricity, produced by the CHP installation, will be exported and sold back to the Grid for a nominal fixed charge.

Space heating will be delivered to the occupied spaces through underfloor heating.

The use of mechanical ventilation systems will be limited to those spaces that require mechanical ventilation to suit function, such as toilet areas, food prep areas, areas in which opening windows are not suitable and internalspaces. Some of the deep planned perimeter spaces will be provided with supplementary mechanical supply and extract ventilation. Mechanical supply and extract ventilation systems will include efficient heat recovery equipment.

Mechanical cooling will be kept to minimum unless adequate comfort conditions cannot be achieved insummer. Generally, this will be limited to high use IT spaces, IT equipment roomsand rooms where opening windows are not appropriate due to acoustic requirements.

Interior lighting systems will be designed to take full advantage of the natural daylight admitted into the building and will include automatic daylight controls in perimeter spaces.

Energy efficient light sources will be selected and automatic presence and absence detection and switching will be incorporated, and daylight dimming controls where appropriate.

A comprehensive energy metering strategy will be adopted and all meters will be read and logged, automatically.

A building energy management system (BEMS) will be provided to manage and control all of the fixed building services in an energy efficient manner. Systems will be suitably zoned and controlled and individual systems will be automatically set back or switched off when not inuse or required.

Renewable Energy

Free standing photovoltaic cells are to be installed on a designated area of the roof to generate electricity from solar energy; refer to architect's plans for locations.

2.3 THIRD PARTY ENERGY CONSUMERS

The central energy centre, which is to be established in the Greenwood Centre Building, has been space planned to allow the system to be expanded to serve other potential third party energy consumers.

Localised heat and power infrastructure can be expanded in the future, along with the installed heat energy generating plant capacity, so that other energy consumers can be connected and served by the new community heating system.

The adjacent Deane House, which is a Council owned building, is a prime candidate for future connection into the community heating system.

The energy centre has space allocated for the future introduction of suitable plate heat exchanger assemblies so that advantage can be taken if a large scale municipal heat network is brought into the area in the future. See Appendix 1 for location of allocated space.

2.4 TECHNOLOGIES NOT INCLUDED

Consideration has been given to a number of energy supply/energy generation technologies in the early design stages of this project.

Table 2.1, below provides a summary of those technologies that have been considered and excluded.

Table 2.1

Community and Residential Buildings		
Item	**Description**	**Remark**
Ground Source Heat Pump (GSHP) Technology	Central GSHP unit in basement plant room and vertical or horizontal ground loop pipework.	Inadequate unobstructed ground available to accommodate ground loops.
Air Source Heat Pump Technology	Central ASHP unit mounted on roof plant area and connected pipe systems in the building.	Available roof space limited due to competing requirements to include green spaces and amenity spaces.
Biomass	Automatic wood burning boiler incorporated in a community heating system	Air quality issues on and around the site preclude the inclusion of wood burning appliances.
Wind Turbine	Building mounted wind turbinegenerators.	Poor availability of wind energy at this site precludes inclusion of this technology.

2.5 UN-REGULATED ENERGY CONSUMPTION

Un-regulated energy use and consumption is concerned with the energy consumed by white goods, household appliances, portable electrical equipment and the like. In essence, Un-regulated energy use is the energy consumed by products which are not part of the fixed building services.

Energy labelling of electric appliances is regulated under EU Directive 2010/30 EU. All such appliances, which are to be supplied and installed under the building contract, will be specified A-Rated or better.

Replacement lamps in light fittings also come under the above mentioned EU directive.

Handover documentation provided at the end of the construction project will include a 'User Guide' and this document will include user advice relating to energy efficient product replacements along with general advice about energy efficiency and energy conservation.

3.0 THE ENERGY PLAN

3.1 GENERAL

In order to formulate a viable energy strategy for this development, a 'baseline' energy model has been produced using IES virtual environment software and SBEM/SAP calculation methodologies.

Iterations to the baseline energy model have been performed and a final energy strategy has been derived.

The servicing strategy, described in section 2.0 of this report, is based upon the establishment of a central energy centre which will serve the building and will be available for connection to other buildings subject to council agreement and any necessary upgrades.

Heat for the development will be produced by a combined heat and power plant supplemented by high efficiency condensing boiler units and distributed via interconnection pipeline routed in the public highway.

