Blue Boar Lane - Sprowston
Site-wide renewable energy and sustainability strategy

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<thead>
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<th>Name</th>
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<td>February 2008</td>
</tr>
</tbody>
</table>
## Contents

<table>
<thead>
<tr>
<th>Subject</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Introduction</td>
<td>1</td>
</tr>
<tr>
<td>2.0 Policy context</td>
<td>2</td>
</tr>
<tr>
<td>3.0 Policy compliance strategy</td>
<td>6</td>
</tr>
<tr>
<td>4.0 Analysis of renewable energy technology</td>
<td>10</td>
</tr>
<tr>
<td>5.0 Minimisation and management of construction waste</td>
<td>15</td>
</tr>
<tr>
<td>6.0 Summary</td>
<td>18</td>
</tr>
</tbody>
</table>
1.0 Introduction

1.1 Brief

Cyril Sweett has been commissioned by Hopkins Homes, Persimmon and Taylor Wimpey Developments Ltd to produce a renewable energy and sustainability strategy for the proposed residential development at Blue Boar Lane, Sprowston.

This strategy looks at overall timeframe of the development in accordance to the requirements of relevant planning policy ranging from the national to the local perspective and sets out the approach necessary to ensure all conditions are satisfied in an effective manner.

This assessment places particular emphasis on:

- Energy;
- Water;
- Materials;
- Waste.

These are key parameters with regard to policy compliance and furthering sustainable development.

1.2 Site location and development proposal

1.2.1 Background

Blue Boar Lane is located approximately 3.5 miles north of Norwich City Centre. A large proportion of the site is primarily used for agricultural purposes with extensive areas of plantation (Boar Plantation, Harrisons Plantation, the Breck and part of Round Hill Plantation).

A Tesco supermarket adjoins the northern boundary of the site. The remaining land to the north, adjacent to Tesco, is allocated in the Broadland District Local Plan for mixed use development including business (B1), residential, local shopping facilities and a community centre. Opposite this site on the north side of Wroxham Road is the Park and Ride facility.

Blue Boar Lane, Wyevale Garden Centre and Cottage Plantation are beyond the site's western boundary. Open fields adjoin the north-eastern boundary of the site.

The proposal is for a residential development providing for up to 1233 dwellings with a new link road linking Wroxham Road to Salhouse Road. In addition there will be necessary social and physical infrastructure, a primary school, pedestrian and cycle links, recreational areas and open space and extensive landscaping.

The scheme is to be developed by a consortium of house builders (Hopkins Homes, Persimmon and Taylor Wimpey) over a number of phases.
2.0 Policy context

2.1.1 National Policy

Planning Policy Statements (PPS) set out the Government’s national policy for different aspects of land use planning in England. Two PPS’s are particularly relevant to sustainability performance of new housing; the supplement to PPS1 and PPS22.

In December 2007, the supplement to PPS1 ‘Planning and Climate Change’ was published, whilst this document does not set any specific quantified targets with respect to renewable energy provision/carbon dioxide (CO2) reduction; there are certain requirements that must be taken into. For example, paragraph 42 reads:

‘In their consideration of the environmental performance of proposed development, taking particular account of the climate the development is likely to experience over its expected lifetime, planning authorities should expect new development to:

- comply with adopted DPD policies on local requirements for decentralised energy supply and for sustainable buildings, 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;
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption, including maximising cooling and avoiding solar gain in the summer; and, overall, be planned so as to minimise carbon dioxide emissions through giving careful consideration to how all aspects of development form, together with the proposed density and mix of development, support opportunities for decentralised and renewable or low-carbon energy supply;
- deliver a high quality local environment;
- provide public and private open space as appropriate so that it offers accessible choice of shade and shelter, recognising the opportunities for flood storage, wildlife and people provided by multifunctional greenspaces;
- give priority to the use of sustainable drainage systems, paying attention to the potential contribution to be gained to water harvesting from impermeable surfaces and encourage layouts that accommodate waste water recycling;
- provide for sustainable waste management; and
- create and secure opportunities for sustainable transport in line with PPG13 including through:
  - the preparation and submission of travel plans;
  - providing for safe and attractive walking and cycling opportunities including, where appropriate, secure cycle parking and changing facilities; and
  - an appropriate approach to the provision and management of car parking.”

