Energy Strategy

Midland Crescent, London, NW3

Prepared by

metropolis pd as green

On behalf of

Stadium Capital Holdings

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On behalf of Stadium Capital Holdings

Produced By	Position	Date
Vitaliy Troyan	Energy and Sustainability Consultant, Accredited SAP Assessor	09/11/2012
Shaun Kelly	Senior Sustainability Consultant, Licensed Code for Sustainable Homes and BREEAM Domestic Refurbishment Assessor, BREEAM AP	09/11/2012

Approved By	Position	Date
Miranda Pennington	Partner, Licensed Code for Sustainable Homes and BREEAM DR Assessor and BREEAM Domestic Refurbishment Assessor	09/11/2012

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Contact Details:
Metropolis Green LLP
4 Underwood Row
London
N1 7LQ
T: 020 7324 2662
E: info@metropolisgreen.com
W: www.metropolisgreen.com

EXECUTIVE SUMMARY

I. This Energy Strategy has been prepared by Metropolis Green on behalf of Stadium Capital Holdings in support of an application for planning permission and conservation area consent for demolition in a conservation area for the proposed development at Midland Crescent Student Housing.

II. This report has been prepared in line with GLA guidance on energy assessments, London Plan policy, London Borough of Camden policy requirements, and follows the Mayor's energy hierarchy: Be Lean, Be Clean, and Be Green. The report describes these policies, the calculation methodology used, and the measures taken to achieve policy requirements in the design of Midland Crescent Student Housing.

III. All energy and carbon figures have been calculated using approved Simplified Building Energy Modelling (SBEM) software, which is used to demonstrate compliance with Building Regulations 2010 and BREEAM New Construction 2011 requirements.

IV. Following London Plan policy 5.2 which requires a 25% reduction in regulated carbon emissions and the London Borough of Camden's Core Strategy policy CS13, this report demonstrates that the proposal can achieve a total reduction of 69,632 $kgCO_2/yr$, this level of CO_2 reduction equates to an overall 40.5% improvement in Building Emissions Rate (BER) over Target Emissions Rate (TER).

V. London Plan policy 5.7 and the London Borough of Camden's Planning Guidance CPG3 requirements are for a 20% reduction in CO_2 emissions through the specification of on-site renewable technologies. This report demonstrates that the development at Midland Crescent Student Housing has potential to achieve a 11.06% CO_2 reduction through specification of a combination of Photovoltaic (PV) and Solar Thermal panels, which does not reach the 20% target due to conflicting demands on the roof space, however, it should be noted that this energy strategy results in an overall 34.31% reduction in regulated carbon emissions.

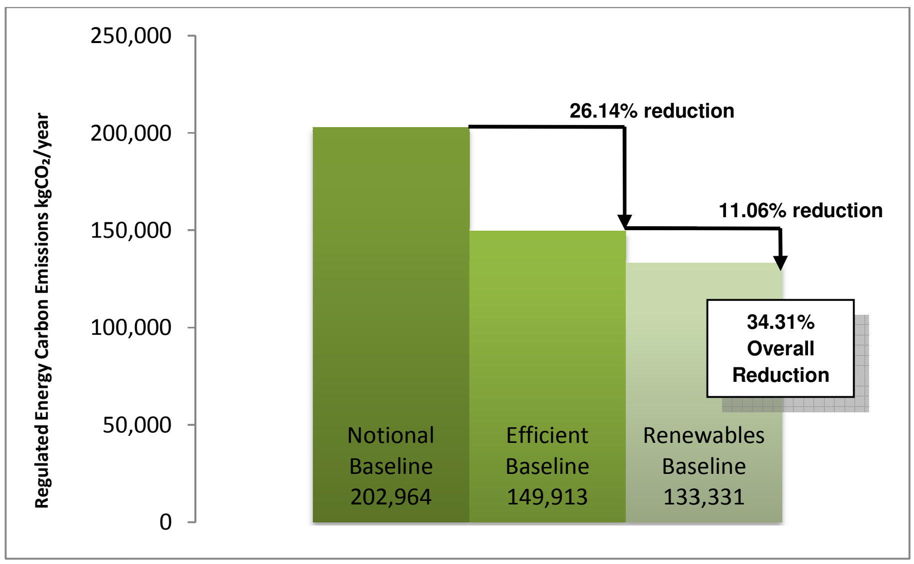
VI. Additionally, in line with the London Borough of Camden's Development Policy DP22, results of energy strategy calculations demonstrate that as a result of the energy and services efficiency measures and renewable technologies proposed, the site has sufficient improvements to achieve the required credits for issue Ene 01 – Reduction of emissions and will contribute to the achievement of BREEAM New Construction 2011 'Very Good' level certification.

VII. The achievements demonstrated in this report are the result of provision and improvement of fabric to high energy efficiency standards, high efficiency mechanical ventilation with heat recovery (MVHR) combined with the specification of communal high efficiency gas fired boilers and roof mounted PV and Solar Thermal panels.

VIII. As a part of the energy efficiency improvements all practical measures have been implemented to minimise risks of overheating. SBEM calculations have shown that the solar gain limits in summer have not been exceeded (Criterion 3 of Building Regulations Part L for new build buildings other than dwellings) and therefore considered to be at the acceptable level.

IX. Figure 1 below shows an ‘at a glance’ summary of the CO_2 reductions for the modelled solutions.

Figure 1 - Regulated Energy Renewables Baseline – PV and Solar Thermal Panels



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1.0 INTRODUCTION

1.0.1. This Energy Strategy has been prepared by Metropolis Green on behalf of Stadium Capital Holdings in support of an application for planning permission and conservation area consent for demolition in a conservation area for the proposed development at Midland Crescent Student Housing.

1.0.2. The application proposes “Erection of a part-4 and part-5 storey building with a double level basement comprising flexible commercial space (Use Classes A1/A2/A3/A4/B1/D1 & D2) at lower basement and round ground floor levels, 138 student bedrooms with communal kitchen, lounge and common room areas at upper basement to fourth floor levels, common room at fifth floor and associated landscaping to site.”

1.0.3. This Energy Strategy has considered the following key Development Plan energy policies. Where these targets have not been met in full, justification has been provided:

- London Plan policy 5.2 and London Borough of Camden Core Strategy Policy CS13 requirement to reduce carbon dioxide emissions;
- Decentralised energy use on site has been investigated in line with London Plan policy 5.6 and Westminster Core Strategy Policy CS13;
- London Plan policy 5.7 and London Borough of Camden Planning Guidance CPG 3 requirements to achieve 20% carbon reduction through the specification of on-site renewable technology;
- London Borough of Camden Development Policy 22 requirements to achieve BREEAM certification at the ‘Very Good’ level.

1.0.4. In line with the Mayor’s energy hierarchy this report assesses the energy efficiency measures of the proposed scheme and the low carbon options for supplying energy to the development before examining the potential for renewable energy technologies to reduce carbon emissions.

1.0.5. This document should be read alongside the Sustainable Design and Construction Statement and Environmental Performance Statement (Ref: 5171/SDCS-1112TP.01) produced by Metropolis Green.

2.0 POLICY CONTEXT

2.0.1 The proposed development at Midland Crescent Student Housing must comply with a number of the following policies, regulations and standards which require the calculation of energy demand and carbon emissions:

- Building Regulations 2010
- London Plan and London Borough of Camden policies
- BREEAM New Construction 2011

2.0.2 The calculations of energy demand and carbon emissions are slightly different for each of the policies/standards; this is discussed in the sections below.

2.0.3 Increased development of renewable energy resources and improvements in energy efficiency are vital to facilitating the delivery of the European, National, Regional and Local commitments on climate change. It is also worth noting that the EU has an ever increasing focus on carbon emissions and in February 2007, EU environment ministers agreed in principle to cut greenhouse gas emissions by 20% by 2020 based on 1990 levels.

2.0.4 The key documents of relevance to this development are highlighted below.

2.1 National Policy

2.1.1 Sustainable development is the core principle underpinning planning. At the heart of sustainable development is the simple idea of ensuring a better quality of life for everyone, now, and for future generations. A widely used definition was drawn up by the World Commission on Environment and Development in 1987: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

2.1.2 Planning has a key role to play in the creation of sustainable communities: communities that will stand the test of time, where people want to live, and which will enable people to meet their aspirations and potential.

National Planning Policy Framework

2.1.3 The National Planning Policy Framework (NPPF) was published in March 2012 and sets out the Government's planning policies for England, and how these policies are expected to be applied. The policies in the document, taken as a whole, constitute the Government's view of what sustainable development in England means in practice for the planning system.

2.1.4 Paragraph 14 of the NPPF states that: At the heart of the NPPF is a presumption in favour of sustainable development, which should be seen as a golden thread running through both plan-making and decision-taking. For decision-taking this means approving development proposals that accord with the development plan without delay.

2.1.5 The NPPF outlines a set of core land-use planning principles that should underpin both plan-making and decision-taking, of which are one is particularly relevant to this energy strategy report. Under paragraph 17, the principle is that planning should:

- support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy);

2.1.6 Design is addressed in section 7 of the NPPF, and paragraph 56 states: The Government attaches great importance to the design of the built environment. Good design is a key aspect of sustainable development, is indivisible from good planning, and should contribute positively to making places better for people.

2.1.7 Meeting the challenge of climate change is addressed in section 10 of the NPPF, and paragraph 93 states: Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impacts of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development.

2.1.8 Further to the above, paragraph 95 addresses local plan-making and states that to support the move to a low carbon future, local planning authorities should:

- plan for new development in locations and ways which reduce greenhouse gas emissions;

- actively support energy efficiency improvements to existing buildings; and
- when setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

2.1.9 Additionally, paragraph 96 discusses decision-taking and states that In determining planning applications, local planning authorities should expect new development to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.1.10 Lastly, it is important to note that paragraph 187 of the NPPF addresses decision-taking by local planning authorities with respect to development applications. This paragraph states that: Local planning authorities should look for solutions rather than problems, and decision-takers at every level should seek to approve applications for sustainable development where possible. Local planning authorities should work proactively with applicants to secure developments that improve the economic, social and environmental conditions of the area.

2.2 Building Regulations

2.2.1 Building Regulations exist to ensure the health, safety, welfare and convenience of people in and around buildings, and the energy efficiency of buildings. The regulations apply to most new buildings and many alterations of existing buildings in England and Wales, whether new, commercial or industrial.