Power will also be produced by the CHP plant and this will be supplemented with grid derived electrical energy.

The community centre buildings will be provided with renewable energy systems, by way of Photovoltaic solar panels.

This section of the report presents a summary of the results obtained during the model processing.

3.2 BASELINE SOLUTION

Building envelope u-values adopted for this development have been enhanced and exceed the minimum statutory values defined in Building Regulations Approved Document L and the accompanying Compliance Guides.

Table 3.1 below, identifies u-values and an air-permeability value adopted and used in the modelling process.

Table 3.1 Envelope Parameters

ITEM	VALUE	UNITS
External Wall	0.2	$W/m^2/K$
Roof	0.13	W/m2/K
Floor	0.2	W/m2/K
Window	1.5	W/m2/K
Glazed Door	1.5	W/m2/K
Solid Door	1.0	W/m2/K
Air Permeability	5.0	m3/h.m2

The methodology adopted in the analysis process first generated a baseline solution. From this baseline, further iterations have been produced whereby improvements in energy delivery systems and the introduction of renewable energy sources have been analysed.

The first calculation iteration, using enhances u-value and air permeability values included intable 3.1, is based upon central heating for the building being provided by high efficiency gas-fired boilers, only. No allowance has been made for CHP or for energy supply from renewable sources. This baseline 'Be Lean' calculation improves of the Building Regulations Part L 2013 minimum requirements.

Results from the next iteration (Be Clean) identify the impact of including a combined heat and power (CHP) unit. In this solution a 44.89 kWth combined heat and power plant is introduced as the lead heat source producing 18.41 kWh/m^2 of energy per year.

Finally, the last set of results (Be Green) identifies the improvement in performance gained from renewable energy sources. Roof mounted photovoltaic panels (9.5kWp) have been used.

3.3 CALCULATION RESULTS SUMMARY

Table 3.2 includes the modelling results and identifies energy demand and carbon emissions for the principal iterations.

Table 3.2 – Community Building Energy Demand and Carbon Emissions

Target CO_2 emission rate (TER) for community building: 32.5 kgCO_2/m^2.yr		
Energy	**Carbon Emissions**	**Remark**
Baseline Case		
133.32 kWh/m^2.yr	32.4 kg(CO2)/m^2.yr	Part L 2013 Compliant
Baseline Case with CHP		
127.59 kWh/m^2.yr	25.6 kg(CO2)/m^2.yr	21.23 % improvement over Part L
Baseline Case with CHP and Renewables		
127.59 kWh/m^2.yr	24.2 kg(CO2)/m^2.yr	25.53 % improvement over Part L

The **Baseline + CHP + Renewable Energy** solution results a building regulation compliant solution, and achieves the planning condition objective for carbon reduction for the building. BREEAM Excellent mandatory energy credits are achieved with this final solution.

3.4 MONITORING, REVIEW & FURTHER APPROVAL

The London Borough of Camden (LBC) require that the mechanisms for monitoring, review and further approval of the Energy Statement proposals is provided within this document.

It is proposed that the following are put in place to satisfy this requirement:

- Approved subcontractor information will be provided to LBC to confirm they are competent and certified to install the photovoltaic cells and CHP units.
- An ‘As Built’ Energy Performance Certificate (EPC) will be provided of the final installation with the inclusion of the photovoltaic cells and CHP units.
- Evidence by way of commissioning certification and photographs of the installed photovoltaic cells and CHP units will be provided to LBC.
- A Display Energy Certificate (DEC) will be provided for the ‘As Built’ installation including the photovoltaic cells and CHP units. This will be provided by the Client for the operational building.

3.5 COMBINED HEAT AND POWER FEASIBILITY ASSESSMENT

The London Borough of Camden (LBC) have requested confirmation that the Combined Heat and Power (CHP) unit proposed for the scheme is proven as feasible. This is especially pertinent since the original scheme included supply of energy from the GPRC energy centre to the proposed adjacent residential block, which has now been removed from its involvement from the GPRC scheme. Also there was a previous proposal for a basement hydrotherapy pool, which has also now been removed from the scheme. Both supply to the residential building and the hydrotherapy pool would provide a strong case for inclusion of CHP in the GPRC scheme due to the constant year round base load requirement. With the omission of these two elements, the continued inclusion of the CHP should be justified.