The requirements of paragraph 42 have been considered throughout the development of the Sprowston proposals and have been set out in the respective assessment documents (i.e. within the Transport Assessment, Flood Risk Assessment, etc).

PPS22 (Renewable Energy) draws on the Governments’ policy on renewable energy set in the Energy White Paper (the aspiration that 10% of UK energy be provided from renewable sources by 2010). PPS22 encourages regional and local
planning authorities to take into account policies within the statement when preparing regional spatial strategies and local documents with the aim to promote and encourage the development of renewable energy resources.

It is important to note that PPS22 recognises that such policies should ‘ensure that requirement to generate on-site renewable energy is only applied to developments where the installation of renewable energy generation equipment is viable given the type of development proposed, its location and design.’

2.1.2 Regional policy

The first integrated Regional Spatial Strategy (RSS) was published by the East of England Regional Assembly (EERA) in 2005. In October 2005 the document ‘Sustainable Futures – The Integrated Regional Strategy for the East of England’ was published, this document sets out Crucial Regional Issues, Issue 8 recognises the importance of renewable energy stating ‘...the region has scope and potential to be seriously innovative with regard to the use of resources in this context, it has particular opportunities relating to renewable energy’.

The EERA Renewable Energy Supplement (November 2005) sets the aspiration of 10% of site energy demand to be provided by a renewable source.

A draft revised version of the Sustainable Futures document entitled ‘Sustainable futures – consultation draft of the revised regional spatial strategy for the east of England’ was issued in September 2007 and is currently at consultation stage. The document sets more stringent aspirations with regard to future renewable energy contributions and commitment to Code Level 3 of Code for Sustainable Homes for affordable and private sector housing.

The Greater Norwich Development Partnership (GNDP) issued an advice note with regard to low carbon development in January 2008 (in response to the publication of the PPS1 supplement). The guidance for designing for optimal environmental performance has been followed within this document (as stated, where applicable - areas such as the provision of sustainable urban drainage systems (SUDs) and sustainable transport have been addressed in the respective assessment documents).

2.1.3 Local Policy

Broadland District Council (BDC) adopted its replacement Local Plan in May 2006. The Local Plan is a guide for the future development of the District. This document is to be replaced by the Local Development Framework (LDF) which is being prepared by the GNDP. Part of the LDF comprises the Local Development Scheme (LDS), this sets out how the rest of the LDF (2007-2021) documents will be prepared. The LDS requires Supplementary Planning Documents (SPD) (which are specific to certain developments or principles) to be produced. Subsequently, a SPD was produced for the Blue Boar Lane site which sets out key sustainability objectives – including consideration of Lifetime Homes and EcoHomes (which has since been superseded by the Code for Sustainable Homes – see below) certification.

2.1.4 The Code for Sustainable Homes (CfSH)

The Code for Sustainable Homes (CfSH) was introduced in April 2007. The CfSH replaces EcoHomes, although the two schemes will run concurrently for a limited period of time. The two schemes are based on similar assessment frameworks;
however there are key differences\(^1\) between the two schemes that ensure they cannot be easily directly compared.

There are six levels of CfSH compliance, Level 3 has been adopted by English Partnerships and the Housing Corporation for grant-funded affordable homes.

It is proposed that Part L of the Building Regulations will be revised to align with the energy targets within the Code. At the time of writing (February 2008) the timeline for Part L revisions is as follows (Table 2.1):

<table>
<thead>
<tr>
<th>Year</th>
<th>Part L change</th>
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<tbody>
<tr>
<td>2010</td>
<td>25% improvement over Part L Building Regulations (2006)</td>
</tr>
<tr>
<td>2013</td>
<td>44% improvement over Part L Building Regulations (2006)</td>
</tr>
<tr>
<td>2016</td>
<td>~150% improvement over Part L Building Regulations (2006)</td>
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Table 2.1: Proposed Part L revisions

Figure 2.1 sets out how the improvements over Part L Building Regulations (2006) correspond to a CfSH rating. It is important to note that compliance with the energy requirement of each Level of the code is the only mandatory target as far as the timeline is concerned.

