BACTON LOW RISE REDEVELOPMENT

Camden

ROLTON GROUP
ENGINEERING THE FUTURE

ENERGY STRATEGY REPORT

12-0083

ENERGY STRATEGY REPORT

FOR

BACTON LOW RISE ESTATE REGENERATION

AT

LONDON BOROUGH OF CAMDEN, LONDON

Rolton Group Limited, Registered in England No. 1547400 at The Charles Parker Building, Midland Road, Higham Ferrers, Northants, NN10 8DN

Copyright © Rolton Group Ltd 2012

CLIENT	EC Harris LLP ECHQ Regent Quarter 34 York Way London N1 9AB
CONSULTING ENGINEERS	Rolton Group Limited The Charles Parker Building Midland Road Higham Ferrers Northants NN10 8DN

REVISION & ISSUE RECORD

Revision	Date	Name	Position	Signature
Draft	November 2012	Author: Umer Uzair	Assistant Project Engineer	
		Check: Neil Adcock MCIBSE BEng Hons C Eng	Associate Director	
		Authorised: Chris Evans BSc(Hons) CEng MCIBSE MASHRAE	Director	

NOTE: IMPORTANT INFORMATION ABOUT YOUR RIGHTS TO READ AND USE THE CONTENT OF THIS DOCUMENT ARE CONTAINED AT THE BACK OF THIS DOCUMENT

BM TRADA CERTIFICATION ISO 9001:2008 UKAS MANAGEMENT SYSTEMS 012
BM TRADA CERTIFICATION ISO 14001:2004 UKAS MANAGEMENT SYSTEMS 012
INVESTOR IN PEOPLE
UK GREEN BUILDING COUNCIL Member
WE EMPLOY LOW CARBON CONSULTANTS

ISSUING OFFICE:-

Higham Ferrers Office
The Charles Parker Building
Midland Road
Higham Ferrers
Northants
NN10 8DN

Peterborough Office
One Minerva Business Park
Lynch Wood
Peterborough
PE2 6FT

Birmingham Office
The David Rolton Building
Twelve Quartz Point
Stonebridge Road
Birmingham
B46 3JL

TEL – 0870 726 0000 FAX 0870 726 0222

Copyright © Rolton Group Ltd 2012

CONTENTS

Copyright © Rolton Group Ltd 2012

1 EXECUTIVE SUMMARY

The Rolton Group, as part of the appointed design team for the proposed regeneration, have been requested to provide an energy strategy relating to the new housing development for the Bacton Low Rise Project. This overview aims to provide a view of the direction the team are taking with respect to the requirements of the applicable adopted policies including the London Plan, Greater London Authority (GLA) and London Borough of Camden policies (including CS13 and DP22/23) on energy and carbon dioxide emissions for the proposed regeneration.

This overview has been written to incorporate the Be Lean, Be Clean, Be Green hierarchy as defined in the London Plan. The 'Be Lean' criterion seeks to minimise energy use through passive measures, i.e. maximising insulation, natural ventilation, etc., 'Be Clean' seeks to minimise the use of energy, i.e. by utilising energy efficient lighting etc, and 'Be Green' relating to the utilisation of renewable technologies.

1.1 PASSIVE DESIGN

To achieve the required energy reduction figures, we are carrying out an analysis of the various houses, apartments/flats and will be insulating the proposed regeneration to a high standard, (see notes below).

For the project we will be targeting Code for Sustainable Homes (CSH) Level 4 which is in accordance with the various local policies and we will be designing the project to achieve the following U values and air permeability levels:

Wall	0.12W/m^{2}K
Floor	0.1 W/m^{2}K
Windows	1.12 W/m^{2}K
Roof	0.1 W/m^{2}K
Door	1.6 W/m^{2}K
Air permeability	4 m^3/m^{2}hr@50Pa

These measures will help enable the site to minimise its energy use before integrating any Low Carbon / Renewable technologies.

1.2 RENEWABLE/LOW CARBON ENERGY SOURCES

It is being assessed to find the most efficient method of minimising Carbon, We anticipate that this will be by using a central district heating distribution system that utilises a highly efficient gas turbine Combined Heat & Power (CHP) unit. The proposal is to utilise the unit installed at the Royal Free Hospital. This system is sized to meet the proposed regeneration energy load with the site also providing back up gas fired boilers, as these turbines typically operate for 99% of the year. The design team is also looking at the available renewable technologies to see if any are appropriate should the CHP not provide the energy savings required for Code Level 4. An overview of the technologies and their suitability has been provided within the relevant section of this report, however our initial investigations indicates that there may not be a requirement for Renewables, and the CHP is of suitable efficiency to lower the Carbon use to the appropriate level.

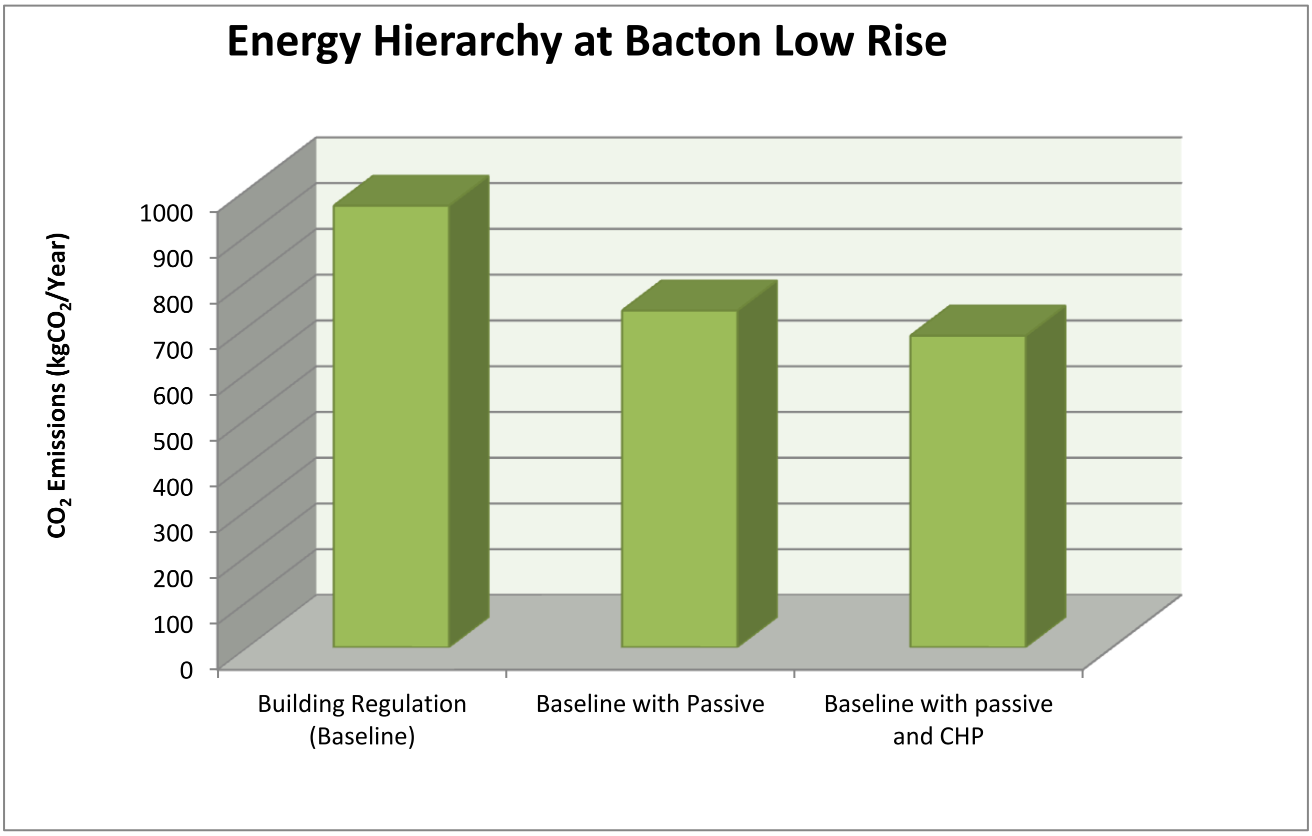
1.3 ENERGY PREDICTIONS

The report provides a detailed assessment of the energy demands and emissions for the proposed regeneration highlighting the improvement over the benchmark emissions relating to the Target Emission Rating defined within the Building Regulations Part L1A SAP 2009, these figures will be for the complete development and exclude non regulated emissions as per the requirements of the Code for Sustainable Homes (CSH) level 4.