2.2.2 The development at Midland Crescent Student Housing will be constructed to be compliant with Building Regulations 2010. The relevant regulations Part L2A, "The Building Regulations 2000 Approved Document L2A: Conservation of fuel and power in new buildings other than dwellings", provides a guidance on ways of complying with the energy efficiency requirements.

2.2.3 The development has been assessed for Part L compliance using approved SBEM software.

2.3 Regional Policy

2.3.1 The London Plan (2011) is the Spatial Development Strategy for London. Section 5 of the Plan covers the mitigation of, and adaptation to climate change and the management of natural resources. The London Plan supports the Mayor's Energy Strategy. The key policies regarding energy efficiency are summarised below.

Policy 5.2 - Minimising CO_2 Emissions

2.3.2 Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy

Policy 5.6 - Decentralised Energy in Development Proposals

2.3.3 Development proposals should evaluate the feasibility of CHP systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

2.3.4 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.

2.3.5 Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7 - Renewable Energy

2.3.6 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.

2.3.7 Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

2.3.8 The Mayor encourages the use of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost effective carbon dioxide emissions savings for a development proposal.

2.4 Local Policy

2.4.1 Alongside the Mayor's London Plan, the London Borough of Camden's Core Strategy sets out the key elements of the Council's planning vision and strategy for the borough. It is the central part of Local Development Framework (LDF) and was adopted in November 2010. The LDF is a group of documents setting out the borough's planning strategy and policies.

2.4.2 The Core Strategy contributes to achieving the vision and objectives of Camden's Community Strategy and helps the Council's partners and other organisations deliver relevant parts of their programmes. It covers the physical aspects of location and land use but also addresses other factors that make places attractive, sustainable and successful, such as social and economic matters. It plays a key part in shaping the kind of place Camden will be in the future, balancing the needs of residents, businesses and future generations.

2.4.3 Within the Core Strategy there are specific policies relating to sustainability.

2.4.4 The Core Strategy sets out the Council's approach to managing Camden's growth so that it is sustainable, meets our needs for homes, jobs and services, and protects and enhances quality of life and the borough's many valued and high quality places. Section 3 focuses on delivering the key elements of Camden's strategy relating to:

- making Camden more sustainable and tackling climate change, in particular improving the environmental performance of buildings, providing decentralised energy and heating networks, and reducing and managing our water use;

- promoting a more attractive local environment through securing high quality places, conserving our heritage, providing parks and open spaces, and encouraging biodiversity;

- improving health and well-being;

- making Camden a safer place while retaining its vibrancy; and

- dealing with our waste and increasing recycling.

2.4.5 The implications of our actions on the environment are increasingly clear and action is needed at global, national and local levels. The Core Strategy has an important role in reducing Camden's environmental impact and achieving sustainable development – meeting our social, environmental and economic needs in ways that protect the environment and do not harm our ability to meet our needs in the future. A Sustainable Camden that adapts to a growing population is one of the elements in the vision in Camden's Community Strategy.

2.4.6 The Core Strategy Policy CS13 sets out the approach that developers should take when considering energy and carbon reductions for developments.

CS13 – Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change

2.4.7 The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) promoting the efficient use of land and buildings;

c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:

14.1 ensuring developments use less energy, 14.2 making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralized energy networks;

14.3 generating renewable energy on-site; and

d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

2.4.8 The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions.

Local energy generation

2.4.9 The Council will promote local energy generation and networks by:

e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them,

f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road).

Camden's carbon reduction measures

2.4.10 The Council will take a lead in tackling climate change by:

g) taking measures to reduce its own carbon emissions;

h) trialling new energy efficient technologies, where feasible; and

i) raising awareness on mitigation and adaptation measures.

2.4.11 The Core strategy has informed the Council's Development Polices. Section 3 of this document set out a number of policies to promote sustainability and tackle climate change.

2.4.12 The objectives of Section 3 are enforced through policy DP22 Promoting sustainable design and construction.

Policy DP22 - Promoting sustainable design and construction

2.4.13 The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5, have been incorporated into the design and proposed implementation; and

b) incorporate green or brown roofs and green walls wherever suitable.

2.4.14 The Council will promote and measure sustainable design and construction by:

c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.

2.4.15 The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;

g) limiting run-off;

h) reducing water consumption;

i) reducing air pollution; and

j) not locating vulnerable uses in basements in flood-prone areas.

Camden Planning Guidance Sustainability (CPG3)

2.4.16 The Core Strategy is supported by Supplementary Planning Documents (SPDs) which play an important role in planning decisions. SPDs provide detailed guidance on how planning strategy and policies will be implemented for specific topics, areas and sites.

2.4.17 CPG3 contains advice and guidance for developers on ways to achieve carbon reductions and more sustainable developments. It also highlights the Council's requirements and guidelines which support the relevant Local LDF policies, including DP22 as noted above.

2.4.18 Section 9 covers sustainability assessment tools, with BREEAM being of particular relevance to this development. The key message of the document is that development of 500sq m or more of non-residential floorspace will need to be designed in line with BREEAM.

2.4.19 Developers are strongly encouraged to meet the following standards in accordance with Development Policy DP22 - Promoting sustainable design and construction:

Table 1 - DP22 Target Summary

Time period	**Minimum rating**	**Minimum standard for categories (% of un-weighted credits)**
2010-2012	Very Good	Energy 60% Water 60% Materials 40%
2013 +	Excellent	

2.5 Environmental Assessment Method: BREEAM 2011 New Construction

2.5.1 BREEAM is the world's leading and most widely used environmental assessment method for buildings. It sets the standard for best practice in sustainable design and is used to describe a building's environmental performance.

2.5.2 BREEAM 2011 New Construction is a performance based assessment method and certification scheme for new buildings. The primary aim of BREEAM 2011 New Construction is to mitigate the life cycle impacts of new buildings on the environment in a robust and cost effective manner.

2.5.3 The BREEAM 2011 New Construction scheme can be used to assess the environmental life cycle impacts of new non-domestic buildings at the design and construction stages. 'New Construction' is defined as development that results in a new standalone structure, or new extension to an existing structure, which will come into operation/use for the first time upon completion of the works.

2.5.4 The proposed development at Midland Crescent consists of two building uses: commercial space on the lower ground -2 level and student accommodation units (and ancillary cycle storage, lobby, management and common room uses) on the other levels of the building. For the purposes of a BREEAM pre-assessment, the commercial space has been defined as an office building type as a generic standard, given that the future use is not known at this stage. The student accommodation use has been defined as a multi-residential (student halls of residence) building type. In order to demonstrate the ability to achieve certification at the desired rating, separate BREEAM pre-assessments have been prepared under the office and multi-residential building types, and are found as Appendices A and B to the Sustainable Design and Construction Statement report produced by Metropolis Green (ref: 5171/SDCS-1112TP.01).

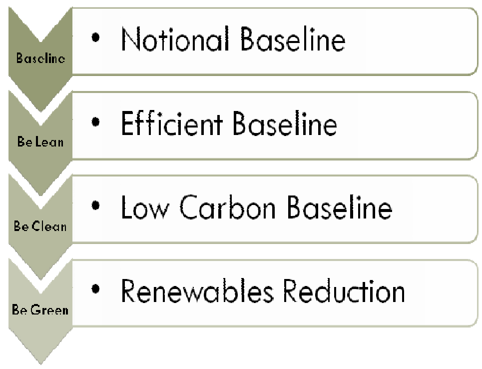
2.5.5 BREEAM credits are also awarded in 9 categories (plus an additional Innovation category) of sustainable design according to performance. These credits are then added together to produce a single overall score on a scale of Pass, Good, Very Good, Excellent and Outstanding, dependent on the total score received from achieving credits across the various categories. There are minimum standards that must be achieved in order to meet the higher rating levels under BREEAM. For more detail, please refer to the BREEAM 2011 New Construction Technical Manual (see the reference in section 2.0 of this report).

2.5.6 A scheme can be assessed at Design Stage (DS) - leading to an Interim BREEAM Certificate and/or at the Post Construction Stage (PCS) – leading to a Final BREEAM Certificate.

3.0 METHODOLOGY

3.0.1 The methodology that has been applied to this energy strategy is in line with the document 'GLA Guidance on preparing energy assessments'[1] and the Mayor's energy hierarchy of Be Lean and use energy efficiently, Be Clean and supply low carbon energy efficiently and Be Green and produce renewable energy. This is illustrated in Figure 2 below.

Figure 2: Energy Hierarchy



3.0.2 The Notional Baseline and associated carbon emissions for the proposed development at Midland Crescent Student Housing have been calculated using SBEM, the approved national calculation methodology for the purpose of compliance with Building Regulations Part L2A for non-domestic buildings.

3.0.3 The Mayor's energy hierarchy requires that energy efficiency should be maximised in the first instance. Energy efficiency of buildings can be improved by increasing the levels of insulation and air-tightness in order to reduce heat losses; the Building Regulations specify minimum standards in this respect. A range of options have been considered including high thermal performance fabric and high efficiency heating equipment, which combined reduce energy demand and carbon emissions of the development. From this a new energy consumption and carbon baseline is calculated and referred to as the Efficient Baseline.

3.0.4 GLA Guidance, the energy hierarchy methodology, London Plan and London Borough of Camden require that all new developments consider decentralised energy generation technology and communal heating systems. CHP, communal heating and hot water systems are

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[1] Greater London Authority September 2011

examined in terms of their suitability for the site, the impact of these technologies is assessed and a new baseline calculated which reduces the CO_2 emissions of the Efficient Baseline further and it is referred to as the Low Carbon Baseline.

3.0.5 The reduction in carbon emissions from on-site renewables must then be investigated. This includes a feasibility appraisal of each of the approved renewable energy technologies in terms of their contribution to meeting the carbon reduction. The most feasible and suitable technology is applied and carbon emissions reduction calculated, this is referred to as the Renewables Baseline.

4.0.1 GLA guidance promote a ‘whole energy’ approach to calculating the energy demand and carbon baseline of the developments.

1. The energy assessment should clearly identify the carbon footprint of the development after each stage of the energy hierarchy. Regulated emissions should be provided and, separately, those emissions associated with uses not covered by Building Regulations (i.e. unregulated energy uses). Note: unregulated emissions are likely to be the same after the first stage of the energy hierarchy.

