

**elementenergy**

Terence O'Rourke Ltd  
*creating successful environments*

**Decarbonising**

**Cambridge:**

***A renewable and low  
carbon energy study***

for

Cambridge City Council

Final Report

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## 1 Summary

### 1.1 Overview

National planning policy guidance such as the Supplement to PPS1 (on Climate Change) and PPS22 (on renewables) clearly signals the role of local regions in reducing CO<sub>2</sub> emissions and meeting renewable energy requirements. Planning authorities must understand the potential for low and zero carbon technologies within their jurisdictions and to set informed targets in terms of carbon reduction / renewable energy in new developments.

This study provides the evidence base for setting targets for the CO<sub>2</sub> performance of new developments in Cambridge. It includes a summary of relevant national planning policy and a review of the local context in terms of development plans and existing policies. The potential for low carbon and renewable energy development is evaluated for applicable technologies. These assessments are complemented by an analysis of the technical feasibility and economic implications of low carbon development. This provides the basis upon which the policy recommendations for the Council's planners are based.

#### 1.1.1 Aims of study

The aims of the study are to:

- Assess the potential for low carbon and renewable energy systems in Cambridge.
- Provide evidence base for planning policies relating to decentralised renewable and low carbon technologies in new development sites.
- Provide advice on the development of planning policy and identify additional supportive measures to achieve policy goals.

This report provides the evidence base for Cambridge City Council to adopt robust and justified planning policies in its Core Strategy in respect of energy efficiency and DLCRE. It also makes recommendations in respect of additional work that is required to support these policies.

#### 1.1.2 Context

The City of Cambridge is undergoing considerable growth. In the period 2001–2021, Cambridge is expected to accommodate 19,000 new homes, with the population expected to increase from 117,700 in 2009 to 151,200 by 2021.

Responding to climate change is a key strategic objective for Cambridge City Council, with one of the Council's Medium Term Objectives for Cambridge being for:

***“A city in the forefront of low carbon living and minimising its impact on the environment from waste and pollution”.***

The Council adopted its Climate Change Strategy and Action Plan in 2008, which sets the City a carbon reduction trajectory amounting to an 89% cut in emissions by 2050 relative to 2005 levels. While this trajectory relates to the City as a whole, planning for new development has a considerable role to play in helping the City Council achieve this target.

Achieving ambitious carbon reduction targets in the context of significant new development and population growth presents a considerable challenge. Furthermore, much of the new development is expected to be delivered through large urban extension sites, many of which have renewable energy and carbon reduction targets already defined in Area Action Plans. This highlights the need for ambitious yet attainable planning policies to guide new development in the city over the coming years.

## 1.2 Renewable and low carbon energy resource assessment

An assessment of the opportunities for low carbon and renewable energy projects in the local area was undertaken to inform the development of recommended planning policies. The main conclusions are summarised below.

### 1.2.1 District heating

- An estimation of density of heat demand in the city was made using a GIS-based approach with Ordnance Survey Address Point data. Relatively high heat demand density is required for economically viable district heating projects.
- Outside of the city centre areas of high heat demand are relatively dispersed.
- The main opportunity for district heating is likely to be in the urban extension sites, of which only the Bell School site is in close proximity to an area of existing high heat density (Addenbrookes). The approaches to meeting energy demands at some of these sites are covered by specific area action plans.
- There may be opportunities for district heating in the city centre on the basis of heat density. Exploitation of these opportunities will be subject to overcoming the technical, economic and practical barriers that retrofitting a community heating network in a historic city centre presents.
- Mapping areas of high heat demand with proposed development sites suggests that there could be an opportunity for cost-effective community heating in the redevelopment of CB1, around the station area.
- The greatest carbon benefits of community heating are realised when low carbon heating plant is employed, for example combined heat and power and / or thermal plant fed by a low carbon fuel source such as biomass. However, there are numerous issues associated with biomass combustion (see below) which could restrict the use of biomass-fuelled plant in certain areas.

### 1.2.2 Biomass

- An estimation of the available biomass resource in the Cambridgeshire area was made based on data from published studies.
- This shows that the maximum theoretically available biomass resource in the region is relatively large, however there is significant uncertainty surrounding the resource currently available.
- The local biomass fuel supply chain is highly fragmented – i.e. the industry is characterised by a large number of small suppliers. Regional targets to increase the mass of biomass fuel available exist, but ultimately woodland owners and fuel suppliers require sufficient incentive to develop the supply chain.
- Biomass price is a key determining factor in the economic argument for managing woodland for fuel production.
- Many barriers exist to using biomass, particularly in urban environments. These include fuel sourcing, security of fuel supply, transportation costs, impacts on traffic congestion, fuel storage issues, and air quality concerns around biomass combustion.

### 1.2.3 Waste to energy

- After the primary principles of waste prevention, reuse, and recycling / composting, energy recovery from waste is the next step in the *Waste Hierarchy*, before disposal. In the context of

rapidly increasing landfill taxes the economics of recovering energy from waste become more favourable.

- Donarbon Waste Management Limited is Cambridgeshire County Council's main waste contractor and is responsible for managing all municipal waste in the county for 28 years.
- A new Mechanical Biological Treatment (MBT) plant was opened in November 2009, and is set to take all of the county's residual black bag waste and separate out elements for recycling and composting, thus helping councils meet recycling and landfill diversion targets.
- There is potential to turn the organic fraction that remains after the separation process into a refuse derived fuel (RDF), which can be used to produce heat and/or electricity.
- The new MBT facility could produce up to around 500GWh/yr of RDF, which is equivalent to around 70% of current domestic gas consumption in Cambridge in energy terms. Note that this is an estimation based on data currently available; at the time of writing the MBT plant is in its first year of operation and exact potential RDF outputs are unknown.
- Combustion of fuels from waste facilities is only likely to be feasible in large-scale plants where strict emissions control of the Waste Incineration Directive can be met economically.
- Using RDF in a CHP application relies on a heat demand in relatively close proximity to the power plant. This is more likely to be acceptable in non-residential developments.

#### 1.2.4 Wind energy

- An assessment of the potential for wind power in Cambridge was made based on wind speed data from the NOABL wind speed database.
- The wind resource in Cambridge is highly constrained due to the relatively modest raw resource and the urban characteristics of the area.
- The wider Cambridgeshire area has higher wind speeds, which suggests that suitable sites for wind turbines lie outside of Cambridge City Council's area.
- The use of wind power to offset carbon emissions from new development in Cambridge is therefore most likely to be via some form of offset fund. Close cooperation would be needed between Cambridge City Council and neighbouring authorities (e.g. South Cambridgeshire District Council).

#### 1.2.5 Other technologies

- Other technologies for extracting energy from waste include **gasification** (a thermochemical process that converts carbonaceous materials into syngas), **pyrolysis** (decomposition of organic materials through heating) and **anaerobic digestion** (decomposition of organic materials by microorganisms in the absence of oxygen).
- Gasification and pyrolysis can also be used to convert biomass (wood waste, energy crops etc) into a cleaner burning fuel and therefore represent potential alternative biomass conversion technologies.
- Anaerobic digestion is unlikely to be suitable within an urban area such as Cambridge but could find application on sites on the edge of or outside the city.
- Experience of using pyrolysis in waste treatment and as a biomass conversion technology is limited in the UK. The technical, economic and environmental viability of this process is therefore somewhat uncertain.
- The potential applicability of gasification in Cambridge is not currently clear. Further work would be required to understand in detail the scales at which the technology might be

deployed, the feedstock requirements in the context of what is locally available, and the wider environmental and economic implications.

- There are numerous other low carbon and renewable energy technologies that may be deployed at the individual dwelling scale in Cambridge. In particular, the uptake of technologies such as solar PV, solar thermal, and heat pumps is expected to increase over the coming years.

### 1.3 Policy option recommendations

Recommended options for consideration for Cambridge City Council's emerging LDF are summarised below in the form of a concise description of each option. Further supporting text and justification is provided in the main body of the report, section 9.2.

#### Proposed Option 1: Targets for carbon emissions in Cambridge

In order to work towards the long-term target of a reduction in carbon dioxide emissions of 89% by 2050 from 2005 levels, the Council will seek to achieve the following minimum reductions against a 2005 baseline; these will be monitored and kept under review:

- 23% by 2020
- 65% by 2030

Accordingly, all development proposals should, as far as possible, contribute towards reducing CO<sub>2</sub> emissions. Planning policies related to the provision of Decentralised and Renewable or Low Carbon Energy set out within the Core Strategy are therefore broadly scoped.

#### Proposed Option 2: Sustainable design and construction

Option 2 proposes that all development should meet the highest practicable standards of sustainable design and construction, including resource and energy efficiency and should aim to maximise reductions of carbon emissions.

All development, including major refurbishment, should be required to demonstrate that:

- It makes effective use of resources and materials through sustainable construction, minimises water use, provides for waste reduction / recycling and reduces carbon emissions.
- It uses an energy hierarchy that seeks to
  - use less energy, in particular by adopting sustainable design and construction measures,
  - supply energy efficiently, including by prioritising decentralised energy generation using low carbon or renewable technologies, and
  - make use of renewable energy.
- It is sited and designed to withstand the long-term impacts of climate change, particularly the effect of rising temperatures on mechanical cooling requirements.

### Proposed Option 3: Sustainability standards

Proposals for all residential and non-domestic developments should demonstrate that they will meet the following targets:

| Development type         | Standard                             | Up to 2013 | 2013–2016 | 2016 onwards |
|--------------------------|--------------------------------------|------------|-----------|--------------|
| Residential development  | Carbon Compliance level <sup>1</sup> | 44%        | 70%       | 70%          |
|                          | Code for Sustainable Homes           | Level 4    | Level 4   | Level 4      |
| Non-domestic development | BREEAM                               | Very Good  | Very Good | Very Good    |

<sup>1</sup>Carbon Compliance level is defined as the reduction of Regulated emissions from a Part L 2006 baseline (TER) via onsite measures (including directly connected low carbon heat)

There will be a presumption that the targets will be met in full except where developers can demonstrate that in the particular circumstances there are compelling reasons for the relaxation of the targets. The onus will be on developers to robustly justify why full compliance with policy requirements is not viable.

Developments that fail to meet the required levels of carbon emissions reductions may be required to make a one-off financial contribution to be used to achieve equivalent emissions savings through off-site measures (potentially to a Carbon Offset Fund should this be put in place). In the first instance, however, the Council envisages that carbon growth resulting from new development will be minimised by requiring on-site carbon reduction measures. The amount of this payment, where applicable, will be determined on a site-by-site basis and calculated in line with a methodology to be set out in an updated Sustainable Design and Construction SPD.

The Council will develop through current and future Development Plan Documents, policies that set the highest standards of carbon emissions reductions, having regard to site circumstances and will seek to ensure that development adapts to climate change. To this effect, sustainability requirements will be tightened to ensure that development takes account of expected further changes in climate and to ensure that the commitments contained in the Cambridge Climate Change Strategy are met. Where standards are set beyond those contained in this policy, the higher standards will apply.

### Proposed option 4: The provision of community energy networks

In order to promote the use of community energy schemes including where a CO<sub>2</sub> benefit can be realised and these are deemed to be feasible in economic and technological terms, the following option is proposed:

- Applications for major developments should show that the potential for community energy networks has been explored.<sup>1</sup>
- Regardless of the number of homes in a proposal, where an existing local community energy network is established, developments will be expected to connect to the network, if feasible.

<sup>1</sup> Large developments referred to in this policy include developments of ten or more dwellings or 1,000m<sup>2</sup> of commercial or mixed-use space.

Where community heating schemes are proposed within the city centre consideration shall be given to the means by which such schemes are fuelled, having regard to the presence of the existing air quality management area.

#### **Proposed Option 5: Renewable energy**

Opportunities for stand-alone renewable energy schemes within Cambridge are limited and new projects within the city are likely to be relatively small scale. Even so, the Council wishes to support renewable energy projects that will contribute towards overall carbon reduction targets for Cambridge, without an unacceptable impact on the local environment. This option relates to proposals for renewable energy developments, including ancillary infrastructure or buildings, which should be permitted where applicants can demonstrate that:

- Adverse impacts on the environment or on amenity have been minimised as far as possible.
- Where any localised adverse environmental or amenity effects remain, that these are outweighed by the wider environmental, economic or social benefits of the proposal.

Where suitable sites for renewable energy are identified, they will be brought forward through the Site Specific Allocations DPD.

## 2 Introduction

### 2.1 Overall objective

The City of Cambridge is currently undergoing a period of considerable growth, with land having been released from the Green Belt for housing development as well as development taking place in the existing urban area of the City. In the period 2001–2021, Cambridge is expected to accommodate 19,000 new homes, with the population expected to increase from 117,700 in 2009 to 151,200 by 2021.<sup>2</sup>

Responding to climate change is a key strategic objective for Cambridge City Council, with one of the Council's Medium Term Objectives for Cambridge being for:

***“A city in the forefront of low carbon living and minimising its impact on the environment from waste and pollution”.***

The Council adopted its Climate Change Strategy and Action Plan in 2008, which sets the City a carbon reduction trajectory amounting to an 89% cut in emissions by 2050 relative to 2005 levels. While this trajectory relates to the City as a whole, planning for new development has a considerable role to play in helping the City Council achieve this target. The Climate Change Strategy recognises the contribution that planning policy contained within the Local Development Framework has to play in influencing the future development of the City Council in a way that enables people to live low carbon lifestyles.