Figure 2.1: Proposed Part L improvements over time

The targets refer to a percentage improvement in the Dwelling Emission Rate (DER) (estimated carbon dioxide (CO\(_2\)) emissions in kg per m\(^2\) per annum arising from the energy use for heating, hot water and lighting for the actual dwelling), over the Target Emission Rate (TER) (the maximum emission rate permitted by Building Regulations), for the dwelling where DER and TER are as defined in Approved

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\(^1\) Including the presence of minimum performance standards for energy, water and other categories within the CfSH.
Document L1A 2006 Edition of the Building Regulations). Within the CfSH this is addressed in credit Ene 1 (Dwelling Emission Rate).

2.1.5 Summary

Each phase of the development will meet the applicable CfSH regulatory requirement. For example, if phase 2 is due for commencement in 2013 (and regulatory revisions occur as programmed) phase 2 will need to achieve a 44% improvement on current Part L.

Achieving compliance with CfSH Level 3 requires a 25% improvement over current building regulations. Although the CfSH Level does not of itself require the use of renewable energy, it is likely that CfSH compliance will deliver the site wide energy targets governed national and regional planning guidance (i.e. 10% by 2010 with the aspiration to double this by 2020).

Due to the rapid advancement of sustainability policy and the effectiveness of renewable energy technology, it is very difficult to provide an accurate description of the sustainable solutions for all future phases of the development. Detailed solutions for each individual phase will be provided as the application progresses, the technologies and design techniques chosen will be those that are most appropriate and feasible at the time.

Phase one of the development will be addressed within the report ‘Blue Boar Lane, Sprowston – Phase 1 Renewable Energy and Sustainability Strategy.’ This document will form part of the Reserved Matters application.

The following section sets a strategy for achieving each level of the CfSH based on current best practice knowledge and guidance – please note that this is subject a change, as and when certain types of construction techniques and renewable energy technology become more commercially viable.
3.0 Policy compliance strategy

3.1 Introduction

This chapter looks at the approach required to achieve each of the CfSH with particular emphasis on compliance with the energy and water elements of the CfSH (typically the most challenging aspects).

3.2 Code Level 3 compliance methodology

The year of compliance for credit Ene1 (improvement over Building Regulations 2006) is 2010, whilst the other credits stated below are mandatory for achieving the CfSH Level 3 status, they do not have to implemented by 2010. For full CfSH Level 3 status 57 credits are required.

Mandatory credits:

Energy (Ene 1)\(^2\) - A 25% improvement in carbon dioxide (CO\(_2\)) emissions over Part L1A (2006) Building Regulations is required. The reduction in CO\(_2\) emissions will be achieved through a combination of thermal efficiency upgrades (i.e. reducing heat-loss through improved insulation) and renewable energy technology – through the use of solar thermal panels to provide a proportion of the daily hot water (DHW) demand.

Water (Wat 1) – Maximum consumption = 105 litres per person per day. To achieve this target, water efficiency measures will be installed in all properties including: dual-flush toilets, low-flow showers, and aerated taps.

Materials (Mat 1) – Where at least 3 of the 5 key elements achieve a relevant code rating from the 2007 version of The Green Guide of A\(^+\) to D:

- Roof;
- External walls;
- Internal walls (including separating walls);
- Upper and ground floors (including separating floors);
- Windows.

Surface water runoff (Sur 1) – ensure that run-off rates and annual volumes of run-off post development will be no greater than the previous condition for the site;

Waste (Was 1) – The space allowed for waste storage should be sized to hold the larger of the two (by volume) of the following:

Either

All external containers provided under the relevant Local Authority/recycling schemes. Containers should not be stacked to ensure ease of access and use.

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\(^2\) As stated above credits are awarded based on the percentage improvement in the Dwelling Emission Rate (DER) (estimated carbon dioxide emissions in kg per m\(^2\) per annum arising from the energy use for heating, hot water and lighting for the actual dwelling), over the Target Emission Rate (TER) (the maximum emission rate permitted by Building Regulations), for the dwelling where DER and TER are as defined in Approved Document L1A 2006 Edition of the Building Regulations. 
Or

The minimum capacity of waste storage as calculated from BS5906 (Code of Practice for Storage and On-side Treatment of Solid Waste from Buildings, 2005).

All containers must be accessible to disabled people, particularly wheelchair users and sited on a hard, Level surface.