2. The applicant should also provide a breakdown of emissions for heating, cooling and electricity demand. The purpose of this information is to help identify the technical feasibility of demand reduction measures, CHP including district heating, and renewable energy technologies.

3. Regulated emissions, which include the energy consumed in the operation of the space heating/cooling and hot-water systems, ventilation, internal lighting, should be calculated. Separately, unregulated emissions i.e. those relating to cooking and all electrical appliances and other small power, should be calculated.

4. Emissions for non-domestic development should establish:

    a. A Building CO_2 Emissions Rate (BER) calculated through the Building Regulations 2010 methodology based on the National Calculation Methodology (NCM) and implemented through SBEM v4 or later or equivalent software. Additional emissions associated with non Building Regulation elements established by using individual end use figures (for example catering and computing) from CIBSE guide baselines (e.g. CIBSE Guide F) or evidence established through previous development work.

b. A short summary of the modelling work output (i.e. a print out such as a BRUKL report) should be provided in an appendix of the energy assessment.

3.0.6 To allow a full comparison results and figures are presented for both unregulated energy and carbon emissions as well as for regulated combined with unregulated emissions which are referred to as 'Whole Energy' for clarity.

3.0.7 Please note that the calculations in this report are based on drawings and information provided pre-planning approval, and as such should be considered subject to change. These results are intended to provide initial assessment of the design to ensure that planning policies can be achieved at this site.

3.0.8 The commercial unit will be let as Shell and Core and as such the minimum standards set out in the document *Non Domestic EPC Conventions for England & Wales Issue 2.0,* have been used to specify the mechanical and electrical (M&E) services and the lighting power density of the retails unit, in order to determine energy performance of the retail unit. These standards have been selected as the M&E plant and services will be specified by the tenant and as such minimum standard performance is expected.

4.0 SITE ENERGY DEMAND & NOTIONAL BASELINE

4.0.1 The development at Midland Crescent Student Housing has been modelled to comply with the current 2010 Building Regulations and Metropolis Green has determined the energy and carbon data using approved SBEM software. Full detailed results are provided in Appendix A of this report.

4.0.2 Table 2 below provides a breakdown of the energy demand for the development. The Notional Baseline represents energy consumption and associated carbon emissions of the proposal and is shown graphically in Figure 3 below and the SBEM input parameters used are set out in Table 3 below.

4.0.3 At this stage, no energy efficiency measures have been applied to this baseline. Improving the energy performance of the building is the next step, detailed in Section 5.0.

Table 2 - Predicted Notional Baseline

Notional Baseline	
Space Heating Energy kWh/yr	215,634
DHW Energy kWh/yr	467,660
Cooling kWh/yr	0
Lighting Energy kWh/yr	108,001
Aux Energy kWh/yr	22,891
Un-Reg Energy kWh/yr	267,434
'Whole Energy' Carbon Emissions $kgCO_2/yr$	341,227
Regulated Carbon Emissions $kgCO_2/yr$	202,964
BER	27.7

Figure 3 - The Energy Hierarchy – Notional Baseline CO_2 Emissions (Regulated Emissions only)

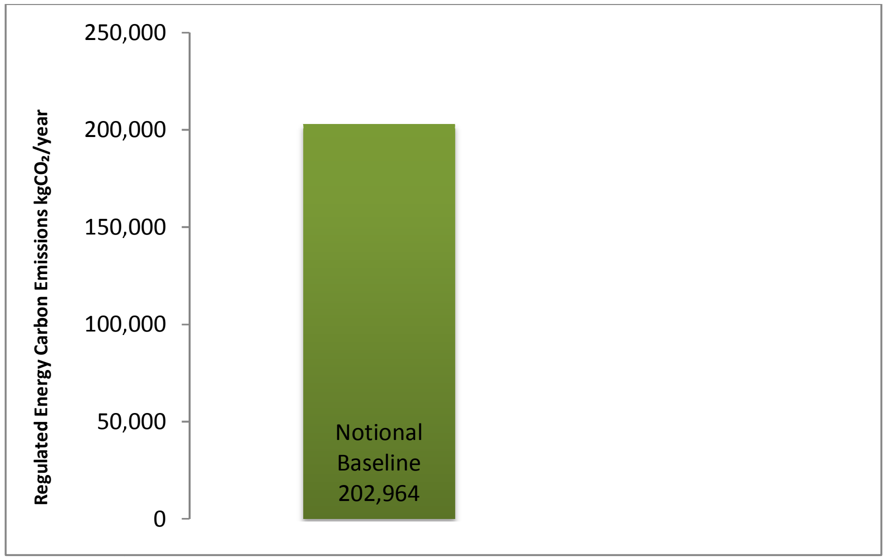


Figure 4 - The Energy Hierarchy – 'Whole Energy' Notional Baseline CO_2 Emissions (Regulated and Unregulated Emissions)

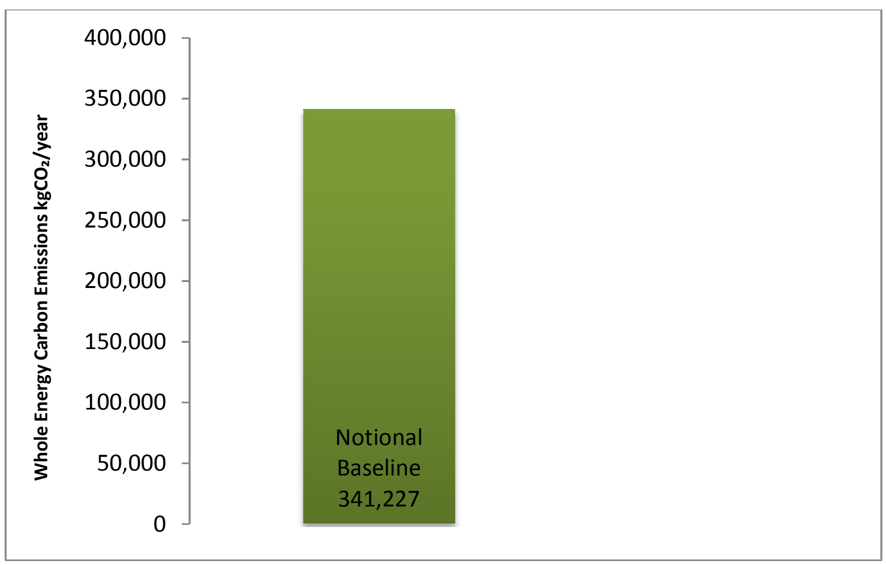
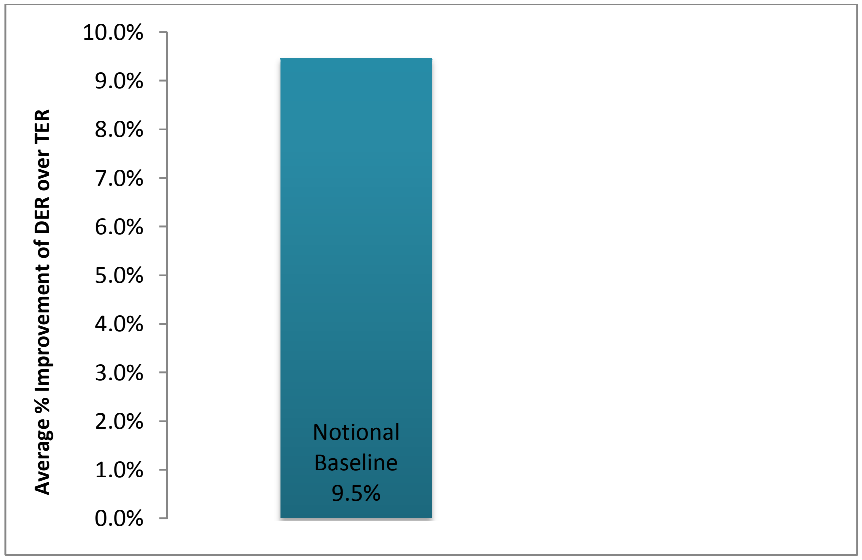


Figure 5 – Notional Baseline BER over TER Improvement



5.0 BE LEAN – ENERGY EFFICIENCY MEASURES

5.0.1 The first stage in the energy hierarchy is to determine the improvement in the energy performance of the building based on fabric and services specifications.

5.0.2 Metropolis Green have worked with the project architects, CZWG Architects LLP to determine the most efficient and feasible way to reduce the carbon emissions of the development.

5.0.3 Minimising heat loss from the building fabric to avoid wasted energy is essential. Heat loss through walls, windows and surface areas of the building must be significantly lower than Building Regulations recommended values, requiring specification of building fabric with low u-values and low rates of uncontrolled air infiltration.

5.0.4 Heat loss through thermal bridges, where the continuity of insulation and/or the building envelope is broken, can be minimised through excellent workmanship and careful design, such as: arrangement of structural elements to ensure that continuity of insulation is maintained or insulating them separately.

Energy Efficiency Measures

5.0.5 Improving the fabric and services efficiency is the most effective way of reducing carbon emissions as these measures will last the lifetime of the building. Reducing the Notional Baseline carbon emissions in turn reduces the amount of low carbon and renewable energy technologies required to comply with regulations and policies, as well as lowering development and operational costs.

5.0.6 The u-values and input parameters that have been used to achieve the optimum improvement over the Notional Baseline are shown in Table 3 below.

Table 3 - Summary of Input Parameters for Notional and Efficient Baselines

SBEM Parameters:	Notional Baseline	Efficient Baseline
External Wall U-value:	0.35	0.20
Ground Floor / Basement Floor U-value	0.25	0.15
Flat Roof U-value	0.25	0.15
Windows & Openings U-values	2.00	1.40
Air Permeability	10	5
DHW System	Communal gas boilers 81%	Communal gas boilers 93%
Space Heating System	Communal gas boilers 81%, underfloor heating, Variable speed pumps with multiple pressure sensors, optimum start/stop	Communal gas boilers 93%, underfloor heating. Variable speed pumps with multiple pressure sensors, metering with out of range alarm, weather compensation, optimum start/stop
Ventilation System	MEV	Mechanical with heat recovery, SFP 0.7 W/l.s, 85% efficiency
Lighting Total Wattage	8 W/m^2	5 W/m^2

5.0.7 Thermal performance of external walls, roofs, the ground floor will be improved with a high thermal performance insulation and the windows are to be high performance double glazing, achieving better than Building Regulations compliant minimum standards. Improving these elements will improve the overall efficiency of the development.