Despite the proposed reform of the Planning System, ensuring that new development responds to climate change is likely to still be at the heart of planning. As such, the Decarbonising Cambridge study seeks to facilitate the development of planning policies to help achieve this carbon reduction trajectory; be these through the current Local Development Framework system or via a new plan making regime. Forming part of the Climate Change evidence base, it will help the Council develop policies for decentralised low carbon and renewable technologies (DLCRE) and other measures to allow new development to adapt to the predicted effects of climate change, through the Core Strategy, Development Control Policies Development Plan Document (DPD) and potentially the Site Specific Allocations DPD and any Area Action Plans that are developed or revised. It also seeks to identify other, more detailed work that may need to be undertaken as part of the evidence base as well as non-planning related interventions that may be required.

### 2.2 Aims of study

The specific aims of the study can be summarised as follows:

- Assess the potential for low carbon and renewable energy systems in Cambridge.
- Provide evidence base for planning policies relating to decentralised renewable and low carbon technologies in new development sites.
- Provide advice on the development of planning policy and identify additional supportive measures to achieve policy goals.

This study has been carried out in accordance with the requirements of paragraph 4.36 of PPS12, which sets out a requirement for Core Strategies to be justifiable, founded on a robust and credible evidence base and the most appropriate strategy when considered against the reasonable alternatives. This evidence base must contain two elements:

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<sup>2</sup> Growth figures from the 2008 Regional Spatial Strategy. Although the RSS has now been abolished, with housing target setting devolved to local authorities, these are the best available data at the time of writing.

- **Participation:** evidence of the views of the local community and others who have a stake in the future of the area.
- **Research / fact-finding:** evidence that the choices made by the plan are backed up by the background facts.

This report provides the evidence base for Cambridge City Council to adopt robust and justified planning policies in its Core Strategy in respect of energy efficiency and DLCRE. It also makes recommendations in respect of additional work that is required to support these policies.

### 3 Climate change, renewable energy and low carbon policy framework

Climate change is regarded as “the *greatest long-term challenge facing the world today*”<sup>3</sup> and is a principal concern for sustainable development. A number of key legislative changes and studies have taken place that highlight the importance of reducing CO<sub>2</sub> emissions and increasing the supply of electricity from renewable energy. These include:

**Stern Review, 2006** – outlined the economic impacts of climate change and concluded that ‘the benefits of strong, early action considerably outweigh the costs’

**Climate Change Act 2008** – sets out a target to reduce carbon emissions by 80% by 2050 from 1990 levels.

**UK Low Carbon Transition Plan, 2008** – the national strategy for climate and energy seeks to deliver emission cuts of 18% on 2008 levels by 2020 (and over a one third reduction on 1990 levels). One of the key steps is to source 40% of the UK’s electricity demand from low carbon sources by 2020 with policies to:

- Produce around 30% of our electricity from renewables by 2020 by substantially increasing the requirement for electricity suppliers to sell renewable electricity
- Fund up to four demonstrations of capturing and storing carbon emissions from coal power stations
- Facilitate the building of new nuclear power stations.

**EU Renewable Energy Directive, 2009** – requires 15% of all UK energy to come from renewables (electricity, heat and transport) by 2020.

**UK Renewable Energy Strategy, 2009** – outlines how the UK aims to move towards generating 15% of its energy (including electricity, heat and transport) from renewable sources by 2020. The strategy is part of the Government’s UK Low Carbon Transition Plan, which plots how a 34% reduction in emissions on 1990 levels by 2020 will be achieved.

The strategy suggests that to achieve the EU target, more than 30% of electricity must be supplied by renewables by 2020 (compared to 5.5% supplied in 2009). Of this, 2% is expected to be met by small scale generation technologies, while the remaining bulk of the target will be met through a combination of larger scale technologies such as onshore and offshore wind; biomass, hydro and wave.

The strategy also states that a Heat and Energy Saving Strategy is being developed and suggests that 12% of heat will be supplied by renewables by 2020. In addition, the strategy:

- Introduces Feed-in-Tariffs (2010) and a Renewable Heat Incentive (2011), which will provide guaranteed payments to individuals, business and communities for renewable heat and small scale electricity generation.
- Suggests that a strategic approach to planning is required to ensure that regions can deliver their renewable energy potential in line with the 2020 targets (p. 15)
- States the need for a swifter delivery of renewable projects through the planning system and quicker, smarter grid connection (p. 15).

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<sup>3</sup> Consultation on a Planning Policy Statement: Planning for a Low Carbon Future in a Changing Climate (2010) p. 14.

The UK Renewable Energy Strategy also states:

*“At the heart of our Strategy is an approach that is based on an assessment of the renewables capacity and constraints to deployment in each region and which seeks to ensure willing engagement by regional bodies, local authorities and communities. Through the planning system, communities will play an integral role in decisions on where renewable energy is located.”* (P. 18, paragraph 4.3)

Local planning authorities are expected to observe the two key planning and renewable energy policy documents, that is **PPS1 Supplement on Climate Change** and **PPS22 Renewable Energy** (considered below) when preparing local strategies and when taking planning decisions.

It states that:

*“...applicants for renewable energy should no longer be questioned about the energy need of their project either in general or in particular locations”* (P. 76, paragraph 4.23)

### 3.1 National and local planning policy framework

#### 3.1.1 National planning policy

In recognition of the importance of tackling climate change the **Planning Act 2008** introduced a new requirement for Regional Spatial Strategies (RSS) (to be replaced by Regional Strategies under the Local Democracy, Economic Development and Construction Act) and Development Plan Documents (DPD) to include policies designed to ensure that the development and use of land contributes to the mitigation of, and adaptation to, climate change (paragraphs 181 and 182).<sup>4</sup>

The Planning Act 2008 established a new system for the approval of major infrastructure projects, which would include major renewable energy schemes, through the Infrastructure Planning Commission.<sup>5</sup> To enable this, a series of National Policy Statements for nationally significant infrastructure projects was proposed. The National Policy Statement for Energy (EN-1) was published for consultation in November 2009. The Act also introduced the Community Infrastructure Levy as a means of raising a charge from development to fund infrastructure projects.

Alongside the Planning Act, the **Planning and Energy Act 2008** enabled local planning authorities to set requirements for energy use and energy efficiency in development plan documents. It states that planning authorities may set a reasonable requirement for:

- a) *“a proportion of energy used in development in their area to be energy from renewable sources in the locality of the development;*
- b) *a proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development;*
- c) *development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations.”* (paragraph 1)

Planning Policy Statements, which are gradually replacing Planning Policy Guidance Notes, set out the Government’s policies on different aspects of spatial planning in England. They provide guidance on planning policy that local planning authorities must take into account when drafting documents and determining applications. The ambitions and policies outlined in PPSs should be fully reflected by planning authorities in the preparation of Local Development Documents.

In terms of energy use and CO<sub>2</sub> reduction the most relevant Planning Policy Statements are:

<sup>4</sup> Note: RSSs have been revoked by the coalition government.

<sup>5</sup> To be replaced by a major infrastructure planning unit within the Planning Inspectorate.

- **PPS1: Delivering Sustainable Development** (2005) and the **Supplement to PPS1: Planning and Climate Change** (2007) – sets Government’s overarching planning policies on the delivery of sustainable development through the planning system and how planning should contribute to reducing emissions and stabilising climate change, and take account of the unavoidable consequences.
- **PPS22: Renewable Energy** (2004) and **Planning for Renewable Energy – A Companion Guide to PPS22** (2004) – sets out Government policies for renewable energy, encouraging appropriate development of further renewable energy schemes and providing specific advice on the range of renewable energy technologies.

PPS1 Supplement on Climate Change confirms that planning has a key role in helping to tackle climate change. It has a pivotal and significant role in helping to:

- *“secure enduring progress against the UK’s emissions targets, by direct influence on energy use and emissions, and in bringing together and encouraging action by others;*
- *deliver the Government’s ambition of zero carbon development;*
- *shape sustainable communities that are resilient to and appropriate for the climate change now accepted as inevitable;*
- *create an attractive environment for innovation and for the private sector to bring forward investment, including in renewable and low-carbon technologies and supporting infrastructure; and*
- *capture local enthusiasm and give local communities real opportunities to influence, and take, action on climate change.”* (paragraph 7)

It introduces new requirements for local planning authorities, which include:

- Provision of an evidence-based understanding of the local feasibility and potential for renewable and low-carbon technologies, including microgeneration, to supply new development in their area.
- Defining a percentage of energy consumption in new development to be secured from decentralised and renewable or low-carbon energy sources (DLCRE), where viable.
- Development area or site-specific targets for greater use of DLCRE where there are particular and demonstrable opportunities.
- Taking the potential for utilising existing or proposed renewable and decentralised energy into account when selecting development sites. (para 26)

Planning authorities are expected to help to achieve the national timetable for reducing carbon emissions from domestic and non-domestic buildings. To achieve this planning policies should support innovation and investment in sustainable buildings and should not deter cutting edge developments.

The supplement gives powers to set local levels of sustainability in advance of national standards, where it can be demonstrated that local circumstances merit this. Local requirements should focus on development area or site-specific opportunities and should specify the requirements in terms of nationally described sustainable buildings standards e.g. Code for Sustainable Homes (CSH).

Consultation on the replacement of the PPS1 Supplement and PPS22 with a new Planning Policy Statement: **Planning for a Low Carbon Future in a Changing Climate** commenced in March 2010. The new policy statement will be a consolidated supplement to PPS1. The draft PPS Supplement seeks to respond to the significant amount of new legislation and policy that has been put in place that affects planning generally and more specifically climate change issues and renewable energy.

The draft PPS Supplement sets out a range of key Government objectives concerning the role of plan making and development in supporting the transition to a low carbon future. Planning should:

- *“Shape places so as to help secure radical cuts in greenhouse gas emissions. This requires the location and layout of new development to be planned to deliver the highest viable energy efficiency, including through the use of decentralised energy, reducing the need to travel, and the fullest possible use of sustainable transport.*
- *Actively support and help drive the delivery of renewable and low carbon energy.*
- *Shape places and secure new development so as to minimise vulnerability and provide resilience to impacts arising from climate change, and do so in ways consistent with cutting greenhouse gas emissions.*
- *Ensure local communities are given real opportunities to take positive action on climate change; in particular by encouraging community-led initiatives to reduce energy use and secure more renewable and low-carbon energy.” (p.15)*

The relevant national planning policies from the draft **Planning for a Low Carbon Future in a Changing Climate** are summarised in the table below. For further details see the appendix, section 11.1.

**Table 1: Overview of relevant national planning policies from the draft PPS Planning for a Low Carbon Future in a Changing Climate**

| Policy   | Description  |
|--|--|
| <b>LCF1</b><br>Evidence Based Planning   | Requires local planning authorities to assess their area for opportunities for decentralised energy  |
| <b>LCF4</b><br>Local planning approach for renewable and low carbon energy and associated infrastructure                   | Seeks policies to support renewable and low carbon energy developments, local criteria-based policies and supports district heating, decentralised energy and community led renewable and low carbon energy developments, where appropriate                        |
| <b>LCF7</b><br>Local planning approach to setting requirements for using decentralised energy in new development           | Local requirements are to be derived from an assessment of local opportunities, which should be consistent with national policy on allowable solutions. Developments should connect to existing or envisaged decentralised energy supply                           |
| <b>LCF8</b><br>Local planning approach to setting authority-wide targets for using decentralised energy in new development | Support for authority-wide targets until 2013 when changes to Building Regulations take effect   |
| <b>LCF9</b><br>Local planning approach to setting requirements for sustainable building                                    | Local requirements should relate to development area or specific sites and be specified in terms of nationally described sustainable building standards (for housing CSH) except where an energy/CO <sub>2</sub> standards is justified                            |
| <b>LCF13</b><br>Designing for a low carbon future in a changing climate  | Sets out the expectations of local planning authorities for the incorporation of wide-ranging carbon reduction measures in the design of development and the weight to be given to these criteria in determining proposals for major development                   |
| <b>LCF14</b><br>Renewable and low carbon energy generation   | Sets out local planning authorities' expectations in respect of mitigation measures, the weight to be given to wider environmental, social and economic benefits, the role of targets and broad areas of search. It also considers proposals within the Green Belt |
| <b>LCF15</b><br>Safeguarding renewable and low carbon energy supplies  | Confirms that planning authorities should consider the impacts of proposed development on existing or proposed development of decentralised, renewable or low carbon energy and the potential for amendments to be made in the event of adverse effects            |

**PPS3: Housing** sets out government policy on the provision of housing in England. Paragraph 15 states that “*Local Planning Authorities should encourage applicants to bring forward sustainable and environmentally friendly new housing developments, including affordable housing developments, and in doing so should reflect the approach set out in the forthcoming PPS on climate change, including on the Code for Sustainable Homes.*”

**PPS4: Planning for Sustainable Economic Development** makes reference at paragraph 10 to the need to deliver more sustainable patterns of development, reduce the need to travel, especially by car, and respond to climate change. In determining planning applications Policy EC10 of PPS4 states that:

*“All planning applications for economic development should be assessed against the following impact considerations:*

- a) *whether the proposal has been planned over the lifetime of the development to limit carbon dioxide emissions, and minimise vulnerability and provide resilience to, climate change”.*

In addition to the publication of the above national policy documents the Government has been developing the wider framework concerning planning and carbon reduction. In 2007 it published **Building a Greener Future**, its policy statement on carbon reduction and domestic buildings. This document confirms that the planning system is expected to support the delivery of the timetable for reducing carbon emissions from domestic and non-domestic buildings. ‘Building a Greener Future’ sets out a progressive tightening of Building Regulations to require major reductions in carbon emissions from new homes to get to zero carbon by 2016. There are similar ambitions to cut carbon emissions from new non-domestic buildings (an ambition to achieve zero carbon in non-domestic buildings by 2019 was set-out in the 2008 budget). A significant amount of work has since been done on how the zero carbon policy should be defined in domestic and non-domestic developments, as discussed in more detail in section 3.5.2.