Copyright © Rolton Group Ltd 2012

Below is an initial graphical representation of the savings anticipated through the energy efficiency, and CHP measures.

The proposed residential regeneration is targeting the Code for Sustainable Homes Level 4 which is an improvement over the current 2010 Part L1A Building Regulations emission rate of 25%. The code also calls for a restricted water consumption of 105l/person/day which we will be achieved by the careful specification of low flow taps, sanitary ware and appliances.



Copyright © Rolton Group Ltd 2012

2 THE BRIEF

The Rolton Group, as part of the appointed design team for the proposed regeneration, have been requested to provide an energy strategy relating to the residential development of the proposed regeneration for the Bacton Low Rise Project. This is provided within this document and shall form part of the planning application submission.

The areas that we have addressed within this document include the following:-

- Policy review
- Passive design and solar design techniques
- Energy efficiency measures
- Incorporate combined heating and power system
- Provision of district heating from the adjacent areas
- Offset of CO_2 emissions through suitable technology
- Future proofing

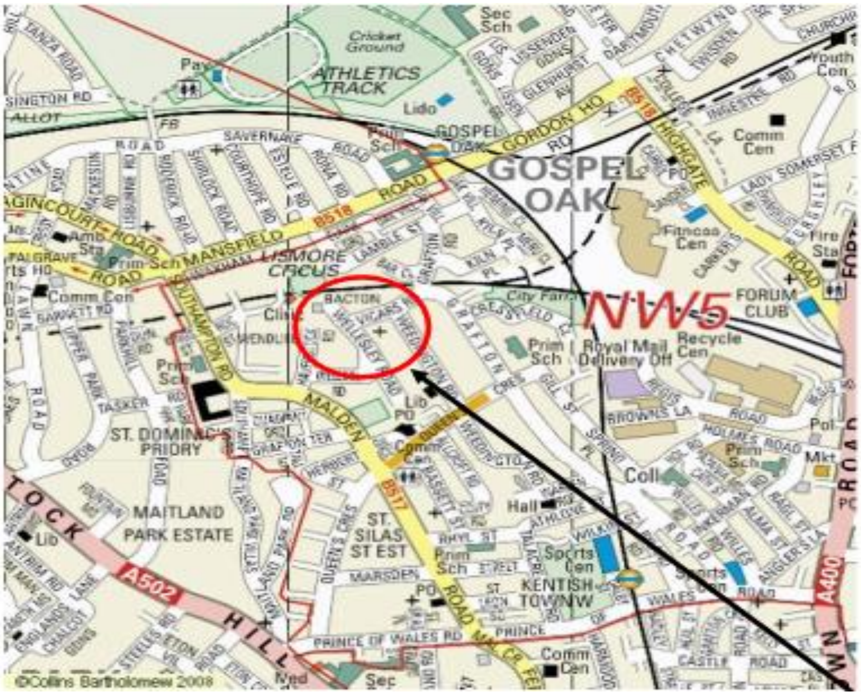
Copyright © Rolton Group Ltd 2012

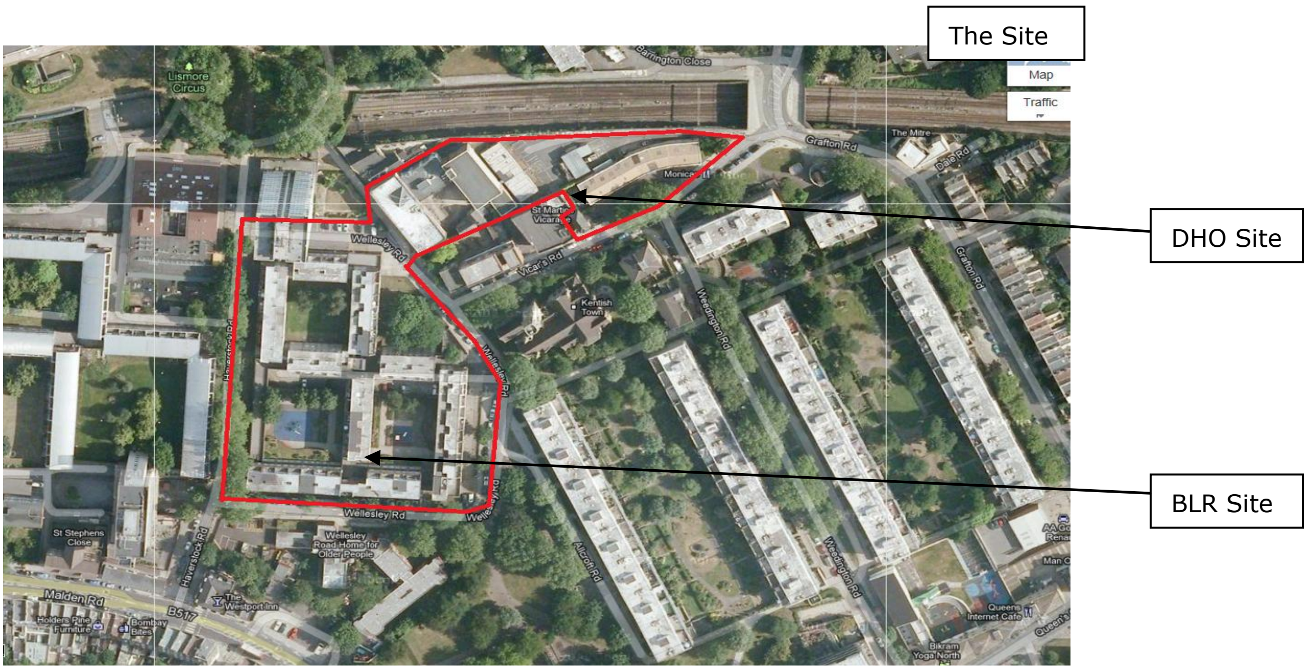
3 SITE DESCRIPTION

The site is located in north London, within the London Borough of Camden to the south of Hampstead Heath. It is bounded by Lismore Circus and the mainline railway to the north, Wellesley Road to the south, Vicars Road to the east and Haverstock Road to the west. The site is split into two parts with the main section to the west denoted as Bacton Low Rise (BLR) and the smaller section to the east denoted as District Housing Office (DHO). It is proposed to redevelop the site with multi-storey blocks of residential units and communal facilities.

These initial assessments are based upon the information currently received and the general information relating to sites of this type. This report is in support of the planning application and reflects all of the necessary planning policies.

Location Plan:





Copyright © Rolton Group Ltd 2012

4 POLICY REVIEW

A policy review has been carried out which includes (in hierarchical order), national policy (i.e. National Planning Policy Framework (NPPF) and Planning Policy Statements), regional policy (i.e. the adopted London Plan, SPG Sustainable Design & Construction, Camden Development Policies (DPD)) and Camden Planning Guidance (i.e. (CPG 3) Sustainability for the London Borough of Camden).

The London Plan chapter 5 and SPG Sustainable Design & Construction policy references 5.2, 5.3. 5.5 and 5.6 has stated that the carbon dioxide emission from the new developments should be reduced by the sustainable use of energy. A hierarchy has been setup by the London Mayor to first reduce the energy demand through sustainable design principles, then second, to supply energy efficiently by prioritising decentralised energy, and as a third and final step through renewable energy measures

The London Borough of Camden Sustainability Camden Planning Guide (CPG3) has stated that the key message is that all new developments are to be designed to minimise carbon dioxide emissions. The most cost effective way to minimise the energy demands are through good design and high levels of insulation and air tightness.

Within the adopted London Plan chapter 5 (London's response to climate change) of SPG Sustainable Design & Construction policy ref 5.2 discusses about minimising the carbon dioxide emissions

> **POLICY 5.2**
> **MINIMISING CARBON DIOXIDE EMISSIONS**
>
> **Planning decisions**
>
> A Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:
>
> 1 Be lean: use less energy
> 2 Be clean: supply energy efficiently
> 3 Be green: use renewable energy
>
> B The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

The above London plan policy has been addressed within this report through the adoption of Be lean, Be Clean and then Be Green hierarchy.