The CHP would be used as the lead boiler, backed up by the gas fired boilers in the scheme as the primary heat sources within the building. Together the two technologies are proposed to provide heat for space heating, via underfloor heating systems, and to heat hot water calorifiers to provide all hot water requirements to the building via a flow and return domestic hot water circuit. This is in addition to any electricity generated by the CHP unit.

Below are the yearly space heating (Figure 1) and hot water heating load (Figure 2) profiles taken from the thermal model.

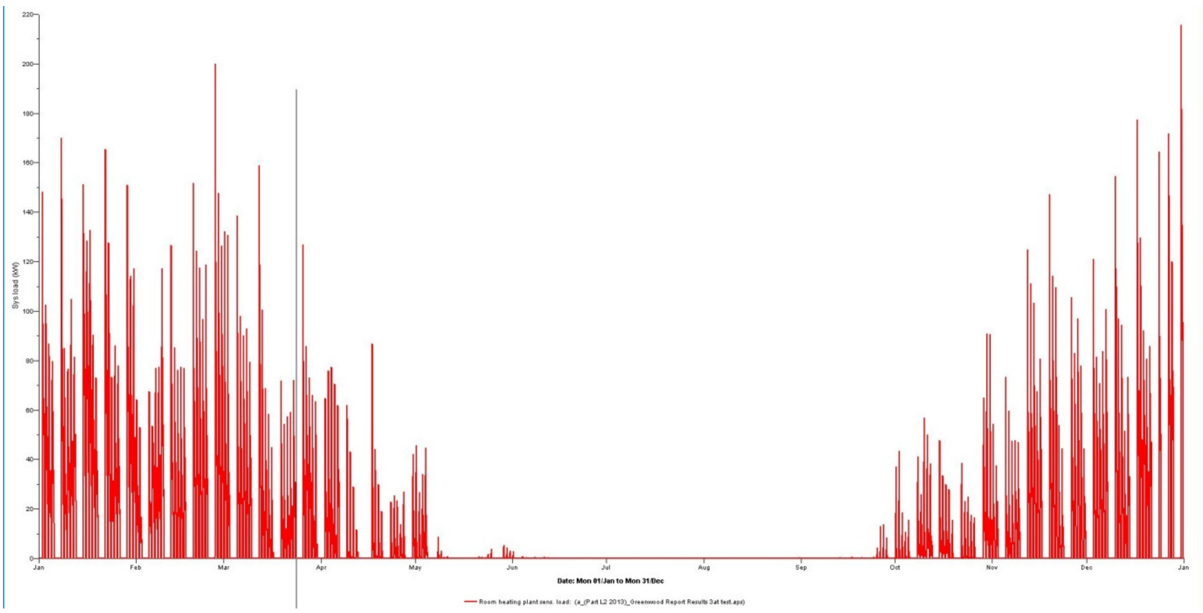


Figure 1 – Community Building Space Heating Yearly Load Profile

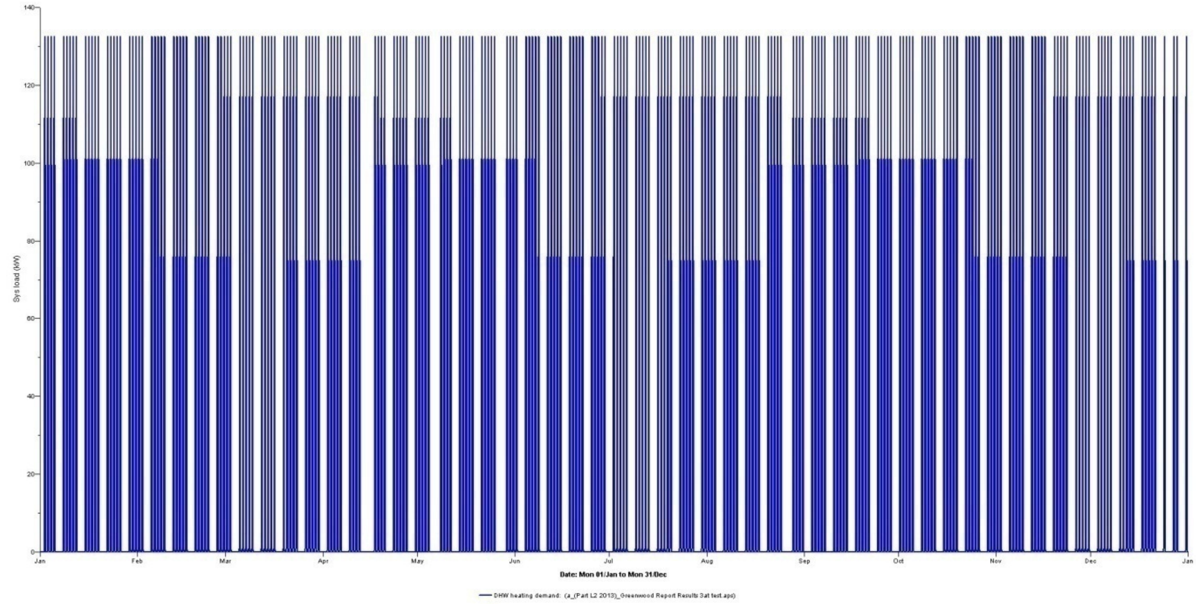


Figure 2 – Community Building Domestic Hot Water Heating Yearly Load Profile

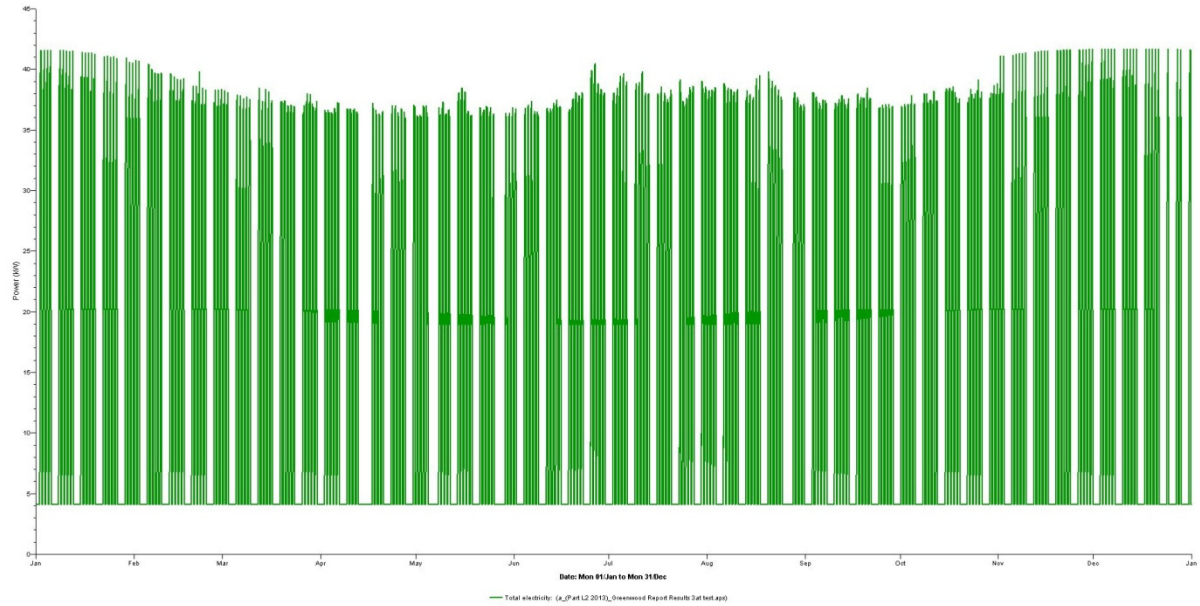


Figure 3 – Community Building Energy Electrical Load Yearly Profile

As can be seen from Figure 2 there is a year round high hot water demand, since there is a large number of toilet, washing and also kitchen facilities due to the nature of the building and its clients (elderly and infirm). This provides a good base load for the CHP unit.

Also, since the building utilises underfloor heating systems in all areas, and the underfloor heating system is a slow response type system, it is economic to run the heating for most of the heating season with a night setback.

These two demands coupled with a sizeable buffer vessel and hot water storage calorifier ensure a year round base load capacity to maximise the use of the relatively small CHP unit which will constantly trickle heat to the buffer and calorifier heat storage and even out any transients in the load requirement seen by the CHP unit.