Building a Greener Future recognizes that where local authorities can demonstrate that there are clear local opportunities to use renewable or low carbon energy, perhaps through decentralised systems to achieve lower carbon emissions, higher targets can be set. Local authorities can play a critical role in establishing such opportunities (paragraph 3.43).

Paragraph 3.45 states that:

*“Where there are specific sites or development opportunities, local authorities should specify the proportion of renewable or low carbon energy, taking account of feasibility, viability and deliverability. They could also expect new developments to connect up with existing schemes where feasible and viable, or be developed with connection in mind where there is a clear strategy to develop new schemes.”*

Paragraph 3.46 goes on to say:

*“Any such higher standards for homes, however, need to be set using the Code for Sustainable Homes rather than any other criteria. It may be that a local authority could focus on the energy efficiency standards in the Code, or the whole Code.”*

The local approach is expected to be set out in a DPD not a Supplementary Planning Document (SPD).

Since the publication of Building a Greener Future the Government has been consulting on *Zero Carbon for Non-Domestic Buildings* (2009) and an update to Code for Sustainable Homes, *Sustainable New Homes – The Road to Zero Carbon, Consultation on the Code for Sustainable Homes and Energy Efficiency Standard for Zero Carbon Homes* (2009), to progress the above improvements. The proposals contained within these documents are considered in more detail in sections 3.5.2 and 3.5.3 below.

### The Local Plan 2006

Cambridge adopted its Local Plan in 2006, with the majority of policies saved from the 22 July 2009. It contains a range of policies related to sustainable development and renewable energy generation as follows:

- Policy 3/1 Sustainable Development
- Policy 3/12 The Design of New Buildings

- Policy 8/16 Renewable Energy in Major New Developments
- Policy 8/17 Renewable Energy

Policy 8/16 Renewable Energy in Major New Developments states that:

*“Developers of major proposals above a threshold of 1,000 square metres or 10 dwellings will be required to provide at least 10% of the development’s total predicted energy requirements on-site, from renewable energy sources. These requirements may be relaxed if it can be clearly demonstrated that to require full compliance would not be viable.”*

Policy 8/17 renewable energy is a criteria based policy supporting renewable energy schemes. The plan recognises that there is significant scope to make use of renewable energy in areas of major change. Demonstration of compliance with policy 8/16 is expected to be through a sustainability statement required by policy 3/1.

The above policies are currently supported by a Sustainable Design and Construction SPD which provides more detailed guidance on design considerations including the need to consider how renewable energy systems can be integrated into major development from the outset of their development. The SPD clarifies that the 10% requirement in Policy 8/16 is assessed in terms of a 10% reduction in CO<sub>2</sub> emissions from development to be met by on-site renewable energy sources. An ‘Energy Statement’ is required to be submitted.

The Local Plan identifies six areas of major change in and around Cambridge:

- East Cambridge
- Southern Fringe
- Northern Fringe
- Madingley Road / Huntingdon Road
- Huntingdon Road / Histon Road
- Station Area

Under current Policy 9/3 urban extensions are expected to incorporate renewable energy technologies and this will be sought through planning obligations.

In respect of the major sites to be developed Area Action Plans (AAP) have been prepared for Cambridge East and North West Cambridge, which take forward the policies contained in the local plan to the next level.

Relevant aspects of the Cambridge East Area Action Plan, 2008 include:

- Policy CE/2 Development Principles requires development to have *“a flexible design making best use of energy and other natural resources, built to be an exemplar of sustainable living with low carbon and greenhouse gas emissions and able to accommodate the impacts of climate change”*.
- Policy CE/24 Energy requires Cambridge East to demonstrate that it will achieve a high degree of measures to increase the energy efficiency of buildings, for example through location, layout, orientation, aspect and external design, encourages development to reduce the specific annual CO<sub>2</sub> emissions by 10% compared to the minimum Building Regulation requirement and seeks the inclusion of renewable energy to provide at least 10% of its predicted energy requirements.
- Supporting text acknowledges that renewable energy provision may be off-site as well as on-site.

The North West Cambridge AAP looks to take advantage of the opportunities offered by the site to provide increased renewable energy generation and reduced CO<sub>2</sub> emissions. It contains policies as follows:

- Policy NW2: Development Principles requires that North West Cambridge is planned and developed to a flexible design which will be energy efficient, and built to be an exemplar of sustainable living with low carbon and greenhouse gas emissions and able to accommodate the impacts of climate change;
- Policy NW24: Climate Change & Sustainable Design and Construction states that:
  1. *“Development will be required to demonstrate that it has been designed to adapt to the predicted effects of climate change;*
  2. *Residential development will be required to demonstrate that:*
    - a) *All dwellings approved on or before 31 March 2013 will meet Code for Sustainable Homes Level 4 or higher, up to a maximum of 50 dwellings across the site. All dwellings above 50 will meet Code for Sustainable Homes Level 5 or higher (these levels include water conservation measures);*
    - b) *All dwellings approved on or after 1 April 2013 will meet Code for Sustainable Homes Level 5 or higher;*
  3. *Non residential development and student housing will be required to demonstrate that:*
    - a) *It will achieve a high degree of sustainable design and construction in line with BREEAM “excellent “ standards or the equivalent if this is replaced;*
    - b) *It will reduce its predicted carbon emissions by at least 20% through the use of on-site renewable energy technologies only where a renewably fuelled decentralised system is shown not to be viable;*
  4. *Decentralised energy will be required at North West Cambridge to meet the targets specified above. The form of decentralised energy system to be used will be determined on the basis of minimising carbon and greenhouse gas emissions. The system will need to serve the whole site unless there are specific circumstances which would render it inappropriate.*
  5. *The above requirements are subject to wider viability testing.”*

It is of note that the above policies were challenged at the examination into the proposed Area Action Plan but were found to be sound by the Inspector, subject to some relatively minor changes.

One further site specific SPD has been adopted by the Council for the Old Press/Mill Lane area. It requires only that development proposals comply with Policy 8/16 and the Council’s SPD on Sustainable Design and Construction.

## 3.2 Other local policy

### 3.2.1 Cambridge Climate Change Strategy and Action Plan

Following a public consultation, Cambridge City Council adopted a Climate Change Strategy and Action Plan in September 2008. The overarching aims of the Plan are to ensure Cambridge contributes towards national and international efforts to avert dangerous climate change and to ensure that climate change risks to Cambridge are identified, assessed, communicated and managed. Specific CO<sub>2</sub> emission reduction targets are defined in terms of reducing emissions from the city as a whole and from the Council’s activities. These ambitious trajectories seek to achieve an 89% cut in CO<sub>2</sub> emissions by 2050 relative to 2005 levels.

The Plan sets out the overall vision, actions to achieve the targets and a monitoring strategy to assess progress. The full document is available for download from the Council's website.<sup>6</sup>

### 3.3 Examples of local planning policy from the UK

In addition to the analysis of the opportunities for and limitations on the deployment of decentralised low carbon and renewable energy (DLCRE) within Cambridge and the surrounding area, a review of 'best practice' sustainable energy planning policies in use by other local authorities has been undertaken. This has been used to inform the recommendations detailed in section 9.2. Examples of policies that are generally deemed to be at the forefront of emissions reductions and renewable energy generation are summarised below, with details included in the appendix.

#### 3.3.1 London Borough of Merton

The London Borough of Merton was the first local authority to include renewable energy targets in its Unitary Development Plan (UDP). Current policies contained in the 2007 plan require all developments with a floorspace of 500m<sup>2</sup> or one or more residential units to incorporate on-site renewable energy equipment to reduce predicted CO<sub>2</sub> emissions by at least 10%. However, the Council is understood to currently be enforcing policies contained in the London Plan, which has a higher requirement for a 20% reduction in CO<sub>2</sub> emissions.

The emerging Core Strategy published in 2009 sets out a different approach, requiring residential development to meet the highest commercially viable level of CSH and commercial development to be built to a minimum of BREEAM Very Good and incorporate renewable energy in line with the requirements of the London Plan or national guidance. Developments that fail to meet the policy requirements will be expected to make a financial contribution to the Merton Carbon Reduction Fund. It is understood from officers that amendments to the emerging policies are likely in light of emerging policies in the London Plan. A Development Control DPD and Sustainable Design and Construction SPD will be prepared which will provide further policies and information aimed at carbon emissions reductions and renewable energy generation.

#### 3.3.2 The London Plan

Policies contained in the London Plan (2008) concerned with climate change and renewable energy include:

- Policy 4A.1: Tackling climate change – sets out an energy hierarchy to be used in assessing planning applications.
- Policy 4A.2: Mitigating climate change – sets out carbon reduction targets for London.
- Policy 4A.3: Sustainable design and construction – identifies measures that should be taken into account in formulating DPD policies (supported by a Sustainable Design and Construction SPD).
- Policy 4A.4: Energy assessment – establishes a requirement for an energy assessment for major developments which includes an assessment of baseline energy demand and CO<sub>2</sub> emissions, proposals for their reduction and proposals for meeting residual energy demands through sustainable energy measures.
- Policy 4A.7: Renewable energy – promotes a presumption that developments will achieve a reduction in CO<sub>2</sub> emissions of 20% from on-site renewable energy generation, unless it is demonstrated that it is not feasible. Boroughs are expected to identify broad areas where the development of specific renewable energy technologies is appropriate.

To support the above policies it is intended that a Renewable Energy SPD will be produced.

<sup>6</sup> [www.cambridge.gov.uk/ccm/navigation/environment-and-recycling/sustainable-city/climate-change/](http://www.cambridge.gov.uk/ccm/navigation/environment-and-recycling/sustainable-city/climate-change/)

The Mayor published the consultation draft replacement London Plan in October 2009. It continues the emphasis on incorporating relevant design and technological measures at the earliest design stage. More stringent targets are proposed for residential and non-domestic buildings, based on carbon reduction targets above Building Regulations 2006 under draft Policy 5.2. It goes on to state that where it can be clearly demonstrated that specific targets cannot be achieved on site, any shortfall may be provided off-site or through a cash contribution in lieu to secure CO<sub>2</sub> savings elsewhere.

The emerging plan contains an updated Sustainable design and construction policy which now also refers to retrofitting of existing buildings. Further policies specifically concern the provision of decentralised energy networks, setting a target of 25% of heat and power in London to be from such systems by 2025, and requiring development proposals to evaluate the feasibility of CHP systems. Renewable energy provision continues to be encouraged, broadly in line with existing policy.

### 3.3.3 London Borough of Croydon

Policy EP16 of the 2006 UDP encourages developers to incorporate renewable energy technologies to reduce a development's CO<sub>2</sub> emissions by at least 10%. Thresholds are set within the policy above which this requirement must be met (10 or more residential units and 1,000m<sup>2</sup> of non-residential space). Where these requirements cannot be met a planning obligation will be sought to secure savings through other local renewable energy schemes. The plan is supported by an SPG on renewable energy and also a planning advice note on 'Preparing Environmental Performance Standards' which sets out updated requirements set out in terms of the CSH (Code level 4) and BREEAM (Excellent).

Updated policies are currently emerging through the Core Strategy Issues and Options, which is proposing even more stringent targets for major development (50% reduction in CO<sub>2</sub> emissions and at least 20% through renewable energy technologies). Similar targets based on CSH and BREEAM are proposed for major development prior to 2013.

### 3.3.4 Milton Keynes

The current Milton Keynes Local Plan (2005) contains policies in respect of sustainable construction (D4) and renewable energy (D5). In respect of the former all residential development exceeding five dwellings and non-residential schemes of more than 1,000m<sup>2</sup> are expected to include energy efficiency, renewable energy and achieve carbon neutrality or provide a financial contribution to a carbon offset fund. Supporting text states that renewable energy is expected to provide at least 10% of building energy use.