Copyright © Rolton Group Ltd 2012

Policy 5.2 also provides a schedule for Building Regulation improvements for the residential buildings,

Residential buildings:

Year	**Improvement on 2010 Building Regulations**
2010 – 2013	25 per cent (Code for Sustainable Homes level 4)
2013 – 2016	40 per cent
2016 – 2031	Zero carbon

The London Plan also quotes the above and we have targeted a reduction in energy use through the utilisation of the Code for Sustainable homes Code level 4 (for the residential development). Code Level 4 requires a 25% improvement compared to the Building Regulations 2010 Part L1A, and this is a reduction that required by the London Plan.

The London Plan policy references 5.5 and 5.6 discuss the decentralisation of energy network :-

POLICY 5.5
DECENTRALISED ENERGY NETWORKS

Strategic

A The Mayor expects 25 per cent of the heat and power used in London to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide levels, including larger scale heat transmission networks.

Copyright © Rolton Group Ltd 2012

POLICY 5.6
DECENTRALISED ENERGY IN DEVELOPMENT PROPOSALS

Planning decisions

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

B 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.

C 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.

The London Mayor has set a target for London to generate 25% of its heat and power requirements through the use of local, decentralised energy (DE) systems by 2025. These will predominantly be based around the use of gas-fired Combined Heat and Power (CHP) system. Therefore, to address the above policy, a Combined Heat and Power system is proposed for this development and will utilise the available heat from The Royal Free Hospital to meet the proposed building's heating demand. The use of this heat will improve the efficiency of the primary energy by utilising more of the generated heat that would otherwise be wasted.

Copyright © Rolton Group Ltd 2012

POLICY 5.7
RENEWABLE ENERGY

Strategic

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.

In the Climate Change Mitigation and Energy Strategy The London Mayor has outlined projections for the installation of different renewable energy technologies to increase London's generation of both electricity and heat up to 2031. It also states that all the major development proposals will seek to reduce carbon dioxide emissions by at least 20% through the use of on-site renewable energy generation where feasible. Under this development proposal carbon dioxide emissions can be reduced over 20% by utilising the waste heat from The Royal Free Hospital therefore the improvements can be made through the use of energy efficient building design and CHP system. Hence no additional renewable energy system would be required to meet the London plan.

According to Camden Planning Guidance (CPG3) Sustainability for London Borough of Camden the council is committed to reducing Camden's carbon emissions. This will be achieved by implementing the decentralised energy networks and Combined Heat and Power (CHP) systems, through energy efficiency measures and through renewable energy.

The Camden Planning Guidance CPG states the following energy hierarchy for sustainable building,

THE ENERGY HIERARCHY:

1. use less energy
2. supply energy efficiently
3. use renewable energy

The Camden Planning Guidance CPG states the following energy hierarchy for sustainable building,

The 3 steps of the energy hierarchy are:

Within this document we have addressed the Be Lean, Be Clean, Be Green strategy as defined within the London Plan and Camden Strategy which targets in hierarchical order the most appropriate methods of minimising energy use.

Copyright © Rolton Group Ltd 2012

With regards to the London Borough of Camden Planning strategy CPG3, particular attention has been paid to the sections relating to Decentralised Energy networks and Combine Heat & Power systems Under chapter 5 it states the following:-

Core Strategy policy CS13:-

5.2 The Mayor of London has set a target that 25 per cent of the heat and power used in London is to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralised heating and cooling networks at the development and area wide level, as well as larger scale heat transmission networks.

5.3 We will expect developments to connect to a decentralised energy network and use the heat unless developers can demonstrate it is not technically feasible or financially viable.

What are developments expected to do?

5.11 Once a development has been designed to be as energy efficient as possible (Energy hierarchy - Stage 1), developments will be required to consider the following steps, in the order listed, to ensure energy from an efficient source is used, where possible:

1. investigating the potential for connecting into an existing or planned decentralised energy scheme and using heat
2. installing a Combined (Cooling) Heat and Power Plant (CHP or CCHP), including exporting heat, where appropriate
3. providing a contribution for the expansion of decentralised energy networks
4. strategic sites are to allow sufficient accessible space for plant equipment to support a decentralised energy network
5. designing the development to enable its connection to a decentralised energy network in the future

To cater for the above, and as mentioned previously it is proposed to utilise the CHP system The Royal Free Hospital provide heating to all the dwellings at the proposed Bacton Low Rise. The details of the above have been provided within the District Heating System section of this report.

The Camden Planning Guidance document also highlights the fact that all developments are to target the reduction of overall Carbon Dioxide emissions arising from the proposed development, under chapter 6 Renewable Energy it states,

WHAT DOES THE COUNCIL EXPECT?

All developments are to target at least a 20% reduction in carbon dioxide emissions through the installation of on-site renewable energy technologies. Special consideration will be given to heritage buildings and features to ensure that their historic and architectural features are preserved.

When assessing the feasibility and viability of renewable energy technology, the Council will consider the overall cost of all the measures proposed and resulting carbon savings to ensure that the most cost-effective carbon reduction technologies are implemented in line with the energy hierarchy.

To address the above, a thermal modelling analysis of the building has been carried out to demonstrate the overall CO_2 emissions reduction from the targeted emissions. The results demonstrates that over 20% CO_2 reductions are achievable through the use of the CHP plant. The predicted site energy section of this report will address this in detail.

Copyright © Rolton Group Ltd 2012

5 PASSIVE DESIGN OVEREHATING AND COOLING REQUIREMENT

With regards to 'Passive Design', this is the process of best employing the conventional elements of construction to both reduce energy consumption and to make best use of the natural elements such as daylight, sunlight and natural ventilation. This will also take into consideration the minimising overheating which, in well insulated dwellings, becomes as significant in terms of comfort as the energy reduction measures are to be overall performance of the building.

This can include the following:-

- The improvement of building fabric U-values
- The improvement of the air permeability of the building
- The use of the shape of the building to limit heat loss and optimise useful solar heat gain
- The optimisation of daylight to reduce the need for artificial lighting
- The use of natural screening of sources of glare or noise
- The use of natural ventilation and cross ventilation

The passive measures that are being employed for this project include where appropriate:-

- Reducing U-values below the levels required to achieve compliance
- Reducing air permeability below the level required to achieve compliance
- Using the shape of the building to limit heat loss and optimise useful solar heat gain. This can be achieved by:-
    - having occupied spaces facing within 30° of due south
    - reducing heat losses through the use of courtyards
- Optimising daylight by:-
    - appropriate use (size and position) of windows in occupied areas
    - using courtyards or atria to introduce daylight to 'deep plan' areas
- The use of natural screening of sources of noise, including the screening of the railway and roads. This can be carried out by using vegetation, other structures, or areas with low occupancy (e.g. bathroom)
- The use of natural screening of sources of glare and solar overheating can be carried out through the use vegetation, balconies and other solar control devices
- The use of natural ventilation through the use of:-
    - openable windows
    - courtyards to provide cross flow ventilation (with the possibility of utilising stack effect ventilation) whilst limiting the effects of direct wind force through the residences

5.1 DWELLINGS

For the Bacton Low Rise regeneration the use of overhangs, natural shading, thermal mass, natural ventilation and, where available, cross ventilation has minimised the possibility of overheating. The worst case scenarios of the various dwelling types have been modelled using the TAS modelling software and the likelihood of high internal temperatures during summer analysed using the SAP calculation programme (which is the Building Regulations method of assessment for overheating). Further checks have also been carried out utilising the TAS simulation program for typical units including each different type of dwelling (one Bedroom, Two Bedroom & Three Bedroom apartments and four Bedroom Maisonette).

The results have indicated that with the option of fully opening windows the likelihood of overheating is 'not significant', however it is recognised that due to security and other issues, it may not be feasible to have windows fully open, in particular on lower storeys. A more detailed analysis was therefore undertaken to help inform the design as the detail progressed, this included an assessment of the amount of glass and blank panels, consideration and utilisation of solar glass, (which will help mitigate excessive solar gain), together with an assessment of the use of a whole house ventilation systems. These will have a positive impact on overheating and will be incorporated into the design. This is above the requirements of Building Control but will help ensure that the dwellings remain comfortable.