**Waste (Was 2)** – A Site Waste Management Plan (SWMP) must be produced and implemented. This will require the monitoring of waste generated on-site and the setting of targets to promote resource efficiency in accordance with the relevant guidance. Specific targets are not required.

**Potential difficulties and constraints:**

No major difficulties in compliance with the CfSH Level 3 (in particular credit Ene 1) are envisaged.

### 3.3 Code Level 4 compliance methodology

The year for compliance with the energy credit Ene 1 is 2013. 68 credits are required to achieve the full CfSH Level 4 status.

**Mandatory credits:**

**Energy (Ene 1)** – A 44% improvement in carbon dioxide (CO₂) emissions over Part L1A (2006) Building Regulations is required.

The 44% reduction in emissions is challenging and will require a combination of advanced efficiency upgrades (for example - low air permeability with mechanical ventilation with heat recovery (MVHR)) and renewable energy technologies such as:

- Solar thermal panels for DHW plus

**Either**

- micro – large scale wind turbines and/or
- Biomass CHP (for apartments) and/or
- Photovoltaics (PV)
- Ground Source or Air Source Heap Pumps (GSHP/ASHP).

Each technology has its own advantages and disadvantages particularly with regard to parameters such as resource availability (i.e. sunlight or wind) and to wider planning constraints – for example potential noise implications of turbines or air quality issues associated with biomass boilers.

A detailed study will be undertaken to determine the most viable strategy for each phase with regard to its anticipated year of completion. This will be conducted when the layout and accommodation schedule for the later phases have been finalised.

**Water (Wat 1)** – As for CfSH Level 3
**Materials (Mat 1)** – As for CfSH Level 3
**Surface water runoff (Sur 1)** - As for CfSH Level 3
**Waste (Was 1)** – As for CfSH Level 3
**Waste (Was 2)** – As for CfSH Level 3
Potential difficulties and constraints:

Between Code Level 3 and 4 there is a notable increase in the difficulty of compliance especially with regard to the credit Ene 1 (Dwelling Emission Rate).

The target of a 44 % reduction in CO\textsubscript{2} emissions means that a large amount of energy must be negated/provided from a renewable source. There are a range of renewable technologies available that may be viable at the site – chapter 4 lists the pros and cons of each, with their performance and viability dictated by overriding factors such as resource availability, planning and end-user application.

The additional credits to increase from 57 to 68 are likely to be achieved in credit Ene 1 (Dwelling Emission Rate) i.e. by going from a 25% to a 44% reduction in CO\textsubscript{2}, Ene 7 (Renewable energy) by providing a 15% reduction in CO\textsubscript{2} emissions as a result of renewable technology and in Hea 4 (Lifetime Homes). The Lifetime Homes standard was developed in 1991. The scheme involves the incorporation of 16 design features that together create a flexible blueprint for accessible and adaptable housing in any setting.

3.4 Code Level 6 compliance methodology

The year for compliance with the energy credit Ene 1 is 2016. 90 credits are required to achieve the full CfSH Level 6 status.

Mandatory credits:

**Energy (Ene 1)** – ‘Zero carbon’ where net CO\textsubscript{2} emissions resulting from ALL energy used in the dwelling are zero or better. This includes regulated (space heating, hot water demand and lighting) and unregulated emissions (cooking and appliances). A zero carbon home is also required to have a Heat Loss Parameter (covering walls, windows, air tightness and other building design issues) of 0.8 W/m\textsuperscript{2}K or less.

The challenge of achieving ‘Zero-carbon’ status is extremely difficult, requiring super-insulated buildings (to reduce space heating demand to practically zero) plus very substantial quantities of renewable energy technology will need to be accommodated on-site – either building mounted systems or decentralised systems or both.

It is particularly pertinent that dwellings are designed to take advantage of passive solar gain in winter without compromising the streetscape, the internal layout or posing the risk of overheating in summer.

Construction methods and materials will have to inherently reduce thermal bridging (thermal bridging occurs where the continuity of the building fabric is broken by the penetration of an element allowing a significantly higher heat loss than its surroundings i.e. at wall/roof junctions).