Policies D4 and D5 are supported by an SPD on Sustainable Construction which sets out requirements for the submission of a Sustainability Assessment. The SPD sets out a checklist against which development must be assessed and the minimum carbon reduction standards to be met (25%) and minimum renewable energy generation (10%). Further details of the carbon offset fund are provided.

Milton Keynes Borough Council published its Core Strategy – pre-submission publication in January 2010. It sets the same threshold as outlined above in respect of requirements for sustainable construction. However, the policy has been developed further in light of background studies, identifying specific Code levels and BREEAM requirements for specific parts of the Borough. Carbon neutrality continues to be a requirement, through a contribution to the Milton Keynes Carbon Offset Fund. A further proposed policy relates to 'Community Energy networks and Large Scale Renewable Energy Schemes', requiring that:

- Developments of more than 100 homes should explore the potential for community energy networks.

- Developments of more than 200 homes will require community energy networks, unless it is proven not to be feasible.
- Where an existing local energy network is established developments will be expected to connect to the network where feasible.

Where national standards exceed those set out in the Core Strategy the draft Core Strategy confirms that the former will take precedence. A Development Management DPD will be prepared which will include further policies on stand alone renewable energy schemes.

### 3.3.5 Central Bedfordshire

The Core Strategy and Development Management Policies for the North Area were adopted in November 2009. They set out the following policies:

- **Policy CS13: Climate Change** – an overarching policy that sets out the range of measures to be considered by proposals including use on renewable energy including on-site and near-site low carbon technologies, use of sustainable design and construction and high energy efficiency standards, tree planting and other carbon-offsetting measures.
- **Policy DM1: Renewable Energy** – will consider favourably proposals for renewable energy and sets out requirements for proposals of more than ten dwellings or 1,000m<sup>2</sup> of non-residential dwellings to incorporate on-site or near-site renewable or low carbon energy generation. Developments should achieve 10% or more of their own energy requirements through such sources unless it is demonstrated that this would be impracticable or unviable.
- **Policy DM2: Sustainable Construction of New Buildings** – future housing development is expected to meet CSH requirements with non-residential development complying with building regulations. Supporting text encourages housing development to meet or exceed Code level 3 with non-residential meeting or exceeding BREEAM ‘Excellent’ (for new development) or ‘Good’ (refurbishments).
- **Policy DM3: High Quality Development** – relates to the requirements of good design set out in PPS1 and high quality housing through good design (PPS3). The Council has promoted good design through design guides and design codes for larger schemes, and design remains a central feature in the determination of planning applications. The Council provides more detailed guidance through the *Design for Central Bedfordshire: A Guide for Development SPD*. The relevant requirements of policy DM3 in terms of energy use and CO<sub>2</sub> reduction include stipulation that all new development (including extensions) will use land and energy efficiently, and comply with guidance on noise, waste management, vibration, odour, water, light and airborne pollution.

Individual targets for specific developments may be pursued through the Site Allocations DPD.

### 3.3.6 Bedford Borough Council

Bedford adopted its Core Strategy and Rural Issues DPD in April 2008. Policy CP26 states that unless it can be demonstrated that the policy requirements are not feasible or viable all new residential developments and non-residential developments over 500m<sup>2</sup> must reduce carbon emissions by a minimum of 10% against Building Regulation requirements. The policy goes on to state that for developments of 50 dwellings or more or over 1000m<sup>2</sup>, 10% of the energy consumed in the new development must be provided by de-centralised, renewable or low carbon technologies. Detailed guidance on the implementation of this policy is contained in a Climate Change and Pollution SPD, which sets out a requirement for all planning applications to be accompanied by a sustainability statement, which should include an energy audit to demonstrate the reduction of carbon emissions.

### 3.3.7 North Northamptonshire

The North Northamptonshire Core Strategy (2008) includes an energy target and specifies a Code level for new developments under “Policy 14: Energy Efficiency and Sustainable Construction”. Targets are set out for large developments including Urban Extensions ramping up from CSH3 to 2012 to CSH6 from 2016, with BREEAM/Eco-build ratings of at least Very Good through the plan period. Elsewhere “residential development involving 10 or more dwellings or 0.5 hectares or more of land, and non-residential development involving 1,000 square metres gross floor area or 1 hectare or more of land should demonstrate that at least 10% of the demand for energy will be met on-site and renewably and/or from a decentralised renewable or low-carbon energy supply”.

A Supplementary Planning Document on Sustainable Design to help developers comply with Policy 14, which was adopted in 2009. It sets out an energy hierarchy to be considered in all proposals which includes building design, energy efficiency and on-site renewables.

### 3.3.8 Ashford

Ashford Borough Council adopted its Core Strategy in 2008. The strategy includes:

- Policy CS8: Infrastructure Contributions (approx £14,000 per dwelling, which may be used to fund strategic energy projects such as Combined Heat and Power (CHP) and biomass. Site specific provision will be through conditions or a Section 106 agreement (which may be a contribution to off-site provision));
- Policy CS9: Design Quality, including efficient use of natural resources and
- Policy CS10: Sustainable Design and Construction.

Policy CS10 aims to deliver zero carbon growth, requiring all major development to incorporate sustainable design features. It expects development to:

*A) Achieve the standard set out below, or specified in a later DPD, or an equivalent quality assured scheme, with a strong emphasis on energy, water and materials. These requirements will be met through:*

- a) *Energy and water efficiency,*
- b) *Sustainable construction materials, and,*
- c) *Waste reduction.*

*B) Reduce carbon dioxide emissions through on-site sustainable energy technologies at the percentage set out below or at such other level as may be specified in a subsequent DPD.*

*C) Be carbon neutral which can be met through a combination of (A) and (B) above, with any shortfall being met by financial contributions to enable residual carbon emissions to be offset elsewhere in the Borough.”*

Minimum CSH and BREEAM ratings are set for four different types of areas: town centre and brownfield urban sites, urban extensions & Greenfield urban sites, Tenterden & The Villages and existing refurbishment. The standards range from CSH2 to CSH4 and Ecohomes ‘Very Good’ for residential development and BREEAM Good to Excellent for non-residential. These standards apply as follows:

Major developments:

- Ten or more dwelling units or on residential sites of 0.5 hectares or more in area.
- For non-residential developments, any scheme of at least 1,000m<sup>2</sup> gross external floorspace or, any development on a site 1 hectare or more in area.

Development in Tenterden and the Villages, and the Countryside:

- Major development will be defined as five or more dwelling units.
- For non-residential units 500m<sup>2</sup> or sites of 0.5 hectares or more.

Ashford Borough Council has produced a Sustainable design and Construction SPD to assist with the implementation of Policy CS10 and intends to produce a further SPD that provides information in respect of carbon offsetting.

### 3.3.9 Dover

Dover District Council adopted its Core Strategy in February 2010. Policy CP5 of the plan sets out the following sustainable construction standards:

- New residential development permitted after the adoption of the Strategy should meet Code for Sustainable Homes level 3 (or any future national equivalent), at least Code level 4 from 1 April 2013 and at least Code level 5 from 1 April 2016.
- New non-residential development over 1,000m<sup>2</sup> gross floorspace permitted after adoption of the Strategy should meet BREEAM very good standard (or any future national equivalent).
- The Council will encourage proposals for residential extensions and non-residential developments of 1,000m<sup>2</sup> or less gross floorspace to incorporate energy and water efficiency measures.

Where schemes are unable to comply with Policy CP5 supporting text allows for commensurate energy and water savings to be made elsewhere in the District through a financial contribution to the Council to enable it to help fund schemes that would make the savings.

Specific targets have been set for the four Strategic Allocations in the district, related to CSH and BREEAM.

### 3.3.10 Uttlesford District Council

Uttlesford District Council's SPD on home extensions is widely regarded as an example of best practice in using the planning system to reduce the carbon impact of existing buildings. This is achieved by making planning permission for extension work subject to the implementation of energy efficiency improvements throughout the existing building. Extension work in this context refers to adding floorspace to the existing property, the construction of new annexes, and loft and garage conversions. The aim of this policy is to mitigate the additional energy requirements (and therefore CO<sub>2</sub> emissions) that result from extension, and ideally achieve a net reduction in the property's energy consumption. This SPD has been cited by the Energy Saving Trust in a case study, which provides further details of how the policy is implemented and practical experience gained.<sup>7</sup>

## 3.4 Implications of the change of Government

Following the formation of the Conservative – Liberal Democrat alliance the Coalition government has implemented a number of its key pre-election promises in respect of changing the planning system. All regional spatial strategies, with the exception of the London Plan, have been revoked, which has removed an additional layer of support in the East of England for policies aimed at addressing climate change. In addition the Government has confirmed that it intends to abolish the Infrastructure Planning Commission, which will be replaced by a Major Infrastructure Planning Unit as part of the Planning Inspectorate along with Regional Development Agencies, which will be replaced by Local Enterprise Partnerships.

<sup>7</sup> The case study is available at [www.energysavingtrust.org.uk/business/Business/Local-Authorities/Planning-and-new-build/England-planners-support-pack](http://www.energysavingtrust.org.uk/business/Business/Local-Authorities/Planning-and-new-build/England-planners-support-pack).

'Our Programme for Government' was published in May 2010 which sets out the coalition's agreement in respect of key policy areas. The following are relevant to this study:

### **Communities and local government**

- The radical devolution of power and greater financial autonomy to local government and community groups. This will include a review of local government finance.
- The rapid abolition of Regional Spatial Strategies and the return of decision-making powers on housing and planning to local councils.
- Publication and presentation to Parliament of a simple and consolidated national planning framework covering all forms of development and setting out national economic, environmental and social priorities.
- A requirement for continuous improvements to the energy efficiency of new housing.
- Provision of incentives for local authorities to deliver sustainable development, including for new homes and businesses.

### **Energy and climate change**

- A push for the EU to demonstrate leadership in tackling international climate change, including by supporting an increase in the EU emission reduction target to 30% by 2020.
- Seeking to increase the target for energy from renewable sources, subject to the advice of the Climate Change Committee.
- Continuing public sector investment in carbon capture and storage (CCS) technology for four coal-fired power stations.
- Establishment of a full system of feed-in tariffs in electricity – as well as the maintenance of banded Renewables Obligation Certificates.
- Introduction of measures to promote a huge increase in energy from waste through anaerobic digestion.
- Through 'Green Deal', encourage home energy efficiency improvements paid for by savings from energy bills. Take measures to improve energy efficiency in businesses and public sector buildings. Reduce central government carbon emissions by 10% within 12 months.
- Encourage community-owned renewable energy schemes where local people benefit from the power produced. Allow communities that host renewable energy projects to keep the additional business rates they generate.
- Work towards an ambitious global climate deal that will limit emissions and explore the creation of new international sources of funding for the purpose of climate change adaptation and mitigation.

### **Environment, food and rural affairs**

- Create a presumption in favour of sustainable development in the planning system.

### **Transport**

- Mandate a national recharging network for electric and plug-in hybrid vehicles.
- Support sustainable travel initiatives, including the promotion of cycling and walking, and encouragement of joint working between bus operators and local authorities.

In most cases there is limited detail of the precise implication of the above policies for local authorities. Whilst the above document provides likely headline changes there may also be other changes as the two parties continue their discussions on forthcoming policy changes.

In July 2010 a Draft Structural Reform Plan was published. The following are of note:

- Development of a Localism Bill, to be passed by November 2011.
- Local Enterprise Partnerships to be in place with RDA functions transferred in full by April 2012.
- the Government intends to carry out a review of zero carbon homes and non-domestic buildings by December 2010.
- New national planning policy in place based on 'Open Source Planning' by April 2012.

### 3.4.1 Implications of the new Government: conclusions

Whilst the Conservative's Policy Green Paper published prior to the election suggested that radical reform would be undertaken, it remains unclear from the Programme for Government and the Draft Structural Reform Plan how exactly it is intended to change the planning system, other than those headline changes that are detailed above. It is envisaged, however, that changes will be made to emphasise the localism agenda within planning. It is expected that there will be continuing support for measures to reduce the impacts of climate change.

At the local level the process of plan making will currently remain but is likely to have a greater local emphasis in future. No details are currently available as to how this might be undertaken, although it is envisaged that the process of local engagement could lead to delays in adopting plans. This would impact on the need to get a series of policies in place for low carbon and renewable energy, with provision for a Carbon Offset Fund.

Potential changes to Section 106 and CIL appear to be broadly in line with those that emerged under the previous Government, although this is not certain.

Whilst there is clearly uncertainty as to possible future changes to the planning system the emphasis on dealing with climate change and promoting renewable energy appears likely to remain. The implementation of policies aimed at achieving these may, however, be affected by the emphasis on localism.