Copyright © Rolton Group Ltd 2012

5.2 U VALUES

With regards to the improvement of U-Values, the table below shows the target U Values to the development compare to the current values. It is proposed that the u values be used and to help meet the code requirements subject to viability for the Bacton Project:-

U-Values *[W/m²/K]*

	UK Typical Common Practice	Proposed Standards
Wall Insulation	0.30	0.12
Roof	0.20	0.10
Floor	0.25	0.10
Glazing	2.00	1.12
Door	2.00	1.60

5.3 CODE FOR SUSTAINABLE HOMES (CSH)

The proposed development has been designed in accordance with the Code for Sustainable Homes level 4 guidelines, which is the BRE's design standard for residential buildings. Under Camden Planning Guidance (CPG3) section 8.15 it states that developments are to follow the BRE's Green guide for material specifications,

> 8.15 You are encouraged to use the BRE Green Guide which provides guidance on how to make the best environmental choices when selecting construction materials and building components. The Green Guide ranks, materials and components on an A+ to E rating scale – where A+ represents the best environmental performance / least environmental impact, and E the worst environmental performance / most environmental impact.

However to meet the above and other green credentials, the proposed building do not only specify the Green Guided A+ rated construction materials but is also designed to incorporate all the green design principles such as energy efficient lighting, A+ rated home appliances, the energy efficient building fabric and efficient mechanical and electrical systems. The CSH level 4 is in excess of 25% betterment of Part L 2010 building regulations and therefore the proposed designed aims to achieve such a high level not only under Energy and materials but that the overall construction will be environmentally sustainable.

Copyright © Rolton Group Ltd 2012

6 DISTRICT HEATING AND COMBINED HEAT AND POWER STRATEGY

Once the passive measures have been assessed, the implementation of adopted London Plan policies (5.2 & 5.6) and the Camden Core Strategy (policy CP13) look to decentralised energy networks within a scheme utilising CHP in conjunction with a site wide district heating main.

Due to the multi storey nature of the Bacton project, and the proximity of The Royal Free Hospital, it is well suited to the connection of a district heating system. It is proposed to serve the various dwellings via the integrated CHP system and a piped distribution network. This system will enable the residential development to be linked to the heating distribution network.

Combined Heat and Power (CHP) involves the on-site generation of electricity and the effective use of the 'waste' heat from this process. The high efficiency of this system is due to the fact that more of the energy input to the process is utilised than with traditional (grid) electricity generation. The electrical transmission losses associated with grid electricity are also minimised.

Factors that will be considered in the detailed design are as follows:

- Provision of a proportion of the site electrical load via the CHP system along with the provision of the subsequent 'free' hot water and heating.
- Gas technology is well proven and integrates well with traditional systems.
- Operates well with multi use sites. Integration from The Royal Free Hospital is being evaluated by the project as the load profiles would benefit from a wider and more varied distribution, increasing hours run and system size, and therefore increasing the efficiency of the system.
- These systems need to be carefully designed so as to accurately match the heat and power requirements of the site.

The key targets for the development will meet the Code for Sustainable Homes Level 4 and will reduce over 20% of its Carbon Dioxide (CO_2) from efficient design and approximately 68% from efficient CHP plant by utilising the 'waste' heat from the hospital to meet the heating demands of the proposed Bacton Low Rise sites.

The above proposal is in accordance with London plan policy reference 5.5 and 5.6 as discussed above and also the Camden Core Strategy Policy CP13. The following key message has been given under chapter 5 of Camden plan,

KEY MESSAGES

Decentralised energy could provide 20% of Camden's heating demand by 2020.

Combined heat and power plants can reduce carbon dioxide emissions by 30-40% compared to a conventional gas boiler.

Where feasible and viable your development will be required to connect to a decentralised energy network or include CHP.

Camden Core strategy policy CS13 requires carbon dioxide emissions to be minimised by following the energy efficient design and through decentralised energy network including CHP system. The Mayor of London has also set a target that 25% of the heat and power used in London is to be generated through the use of localised decentralised energy systems by 2025. In order to achieve this target the above CHP proposal is to access the 'waste' heat from The Royal Free Hospital.

Copyright © Rolton Group Ltd 2012

The Camden plan highlights the above under section 5.11 of the policy document,

> Once a development has been designed to be as energy efficient as possible (Energy hierarchy - Stage 1), developments will be required to consider the following steps, in the order listed, to ensure energy from an efficient source is used, where possible:
>
> 1. investigating the potential for connecting into an existing or planned decentralised energy scheme and using heat
> 2. installing a Combined (Cooling) Heat and Power Plant (CHP or CCHP), including exporting heat, where appropriate
> 3. providing a contribution for the expansion of decentralised energy networks
> 4. strategic sites are to allow sufficient accessible space for plant equipment to support a decentralised energy network
> 5. designing the development to enable its connection to a decentralised energy network in the future

The above hierarchy has been addressed under other section of this report and an investigation has been made to access the potential of connecting existing Royal Free's Combined Heat Power plant to the proposed Bacton site. The suitable plant room space has also been proposed for this site to facilitate the CHP connections and utilisation of waste heat.

Copyright © Rolton Group Ltd 2012

7 ENERGY ASSESSMENT

7.1 APPROACH

The approach taken by this report is in accordance with London Borough of Camden's Bacton Low Rise Planning Brief Supplementary Planning Guidance document, the adopted London Plan (London's Response to Climate Change) policy reference 5.2 (minimising carbon dioxide emissions) and Camden Planning Guide policy reference 2.3 (the energy hierarchy) which follows the hierarchy:

- Be Lean, using less energy, in particular by adopting sustainable design and construction measures
- Be Clean, supplying energy efficiently, in particular by prioritising decentralised energy generation
- Be Green, using renewable energy

The essential standards highlighted in the adopted London Plan and Camden Planning Guide have been used to focus the solutions to the most appropriate technologies and passive systems. Camden Core Strategic policy CS13 (Tackling Climate Change through Promoting Environmental Standards) have been targeted for this development and the above 20% carbon dioxide emissions reduction has been achieved through the 68% efficient Combine Heat & Power (CHP) system. This CO_2 reduction has been achieved through energy efficient design and demonstrates that there is no need for onsite Renewable energy system as the above required savings have been made without it.

7.2 ENERGY PREDICTIONS

This report provides an assessment of the energy demands and emissions for the proposed regeneration highlighting the improvement over the benchmark emissions relating to the Target Emission Rating defined within the Building Regulations 2010. These figures are for the complete development and exclude non-regulated emissions.

To achieve the energy reduction figures detailed above we have carried out an analysis of the one, two and three Bedroom apartments and four bedrooms Maisonette, using high standard of insulation. We also include for the use of the central district heating distribution system that will incorporate a CHP system.

Initially to understand the energy reductions required to meet the requirements of the Code for Sustainable Homes we have calculated the anticipated energy demand utilising a thermal simulation program.

Based on the design team information available, an initial virtual dynamic thermal model of a number of the residential dwellings has been developed. The purpose of the modelling is to calculate the predicted carbon emissions from the building, and determine the impact of the code requirements on the building design. This initial model is currently based on the calculations set out in 'The Government's Standard Assessment Procedure for Energy Rating of Dwellings' (SAP 2009 version 9.90), which forms the basis of the calculations set out in The Code for Sustainable Homes 2010. The final scheme has been assessed in the next draft.

Copyright © Rolton Group Ltd 2012

7.3 CREATING THE MODEL

At this time the design for the proposed regeneration is in its preliminary pre planning design stage. In order to ensure that the various energy, CO_2 and sustainability targets are achievable, these need to be assessed and recognised so that the solutions can be allowed for at the early stages of the design process. Sample models based on the initial Karakusevic Carson Architects layouts of differing typical houses, apartments and maisonettes were created and then modified in accordance with NHER SAP 2009 requirements to calculate the thermal characteristics of the residential dwellings. This model has been modified to bring it in line with the current 2010 Part L1A Building Regulations, and as such represent a base case from which carbon reduction calculations has been carried out.

The current Part L 2010 Building Regulations assessed the actual building against the similar notional building which has made it challenging to meet the higher carbon dioxide emissions reduction. The current planning policies (London Plan and Camden Planning Guide) refers to the improvement and carbon savings above the Part L level and therefore our proposals focus on meeting the planning policies in excess of the part L requirements. Hence when examining the application of passive measures / modifications to the model, we were able to determine how much of an improvement in carbon emissions could be practically introduced to provide the 25% energy reduction required by Level 4 of the Code for Sustainable Homes. In the next draft the scheme has been assessed to further analyse our assumptions and tailor the buildings towards the optimal solution for each block/site.

With regards to the supplementation of the current passive measures the Bacton scheme will be utilising Combined Heat and Power system which will fulfil the heating demands of the development. The current Building Regulations Part L1A 2010 sets out the Carbon emission targets for all building developments within the UK. In the Part L requirements were increased to achieve 25% better emissions than the 2006 regulations, and computer modelling was introduced to compare proposals against this notional equivalent 2006 building. In 2010 Part L Building Regulations were increased again by another 25%, which equates to 44% better than 2002 regulations. In 2013 it is intended to increase the improvement by a further 25%.