The systems have been sized at the following:

- **CHP UNIT - 45 kW thermal; 20 kW electrical**
- **BUFFER VESSEL - 3,000 litres**
- **HOT WATER CALORIFIER - 1,500 litres**

A cost benefit analysis of the CHP unit has been carried out, and an executive summary is provided in Appendix 2. The cost benefit analysis shows that the proposed CHP unit has a payback of **7 years**. The capital cost of the CHP installation including supply and fit of the unit, pipework, flue, gas train etc. and maintenance has been taken into account in the assessment.

It can be seen from the baseline 'Be Lean' and 'Be Clean' BRUKL reports that the CHP will provide **21.77 tonnes/CO_2** reduction to the building, per annum.

Based on the evidence above, it is posited that the proposed CHP installation is highly beneficial to the scheme and proven to be feasible.

Below is an air quality assessment of the CHP installation.

3.6 AIR QUALITY

An Air Quality Assessment Report has been generated by Resource and Environmental Consultants Ltd, dated September 2013 Revision 5, which has been submitted to the LBC planning department. This sets out, in Table AIII.2 in Appendix III, that at that time the CHP units were designed with an emission rate of 0.0046 g/s NO_x emissions.

Subsequently the unit has been reselected, and the manufacturer confirms that the single CHP unit will omit 0.000957 g/s NO_x emissions.

This is considerably less than the figures previously stated in the Air Quality Assessment Report.

4.0 CONCLUDING REMARKS

As part of a planning submission for this development, an Energy Statement is required to be prepared and submitted. This document is intended to fulfil that requirement.

Development proposals are at RIBA Stage 4 and the measures and features that have been described in this document, relating to energy conservation and energy supply, are a fundamental and integral part of the Stage 4 design solution.

The output from the modelling processes described in this document and the calculated carbon emissions arising, has been assessed under the BREEAM. In both cases, buildings exceed the mandatory energy credits which are required to achieve the stated ratings of **Excellent.**

This development is entirely compatible with a long term, London-wide, drive to deliver heat and power via decentralised heat networks incorporating combined heat and power.

Project proposals include producing heat and power for the community centre by a site based combined heat and power unit supplemented with high efficiency gas fired condensing boilers and grid electricity with the opportunity for connection of other energy users in the future.

To achieve the required 25.16% carbon reduction for the community centre 44.89 kW thermal CHP is required.