### 3.5 National building regulations and zero carbon policy

#### 3.5.1 Building Regulations

In addition to setting national planning policy, the Department for Communities and Local Government is responsible for national Building Regulations. These exist to ‘ensure the health, safety, welfare and convenience of people in and around buildings, and the water and energy efficiency of buildings’.<sup>8</sup> In terms of energy use and CO<sub>2</sub> emissions the relevant aspect of the Building Regulations is Part L.<sup>9</sup> This sets minimum standards for buildings in the form of a **dwelling emission rate (DER)**, measured as kilograms of CO<sub>2</sub> per square metre of floor area per year (kgCO<sub>2</sub>/m<sup>2</sup>.yr). Periodic reviews and changes to the regulations are necessary and the current revision of Part L is Part L 2006.

The government has committed to introducing zero carbon homes policy from 2016. To deliver this vision Part L is due to be changed in 2010, 2013 and 2016, with each revision stipulating more stringent standards in terms of carbon emissions. The proposed changes are summarised in the following figure.

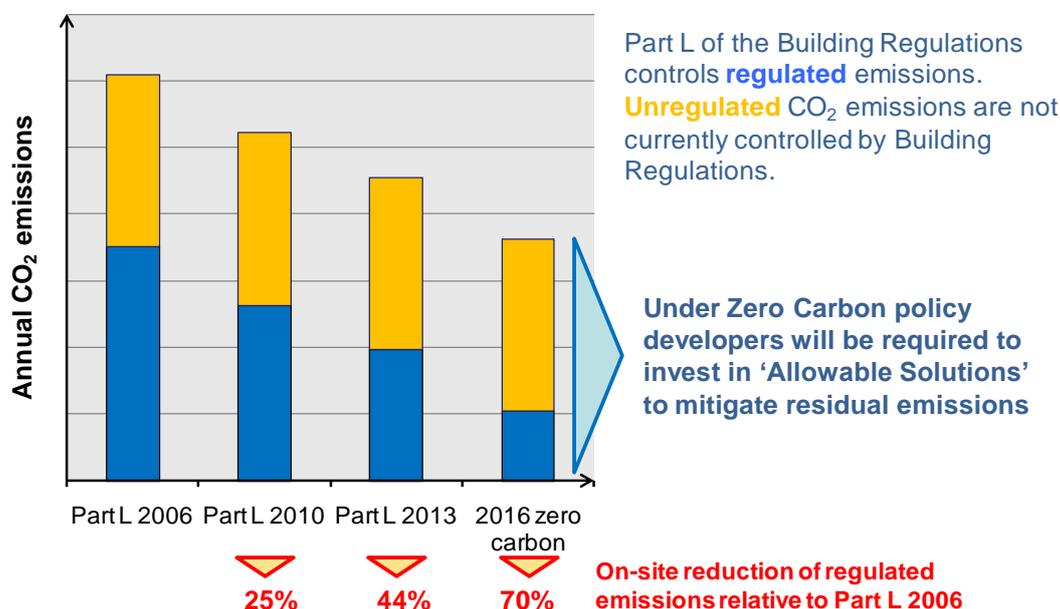


Figure 1: Graphic representation of proposed changes to the Building Regulations

Building Regulations split total CO<sub>2</sub> emissions from dwellings into two types: **regulated** and **unregulated** emissions. Regulated emissions are those arising from fuel use for space and water heating, any fixed cooling systems, fixed lighting and fans and pumps installed. Unregulated emissions include those arising from energy used for cooking and any electricity for appliances.

Traditionally Part L has only dealt with buildings’ regulated emissions. However, zero carbon homes policy requires all regulated and unregulated emissions to be offset, either through on-site measures or through investment in Allowable Solutions, which will be used to achieve equivalent carbon savings elsewhere. Zero carbon policy is discussed in more detail in section 3.5.2, below.

As indicated by Figure 1, future changes to Part L are measured relative to Part L 2006, with reductions in regulated emissions of 25%, 44% and 70% required by on-site means from 2010, 2013 and 2016 respectively.

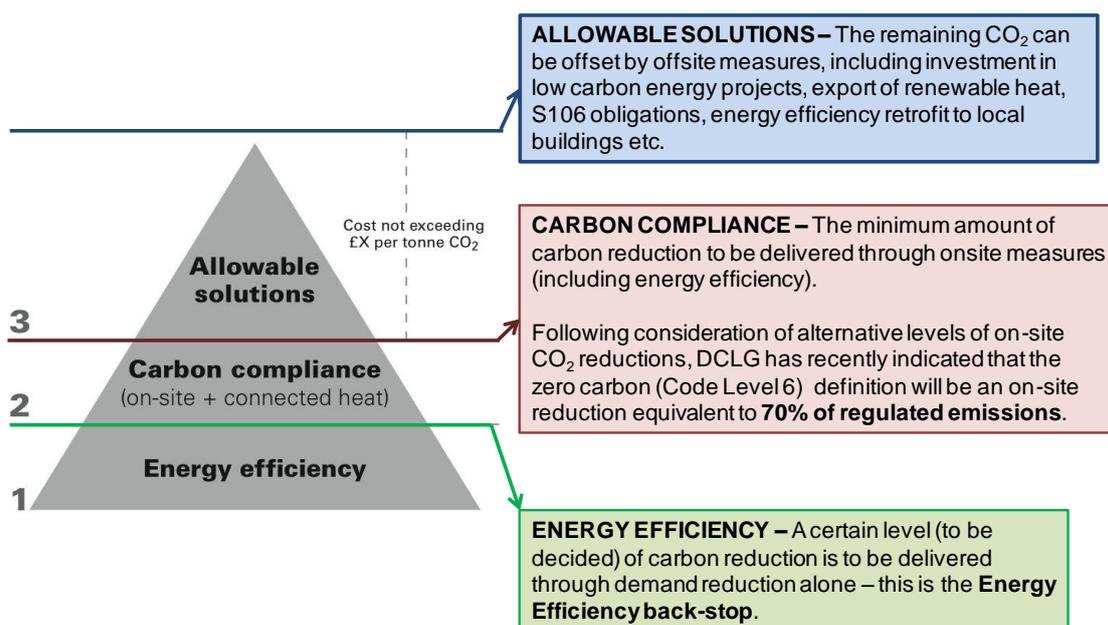
<sup>8</sup> [www.communities.gov.uk/planningandbuilding/buildingregulations](http://www.communities.gov.uk/planningandbuilding/buildingregulations).

<sup>9</sup> Building Regulations are stated through ‘approved documents’ and Part L is split into four parts: Approved Document L1A, L1B, L2A and L2B covering new dwellings, existing dwellings, and new and existing buildings other than dwellings respectively.

### 3.5.2 Zero carbon policy

#### Zero carbon homes

Zero carbon policy aims to eliminate or mitigate (offset) all CO<sub>2</sub> emissions from a new building, regulated and unregulated. It has been recognised that to eliminate all emissions through provision of on-site low carbon and renewable energy is prohibitively expensive and may not be technically achievable in certain types of development. In light of this, Government proposes that the zero carbon standard will be based on a hierarchy of CO<sub>2</sub> reduction through energy efficiency, CO<sub>2</sub> reduction through provision of on-site low carbon energy supply and finally, offsetting the remaining CO<sub>2</sub> emissions from the development by investing in carbon reduction projects elsewhere. This hierarchy is shown in the diagram below.



**Figure 2: Schematic describing the hierarchical approach to CO<sub>2</sub> emissions reduction used in the definition of zero carbon homes and buildings**

Energy efficiency back-stop levels, based on the work of the Zero Carbon Hub<sup>10</sup>, are included in the Department of Communities and Local Government (DCLG) consultation on zero carbon homes.<sup>11</sup> The recommended levels are not yet part of formal policy and are therefore subject to change. However, they give an indication of the preferred metrics and likely level of improvement that will be required.

The Carbon Compliance level is the level of CO<sub>2</sub> reduction that must be achieved through measures adopted on-site (although connection to a source of low carbon heat, which may be generated offsite, can also contribute toward meeting the required Carbon Compliance level). The following measures are identified as potentially meeting the carbon compliance definition:

- Further energy efficiency measures, beyond those selected to meet the energy efficiency standard.
- Low and zero carbon generation technologies which are installed within the buildings (e.g. roof-mounted solar panels).

<sup>10</sup> See [www.zerocarbonhub.org/news\\_details.aspx?article=5](http://www.zerocarbonhub.org/news_details.aspx?article=5).

<sup>11</sup> DCLG consultation: *Sustainable New Homes: The Road to Zero Carbon: Consultation on the Code for Sustainable Homes and the Energy Efficiency standard for Zero Carbon Homes*. See [www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/codesustainable/](http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/codesustainable/)

- Low and zero carbon energy installations built within the development (e.g. development-scale combined heat and power (CHP)).
- Directly connected heating or cooling networks, where the ‘physical connection’ can be easily demonstrated through the physical pipework.

The Carbon Compliance level that must be achieved in domestic developments has been set at a 70% reduction on Part L 2006 regulated emissions.

The final part of the zero carbon hierarchy, once the Carbon Compliance level has been met, is to further reduce the CO<sub>2</sub> emissions of the dwellings or to offset remaining emissions by investment in a range of other measures, collectively referred to as ‘allowable solutions’. Exactly what is meant by an Allowable Solution is currently a matter of debate and ongoing work within government. A number of potential carbon reduction measures that could constitute an Allowable Solution were considered in the government’s consultation on the definition of zero carbon homes and non-domestic buildings. In July 2009, a statement by the Minister for Housing and Planning identified the potential Allowable Solutions that had received ‘broad support’ in the responses to the consultation on the zero carbon definition, as follows:

- *Further carbon reductions on site beyond the regulatory standard*
- *Energy efficient appliances meeting a high standard which are installed as fittings within the home*
- *Advanced forms of building control system which reduce the level of energy use in the home*
- *Exports of low carbon or renewable heat from the development to other developments*
- *Investments in low and zero carbon community heat infrastructure*
- *Other allowable solutions remain under consideration*

The above list is not conclusive and other potential allowable solutions remain under discussion. Cambridgeshire, for example, is one of a number of regions looking into the possibility of establishing a local carbon offset fund, whereby developers make a payment into the fund on the basis of a set tariff per tonne of remaining CO<sub>2</sub> emissions from their development (developers would only be able to pay into the Fund to mitigate the CO<sub>2</sub> emissions that remain once the Carbon Compliance level had been met or exceeded). In order for such a local offset fund to have a role, it would need to be recognised as an Allowable Solution.

The intention is that investment in allowable solutions will generate sufficient CO<sub>2</sub> saving to mitigate the CO<sub>2</sub> emitted by the home over a period of 30 years from the build. It is also proposed that the cost of investment in Allowable Solutions will be capped at a certain level. A number of potential capped costs are under discussion, ranging from 50 to 200 £/tCO<sub>2</sub>.

### Zero carbon for non-domestic buildings consultation, 2009

Consultation on policy options for “Zero carbon for non-domestic buildings” commenced in November 2009 and finished at the end of February 2010. This follows the ambition set out in the Budget 2008 for all new non-domestic buildings to be zero carbon from 2019. The definition of zero carbon proposed for non-domestic buildings, as set-out in the consultation paper, follows the same hierarchical approach to that adopted in the zero carbon homes definition, i.e.:

1. Energy efficiency.
2. Carbon compliance – a certain level of CO<sub>2</sub> reduction through onsite measures (including energy efficiency and directly connected low carbon heat).

3. Allowable Solutions – reduction or offsetting of remaining emissions through investment in allowable solutions, which may include further onsite CO<sub>2</sub> reduction measures and potentially offsite carbon reduction.

The key difference between the zero carbon definition for non-domestic buildings compared to homes is likely to be the level of Carbon Compliance. Whereas in the case of homes it is proposed that a 70% reduction of regulated emissions (compared to the Part L 2006 standard) is set for all dwellings, it is expected that the carbon compliance level for non-domestic buildings will vary depending on the building's usage. This is to recognise the varying challenges in achieving high levels of CO<sub>2</sub> reduction through onsite means between different types of non-domestic building.

The levels of carbon compliance will be set for the various building types with the intention of achieving a certain level of carbon compliance on aggregate across new additions to the non-domestic stock. The recent consultation paper sought views on three potential scenarios, differing in terms of ambition for this aggregate level of carbon compliance. These scenarios are broadly defined as follows:

- **Off-site rich:** this prioritises the new building's contribution to off-site measures by setting lower carbon compliance targets and increasing the use of allowable solutions.
- **Balancing on-site and off-site:** this sets stretching on-site targets, but at a lower capital cost per building than for the 'on-site rich' scenario, and deploys allowable solutions for the remaining emissions.
- **On-site rich:** this sets ambitious on-site measures, pushing almost as far as is technically possible for 2019, reflecting the principle behind the approach taken for homes.

Views were sought through the consultation as to which scenario is favoured and significant further work on this matter is anticipated before the final shape of the zero carbon definition for non-domestic buildings emerges. Work on what measures should constitute allowable solutions for non-domestic buildings is also expected, alongside the ongoing thinking on allowable solutions for the domestic sector.

A common approach to allowable solutions is intended for domestic and non-domestic buildings. This would be introduced in 2016 for the former and 2019 for the latter although an element of allowable solutions for the latter could be introduced. Zero carbon will include regulated emissions (heating, cooling, lighting and water heating) and unregulated emissions e.g. appliances.