**Water (Wat 1)** – Maximum consumption = 80 litres per person per day. To achieve this target, water efficiency measures will be installed in all properties including: dual-flush toilets, low-flow showers, and aerated taps. In addition, advanced measures such as grey-water recycling and rainwater harvesting will be required.

**Materials (Mat 1)** – as for CfSH Level 3
**Surface water runoff (Sur 1)** – as for CfSH Level 3
**Waste (Was 1)** – as for CfSH Level 3
**Waste (Was 2)** – as for CfSH Level 3
Potential difficulties and constraints:

The most demanding aspect of achieving Code Level 6 is the provision of an adequate supply of energy from a renewable source; Chapter 4 provides a breakdown of potentially viable technology and lists the advantages and disadvantages of each.

The additional credits to increase from 68 to 90 will predominantly be achieved through credit Ene 1 ( Dwelling Emission Rate) i.e. by going from 44% to ‘zero-carbon’, in Ene 2 (decreasing the HLP) and Wat 1 (decreasing water consumption). Other categories (often labelled as having relatively less significance) will have to be appropriately addressed in order to ensure as close to maximum performance as possible, these are categories such as Health and Wellbeing and Ecology

3.5 Energy calculations

The following approach is used to determine the baseline performance of each dwelling, the amount of energy that can be reduced through efficiency upgrades and the subsequent amount of energy that must be provided from a renewable source to hit the relevant targets.

The strategy utilises the methodology and calculations specified in The Government’s Standard Assessment Procedure for Energy Rating of Dwellings (2005 Edition) (please note this document is in the process of being revised albeit the issue date has not been stipulated).

Stage 1: Predict energy demand
To determine the site baseline energy demand the energy consumption of each dwelling needs to be determined through tabulating the space heating, hot water and electrical demand of each unit (this involves analysis of the 2005 compliant Standard Assessment Procedure (SAP) data sheet for each proposed house-type).

Stage 2: Energy efficiency improvements
Various options are considered to improve the efficiency beyond the standards required by the Building Regulations. These options can include enhancements to the building envelope, and to the performance of the lighting and building services (i.e. heating/cooling/ventilation).

The incorporation of efficiency upgrades results in a reduction in the site’s energy demand, hence the total amount of energy to be provided from a renewable source decreases. This approach is particularly important at the site as given the location there is likely be limited availability of natural renewable resources.

Stage 3: Identify appropriate renewable energy technologies
Following the application of energy efficiency measures, the most appropriate renewable energy technologies (i.e. those which make best use of available resources) are identified. The technical, economical, practical and environmental impacts of the range of renewable energy technologies are investigated below in order to establish their overall feasibility.
4.0 Analysis of renewable energy technologies

A range of renewable energy technologies will be considered for the site including:

- Photovoltaics (PV);
- Solar thermal panels;
- Wind turbines;
- Biomass;
- Ground Source Heat Pumps (GSHP);
- Combined Heat and Power (CHP).

The following section provides a description of the feasibility of each;

**Photovoltaics (PV)**

**Description**
Photovoltaic systems use cells to convert sunlight into electricity. The PV cell consists of one or two layers of a semi conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity.

**Advantages**
Tried and tested form of renewable energy generation with a mature supply chain and a long design life (20 – 30 years). Virtually no maintenance is required and the systems can easily be incorporated into the design of the buildings.

**Disadvantages**
At present, this technology has a relatively high cost and a low efficiency – a lot of research has been invested in the development of Thin-Film Photovoltaics (TFPV) – and there is real anticipation that the cost of PV will be significantly reduced if this technique comes to fruition, albeit at present it remains one for the future.

For optimum performance the panels need to be installed at the angle that will maximise solar radiation (i.e. within ± 45° of south).

**Compliance analysis:**
- Code 3: Does not form part of the strategy;
- Code 4: Some element of PV is likely to be necessary;
- Code 6: Large areas of PV are likely to be required.
Solar thermal

**Description**
Solar thermal panels produce hot water from solar energy and reduce the need for conventional water heating (i.e. gas).

Typically around 40% of annual hot water demand can be provided through the use of solar thermal panels.

**Advantages**
Inexpensive and effective. Straightforward technology in terms of operation and maintenance (little required).

**Disadvantages**
For optimum performance the panels need to be installed at the angle that will maximise solar radiation (i.e. within ±45° of south). The technology can only save a finite amount of CO₂.