5.0.8 Further energy efficiency measures can also be applied to space heating and hot water generation utilising 93% efficient gas boilers for domestic hot water and space heating. Additional heating system control features such as zone and time and temperature controls, will be required.

5.0.9 The design team have committed to going beyond the minimum low energy lighting requirements and will specify lighting at 5W/m^2.

5.0.10 As a result of the above measures and improvements, a new energy demand and carbon baseline has been calculated from the Notional Baseline and is referred to as the Efficient Baseline. This new Efficient Baseline completes the first stage of the energy hierarchy, to be lean and use energy efficiently, as illustrated in Table 4 below.

Energy and CO_2 Reductions

5.0.11 The predicted CO_2 reduction measured from the Notional Baseline and delivered through the efficiency measures detailed above equates to 53,050 $kgCO_2$/year, or an overall 26.14% reduction (Figure 6).

5.0.12 Based on SBEM calculations the fabric and service efficiency improvements detailed above result in a 33.3% improvement of BER over TER which meets and exceeds the London Plan policy 5.2 target for a 25% improvement in BER over TER. Table 4 below sets out energy and carbon emission results for the Efficient Baseline.

Table 4 - Efficient Baseline Energy and Carbon Emissions

Efficient Baseline	
Space Heating Energy kWh/yr	29,495
DHW Energy kWh/yr	402,728
Cooling kWh/yr	0
Lighting Energy kWh/yr	79,240
Aux Energy kWh/yr	45,196
Un-Reg Energy kWh/yr	267,434
'Whole Energy' Carbon Emissions $kgCO_2$/yr	288,176
% Improvement over Notional Baseline 'Whole Energy'	15.55%
RegulatedCarbon Emissions $kgCO_2$/yr	149,913
% Improvement over Notional Baseline Regulated Emissions	26.14%
% Improvement BER over TER	33.3%

Figure 6 - Be Lean – 'Whole Energy' Efficient Baseline

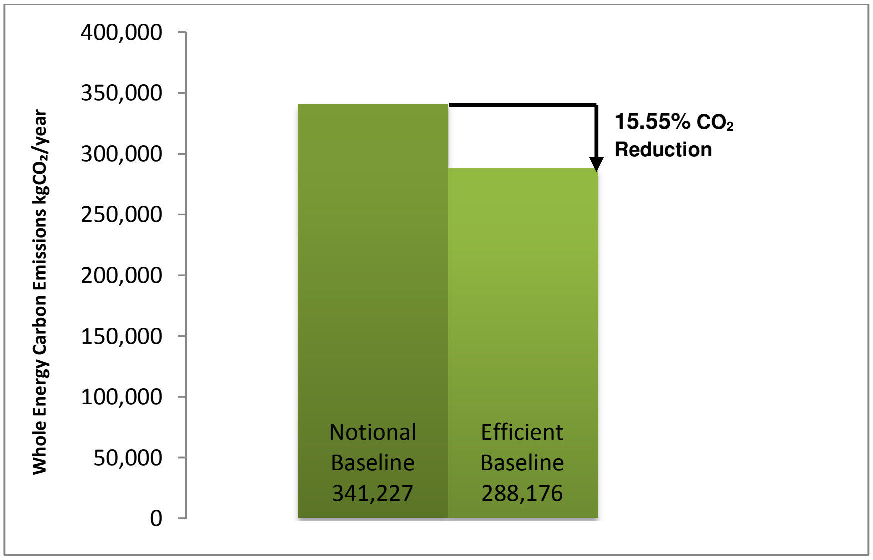


Figure 7 - Be Lean – Regulated Energy Efficient Baseline

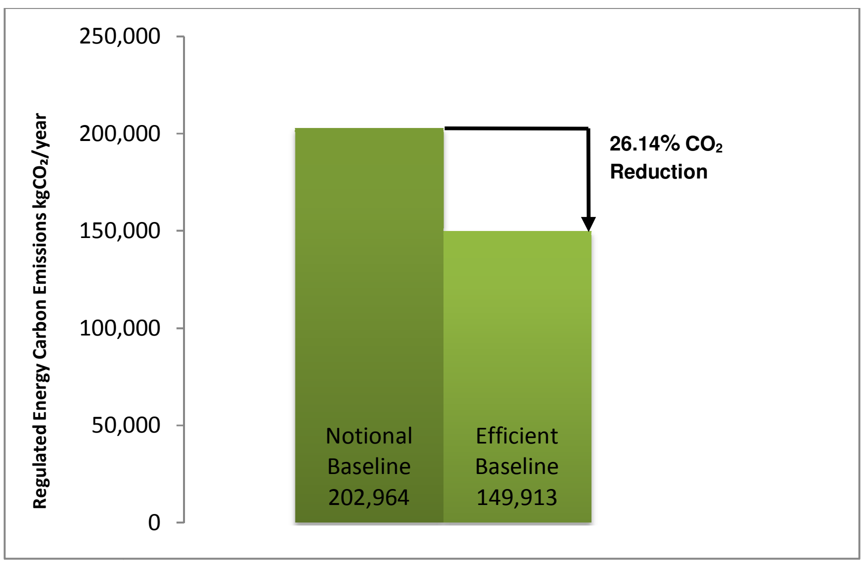
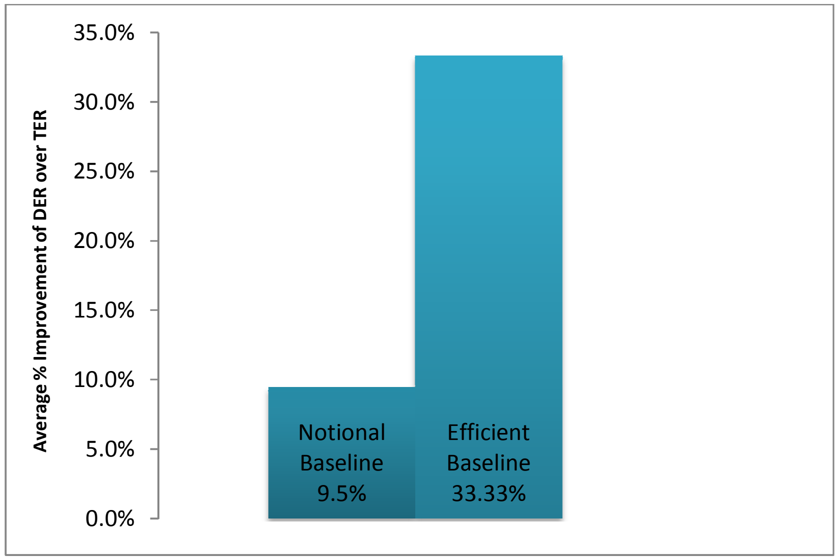


Figure 8 – Efficient Baseline BER over TER Improvement



5.1 Overheating and Cooling

5.1.1 The design team have worked to ensure that the risk of summer overheating and reliance on mechanical cooling is minimised in line with the 'cooling hierarchy'. This is demonstrated through the application of passive design measures for the development.

5.1.2 Internal heat generation has been minimised through energy efficient design. The proposal for Midland Crescent Student Housing demonstrates that issues of potential overheating have been considered carefully and addressed through a combination of high levels of fabric performance and insulation and energy efficient design, resulting in low U-values.

5.1.3 The orientation of the building is constrained by the site location, existing neighbouring railway lines and street orientation. Due to the location of the site and the impacts of noise and air pollution, (as set out in the Local Air Quality Assessment produced in support of the application by Ramboll), windows will not be openable and passive ventilation cannot be provided to either the commercial spaces or the accommodation units on site.

5.1.4 Fresh air ventilation will be provided to the whole building via a mechanical ventilation system including heat recovery which will contribute to mitigating the risk of summer overheating. Air intakes for the living areas will be on the roof of the developments, away from the main road in order to avoid high concentrations of pollutants.

5.1.5 All accommodation units will be fitted with internal blinds allowing occupants further passive options for controlling internal temperatures.

5.1.1 The commercial space is being developed as shell and core and as such comfort cooling will not be specified, however due to practical concerns associated with noise and air pollution combined with commercial viability factors, space will be available for future cooling plant on the roof should it be required by commercial tenants.

5.1.2 SBEM calculations show that the solar gain limits in summer have not been exceeded (Criterion 3 of Building Regulations Part L for new build buildings other than dwellings) and therefore considered to be at the acceptable level for the Midland Crescent Student Housing proposal.

5.1.3 During operation of the building, mechanical ventilation and internal blinds will aid the occupants in managing their internal environment.

5.1.4 This report shows that all practical measures have been taken to minimise risks of overheating and cooling demand. These measures are in line with the 'cooling hierarchy' and include passive and low energy measures.

6.0 BE CLEAN – COMMUNAL HEATING AND COMBINED HEAT & POWER

6.0.1 The second stage in the Mayor’s energy hierarchy is to investigate the application of CHP to the site, to produce energy more efficiently with the aim of reducing the carbon baseline further.

6.0.2 The Mayor requires that all new developments consider CHP, a decentralised energy generation technology, before renewables are applied to the site. Building up a network of mini-power stations that are far more efficient than traditional centralised power stations is an important part of the Mayor’s overall strategy to move London towards its long term carbon reduction targets.

6.0.3 CHP is an engine which produces electricity. The process of creating the electricity produces heat as a by-product. Heat can be easily stored in a thermal storage tank and distributed across the site to provide for the hot water and heating demands of the site.

6.0.4 The Mayor’s energy hierarchy and the London Plan Policy 5.6 require all major developments to demonstrate that the proposed energy systems have been selected in accordance with the following hierarchy:

- Connection to existing heating or cooling networks
- Site wide CHP network
- Communal heating and cooling.

6.0.5 The order of preference has been adhered to and as there is not an existing CHP distribution network in close proximity to the site it is not possible to implement the first option.

6.0.6 A preliminary study of the application of CHP to the site has been undertaken in order to assess if CHP is a suitable technology for the proposed scheme and to determine the level of CO_2 reduction that can be expected. This is an initial study to determine feasibility and CO_2 reductions.