### 3.5.3 The Code for Sustainable Homes

The Code for Sustainable Homes (CSH) is a national standard for sustainable building. New homes are assessed against nine design categories from Energy / CO<sub>2</sub>, to Water, Materials, Management and Ecology. There are a total of 34 'issues' against these nine categories and credits are achieved for meeting the specific requirements of issues. The Code provides a tradable credit scoring system in that developers can choose which credits to target. However, there are a number of mandatory issues – i.e. a certain minimum number of credits must be achieved against certain issues to achieve a given Code level. One such mandatory issue is the first in the energy category, which sets minimum standards of dwelling emission rate reduction relative to Part L 2006 standards.

At the assessment stage credits are converted into points via a weighting system and points are summed to calculate a total score.<sup>12</sup> The dwelling is then awarded a Code level from 1–6 based on the total score.

<sup>12</sup> The weighting system means that a credit scored in one category can be more valuable than a credit scored in another.

Unless stipulated by local planning policies, building to any level of the Code remains voluntary for private development. However, gaining a Code rating became mandatory for new homes from May 1<sup>st</sup> 2008. If no target Code level is sought the dwelling is given a 'Nil Rated' status. While the Code is a voluntary standard, all public sector housing must currently achieve level 3 to obtain central government funding. This minimum standard is set to rise to level 4 from 2011.

The CSH has been designed to show the future for the building industry. For example, the mandatory requirements in terms of CO<sub>2</sub> reduction in the Code mirror the proposed changes to Part L in 2010 and 2013. Therefore developers building Code homes gain relevant experience that will allow them to comply with future changes to minimum mandatory standards imposed through changes to Building Regulations. The CO<sub>2</sub> reduction standards required by each level of the Code are tabulated below together with notes describing how these standards relate to the minimum regulatory standards that will be introduced through changes to Building Regulations and introduction of zero carbon homes policy.

| Code level | % Reduction on Part L 2006 Regulated Emissions  | Notes   |
|------------|---|---|
| 1          | 25%   | <b>Initially the Code level 1 and 2 targets were set at 10% and 18% improvements, respectively. These targets have now been superseded by the 2010 revision to Part L of the Building Regulations.</b>                    |
| 2          | 25%   |   |
| 3          | 25%   | Equivalent to Part L 2010.  |
| 4          | 44%   | Equivalent to Part L 2013.  |
| 5          | 100%  | This exceeds the Carbon Compliance level expected to be required by Zero Carbon Homes Policy.   |
| 6          | Zero Carbon (100% of regulated emissions and all unregulated emissions reduced through onsite measures. | This is a more stringent standard than proposed in the Zero carbon Homes policy as all emissions have to be dealt with on-site, there is no option to use allowable solutions to deal with a proportion of the emissions. |

**Figure 3: Minimum CO<sub>2</sub> reduction standards required by each level of the Code for Sustainable Homes**

A common misconception is that the Code will be made mandatory as part of the government's zero carbon homes ambition, for example that the zero carbon homes policy is equivalent to Code level 6 becoming mandatory. It is important to recognise that this is not the case and that although the Code is intended to provide a lighthouse to future changes to the Building Regulations and Zero Carbon Policy, there is a clear distinction between them. The minimum CO<sub>2</sub> standards will be set by the changes to the Building Regulations and Zero Carbon policy, as described above, and, currently, there is no intention that the Code will become mandatory for private market housing (although the Homes and Communities Agency does require certain Code levels to be achieved in publicly funded housing).

Although there is no expectation that the Code will become mandatory, as it is a nationally recognised standard, with formal assessment procedures in place, the Code could provide a useful tool for local authorities to use in setting targets for new housing (i.e. although there is no national requirement, the

local authority could require a particular Code level to be achieved through their development management policies).

**Sustainable New Homes – The Road to Zero Carbon, Consultation on the Code for Sustainable Homes and Energy Efficiency Standard for Zero Carbon Homes, December 2009**

The Government conducted a consultation on policy and technical changes to the Code for Sustainable Homes in the first few months of 2010, which included embedding the new definition of zero carbon for new homes. The consultation sought views on the following:

- Energy efficiency standards for zero carbon homes.
- Aligning with the zero carbon definition for homes.
- Aligning the CSH with proposed changes to building regulations (2009), that is Code levels 1-3 to meet 25% reduction in carbon emissions, Code level 6 to reflect the definition of zero carbon homes (70% carbon compliance, with allowable solutions to mitigate remaining regulated and all unregulated emissions) and Code level 5 to include 70% carbon compliance with 30% allowable solutions (no requirement to cover unregulated emissions).
- Producing credits for energy display devices

It is proposed that the revised Code requirements will become effective in October 2010 alongside changes to the building regulations.

**3.6 Cambridgeshire Carbon Offset Fund**

In parallel with this study, Cambridgeshire Horizons have been conducting an assessment of the potential for development of a Carbon Offset Fund (COF). The COF would receive payments from developers in relation to the CO<sub>2</sub> impact of their developments (among other potential sources of investment), to be invested in carbon reduction initiatives across Cambridgeshire<sup>13</sup>. The basic premise of such a fund is that there will be an element of the CO<sub>2</sub> emissions of new developments that will be very costly and in some cases not technically feasible to eliminate through measures taken within the site, such as improved energy efficiency and low carbon generation. Rather than reduce all emissions, developers will make a payment into the fund, based on a fixed tariff per tonne of residual CO<sub>2</sub> emissions. The payments from developers across the local authority areas participating in the fund will be pooled and invested in the most cost-effective or highest impact carbon reduction opportunities.

The logic of the COF is very similar to the thinking behind the emerging zero carbon policies (see section 3.5.2), in that a certain minimum amount of CO<sub>2</sub> reduction will be required through measures taken on the site (the Carbon Compliance level), while the remaining emissions can be offset by investment in Allowable Solutions. The greatest opportunity for the COF as part of long-term carbon reduction initiatives in Cambridgeshire is likely to be if investment in the COF is recognised as an allowable solution, such that developers of sites in Cambridgeshire contribute into the fund under zero carbon policy (from 2016 for domestic development) as a means of mitigating the portion of their sites' emissions that have not been dealt with onsite.

There is a wide-range of carbon reduction initiatives that the COF could be used to fund, these might include:

- Investment in large-scale low carbon infrastructure, such as district heating systems
- Improving the energy efficiency of the existing building stock

<sup>13</sup> Carbon Offset Mechanism for Cambridgeshire, Element Energy, Terence O'Rourke & Manches LLP, in progress (2010)

- Investing in renewable energy generation projects

The types of project that the fund invests in will depend on the priorities of the local authority partners and potentially on the mechanisms used to collect contributions from developers. There are also a variety of options for how the funds might be applied, for example funding may be provided as a grant, e.g. grants to home-owners to insulate their properties, as a loan or as an equity investment with a potential for a financial return to the fund. The manner in which funds could be collected and invested by the COF are explored in detail in the Cambridgeshire Horizons report. In summary, the COF provides a potentially useful mechanism to overcome one of the greatest barriers to a wide-range of types of carbon reduction initiative, whether it is simple energy efficiency measures or large-scale infrastructure projects, which is the need for up-front investment.

In terms of collecting payments from developers into a COF, the Community Infrastructure Levy (CIL) and S106 obligations both provide potential mechanisms that are already established in policy. There are, however, some concerns regarding both of these mechanisms. Although CIL is intended to enable the pooling of contributions to provide funding for infrastructure to support development of an area, the purposes for which the funds are sought should be identified in the integrated development plan and local infrastructure framework. This may limit the flexibility of the COF in identifying investment opportunities. The concerns regarding the use of S106 as a collection mechanism mainly relate to how the scope of S106 is narrowed by the CIL regulations. It is not intended after the adoption of CIL regulations that S106 will be used for the pooling of large numbers of contributions to a particular project or type of infrastructure and it will be a requirement that the use of S106 obligations is restricted to items that are directly related to the particular development, including a 'geographical or functional link'. Although a functional link between a carbon reduction initiative and the CO<sub>2</sub> impact of a development may be demonstrated, it would need to be argued that a geographical link is not critical to the aim of the planning obligation, which is to reduce CO<sub>2</sub> emissions.

The use of S106 and CIL as types of allowable solutions was explored in the government consultation on the definition of zero carbon homes and non-domestic buildings. In responses to the consultation document<sup>14</sup>, neither mechanism received strong support as an allowable solution. Concerns ranged from diversion of these funding streams from the kinds of infrastructure needs for which they are typically used, to concerns over ensuring proper auditing of the CO<sub>2</sub> reductions delivered by investments, to the skills and experience of local authority partners in administering the funds and identifying suitable investment opportunities. The minister's statement that followed the response to the zero carbon consultation did not identify CIL or S106 among the potential allowable solutions that received 'broad support'. If the COF were to be recognised as an allowable solution, then an alternative route for collection of developer contributions may need to be established.

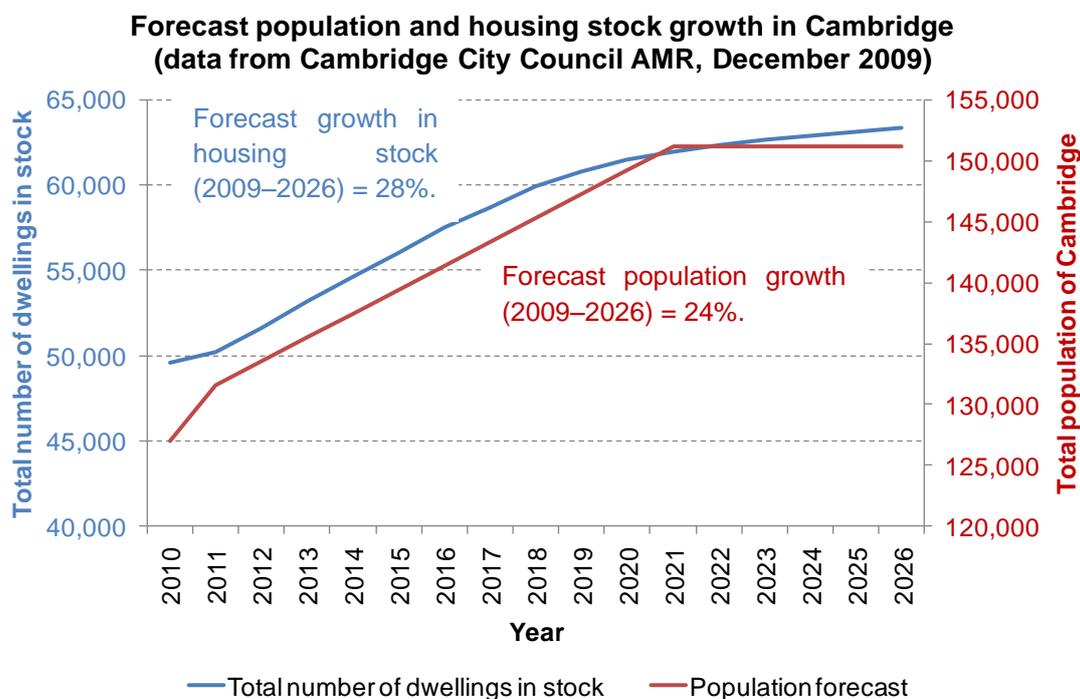
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<sup>14</sup> Definition of zero carbon homes and non-domestic buildings – consultation: Summary of responses, Communities and Local Government, July 2009

## 4 Local context

### 4.1 Population and housing stock growth

According to the Cambridge Local Plan, Cambridge has “one of the fastest growing economies and populations in Britain”.<sup>15</sup> The following figure summarises the expected growth in population and total number of dwellings in Cambridge to 2026.



**Figure 4: Population and housing growth forecast for Cambridge city<sup>16</sup>**

This forecast development is to be delivered against a background of challenging CO<sub>2</sub> reduction targets for the city. For example, the Climate Change Strategy and Action Plan, which was adopted by the City Council in September 2008 sets a CO<sub>2</sub> reduction trajectory for Cambridge such that an 89% reduction is achieved by 2050 (relative to 2005 levels).<sup>17</sup> This target provides specific motivation for achieving low carbon development in Cambridge.