**Compliance analysis:**
- Code 3: Will form part of the strategy;
- Code 4: May form part of the strategy;
- Code 6: May form part of the strategy.

Wind turbines

**Description**
Wind turbines use the wind's lift forces to rotate aerodynamic blades that turn a rotor to generate electricity.

**Advantages**
A way of producing electricity with zero emissions. The cost of the turbines is low compared to other technologies with a further reduction in prices forecast as production-lines increase in size.

**Disadvantages**
Major planning issues (i.e. noise, wildlife, aesthetics).

For optimum performance the wind speed at the site needs to be between 8 – 12 m/s. The department for Business Enterprise and Regulatory Reform (BERR) wind speed database ([www.berr.gov.uk](http://www.berr.gov.uk)) indicates that the wind speed at the Sprowston site is approximately 5.2 m/s at 10 m (i.e. far lower than ideal).

**Compliance analysis:**
- Code 3: Does not form part of strategy;
- Code 4: Does not form part of strategy;
- Code 6: Despite the windspeed availability being lower than desirable, in order to hit the zero-carbon requirement some form of wind-turbines may be required. Potentially, a larger turbine shared between a number of homes may be feasible. This will require a full detailed analysis at a later stage of the planning application.
Biomass

**Description**
Burning wood or wood products, as a fuel is considered to be a “carbon neutral” process because the CO₂ released during combustion is equal to that absorbed during growth of the fuel. Biomass can be used to provide energy for district heating schemes. In district heating systems more than one building or dwelling is heated from a central source. Biomass fuels are combusted in a boiler and then heat in the form of steam or hot water is transferred, via a distribution network of underground pipes to different buildings. This is then used for space heating and hot water in each home.

**Advantages**
Reliable and cost effective and work well in an area where there is a local supply of fuel.

**Disadvantages**
The management of such a shared system is complex, and would require a management strategy to address operation and maintenance, and to charge residents on an equal basis.

The majority of the site is of medium density, which is not ideal for a centralised system, as the distribution pipework is costly and relatively inefficient.

There are wider planning issues to consider such as air quality (the emissions from the stacks may influence the local air quality).

Fuel delivery and storage needs to be analysed in detail.

**Compliance analysis:**
- Code 3: Does not form part of strategy;
- Code 4: May form part of strategy;
- Code 6: A proportion of the site’s energy may be provided through biomass – especially if a local source of fuel can be identified.

**Ground Source Heat Pumps (GSHP)**

**Description**
Ground source heat pump systems (GSHP) extract constant temperatures from below ground, and convert them into temperatures which can be used for space heating. Heat can be extracted either by means of a “horizontal” system, where pipe coils are laid in trenches, or by a “vertical” system, which uses boreholes.
Advantages
The system does not require any external fuel and can be designed to heat a whole building, typically through underfloor heating.

Disadvantages
If there are spatial restrictions on site, a vertical system would be required, which adds significant cost to the installation. Furthermore, this technology uses electricity to operate the circulation pumps, and the heat pumps themselves.

Compliance analysis:
- Code 3: Does not form part of strategy;
- Code 4: May form part of strategy;
- Code 6: A proportion of the site’s energy may be provided through GSHP – particularly if a large area for a horizontal array of piping can be allocated.

Air Source Heat Pumps (ASHP)

Description
Air Source Heat Pumps (ASHP) work in a similar way to the ground source system. Instead of heat being extracted from the ground it is extracted from the air by a unit that is sited outside.

Advantages
The system does not require any external fuel and can be designed to heat a whole building, typically through underfloor heating. The technology is less expensive than GSHP and has no need for ground loops. The installation of the units is straightforward.

Disadvantages
Electricity is required to pump the heat. Typically, the efficiency and lifetime is lower than other renewables. Furthermore, as the equipment is located externally it is subject to the elements hence requires weather proofing.

Extensive work is being undertaken to address the above issues, it is anticipated that the installation of ASHPs may become more favourable by the later phases of the development.

Compliance analysis:
- Code 3: Does not form part of strategy;
- Code 4: May form part of strategy;
- Code 6: May form part of strategy.
**Combined Heat and Power (CHP)**

**Description**
Combined Heat and Power (CHP) systems generate both electricity and thermal energy from a single fuel source, which is typically natural gas. This is an efficient technology, and can generate considerable CO₂ savings in the right conditions.