The experience gained from undertaking Part L calculations indicates that the achievement of Part L 2010 is very difficult to achieve by just using the insulation properties of current building products, therefore the utilisation of the Combined Heat and Power system is deemed necessary to meet the required emissions reductions targets.

Copyright © Rolton Group Ltd 2012

8 RENEWABLE ENERGY OPPORTUNITIES

For the provision of Renewable Energy, a number of established renewable technologies have been looked into to reduce the use of fossil fuels and reduce overall onsite energy consumption. This section deals with the selection of appropriate renewable and clean technologies which are suitable for this development, however as the proposed CHP system will reduce the overall CO_2 emissions and building design will be in accordance with CSH level 4 therefore the need of any renewable energy technology will be in excess of the requirements. Please note that annual energy figures are used throughout this report to allow the comparison of non-linear energy uses such as heating systems etc.

8.1 ACHIEVING CO_2 REDUCTION

Be Clean

The following technologies come under the heading of 'Clean' as they are efficient ways of generating energy, or supplying energy in an efficient manner.

The following solutions have been assessed to provide the optimum level of energy that can be achieved for a level of investment acceptable to the client. Below, we have highlighted the most common 'Clean' technologies and commented on their appropriateness for the proposed development.

Biomass Heating

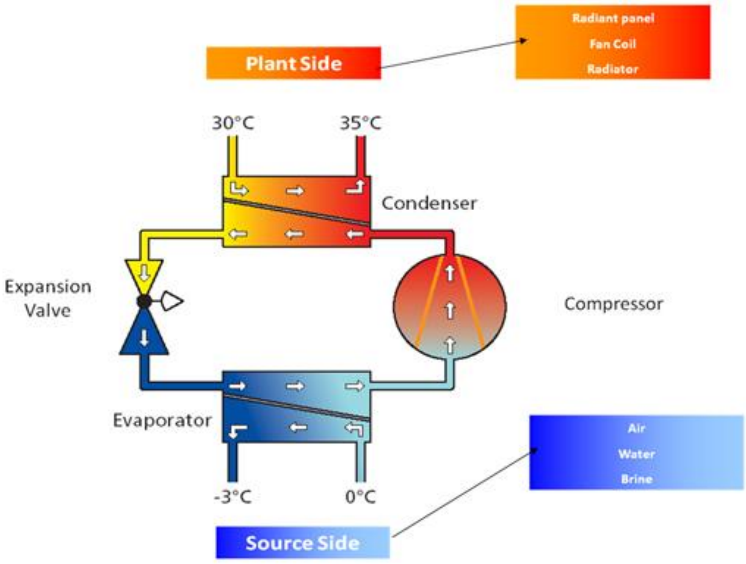
Biomass heating consists of a boiler that produces hot water from the combustion of wood chips or wood pellets. The location of the site needs to be within 25 miles of a biomass fuel source. A plant room area would be required and space for biomass and ash storage. High maintenance of the equipment and storage are often the main reasons for these types of facilities not being utilised. Such a system requires a high amount of input from the user, relative to a traditional gas fired installation, to work effectively. For our typical house model we would require a weather proof store of approximately $3m^2$ to allow for a pellet fuel storage facility including automatic fuel feeding system.

Currently, for the project there is a local suitable supply of biomass in the area but due to the fact that CHP plant will meets the associated carbon dioxide emissions without the need of any other Renewables.

Copyright © Rolton Group Ltd 2012

Heat pumps

Heat pumps are efficient clean sources of energy. A heat pump uses a refrigerant as a medium to exchange heat between the building and a heat source. There are two types of heat pump, an air source heat pump which exchanges the heat with the outside air and a ground source heat pump which exchanges heat with the ground via a bore hole or a coil of pipe within the ground (know as a slinky). A heat pump uses a compressor to change the thermodynamic state of the refrigerant with minimal energy input. This process changes the temperature of the refrigerant to a level where natural heat transfer occurs between the refrigerant and the air or ground. For example if we compress a fluid it becomes hot and we are able to transfer this heat between the heat pump and the building. This process reduces the temperature of the refrigerant, but if we allow it to expand it reduces the refrigerant temperature further. This state of the refrigerant can then be put through a heat exchanger to the outside air or ground where is can then gain the heat lost to the building back from the outside, before the process starts all over again. The following diagram shows this process.



Because of the natural heat transfer which occurs in the above system, we are able to transfer more heat into the building that the electrical energy used to power the compressor. For this reason we use the term Coefficient of Performance (COP) rather than efficiency.

Heat pumps can provide both heating and cooling with typical COPs of 2.0-4.0 for ground source and 2.5-3.0 for air source heat pumps. Although the efficiencies for ground source systems are better, the associated extra costs over air source systems tend to make them much less viable for small installations. Also large ground source heat only heat pumps are not viable as they extract so much heat from the ground that the ground will freeze and would not be able to recover.

A slinky ground source heat pump system for a dwelling would normally require approximately 200m of pipework buried at 1-2m.

The air source heat pump technology includes an outdoor unit which allows for the heat transfer between the refrigerant and the outdoor air. It is therefore important to consider the positioning of the outdoor units as a good airflow is required to help with the heat transfer which in turn will help to maintain a high COP for the system.

For the development, heat pump technology could be used to minimise energy use and CO_2 emissions, this will need to be coordinated with the suitable positioning of any outdoor units. However as the proposed CHP system will meet required CO2 emissions reductions therefore this technology has not been further assessed.

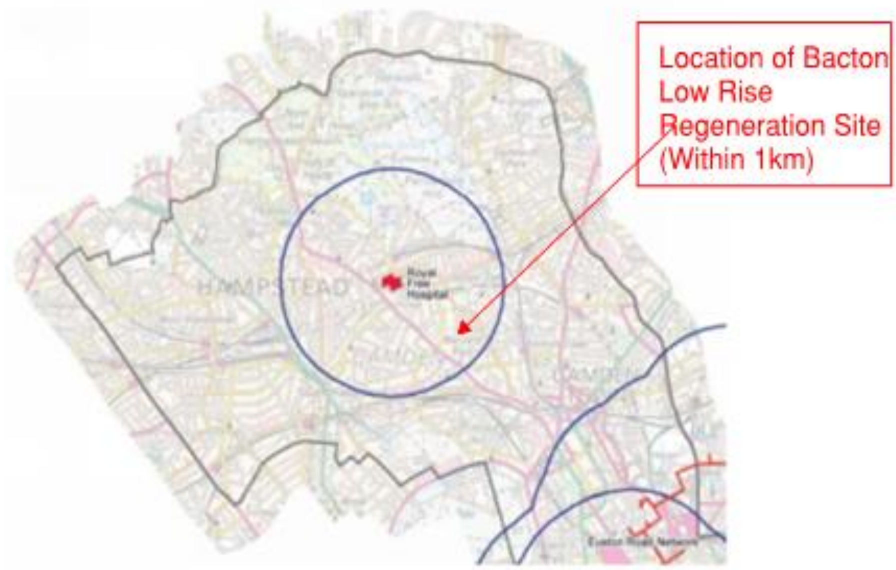
Copyright © Rolton Group Ltd 2012

Biomass/gas combined heat and power

This is a very efficient system which can provide heating, cooling and electricity, but is only suitable for buildings with high periods of heating or hot water demand such as leisure centres and industrial buildings. When heat is not required by the heating system, it could be used to provide energy for the hot water generation. When electricity is not required on the site, then it can be exported to serve the surrounding facilities, assuming the heating/domestic load is not being met. These systems can also be integrated with absorption chillers to provide chilled water. Therefore the existing CHP system which has been installed at Royal Free Hospital will provide the access heat to facilitate the proposed Bacton development.