6.0.7 The preliminary study of the application of CHP is based on a CHP engine providing space heating and DHW to the development with modulating output at varying efficiencies between 25% and 100% to account for peaks and troughs in hot water demand.

Feasibility

6.0.8 A communal CHP solution has been investigated and found not to be the optimal technology for this site primarily due to the impacts such a system would have on local air quality.

6.0.9 Initial investigations regarding the possible incorporation of a CHP unit in to the design included screening modelling of emissions to air from the unit. Results of this exercise showed that a CHP would have an adverse impact on air quality. CHP was therefore not included in the proposal. For further details please see the Local Air Quality Impact report produced by Ramboll in support of the planning application for this proposal.

6.0.1 It has been established that the specification of highly efficient gas fired communal boilers providing space heating and DHW together with the fabric improvements discussed in section 5.0 above delivers the optimal carbon reductions in the most cost effective way with minimal local air quality impacts and satisfies the London Plan policy 5.6 requirements.

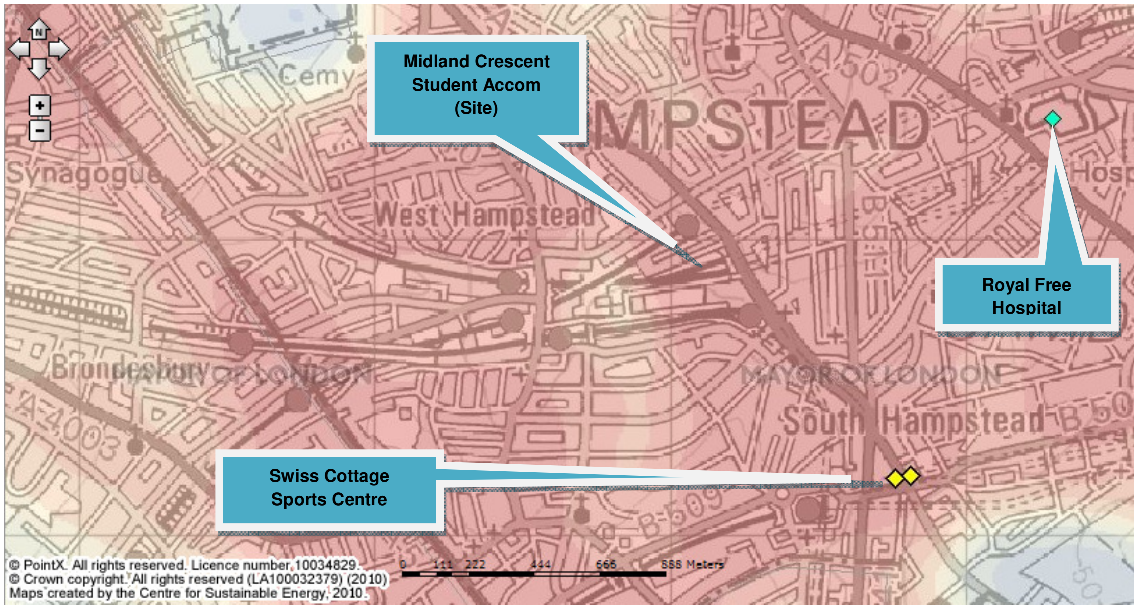
Local Connection

6.0.2 An investigation of the area was undertaken using the London Heat Map tool to determine opportunities to connect to existing heat infrastructure.

6.0.3 Investigation into existing and proposed heat networks in the area using the London Heat Map has shown that the nearest existing CHP installations are located at the Royal Free Hospital and the Swiss Cottage Sports Centre 1700m and 1000m distant respectively. There are no existing or proposed district heat networks which could be considered for connection either now or in the future. Consideration has been given to connection to the existing CHP installations but it has been determined that connection to any of these facilities is not feasible due the distance between the sites (see Figure 9 below). Additionally the cost involved in infrastructure works would be extremely high and would include not only the cost of digging the roads and laying pipes but would be very disruptive to the local area in terms of road closures.

6.0.4 Provision for future connection to a district heat network will be included in the M&E design to ensure that in future, if a heat supply from a district heat network were to become available, the site could be connected easily and with minimal cost and disruption.

Figure 9 - London Heat Map Indicating CHP Sites and District Heat Networks



7.0 BE GREEN – RENEWABLE ENERGY TECHNOLOGY

7.0.1 The third stage of the energy hierarchy refers to the production of renewable energy, which relates to London Borough of Camden and London Plan policies.

7.0.2 Each of the approved renewable energy technologies have been appraised, examining the size and cost of each system required to maximise CO_2 reductions. The feasibility of each technology at the proposed site is also discussed in the following sections in order to determine the most suitable solution for the site.

7.0.3 London Plan approved renewable energy technologies include:

- Wind
- Photovoltaics
- Solar Water systems
- Biomass Heating / CHP
- Ground Sourced Heating / Cooling

7.0.4 The choice of technology will be dependent upon a range of factors including: orientation, height, window size, surrounding buildings and environment, site size and layout, geology, conservation and biodiversity.

7.0.5 London Plan Policy 5.7 and London Borough of Camden CPG3 requirements for a 20% reduction in CO_2 emissions (where feasible) as a result of specification of onsite renewables, have not been met due to the constraints of the site, including neighbouring and underground infrastructure and competing uses for the roof space including plant, access, green roof and renewables.

7.0.6 It has been determined that a combination of PV panels and Solar Thermal water heating, is a viable and feasible solution at Midland Crescent Student Housing, in terms of striving to achieve the London Borough of Camden’s target of 20% energy reduction through the use of renewables.

7.0.7 The following sections set out the energy and carbon reductions achievable and the feasibility & applicability of the approved renewable technologies to the applications proposal.

7.1 Solar Photovoltaic and Solar Thermal

7.1.1 Photovoltaic systems convert solar energy directly into electricity through semiconductor cells. The panels generate electricity from both direct light and diffuse light. Photovoltaic panels can either be mounted external to the building or be integrated into the building cladding (known as Building Integrated Photovoltaic or BIPV).

7.1.2 Solar Thermal hot water heating systems harvest energy from the sun to heat water. The solar heating collectors are generally positioned on the roof of a building, they can also be wall mounted, although with reduced efficiency. A fluid within the panels, heats up by absorbing solar radiation. The fluid is then used to heat up domestic water which is stored in a separate water cylinder.

Feasibility

7.1.3 It has been determined that both Solar Thermal panels PV panels are considered to be a feasible options for this the Midland Crescent Student Housing site, in terms of aiming to achieve the London Borough of Camden's target of 20% energy reduction through the use of renewables. The PV panels offering significant reductions in electrical energy and the Solar Thermal panels reducing energy related to hot water consumption.

7.1.4 Results of implementing Solar Thermal and PV panel are summarised in Table 5 below. The proposed solution will contribute to delivering an overall 34.31% CO_2 reduction for the site, further increasing the BER over TER improvement of the development to 40.5% (Figure 11). This achievement contributes to further exceeding the London Plan policy 5.2 targets, that require new development to reduce their carbon emissions by 25% and achieves CS13 targets to reduce carbon emissions. The calculated BER of the development is 18.2 $kgCO_2/m^2$.

7.1.5 The available roof space has been investigated and it has been determined that there is sufficient space for a total of 78no (100 m^2) PV panels. With an array of this size it is possible to offset the electrical consumption of the development by a total of 11,299 kWh/year, hence lowering the carbon emissions of the development by 16,582 $kgCO_2$/year from the Efficient Baseline.

7.1.6 With a total of 43no (100 m^2) Solar Thermal panels, the hot water consumption of the development will be offset by a total of 53,560 kWh/yr, reducing the carbon emissions of the development by 10,605 $kgCO_2$/yr.

7.1.7 A total 11.06% carbon reduction can be achieved with the modelled onsite renewables. The roof has been utilised to its full potential, although due to the conflicting demands for the use of the roof space available for the efficient placement of the PV and Solar Thermal arrays the London Plan Policy 5.7 and DP22 target for a 20% reduction in CO_2 emissions through the specification of renewables has not been met, although it should be noted that all other targets are exceeded and a significant overall 34.31% CO_2 reduction has been achieved for the site.

7.1.8 Results of implementing the PV and Solar Thermal panels are summarised in Table 5 below. The carbon reductions illustrated graphically in figures below.

Table 5 - Energy and Carbon Emissions with PV and Solar Thermal Panels

Renewables Baseline	
Space Heating Energy kWh/yr	29,495
DHW Energy kWh/yr	349,168
Cooling kWh/yr	0
Lighting Energy kWh/yr	79,240
Aux Energy kWh/yr	45,196
Un-Reg Energy kWh/yr	267,434
'Whole Energy' Carbon Emissions $kgCO_2/yr$	271,594
% Improvement over Efficient Baseline 'Whole Energy'	5.8%
Regulated Carbon Emissions $kgCO_2/yr$	133,331
% Improvement over Efficient Baseline Regulated Emissions	11.06%
% Improvement BER over TER	40.5%

metropolis green

Figure 10 - Be Green - 'Whole Energy' Renewables Baseline – PV and Solar Thermal Panels

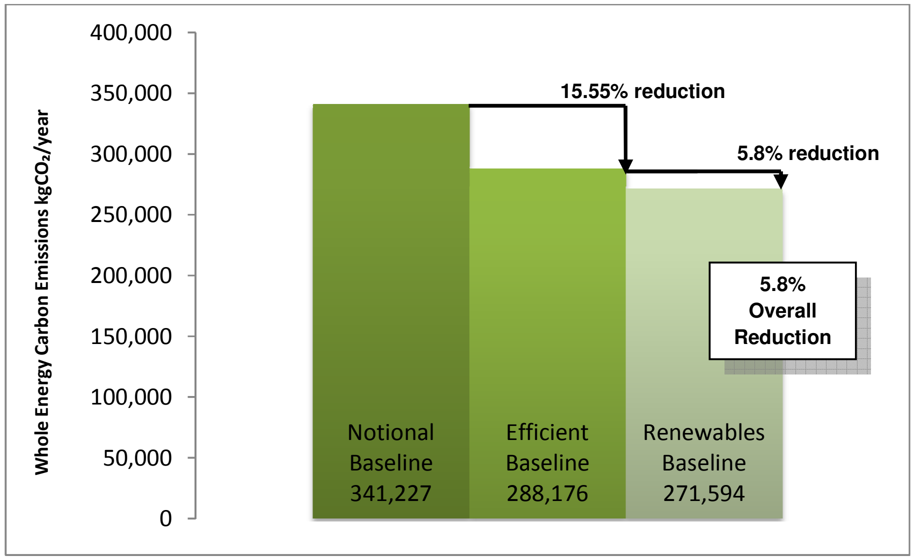


Figure 11 - Be Green – Regulated Energy Renewables Baseline – PV and Solar Thermal Panels