Micro-CHP is being developed specifically for the domestic market, and several major manufacturers are currently working towards making this available. However, at the time of writing (February 2008), no models are available for installation, and therefore this is not recommended as part of the energy strategy. This may be an appropriate technology in the future, although is not being offered for further consideration in this case.

**Advantages**
Combined Heat and Power (CHP) systems generate both electricity and thermal energy from a single fuel source, which is typically natural gas. This is an efficient technology, and can generate considerable CO₂ savings in the right conditions.

**Disadvantages**
The technology is most efficient when operational for as many hours as possible per year, at as high an output as possible. A rough “rule of thumb” for this would be to operate the CHP unit for a minimum of 4,400 hours per year. This means that the system would ideally still be running at full capacity over the summer months, i.e. producing thermal energy during the hottest parts of the year, when thermal demand will be minimal.

**Compliance analysis:**
- Code 3: Does not form part of strategy;
- Code 4: Unlikely to form part of strategy;
- Code 6: Will only form part of the strategy if there is a suitable application for the waste heat from the process.
5.0 Minimisation and management of construction waste

5.1 Introduction

Good practice waste minimisation and management (WMM) will be implemented at the development site. Good practice WMM follows the hierarchy that it is essential to reduce the quantity of waste generated and then to maximise the amount that can be reused and/or recycled. To ensure successful WMM good practice principles will be adopted and adhered to at the earliest stage possible.

Table 5.1 details the approach that will be followed:

Table 5.1: Waste minimisation and management (WMM) strategy

<table>
<thead>
<tr>
<th>Stage</th>
<th>Action</th>
<th>Responsibility of:</th>
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<tbody>
<tr>
<td>Pre-design</td>
<td>1) Set project requirement for good practice WMM</td>
<td>Developer</td>
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<tr>
<td>Design &amp; Procurement</td>
<td>2) Identify key opportunities for waste minimisation</td>
<td>Design and procurement team</td>
</tr>
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<td></td>
<td>3) Develop Site Waste Management Plan (SWMP)</td>
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<td>4) Develop tender and contractual requirements for good practice SWMP implementation and target Quick Wins</td>
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<tr>
<td>Pre-construction</td>
<td>5) Set targets and Key Performance Indicators</td>
<td>Contractor and sub-contractors</td>
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<td>6) Define responsibilities and contracts</td>
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<td></td>
<td>7) Identify waste arisings, reuse and recycling routes</td>
<td></td>
</tr>
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<td></td>
<td>8) Site design and training</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>9) Monitor waste management</td>
<td>Contractor and sub-contractors</td>
</tr>
<tr>
<td>Post-construction</td>
<td>10) Review performance of the SWMP and lessons learnt</td>
<td>Contractor and sub-contractors</td>
</tr>
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</table>

The following section describes the steps involved in the WMM process and highlights the benefits of successful execution.
5.1.1 Site Waste Management Plans (SWMP)

The SWMP for the development will be developed from the pre-design stage to inform the adoption of good practice waste minimisation in design and will be implemented in all construction site activities in-line with good practice guidance published by the Waste & Resources Action Programme (WRAP).

- The SWMP will include targets for waste reduction and recovery and the most significant cost-effective options for improvement (known as ‘Quick-wins’) will be identified.
- Information on how the targets will be achieved during construction activities and how the actual Levels of waste reduction and recovery will be monitored for comparison with the targets set.

Following the initial development of the SWMP by the design team, it will be expanded and adopted by the principal contractor(s).

To ensure the effective implementation of the SWMP the following steps will be followed:

- Identification of a named person responsible for producing and implementing a SWMP. This person may also be given responsibility for ensuring compliance with Duty of Care regulations. The intention is for this to result in an immediate noticeable improvement in waste segregation and record keeping for waste;
- Production of a register of the likely types/quantities of construction waste;
- Formalised training provision for personnel at each Level of the waste chain supply so waste awareness improves. All contractors will be required to sign and formally agree to the document;
- Identification of target recovery rates for each waste type, together with formal measurement of these targets to demonstrate compliance and implementation of the SWMP.