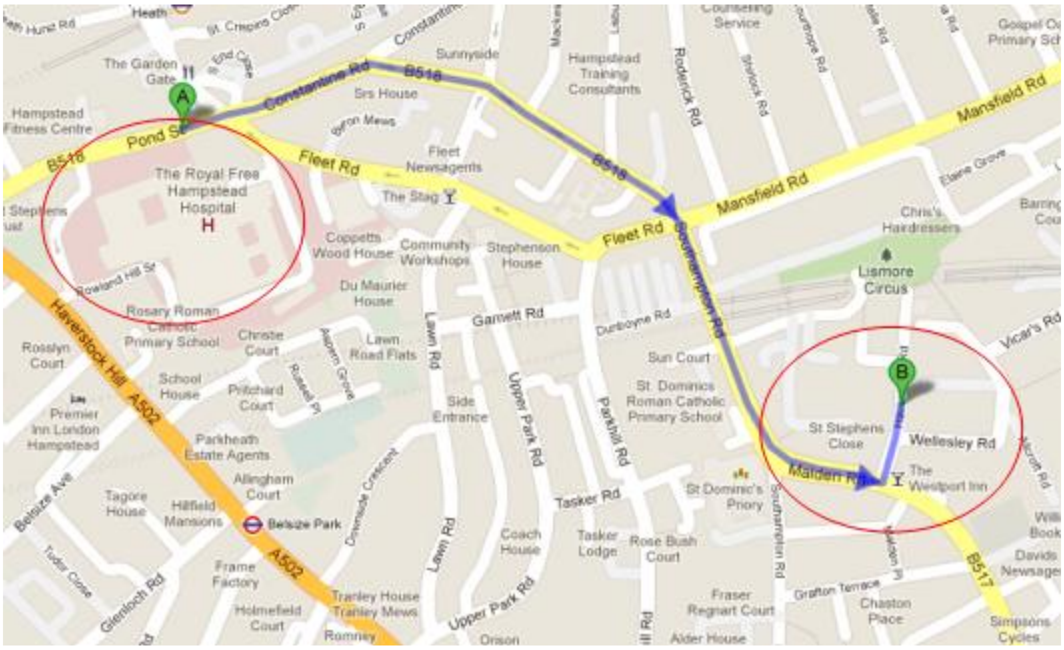
Potential for Communal Heating and CHP

The map below has been taken from the Camden Planning Guidance Core Strategy document indicates the proximity of the proposed Bacton Low Rise Regeneration development and Royal Free Hospital (proposed heating CHP network). The proposed development is within Close proximity (1km) to The Royal Free Hospital's Combined Heat and Power scheme and can benefit from the existing system.



The above map is taken from map 4 of Camden Planning Guidance

Copyright © Rolton Group Ltd 2012



The above map shows the distance from Royal Free Hospital to the proposed Bacton development

The above confirms that the use of CHP system will provide a feasible solution to the production of energy for this project enabling a reduction in the site energy demand. The proposed Royal's Free Hospital waste heat injection plan is suitable for this development and will significantly reduced the overall CO_2 emissions which would have occurred through the use of extra fossil fuel consumption to meet the building heating demands. This type of technology will be utilised for the development in conjunction with a district heating system.

Copyright © Rolton Group Ltd 2012

Be Green

The following technologies come under the heading of 'Green' as they are renewable sources of energy only requiring the natural elements to provide energy.

Below, we have highlighted the most common 'Green' technologies and commented on their appropriateness for the proposed development.

Solar water heating

The utilisation of evacuated tubes or solar panels mounted on the roof can save up to 50-60% of annual energy requirement for domestic hot water. However, there is still a requirement for domestic water generation equipment to cover cloudy days and to top up the energy that the solar heaters cannot provide. These installations are available for domestic installation but will need a hot water storage facility to be provided. Although these items are particularly suited to high hot water load buildings such as kitchens and sports facilities, modern dwellings can also benefit.

Typically solar hot water generators in the UK are able to provide approximately 450kWh per annum per m^2 of collector, and studies from the Energy Saving Trust have shown that savings in the region £55/year on average are achieved over heating the hot water with gas.

Note: Solar hot water systems are not sized in peak kilowatts as this figure is dependent on the solar radiation and the flow rate of the water within the system. The flow rate of water within the system should be designed such that the system won't overheat, i.e. the water temperature shouldn't reach more than 90 degrees Celsius.

Dwellings with hot water storage facilities are suitable for the installation of solar hot water generators, however this is not considered at this stage for this development at later design stage. However as the proposed CHP system will meet required CO_2 emissions reductions therefore this technology has not been further assessed.

Wind turbine

The main advantage of wind turbines is that the energy is free and with modern technology it can be captured efficiently. It is therefore a fully renewable source of energy and produces no pollution (apart from the pollution from manufacturing). However, wind turbines do not produce the same amount of electricity all the time and there will be periods when they produce no electricity at all.

When in operation, they can also disturb local bird populations and cause death to those venturing too close to the rotating blades. However the Royal Society for the Protection of Birds (RSPB) states that this is insignificant in comparison to the problems that will be caused to birds if global warming is left unchecked. Wind turbines can be column mounted or building mounted. The more efficient of these is the column type of up to 150m, which can produce a peak output of 3MW each.

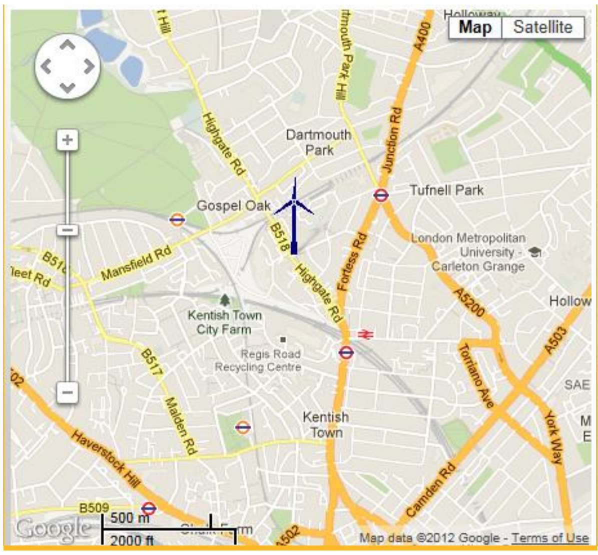
Unfortunately, wind turbines are not suitable for sites of a restricted size and limited network connectivity. For this type of site we would suggest that pole mounted devices of typically 6-11m in height would be more suitable. These can cause an aesthetic issue which would need to be addressed and turbulence from adjacent buildings and trees may make the solution unviable. These units can increase ambient noise levels which may prove problematic with the neighbours.

A typical installation for a domestic wind turbine would be a Kingspan wind 3kw unit on a 6.5-11m pole. This will have a rotor diameter of 3.9m and in average wind speed areas of 5m/s could produce up to 4500 kWh per annum.

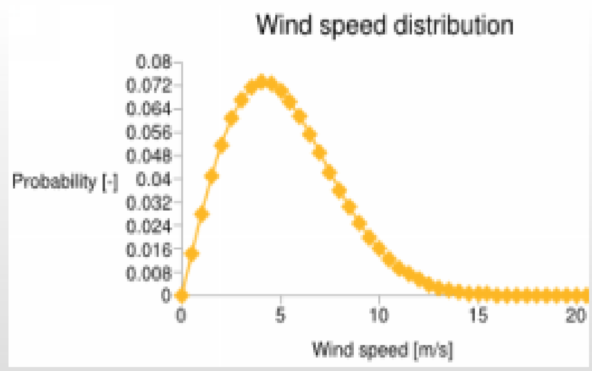
Copyright © Rolton Group Ltd 2012

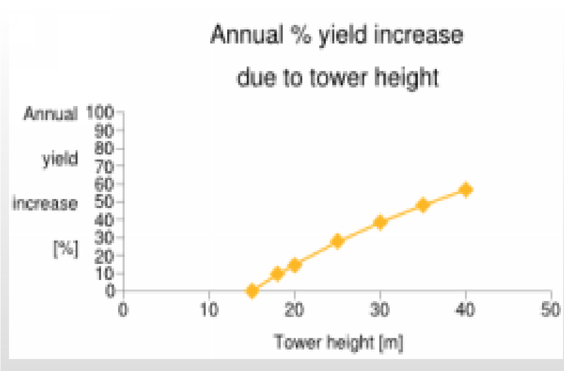
Alternatively building mounted turbine can be provided, such as the 1.5kW 'Swift' manufactured by Renewable Devices, which includes an immersion heating so that any electrical energy not being used is transferred to heat the hot water in the dwelling. With average wind speed of 5.5m/s this type of turbine could produce up to 1753 kWh per annum.

The following was extracted from the DTI wind speed database and shows the annual mean wind speed for the site and its relevant grid in the yellow box, this varies for differing heights of turbines.