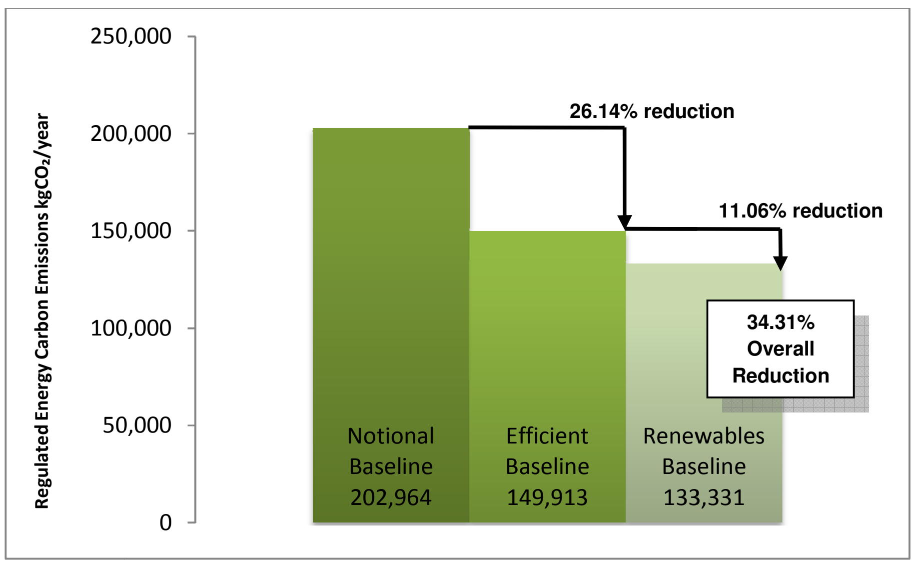
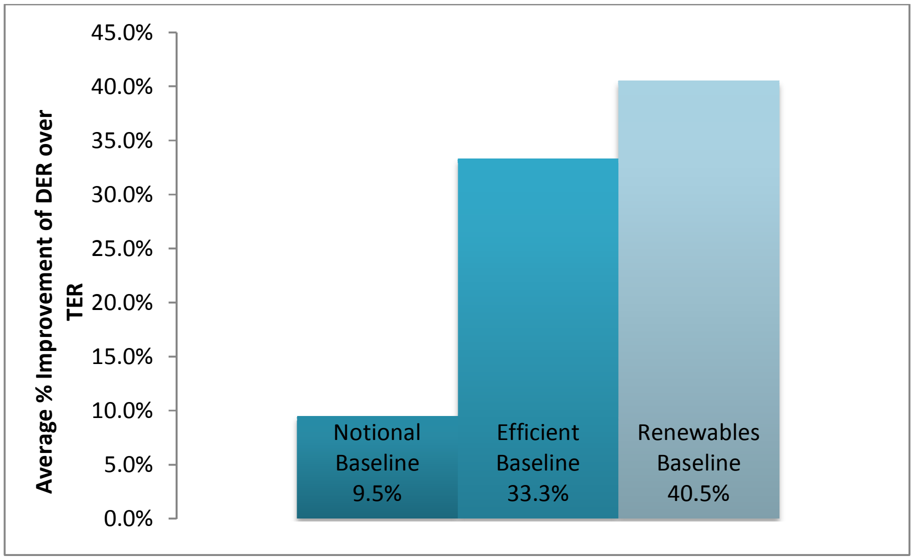


Figure 12 - Be Green – Renewable Baseline BER over TER Improvement



Plant Selection and Maintenance

7.1.9 Careful consideration has been given to maximising the use of PV and Solar Thermal on site to both provide renewable energy to the site and to meet London Plan, BREEAM and London Borough of Camden policy targets. Efforts have been made to ensure the visual impact of panels is minimised, and to ensure the appropriate placement for optimal orientation and functionality of the panels.

7.1.10 The modelled PV array was based on 78no. mono-crystalline silicon midrange (185Wp) PV panels with an efficiency of 14.5%. This equates to a total PV area of 100 m^2.

7.1.11 Based on SBEM calculations and a viability study on roof spacing and orientation undertaken for the site, the results show that the available roof space can accommodate 43no evacuated tube thermal collectors. This will equate to a site total collector area of approximately $100m^2$.

7.1.12 Orientation and layout of the panels on the available roof space has been carefully investigated and the proposed array has been arranged with modules facing south to maximise the output and increase efficiency of the systems actively contributing to the sustainability of the proposed development. As all panels will be situated on the roof of the building, there is no additional land use associated with these technologies.

7.1.13 The panels should be installed tilted at an angle of 10-30° in order to maximise the output of the array. The minimum angle panels should be installed at is 10°, any less and the modules will not self clean, invalidating their warranty.

7.1.14 The modules will also need to be spaced at approximately 800mm apart to avoid over shading of neighbouring modules and to provide a walkway for safe installation and access. The final layout of panels is subject to specialist sub contractor design and may differ from this layout.

7.1.15 PV systems require an inverter which converts the low voltage direct current electricity produced by the array of panels into 240V 50/60Hz alternating current. Inverters along with the meters will be situated close to the panels either on the roof or in electrical cupboards within service risers.

7.1.16 PV systems require minimal maintenance, as long as the panels are installed at or above the recommended angle they will self clean, there are no regular maintenance requirements for PV panels or the inverters. If panels are positioned at 10 degrees or higher they will self clean, and monitoring of the system output will identify any panel problems or failures (monitoring can be remote/web based).

7.1.17 Inverters would be expected to be replaced after 12-13 years (we are working on a 25 year life based on feed in tariff incomes but PV panels will continue to provide output for up to 40 years (at a reduced level as output degrades over time)).

7.1.18 Inspection of the mechanical fixings to ensure that panels have not come loose due to fixings corroding etc will be required but does not require a specialist to undertake this and could be absorbed into the building inspection/maintenance programme.

Backup Systems

7.1.19 PV panels do not require backup systems as the mains grid provides electrical supply when the PV array is not generating energy. The Solar Thermal system would not be providing the main or total energy supply for hot water or space heating, therefore gas boilers, will provide backup to the system.

Plant Location / Land Use

7.1.20 Panels and inverters are installed on the roof, Solar Thermal pumps, pre-heat and other tanks will be installed in the plant room. As all plant required for this technology will be accommodated within the building footprint, no additional land is required.

Planning Considerations

7.1.21 It should be noted that there are unlikely to be obstacles in obtaining planning permission for a PV or Solar Thermal system for this site due to the fact that there is a clear policy objective for provision of renewable technologies for developments to help reduce energy consumption and carbon emissions. Visual impact of the panels must be considered at this site.

Plant Maintenance

7.1.22 Solar Thermal collectors correctly installed will require no maintenance as they will self clean. Associated pumps, tanks, plumbing and controls are likely to require an annual service. Details of actual service and maintenance requirements should be obtained from the renewable supplier based on detailed system design.

7.1.23 PV systems require minimal maintenance, as long as the panels are installed at or above the recommended angle they will self clean, there are no regular maintenance requirements for PV panels or the inverters. If panels are positioned at 10 degrees or higher they will self clean, and monitoring of the system output will identify any panel problems or failures (monitoring can be remote/web based).

7.1.24 Inverters would be expected to be replaced after 12-13 years (we are working on a 25 year life based on feed in tariff incomes but PV panels will continue to provide output for up to 40 years (at a reduced level as output degrades over time)).

7.1.25 Inspection of the mechanical fixings to ensure that panels have not come loose due to fixings corroding etc will be required but does not require a specialist to undertake this and could be absorbed into the building inspection/maintenance programme.

Noise

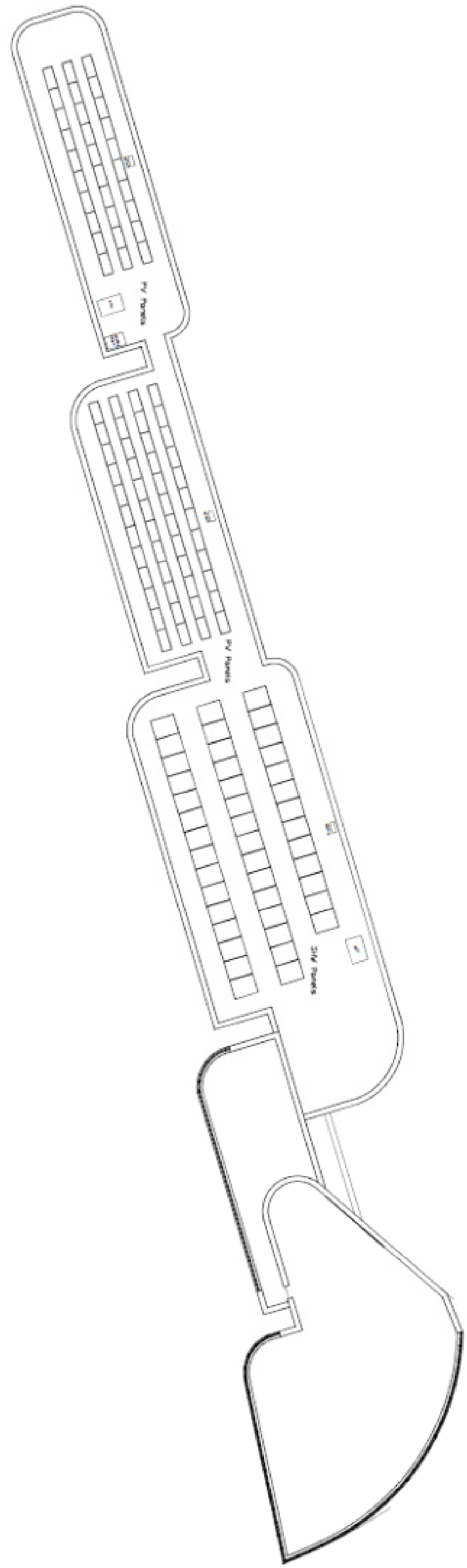
7.1.26 PV and Solar Thermal panels have no impact in terms of noise, although the pumps (equivalent to central heating pumps) may emit negligible noise levels the siting of the pumps, low levels of noise and the proximity of neighbours mean that there will be no impact on building users or neighbours through specification of Solar Thermal and related pumps.