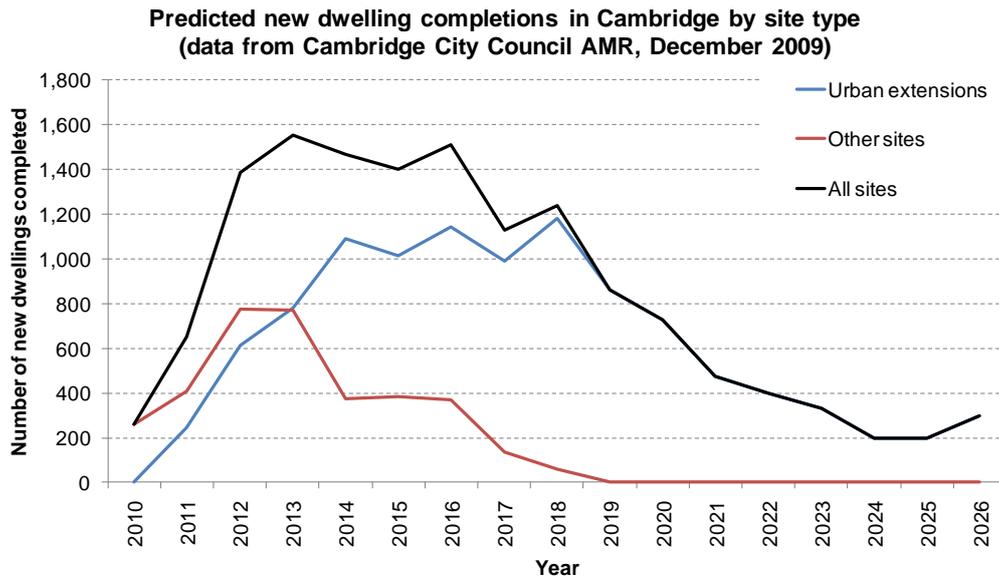
### 4.2 Housing delivery by site type

The data presented in Figure 4 suggest that around 14,000 new homes are expected in Cambridge in the period to 2026. These figures are set out in the Council’s Annual Monitoring Report, which includes a breakdown of housing delivery trajectories by development type, as summarised in the following graph.

<sup>15</sup> Cambridge City Council Local Plan (2006), p.11.

<sup>16</sup> Note that population growth figures were only available to 2021 (assumed no change in population after this date).

<sup>17</sup> Per capita CO<sub>2</sub> emissions for Cambridge residents in 2005 were 6.2tCO<sub>2</sub>. The Action Plan sets targets of reductions of 23% by 2020, 65% by 2030 and 89% by 2050.

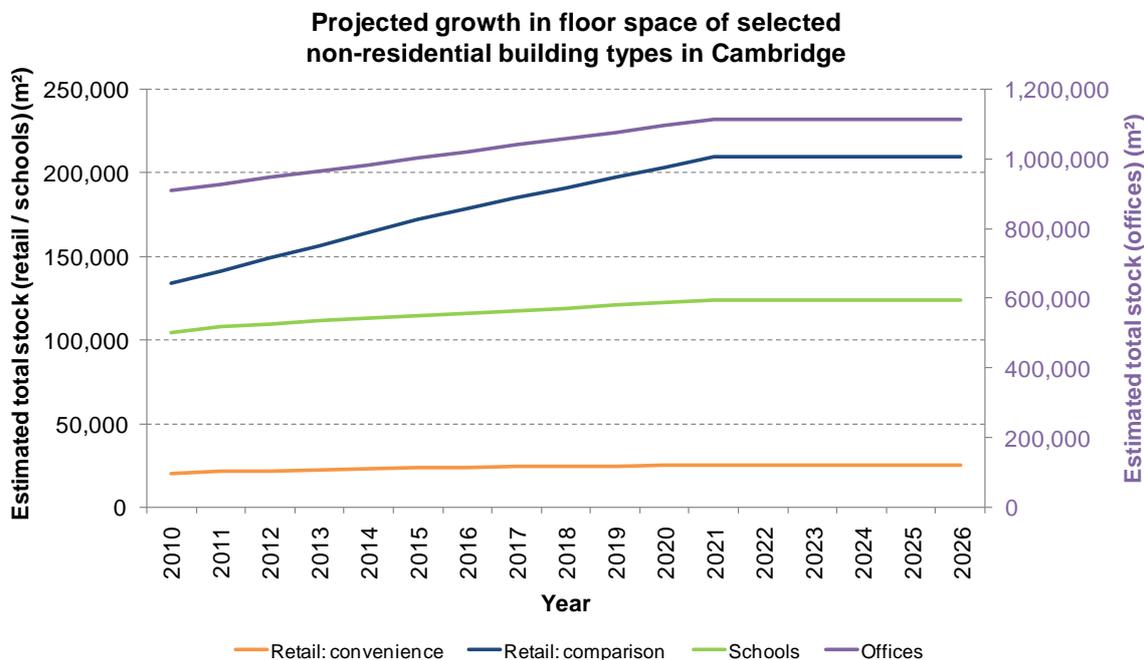


**Figure 5: Forecast new dwelling completions in Cambridge by site type**

In this figure, ‘Other sites’ includes local plan allocations without planning permission, small (10–49 dwellings) and large (50+ dwellings) sites with planning permission. These figures suggest that of the c.14,000 new homes expected from 2010–2026, around 10,500 (75%) will come from large urban extension sites. These sites include Cambridge East, Clay Farm, Bell School, Trumpington Meadows, Glebe Farm, NW Cambridge (University of Cambridge) and the National Institute of Agricultural Botany (NIAB) site. Specific sustainability and CO<sub>2</sub> reduction targets for some of the urban extension sites are set in site-specific Area Action Plans.

### 4.3 Non-residential development

Residential development is expected to be accompanied by growth in buildings for non-residential usage. The following graph shows the anticipated increase in internal floor area for a selection of building usages over the study period.



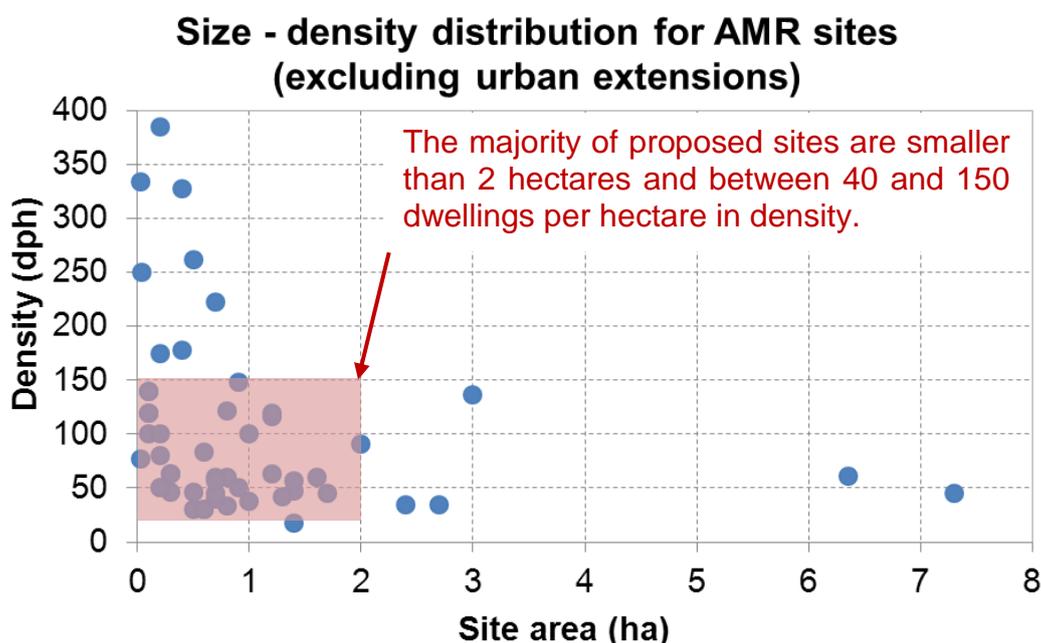
**Figure 6: Forecast growth in non-residential buildings in Cambridge for a selection of building types**

The data sources behind this graph are given in the appendix, section 11.3. These figures suggest that the housing stock growth of around 28% between now and 2026 could be accompanied by a similar level of growth in office and retail (comparison goods) space. This highlights the need to develop policies that address non-residential and residential development in Cambridge.

### 4.4 Development site characteristics

The sites most relevant to this study are those termed ‘Other sites’ in Figure 5, above. Sites currently being assessed by Cambridge City Council in the emerging Strategic Housing Land Availability Assessment (SHLAA) and those allocated for development in the Annual Monitoring report are typically relatively small and exhibit a range of densities, as shown in the following graph.<sup>18</sup> The SHLAA will be used as evidence to support the delivery of land for residential development in the Council’s Core Strategy and Site Specific Allocations development plan documents. The primary role of the SHLAA is to:

- Identify sites with potential for housing;
- Assess their housing potential; and
- Assess when those sites are likely to be developed.



**Figure 7: Characteristics of proposed new development sites in the Annual Monitoring Report**

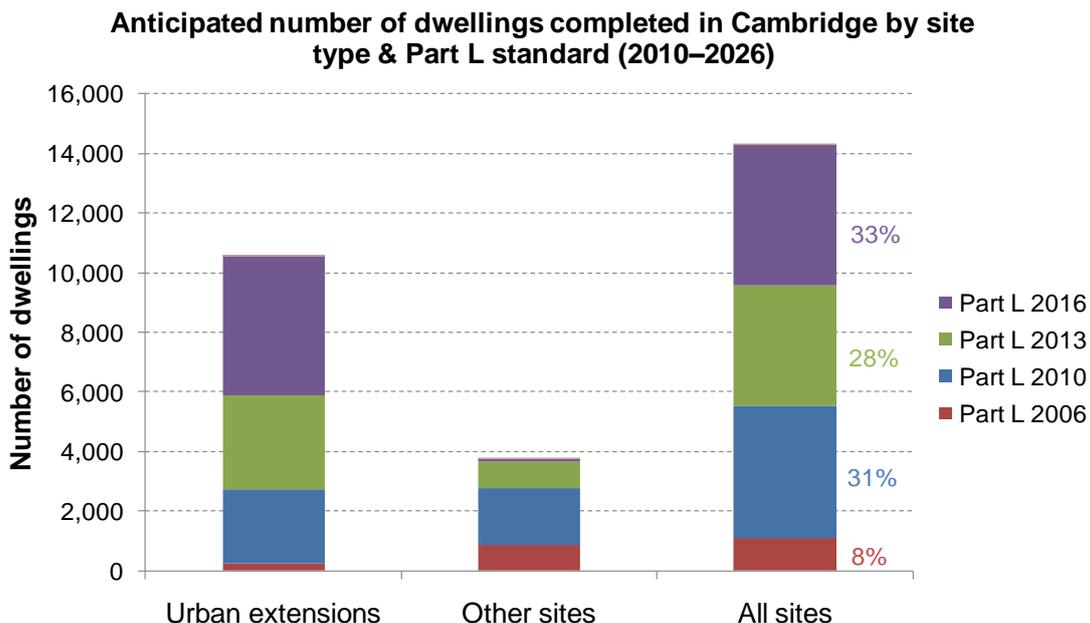
Development site characteristics are relevant when considering technically and economically feasible options for low carbon development. This is discussed in more detail in section 5.

<sup>18</sup> Note that the SHLAA is currently being prepared by the City Council. The sites are in the process of being assessed by officers in order to determine their suitability and availability for development, and will be subject to further consultation with Members and other key stakeholders. As such the sites currently identified will be subject to change. Further sites could be identified through the consultation on the draft SHLAA and it is also anticipated that other sites may be put forward for development as part of consultation on development plan documents, notably the Site Specific Allocations document.

### 4.5 Forecast growth in Cambridge carbon emissions

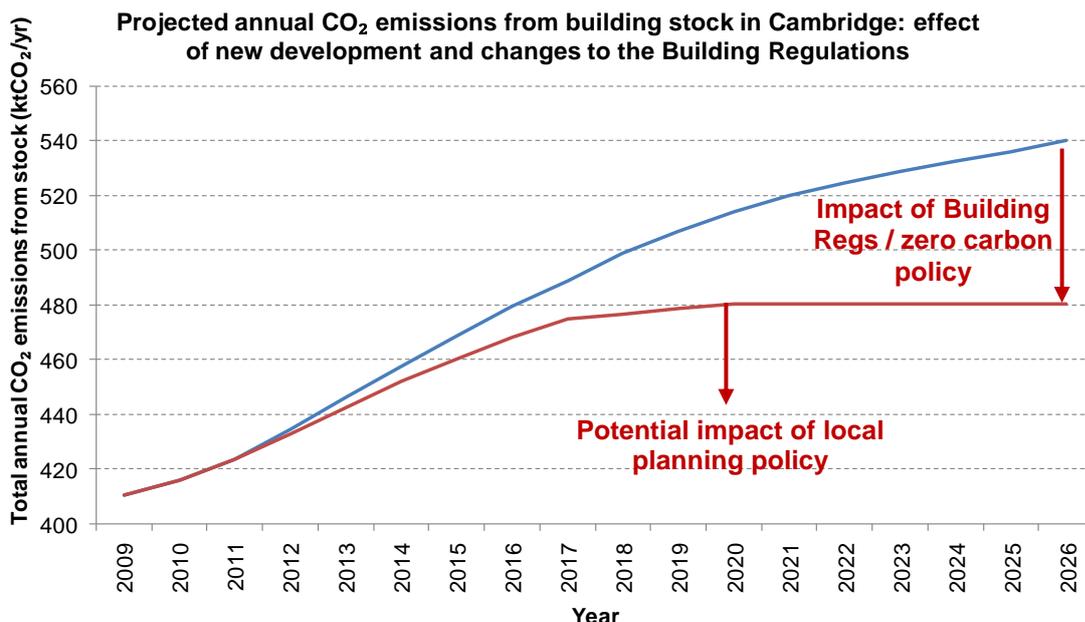
Based on the growth projections discussed in the preceding sections, a forecast can be made of the associated rise in the city’s carbon emissions footprint.