5.1.2 Waste minimisation

Waste minimisation will be considered throughout the construction phase. Key aspects of waste minimisation are:

**Design solutions**

- Building form – the proposed buildings are designed to ensure an efficient construction process and to ensure compatibility between market supply and specification;
- Design complexity – the construction process will be standardised (where possible) to reduce the quantity of materials required;
- Specifications – over-specification will be avoided and variation in components and joints will be minimised; the reuse and recycling opportunities for the specified materials will be evaluated before specification.
Logistics

- Logistic Plan – this will be developed at the on-set of the project to enable efficient management of the delivery and storage of materials and that the most effective logistic methods are adopted;
- Movement of material – to the site and within the site will be improved to alleviate space constraints for storage and site congestion.

Modern Methods of Construction (MMC)

- At present, it is anticipated that a significant component of the development will be traditional masonry; however there may be some scope for off-site manufacturing of key components. Typically off-site manufacturing results in improved waste minimisation.

Materials Procurement

- Materials storage – material storage areas will be safe, secure and weatherproof to prevent damage and theft;
- A supply chain manager will develop relationships and partnerships with suppliers during construction who can implement waste minimisation at source;
- ‘Take-back’ schemes – schemes will be set up with suppliers to take back surplus materials.

Packaging

- Reduce and reuse – the supply chain will be encouraged to supply products and materials that use minimal packaging and segregate packaging for reuse.

5.1.3 WRAP - recycled content toolkit

The WRAP recycled content tool-kit will be used to determine the percentage of recycled content in the new buildings. The tool-kit identifies the ten largest opportunities to increase the overall use of recycled material in the building by looking at the following categories:

- Building Type;
- Dimensions;
- Substructure;
- Superstructure;
- Internal finishes;
- Windows and Doors;
- External Walls.

The toolkit will be used throughout the development process and applied to all the proposed building types. The results will demonstrate the Level of recycled content in the scheme and emphasise the onus on compliance with industry best practice standards.
6.0 Summary

6.1.1 Code compliance

This report sets out the approach required to hit the differing Levels of the Code for Sustainable Homes over the different phases of the proposed development – with particular emphasis on credit Ene 1 (Dwelling Emission Rate) due to mandatory timeline constraints enforced by central government.

To comply with the energy/CO₂ demands of each Code standard some form of renewable energy generation is inevitable. This report analyses the most viable technology to meet the required generation criteria.

Table 6.1 sets out the proposed approach:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Code Level 3</th>
<th>Code Level 4</th>
<th>Code Level 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photovoltaics (PV)</td>
<td>Not required</td>
<td>May form part of compliance strategy</td>
<td>Large area of PV likely to be required</td>
</tr>
<tr>
<td>Solar thermal</td>
<td>Proposed as part of compliance strategy</td>
<td>May form part of compliance strategy</td>
<td>May form part of compliance strategy</td>
</tr>
<tr>
<td>Wind</td>
<td>Not required</td>
<td>Unlikely to form part of compliance strategy</td>
<td>May form part of compliance strategy</td>
</tr>
<tr>
<td>Biomass</td>
<td>Not required</td>
<td>May form part of compliance strategy</td>
<td>May form part of compliance strategy</td>
</tr>
<tr>
<td>Ground Source Heat Pumps (GSHP)</td>
<td>Not required</td>
<td>May form part of compliance strategy</td>
<td>May form part of compliance strategy</td>
</tr>
<tr>
<td>Air Source Heat Pumps (ASHP)</td>
<td>Not required</td>
<td>May form part of compliance strategy</td>
<td>May form part of compliance strategy</td>
</tr>
<tr>
<td>Combined Heat and Power (CHP)</td>
<td>Not required</td>
<td>May form part of compliance strategy</td>
<td>May form part of compliance strategy</td>
</tr>
</tbody>
</table>

6.1.2 Waste Minimisation and Management

A Site Waste Management Plan (SWMP) will be devised and instigated at the earliest opportunity. Good practice Waste Minimisation and Management (WMM) procedures will be followed throughout the construction process with the intention to reduce the overall amount of construction waste.

The recycled content of building materials will be maximised in-line with best-practice protocols. The Waste and Resource Action Programme (WRAP) tool-kit for investigating recyclable content will be utilised.