Life Cycle Costs and Carbon

7.1.27 In terms of lifecycle costs of PV Solar Thermal, the panels have a long lifetime (25 to 30 years) with low maintenance requirements and although the initial capital costs are high, the system modelled will pay back in a relatively few years. Maintenance and replacement of system components must be taken into account when considering life cycle costs, but these technologies will both still return a profit when factoring in the energy savings, Feed in Tarrif and Renewable Heat Incentive payments.

7.1.28 Solar Thermal systems have low embodied energy which is repaid within a few years (faster than photovoltaics).

Figure 13 - Proposed PV and Solar Thermal Roof Layout



7.2 Wind Turbines

7.2.1 Wind is one of the most cost-effective methods of generating renewable electricity. However wind is more suited to low density areas where there is more space necessary for maintenance, less turbulent wind patterns, and they are less likely to be the cause of noise and vibration to nearby properties. High density areas are not ideal with current wind turbine technology.

Feasibility

7.2.2 Installation of wind turbines is neither feasible nor suitable for Midland Crescent Student Housing. This technology would have a visual impact on the site and due to the location of the site in a conservation area, application of this technology is deemed not acceptable.

7.2.3 There are a number of concerns with wind turbines in an urban environment including; visual impact, noise, cost, maintenance, space, as well as mechanical loading implications for installation of turbines 'on building'. Although calculations for the modelled systems indicate that wind systems contribute to carbon reductions, it must be noted that under dense urban environments the energy outputs generated by wind turbines can be quite unpredictable. This is mainly due to the neighbouring buildings acting as obstructions causing turbulence to the incoming wind flow. The site would need to be evaluated appropriately (over a period of 12 months) using wind speed monitoring & recording devices in order to give an accurate prediction in terms of energy output derived by the real wind speed measurements recorded on site.

7.2.4 In addition to these concerns, the actual energy output of any turbines installed is likely to be much lower than the modelled outputs due to turbulence created in the urban environment. Turbulence can be overcome by installing turbines on minimum 30m towers but this will exacerbate the concerns/impacts listed above.

7.2.5 Therefore, wind turbines have been determined to be unsuitable for the development at Midland Crescent Student Housing.

7.3 Biomass Heating

7.3.1 Wood is the most commonly used form of biomass fuel, and can either be burned in solid fuel boilers for central heating applications, or for raising steam for power generation in large installations.

7.3.2 Typically, biomass installations are sized to meet a base heat load with peak load and load variations to be met from gas-fired boilers. Biomass boilers operate most efficiently and are therefore most cost effective when working continuously at full load, they do not respond well to rapidly fluctuating demand. When assessing the feasibility of a biomass installation, storage space and biomass delivery requirements need to be taken into account.

Feasibility

7.3.3 Although the investigation shows that a biomass boiler could provide a higher level of carbon reductions than gas boilers (from the Efficient Baseline), the main operational concerns are raised in relation to air quality, storage capacity and logistics of parking for delivery of wood pellets/chips etc.

7.3.4 Air quality is another major concern with biomass heating due to NO_x (Nitrogen Oxides) and Particulate Matter (PM10) emissions.

7.3.5 The entirety of the London Borough of Camden is designated as an Air Quality Management Area (AQMA), with current technology, biomass fuelled boiler may negatively impact on local air quality which is deemed inappropriate in an Air Quality Management Area unless abatement technology can provide sufficient mitigation.

7.3.6 Biomass systems also require space for storage and delivery of fuel. Additionally, fuel delivery carries implications for parking, increased emissions and pressure from transport. In the context of the current layout, there is insufficient space able to be allocated for the biomass storage facility. Therefore, it is determined that biomass heating solution cannot be practically implemented and it is not a suitable renewable energy technology for the site.

7.3.7 When considering life cycle costs, there are higher maintenance requirements than other forms of renewable energy, fuel costs are predicted to rise and the value of net lettable space required for storage must be considered.

7.3.8 When considering noise impact, the impact of fuel deliveries must be considered, otherwise, the impact is similar to conventional plant.

7.3.9 Therefore, it is determined that a biomass heating solution cannot be practically implemented and is not suitable for the development at Midland Crescent Student Housing.

7.4 Ground Source Heat Pump (GSHP)

7.4.1 In the UK, soil temperatures stay at a constant temperature of around 11-12°C, throughout the year. Ground source heat pumps take this low temperature energy and concentrate it into more useful, higher temperatures, to provide space heating and DHW. The process is similar to that used in refrigerators. A fluid is circulated through pipes in the ground absorbing the heat from the soil, the fluid is passed through a heat exchanger in the pump which extracts the heat from the fluid and increases it via a compression cycle. This is then used to provide underfloor heating and heat new hot water.

Feasibility

7.4.2 The site is sandwiched between two railway lines offering limited area and therefore little scope for specification of new GSHP collectors.

7.4.3 It has been determined that connection to existing or installation of new GSHP plant is not a feasible option for the Midland Crescent Student Housing scheme due to the large area required for boreholes exterior to the building. There is a lack of available suitable space for boreholes due to the existing transport and utility infrastructure beneath the site and in addition to the restrictions that the existing building places on accommodating the plant required to bore holes.

7.4.4 Analysis shows that installation of a GSHP, is one of the most costly options for this site and would require further detailed analysis of conflicts with existing systems, ground conditions and soil conductivity before determining whether or not the required levels of carbon savings could be achieved.

7.4.5 Land use, plant space and physical security for the ground collectors and the heat pump units also need to be taken into consideration. For horizontal collector systems, a potentially large area is required for the collector pipework. This area should be free of trees which will cause problems for installation of the pipework. It can be beneath the building but it is most effective in an open area. For borehole or vertical collectors, land requirements are reduced but still significant as the boreholes must be a minimum of five metres apart.

7.4.6 Studies have raised concerns over operational efficiencies matching manufacturers stated efficiencies and costs of maintenance required. Taking all of these considerations into account, it is judged that GSHP is not a suitable or commercially viable technology for Midland Crescent Student Housing.

7.5 Summary

7.5.1 An appraisal of site suitability and energy calculations have determined that PV and Solar Thermal technology are suitable technologies for the site and can contribute significant energy and carbon reductions. As discussed above there are not any other renewable technologies suitable for this site and as such this energy strategy cannot propose any CO_2 reductions associated with renewables for this development.

8.0 CONCLUSION

8.0.1 Following the energy hierarchy has enabled significant carbon reductions to be calculated for the proposed development at Midland Crescent Student Housing. The total regulated carbon emissions reductions are calculated to be 34.31% and a BER over TER improvement of 40.5% which significantly exceeds London Plan policy requirements for a 25% improvement.

8.0.2 The results of this energy strategy in conjunction with the BREEAM pre-assessment undertaken for this project indicate that the development is on target to achieve certification at the 'Very Good' level. The high levels of performance shown in this energy strategy are considered to be an example of exemplary sustainable design in line with London Borough of Camden policy DP22 requirements.

8.0.3 In accordance with the London Borough of Camden and London Plan, baseline figures derived from SBEM calculations have been used in this energy strategy report, including: space heating, DHW, cooling, lighting, pumps and fans, figures have also been provided demonstrating un-regulated energy demand and related emissions. The proposed development at Midland Crescent Student Housing is calculated to have a regulated energy Notional Baseline of 202,964 $kgCO_2$/year.

8.0.4 In the first stage of the energy hierarchy (Be Lean), a 53,050 $kgCO_2$ carbon reduction associated with the proposed fabric and services energy efficiency measures has been predicted. These measures result in a 26.14% reduction from the Notional to the Efficient Baseline, and a 33.3% BER over TER improvement, exceeding London Plan policy 5.2 and meeting the London Borough of Camden's policy CS13 requirements.

8.0.5 As a part of the energy efficiency improvements all practical measures have been implemented to minimise risks of overheating. SBEM calculations have shown that the solar gain limits in summer have not been exceeded (Criterion 3 of Building Regulations Part L for new build buildings other than dwellings) and therefore considered to be at the acceptable level.

8.0.6 For the second stage in the hierarchy (Be Clean), investigations show that there is no opportunity to connect to a local CHP plant installation or district heat network, and due to impacts on local air quality, communal CHP has been determined not to be appropriate for this site.

8.0.7 In the final stage of the energy hierarchy (Be Green), site analysis and calculations have determined that an array of PV and Solar Thermal panels offer the highest level of carbon emissions reductions with these technologies contributing an 11.06% reduction in regulated carbon emissions.

8.0.8 The London Plan policy 5.7 and London Borough of Camden's policy requirements are for a 20% reduction in CO_2 emissions through the specification of on site renewables. This target has not been able to have been achieved due to conflicting demands on the roof space, however, it should be noted that this energy strategy results in an overall 34.31% reduction in regulated carbon emissions.

8.0.9 Table 6 below provides a summary of the energy demand, CO_2 emissions, and overall carbon reductions for the modelled baselines of the development at Midland Crescent Student Housing.

8.0.10 Figure 16 and Table 7 and Table 8 below demonstrate the results of this energy strategy in the format set out in the document *GLA Guidance on preparing energy Assessments* (GLA, Sept 2011). This graph and these tables have been included to facilitate ease of reference against the GLA guidance. The figures used are derived from the same calculations that this report is based on and demonstrate that the site complies with London Plan and GLA requirements.