Wind speed (m/s) at 45m above ground level around turbine		
6.7	6.5	6.3
6.4	**6.2**	6.2
6.3	6.1	6.1
Wind speed (m/s) at 25m above ground level around turbine		
6.3	6.0	5.8
6.0	**5.7**	5.7
5.8	5.6	5.6
Wind speed (m/s) at 10m above ground level around turbine		
5.5	5.2	5.1
5.1	**4.9**	5.0
5.0	4.9	4.8





With the above calculated yield the occupier would be able to save up to £354.48 on their energy bill depending on the utilisation of the available energy, but would also be eligible for 10.4p per kWh generated from the governments feed in tariff, however the Feed in Tariff is now linked to index and the above figure would be different at the time of application.

These systems typically need a minimum average wind speed of 5m/s with an average of 7m/s to work effectively. The figures for this site are less than the minimum average speed requirement at 10m. We would therefore suggest this technology is not utilised for this site. However as the proposed CHP system will meet required CO_2 emissions reductions therefore this technology has not been further assessed

Copyright © Rolton Group Ltd 2012

Photovoltaic

The utilisation of PV in the UK is currently at a fairly low level due to the lack of good external light levels along with expensive equipment compared to other renewable technologies. The photovoltaic cells absorb direct sunlight and with use of semiconductors change this directly into electrical current. In the UK they are particularly suited to powering remotely located items of electrical equipment with low electrical loads such as parking meters, and illuminated road signs, as the cost for cabling and power lost in transfer make it more economic. Some street light manufacturers have introduced LED luminaries with built in PV's which is an ideal packaged solution.

As the technology develops and as integrated roof solutions become readily available which reduce the cost by implementing the PV panels as the roof covering, then the feasibility of this type of system increases.

The main draw back with PV generated electricity is that the profile of generation is usually not matched by the load profile of the building. It is obviously much simpler to use the energy generated directly, as any type of power storage reduces the efficiency of the system, but matching the supply and demand profiles is out of the control of the consumer.

We would therefore suggest that PVC's are looked at and utilised for the provision of some of the remote external lighting requirement for this site such as bin stores etc. This will also provide minimisation of external cabling to the lighting which has a significant benefit in cost and energies expended for the excavation and cable installation.

PVC supplied external lighting could be utilised in the development to generate electricity However as the proposed CHP system will meet required CO_2 emissions reductions therefore this technology has not been further assessed

Rainwater and Greywater harvesting

A rainwater harvesting system is where the rainwater drainage system on a property is used to capture water in a storage facility such as a water butt or a water storage tank. This water is then used irrigate the garden or even to flush the toilet within the house. A greywater system takes the waste water drainage within the house including the sinks and bath (but not the toilet), filters it to remove soap etc. is sterilised so it is suitable for storage and then stored for later use for flushing the toilet.

Within the UK, the provision of water from the local authorities generally uses 1kWh per m^3 to clean and pressurise the supply to the point of use. By introducing a rainwater or greywater harvesting system not only are we able to reduce water usage which also saves the consumer money, we are able to reduce the energy usage and carbon emissions from the water supplier.

It should be noted that although technically we can save energy and carbon through using rain water harvesting, it is not taken into account within the Part-L calculations as it is not a energy saving directly associated with the development.

Having said that there are credits available within the Code for sustainable homes for including a rainwater or greywater system within the development.

A study by the Environment agency in a property which collected water from house similar to our standard model they were able to save 53% of their potable water. With an approximate water usage of 164 m^3 for our standard model this could equate to an annual saving of £96.48 on the water and drainage bill. It is understood that water retention is required on site, therefore it should be easy to integrate this requirement into the development.

A rainwater recycling system could be provided which will capture rainwater, before pumping it to supply any external irrigation requirements. However the Rainwater and Greywater system will be investigated for Code for Sustainable Homes Level 4.

Copyright © Rolton Group Ltd 2012

9 PREDICTED SITE ENERGY RESULTS

The following assessment is based on the SAP calculations for a representative selection of dwellings,

This assessment is therefore based on the following:

Domestic Properties

- Modelling of selected one, two, three and four bedrooms flats and maisonette
- Calculation of Baseline (2010) emissions (Taken as the calculated Target Emission Rate)
- Improvements above 2010 regulations as detailed within this report
- Team target to meet Code for Sustainable Homes Level 4

The results for the representative dwelling have been applied to the whole development by taking on average for each type of unit included and multiplying this type by the number of dwellings of that type.

From the assessment above we have then carried out SAP assessments of four differing types of dwellings (including 1B2P Market Flat, 2B3P Market Flats, 3B5P (Wheelchair Access) Market Flat and a 4B6P Maisonette Houses), for a variety of orientating we have then utilised these calculations for the overall site energy demands and associated Carbon emissions.

Energy Efficiency

To reduce the energy use below the 2010 regulations, we have calculated the energy use utilising the following figures which are significantly better the required Part L1A 2010:-

Element	**Area weighted average U-values required by Part L [W/(m² K)]**	**Calculated area weighted U-values for actual building [W/(m² K)]**
Wall	0.30	**0.12**
Floor	0.25	**0.10**
Roof	0.20	**0.10**
Opening	2.00	**1.12**

We have also improved a number of other items including the following:-

- Improved Systems and Lighting Efficiencies by proposing 100% low energy internal lighting
- Whole house ventilation system with heat recovery system
- Air pressurisation to Q_{50} = 4 m^3/hr m^2

The results of the representative Standard Assessment Procedure (SAP) 2009 calculations have been driven on the basis of above proposed improvements:-

Copyright © Rolton Group Ltd 2012

Basing the overall site loads on these figures of area and energy use we can calculate the initial energy loads for the whole site with the various improvements made as calculated:-

There are two sites at Bacton Low Rise the DHO site and the BLR Site, below table demonstrates overall carbon dioxide emissions savings which can be made through passive measures and with CHP system across the whole scheme,

Dwelling Types across the whole site	**Actual Emissions (tonnes)**	**Target Emissions (tonnes)**
1B2p	19.57	38.00
2B3p	15.56	29.78
2B4p	29.88	57.16
2B4p WAU	1.80	3.44
3B5P	18.74	35.79
3B5P WAU	16.93	32.33
3B6P	9.93	18.97
4B6P	1.75	3.35
M2B4P	3.34	6.37
M3B4P	2.08	3.98
M3B5P	17.11	32.64
M4B6P	1.17	2.24
M4B7P	2.11	4.03
H3B6P	8.21	15.68
H4B6P	12.27	23.42
H5B7P	9.82	18.73
H6B8P	4.55	8.69
Total	174.82	334.60

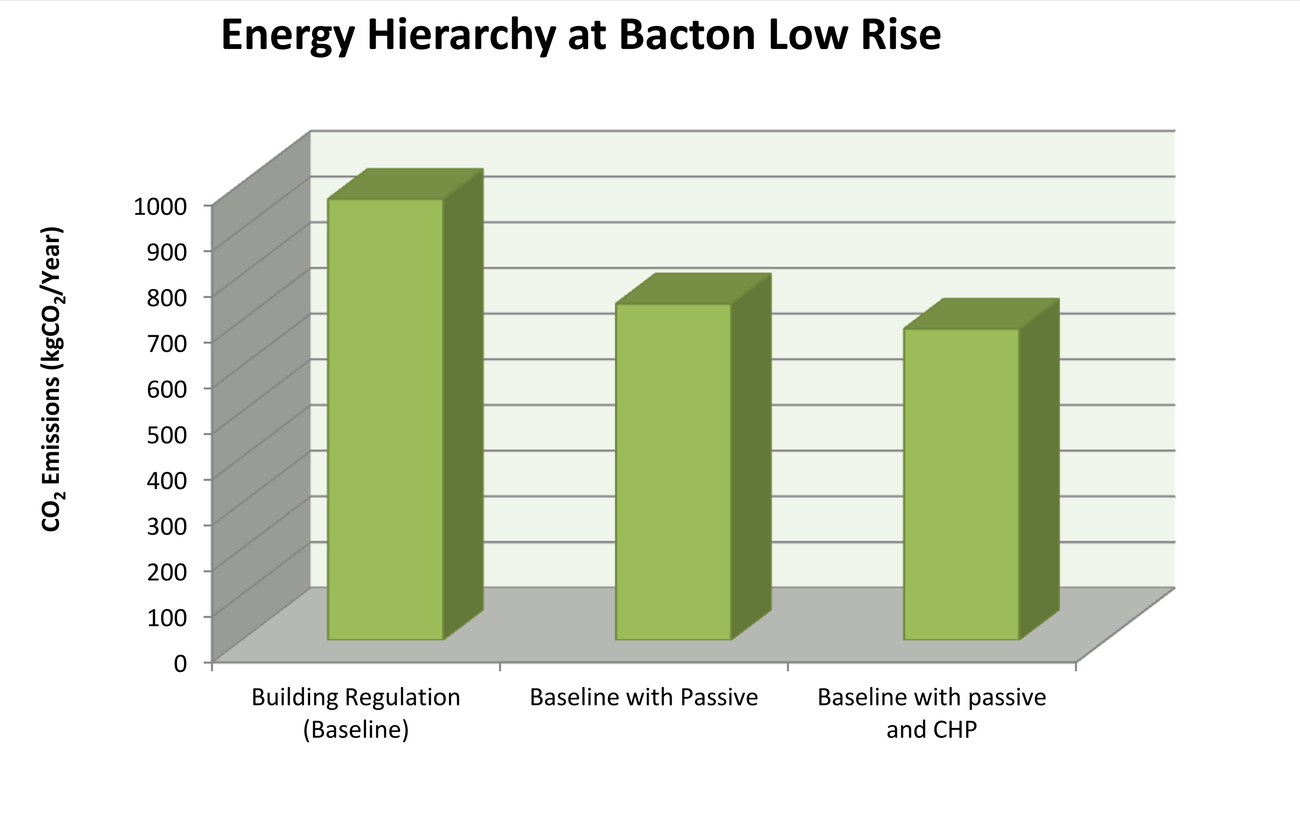
The above table demonstrates that the significant improvements have been achieved with regards to overall Carbon emissions from the whole site,