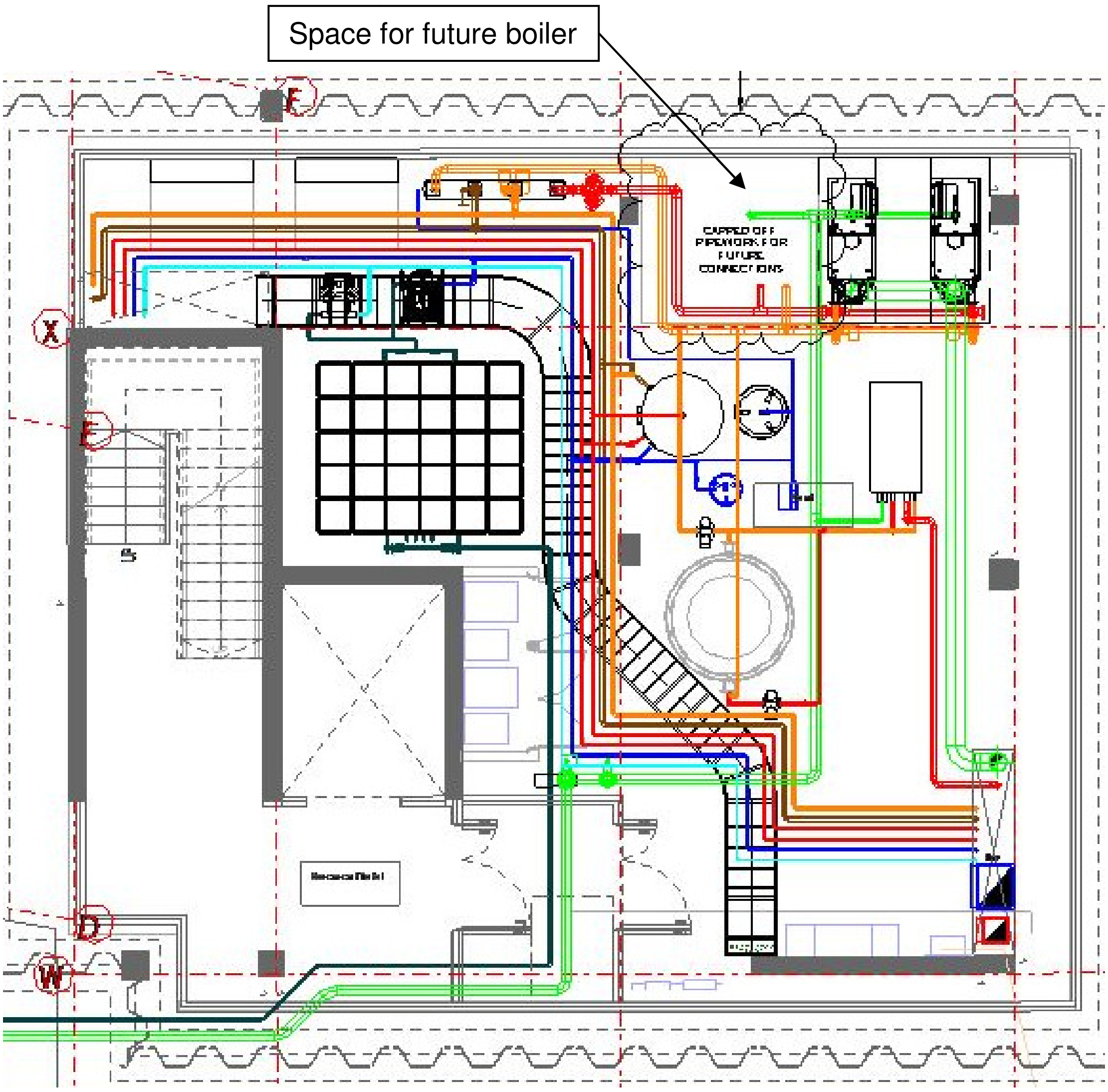
The competing need to provide green spaces and also to provide amenity space for the building users on the roof area has meant that a compromise has been made with respect to the amount of space available for renewable energy systems.

Solar photovoltaic cells have been included in the proposals and thiswill provide a contribution to the developments annual energy needs.

Other renewable technologies have been considered. However, site constraints and issues local air quality have precluded their inclusion into the scheme.

In conclusion, Synergy Consulting Engineers believe that the energy conservation and energy supply proposals described in this Energy Statement represents a pragmatic and feasible energy plan for the development.