Table 6 - Energy Hierarchy Summary

	Notional Baseline	Efficient Baseline	Renewable Baseline
Space Heating Energy kWh/yr	215,634	29,495	29,495
DHW Energy kWh/yr	467,660	402,728	349,168
Cooling kWh/yr	0	0	0
Lighting Energy kWh/yr	108,001	79,240	79,240
Aux Energy kWh/yr	22,891	45,196	45,196
Un-Regulated Energy kWh/yr	267,434	267,434	267,434
Whole Energy CO_2 Emissions $kgCO_2/yr$	341,227	288,176	271,594
Whole Energy CO_2 Reduction $kgCO_2/yr$	-	53,050	16,582
Regulated Energy CO_2 Emissions $kgCO_2/yr$	202,964	149,913	133,331
Regulated CO_2 Reduction $kgCO_2/yr$	-	53,050	16,582
Percentage Regulated CO_2 Reduction	-	26.14%	11.06%
Total Percentage Regulated CO_2 Reduction	-	26.14%	34.31%
% Improvement BER over TER	9.5%	33.3%	40.5%

Figure 14 - Be Green – Regulated Energy Renewables Baseline – PV and Solar Thermal Panels

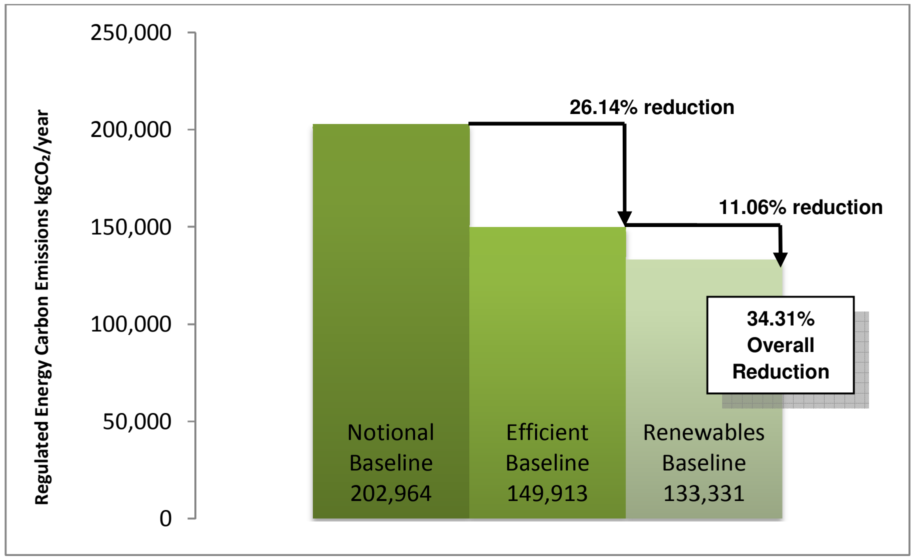


Figure 15 - Be Green – Renewable Baseline BER over TER Improvement

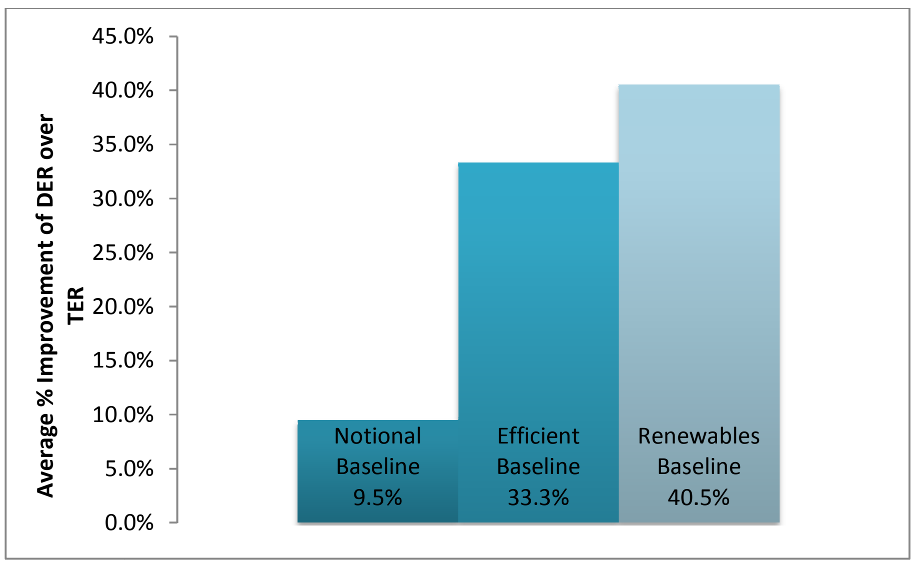


Figure 16 - GLA Energy Assessment Compliance

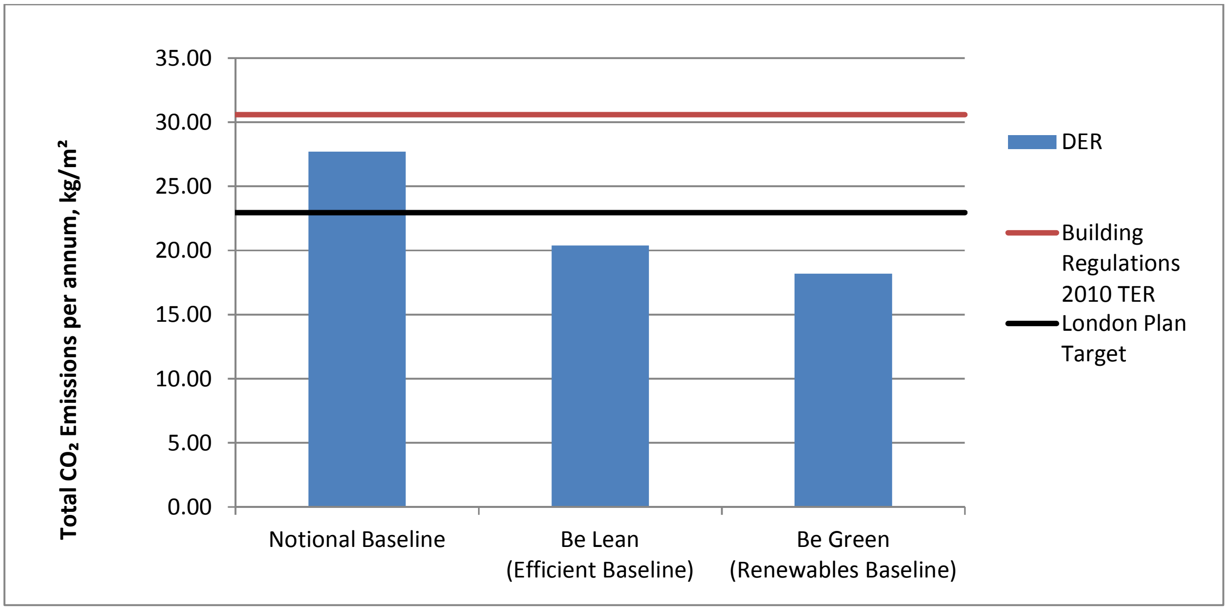


Table 7 - Carbon Dioxide Emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Building Regulations 2010 Part L Compliant Development	203.0	138.3
After energy demand reduction	149.9	138.3
After CHP		
After renewable energy	133.3	138.3

Table 8 - Regulated carbon dioxide savings from each stage of the Energy Hierarchy

	Regulated Carbon dioxide savings	
	Tonnes CO_2 per annum	**%**
Savings from energy demand reduction	53.1	26.1%
Savings from CHP		
Savings from renewable energy	16.6	11.1%
Total Cumulative Savings	**69.6**	**34.3%**

APPENDIX A – SBEM & BRUKL RESULTS

Figure 17 - Notional Baseline SBEM Results

Notional Baseline

Non-Residential			Energy Consumption Breakdown								Gas Consumption	Electricity Grid	Electricity Offset	CO2 Emission	SBEM 2010		% Improvement BER over TER
Floor	Description	Floor area (m2)	Space Heating (Main) (kWh/an)	Space Heating (Main 2) (kWh/an)	Space Heating (Secondary) (kWh/an)	DHW (kWh/an)	Cooling (SBEM) (kWh/an)	Lighting (kWh/an)	Aux (kWh/an)	Un-Reg (kWh/an)	kWh.annum	kWh.annum	kWh.annum	KgCO2.annum	BER	TER	
	Midland Crescent	7337	215,634			467,660		108,001	22,891	267,434	683,295	398,326		**341,227**	**27.70**	**30.60**	9.5%
Total / Average		7337	**215,634**	**0**	**0**	**467,660**	**0**	**108,001**	**22,891**	**267,434**	**683,295**	**398,326**	**0**	**341,227**			

Figure 18 - Efficient Baseline SBEM Results

Efficient Baseline

Non-Residential			Energy Consumption Breakdown								Gas Consumption	Electricity Grid	Electricity Offset	CO2 Emission	SBEM 2010		% Improvement BER over TER
Floor	Description	Floor area (m2)	Space Heating (Main) (kWh/an)	Space Heating (Main 2) (kWh/an)	Space Heating (Secondary) (kWh/an)	DHW (kWh/an)	Cooling (SBEM) (kWh/an)	Lighting (kWh/an)	Aux (kWh/an)	Un-Reg (kWh/an)	kWh.annum	kWh.annum	kWh.annum	KgCO2.annum	BER	TER	
	Midland Crescent	7337	29,495	0	0	402,728	0	79,240	45,196	267,434	432,223	391,869		**288,176**	**20.40**	**30.60**	33.3%
Total / Average		7337	**29,495**	**0**	**0**	**402,728**	**0**	**79,240**	**45,196**	**267,434**	**432,223**	**391,869**	**0**	**288,176**			

Figure 19 - Renewable Baseline SBEM Results

Renewables Baseline Solar Thermal and PV

Non-Residential			Energy Consumption Breakdown								Renewables			Gas Consumption	Electricity Grid	Electricity Offset	CO2 Emission	SBEM 2010		% Improvement BER over TER
Floor	Description	Floor area (m2)	Space Heating (Main) (kWh/an)	Space Heating (Main 2) (kWh/an)	Space Heating (Secondary) (kWh/an)	DHW (kWh/an)	Cooling (SBEM) (kWh/an)	Lighting (kWh/an)	Aux (kWh/an)	Un-Reg (kWh/an)	SHW, m2	PV, m2	PV Energy Offset	kWh.annum	kWh.annum	kWh.annum	KgCO2.annum	BER	TER	
		7337	29,495			349,168		79,240	45,196	267,434	100	100	-11,299	378,663	391,869	-11,299	**271,594**	**18.20**	**30.60**	40.5%
Total / Average		7337	**29,495**	**0**	**0**	**349,168**	**0**	**79,240**	**45,196**	**267,434**	**100**	**100**	**-11,299**	**378,663**	**391,869**	**-11,299**	**271,594**			