Reduced Scheme Total (average approx) 160 tCO_2/PA
Reduction from 2010 Total (average approx) 47.75%

The above analysis shows the overall emissions reductions from the whole development however to analyse the benefit of each Be lean, Be Clean and Be Green measures at this stage we have further assessed a sample dwelling at different design development stages. The assessment below is based upon one bedroom apartment at BLR site Block D Bacton Low Rise development, however as the same design principles will be applicable across the whole site therefore the overall savings will be similar across the whole site. Also below is the representation of a worst case scenario therefore the better savings will be made across the site.

Scenario	**Carbon Dioxide $kgCO_2$ per annum**	**Saving [$kgCO_2$/year]**	**Scenario Saving (excl. Appliances)**	**Total Saving (excl. Appliances)**
Building Regulation (Baseline)	965	-	-	
Baseline with Passive	736	229	24%	24%
Baseline with passive and CHP	681	55	8%	29%

Copyright © Rolton Group Ltd 2012



Sample one bedroom apartment comparison chart

The above graph and the table shows the impact of improvement from base scenario to CHP and CO_2 emissions can be reduced at above 29% just from the passive measures and CHP system from the baseline scenario. The above demonstrates that the savings can be made across the whole site with passive measures and utilising the waste heat from the CHP plant.

Future Proofing

Currently the design has been carried out to meet Code Level 4, for future this may well increase; these increases will be dealt with as they occur.

9.1 SUMMARY

From the comparison of the 2010 base level assessment against the improved model it can be seen that there is an initial reduction, without the use of CHP or renewable technology, of 24% of the CO_2 emission for the proposed regeneration just through passive measures.

Therefore in order to meet the requirements of Code Level 4 a further reduction is required and will require the application of CHP integration. The above figures provide us with a total reduction of 29% compared to the Part L 2010 levels which exceeds the requirements of the Code for Sustainable Homes Code Level 4 requirement of 25%, it should be noted that for the code calculation appliances and cooking is not taken into consideration. The Part L Building Regulations do not take into account the impact of carbon dioxide emissions occurred from the cooking and appliance and as standard practice the impact and cooking emissions needs to be calculated separately as non regulated emissions.

Copyright © Rolton Group Ltd 2012

10 SITE WIDE ENERGY ASSESSMENT INCLUDING NON REGULATED LOADS

The calculation process used above defines the relevant energy use of the site, this has been carried out in line with the Government's Standard Assessment Procedure for Energy Rating of Dwellings, 2009 version 9.90 (SAP). This assessment procedure also provides the energy improvement target for The Code for Sustainable Homes, this is by default the standard method for measurement as defined in the Building Regulations and currently the project is targeting Code Level 4.

SAP 2009 does not require calculating the impact of cooking and appliance emissions and as general practice these emissions are excluded from the overall emissions calculations. However we understand that the adopted London Plan (Chapter 5 London's response to climate change) item 5.22 require separate details of unregulated emissions to recognise explicitly the additional contribution to be made though efficient equipment. The Camden Planning Guide CPG3 item 2.8 also requires the calculation of the overall energy consumption from both the regulated and unregulated sources.

Hence to address the above requests calculations has been carried out integrating the cooking and appliance loads into the process and whilst this is not required for Code for Sustainable Homes assessment below Code Level 6 therefore we have further calculated the impact of unregulated emissions (i.e. cooking and appliances) and listed in the table below,

Energy Assessment including Cooking and Appliance loads:-

Scenario	**Carbon Dioxide [kgCO_2/year]**	**Saving [kgCO_2/year]**	**Scenario Saving (inc. Appliances)**	**Total Saving (inc. Appliances)**
Baseline Emissions (2006)	965	-	-	-
Baseline with Appliances	1888	-	-	-
Baseline with Appliances and Passive Measures	1659	229	12%	12%
Baseline with Appliances Passive Measures and CHP	1604	55	3%	15%

As can be seen in the table above the energy reduction by the integration of the CHP District Heating System is 15% below the Baseline Emissions (or 12% below the site energy levels after applying passive savings).

Copyright © Rolton Group Ltd 2012

APPENDIX A
SAP 2009 VERSION 9.90 COMPLIANCE REPORTS

BACTON LOW RISE - As designed

Copyright © Rolton Group Ltd 2012

APPENDIX B
COPYRIGHT INFORMATION

Copyright © Rolton Group Ltd 2012

THIS PAGE CONTAINS IMPORTANT INFORMATION ABOUT YOUR RIGHTS TO READ AND USE THE CONTENT OF THIS DOCUMENT

COPYRIGHT

This document is the copyright of Rolton Group Ltd ("**Rolton Group**"). The reproduction or transmission of all or part of this document, whether by photocopying or storing in any medium by electronic means or otherwise, without the prior written consent of Rolton Group or pursuant to a formal licence is prohibited.

This document and any copies of it shall only be used for the purpose for which this document was originally supplied by the Rolton Group and for no other purpose ("**Intended Purpose**").

NON-DISCLOSURE

This document contains confidential information. In consideration of Rolton Group disclosing such confidential information this document should be held and maintained in confidence and should only be disclosed to:

1. EC Harris LLP, London (The Client);
2. Professional advisors to the Client;
3. The Local Authority for the site location;
4. The Environment Agency;
5. Client's permitted assignees established by written assignment; and
6. Professional advisors of permitted assignees.

This document shall not be disclosed or made available to any other individual, firm, company or organisation without the prior written consent of Rolton Group.

The confidential information in this document shall only be used for the Intended Purpose.

FREEDOM OF INFORMATION

Authorised or unauthorised copies of this document may come into the possession of organisations that are designated under the Freedom of Information Act 2000 ("**the Act**"). Such organisations that are designated in the Act are requested by Rolton Group to respect the above statements relating to confidentiality and copyright. Rolton Group has invested and imparted substantial skill, economic resources and labour in producing this document and any disclosure shall prejudice the commercial interests of the Rolton Group.

DISCLAIMER

The information in this document should only be used by suitably skilled and experienced individuals. Unless expressly agreed otherwise in writing, Rolton Group shall not have any responsibility or liability to any individual, firm, company or organisation for the content of this document or any information derived from it other than to the client of the Rolton Group that has commissioned the document and any permitted assignees established by written assignment. Rolton Group does not seek to exclude or limit its liability for death or personal injury resulting from its negligence.

If you do not accept the terms above then do not read the content and return this document to Rolton Group at the address given on the flyleaf.

ENQUIRIES

Any enquiries regarding this document and its content should be directed to Rolton Group: Tel: +44 (0)870 726 0000 E Mail: enquiries@rolton.com.

Copyright © Rolton Group Ltd 2012