APPENDIX 1: PLANTROOM LAYOUT



APPENDIX 2: CHP COST BENEFIT ANALYSIS

1. SITE APPRAISAL - ENERGY DEMAND

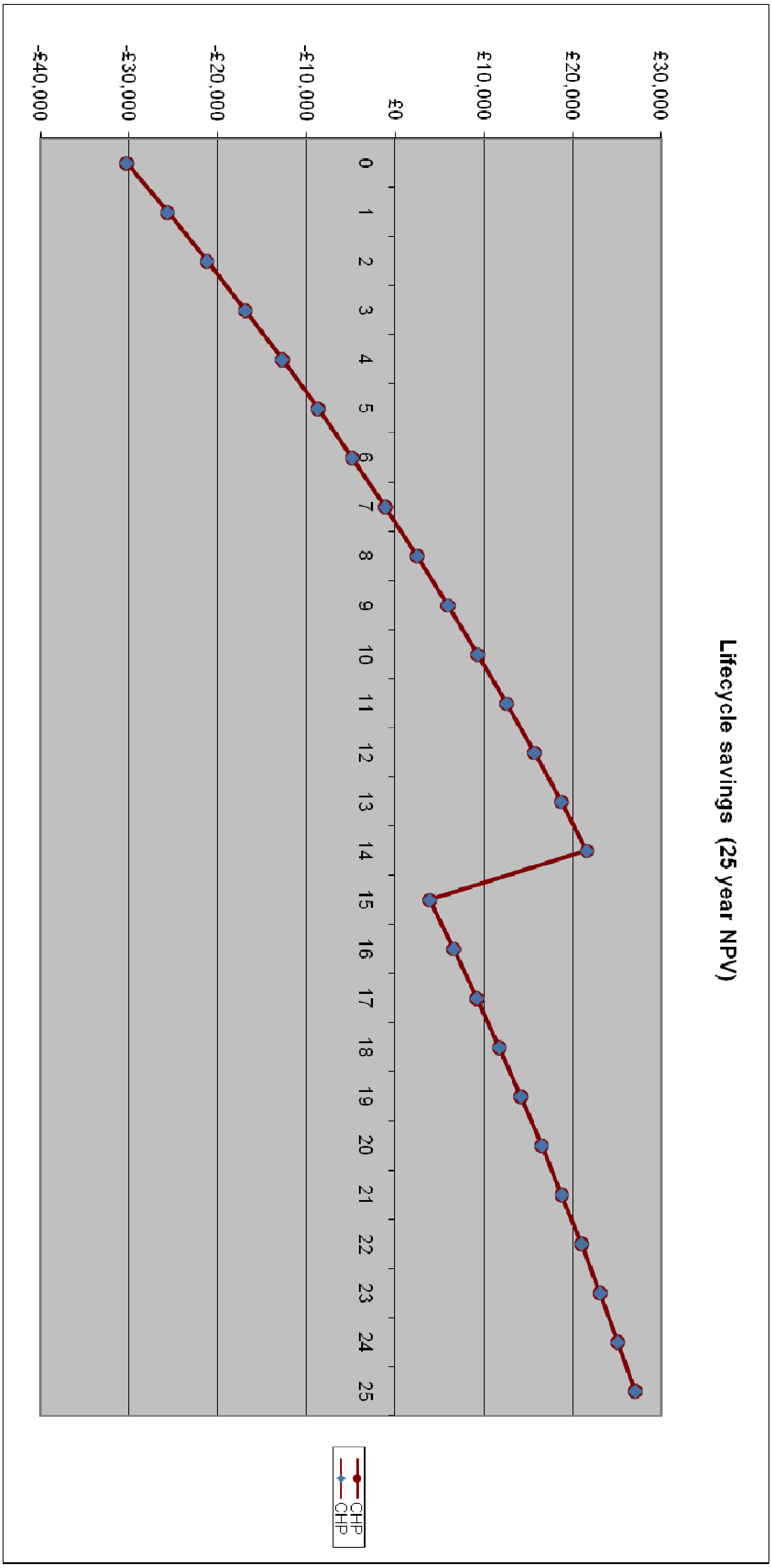
Heating (thermal)	109,666kWh
Domestic Hot Water (thermal)	317,763kWh
Electricity	137,003kWh
Gas	474,922kWh
Total CO2	164.86 T CO2
Total Fuel Cost	£41,236.88

2. TARGET CO2 REDUCTION

	41.22 T CO2

3. CHP ANALYSIS

Area of site	3,201 m2
Annual HW energy /m2	99.3 KWh/m2
Annual HTG energy /m2	34.3 KWh/m2
Annual Elec energy / m2	42.8 KWh/m2
Elec Cost from Grid	£0.1450
Elec Sale Price to Grid	£0.0400
Gas Cost (Boiler)	£0.0450
Gas Cost (CHP)	£0.0450
Boiler efficiency	91%
CHP Availability	90%
CHP Input (KW of gas)	70 KW
CHP Output (th)	45 KW
CHP Output (e)	20 KW
Elec from grid	27,542kWh
Elec to grid	14,856kWh
Gas to Boiler (top-up)	242,262kWh
Gas to CHP	414,388kWh
Total CO2	136.58 T CO2
Elec bought from grid	£3,993.57
Elec sold to grid	£594.22
Gas to top-up Boiler	£10,901.78
Gas to CHP	£18,647.48
Feed-in Tariff	0
Net annual fuel saving	£8,288.28
Capital cost (CHP)	£35,000.00
Capital Cost (Acoustic)	£0.00
Annual Maintenance	£3,500.00
Replacement	15 years
CO2 Saved	28.29 T CO2


Lifecycle savings (25 year NPV)
£30,000
£20,000
£10,000
£0
-£10,000
-£20,000
-£30,000
-£40,000
0
1
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4
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