Changes to Part L of the Building Regulations and the introduction of zero carbon policy for homes and non-domestic buildings will be key to limiting the emissions impact of new development in the city. The impact of each Part L standard on new homes built in Cambridge can be estimated from the build trajectory presented in Figure 5. Assuming that changes to Part L take affect at the end of the year, and that buildings with planning permission have up to a year to complete, the number of homes built to each standard is presented below.



**Figure 8: Anticipated dwelling completions by Part L standard**

A similar forecast of the amount of new non-domestic space that will fall within each Part L standard can also be made, although at the present time the CO<sub>2</sub> reduction standards that will be enforced in non-domestic buildings at each stage is not clear (it is likely that a differing standard will be imposed depending on building type, in order to deliver a certain aggregate reduction target across the new non-domestic stock as a whole). Based on the growth forecast and anticipated Part L changes, the impact of national policy on growth of CO<sub>2</sub> emissions from new developments has been predicted, as shown in the figure below.



**Figure 9: Impact of the building regulations on forecast growth of CO<sub>2</sub> emissions in Cambridge as a result of new development**

As shown in the plot above, new development in Cambridge is expected to result in significant emissions growth over the period to 2020. It is assumed that beyond 2020, zero carbon policy will ensure that new development imposes no net increase in CO<sub>2</sub> emissions – this assumes that all CO<sub>2</sub> reduction through allowable solutions is delivered within Cambridge.

Local planning policy could act to further reduce the growth in emissions related to new development, by imposition of CO<sub>2</sub> reduction policies that are more onerous than the national building regulations. Decarbonisation of new development ahead of national regulations could be achieved by development management policies requiring certain Code for Sustainable Homes standards to be achieved or by requiring a certain percentage of development CO<sub>2</sub> emissions to be reduced by onsite renewable energy generation.

Planning policies relating to energy use and CO<sub>2</sub> emissions in certain of the urban extension sites have been adopted in the relevant Area Action Plans, for example those for the North West Cambridge and Cambridge East sites. The policy recommendations arising from this study are therefore most applicable to dwellings delivered within the ‘other sites’(as shown in Figure 5 and Figure 8), i.e. the distribution of smaller sites outside the urban extensions.

## 5 Strategies for delivering low carbon development

### 5.1 Overview of technologies

Low carbon building development can be achieved through various means. It is widely accepted that the first priority for any efficient new building is to reduce demand for energy through appropriate siting, orientation, and advanced standards of energy efficiency (insulation measures). A building's in use carbon emissions ultimately depend on the amount and type of fuel used to meet the energy demands, which means the next step is to select a highly efficient heating system and to consider the fuel options available. The carbon impact of fuels varies by fuel type (i.e. using one unit of a given fuel leads to a certain level of CO<sub>2</sub> emissions, expressed as kgCO<sub>2</sub>/kWh), for example biomass is considered a 'low carbon' fuel in these terms relative to fossil fuels (and electricity derived from fossil fuels). Finally, some or all of a building's energy demand can be met by renewable energy technologies such as solar thermal to meet hot water demands and photovoltaics to generate low carbon electricity.

The following table summarises the principal technologies available for low carbon building development.

**Table 2: Overview of technologies for low carbon building**

| Technology                        | Description  |
|-----------------------------------|--|
| Solar photovoltaics               | PV panels based on semi-conductor materials convert sunlight into electricity.   |
| Solar thermal                     | Roof-mounted panels capture energy from sunlight which is typically used to meet a portion of a building's hot water demands.  |
| Building-mounted wind             | Micro wind turbines can be mounted on top of buildings and generate electricity. Electricity output is a strong function of wind speed.  |
| Small / medium / large scale wind | Pole or tower mounted turbines benefit from access to higher average windspeeds. However, siting is restricted by considerations such as distance from buildings and environmental impacts.  |
| Ground source heat pumps (GSHP)   | Collect thermal energy from the ground via deep vertical boreholes or shallow buried ground loops. Low grade heat from the ground is upgraded to a useful temperature by an electrically powered heat pump. Qualify as renewable technology due to very high efficiency. |
| Air source heat pumps (ASHP)      | Identical principle to GSHP, except that heat is taken from surrounding air. Potential for lower capital cost, as less expensive equipment for heat extraction from the air (similar to air conditioning unit).  |
| Biomass boilers                   | Burn solid biomass fuels such as wood pellets or wood chips (boilers that use bio-oils also available) to produce heat.  |
| Micro CHP                         | Gas-fired CHP at the scale of an individual dwelling (1–3kWe). Primarily heating technologies, but generate some electricity that offsets grid electricity, resulting in carbon saving.  |
| Medium / large scale CHP          | Based on electricity generators (usually a reciprocating engine or a turbine), with use of the heat produced to meet local thermal demands. Increase overall efficiency of fuel consumption by use of heat and therefore result in CO <sub>2</sub> savings.              |

## 5.2 The role of energy efficiency

### 5.2.1 Introduction

As mentioned in section 5.1, improving the thermal performance of buildings by specifying high levels of insulation and other energy efficiency measures is a key first step for any new building. The main areas that can be addressed are:

- Improving insulation levels for key building elements (i.e. selecting materials with low U-values), including external walls, doors, windows, roof, floor.
- Reducing uncontrolled air exchanges between the building and the environment by reducing air permeability.
- Addressing thermal bridging by focusing on details of joints in the building.

Achieving high levels of thermal performance must be balanced against other factors such as the additional cost of better performing materials and the physical space implications of thicker insulation for example. The fact that achieving lower U-values generally leads to an increase in build costs suggests that there may be an optimal level of building fabric improvement. A cost-benefit analysis of improving the thermal performance of a typical end of terrace house is explored in this section.

### 5.2.2 Fabric packages

In order to illustrate the potential costs and benefits of improving the building fabric in residential development a total of four fabric packages are considered, as defined below.

**Table 3: Improved fabric packages**

|  |                       | Reference           | Basic               | Good                | Advanced |
|--|-----------------------|---------------------|---------------------|---------------------|----------|
| <b>U values of major building elements (W/m<sup>2</sup>.K)</b> | <b>External doors</b> | 2.5                 | 1.5                 | 1.1                 | 0.7      |
|  | <b>Windows</b>        | 2.5                 | 1.5                 | 1.1                 | 0.7      |
|  | <b>Ground floor</b>   | 0.25                | 0.20                | 0.15                | 0.10     |
|  | <b>External wall</b>  | 0.35                | 0.25                | 0.20                | 0.15     |
|  | <b>Roof</b>           | 0.18                | 0.15                | 0.13                | 0.10     |
| <b>Air permeability, q50 (m<sup>3</sup>/m<sup>2</sup>.hr)</b>  |                       | 10                  | 7                   | 4                   | 1        |
| <b>Thermal bridging y value (W/m<sup>2</sup>.K)</b>            |                       | 0.08                | 0.08                | 0.04                | 0.02     |
| <b>Type of ventilation system</b>                              |                       | Natural ventilation | Natural ventilation | Natural ventilation | MVHR     |

In all cases the thermal demands of the dwelling are met by a high efficiency condensing gas boiler. The ‘Reference’ fabric package is defined such that the dwelling complies with current standards (Part L 2006). The ‘Advanced’ fabric standard corresponds to a super insulated house, similar to the passiv haus standard. With this level of insulation it is assumed that there is no need for a full house wet central heating system, which means that some of the additional expense of the higher levels of insulation is offset by this cost saving. Full details of the cost assumptions behind this analysis are given in the appendix, section 11.4.

The results in this section are for a typical end-of-terrace house, with two different construction methods: traditional cavity masonry and timber frame. These construction techniques represent the

current mainstream methods of house building in the UK. Many other construction systems are also available, but for the purposes of demonstration this section is restricted to the two main types.<sup>19</sup>

### 5.2.3 Cost and performance of fabric improvement

#### Impact on energy demands and CO<sub>2</sub> emissions

The performance of higher fabric standards can be measured in a number of ways. Key metrics include the reduction in thermal demands and CO<sub>2</sub> emissions achieved. The dwelling’s energy demands and resultant CO<sub>2</sub> emissions were calculated following the SAP 2009 methodology.<sup>20</sup> The following graph summarises the effect of each fabric package on thermal and electricity demands, and CO<sub>2</sub> emissions in terms of dwelling emission rate (DER).

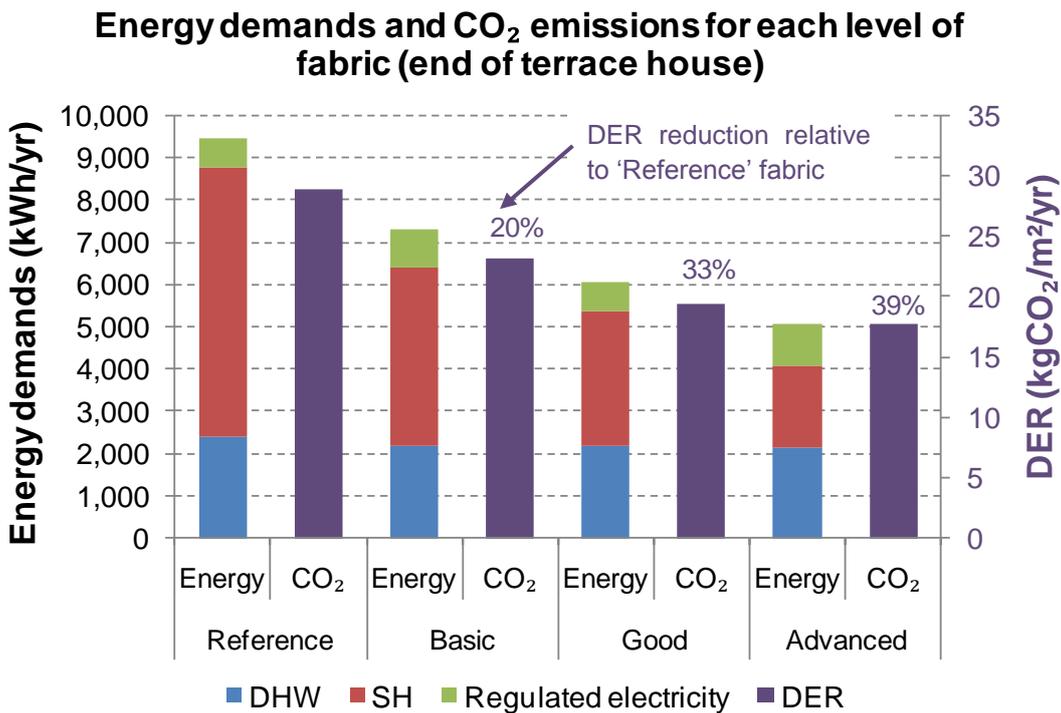


Figure 10: Performance of improved fabric packages

Requirements for thermal energy are broken down into space heating (SH) and domestic hot water (DHW) demands. According to the SAP methodology hot water demands depend mainly on the assumed occupancy of the dwelling, which in turn is dictated by floor area. Improving the building’s fabric is therefore not expected to have a significant impact on demand for hot water. Figure 10 shows that the main effect of improving the fabric is to reduce the space heating demands. Relative to the Reference fabric package, Basic, Good and Advanced fabric levels lead to space heating demand reductions of around 35%, 50% and 70% respectively.

The effect of fabric on regulated electricity demands depends on the proportion of space heating demands met by electric (secondary) heating.<sup>21</sup> A second effect is due to the mechanical ventilation system specified in the Advanced fabric package, which requires an electrically powered fan to control

<sup>19</sup> Other construction systems include Insulated Concrete Framework, Structural Insulated Panels, single skin block with external wall insulation etc.

<sup>20</sup> The consultation version of SAP (cSAP) was used, as at the time of writing the final methodology is yet to be finalised.

<sup>21</sup> In the example presented here it is assumed that there is no need for secondary space heating – i.e. the primary heating system meets all of the dwelling’s thermal demands.

air exchange. This leads to an increased demand for electricity, the extent of which depends on the fan’s specific power.<sup>22</sup>

The overall impacts of these changes in demand in terms of carbon emissions are shown by the dwelling emission rate (DER) values plotted in Figure 10. These data suggest that relative to the Reference fabric (Part L 2006) the Advanced fabric (similar to passiv haus standards) could lead to a reduction of around 40%. This demonstrates that significant CO<sub>2</sub> savings are possible through fabric measures alone, without the need to install low/zero carbon (LZC) technologies.

### Economic impacts

The benefits of reducing a building’s energy demands and CO<sub>2</sub> emissions through improved fabric must be balanced against the cost implications of specifying materials with lower U values, and reducing air permeability and thermal bridging. The following graph shows the capital cost implications of each level of improved fabric, expressed as costs in addition to the Reference fabric package. It should be noted that these are generic cost figures for a typical end of terrace dwelling. In practice costs are sensitive to many factors; however these results give an indication of typical additional costs of fabric improvement. Full details of the cost assumptions are given in the appendix, section 11.4.

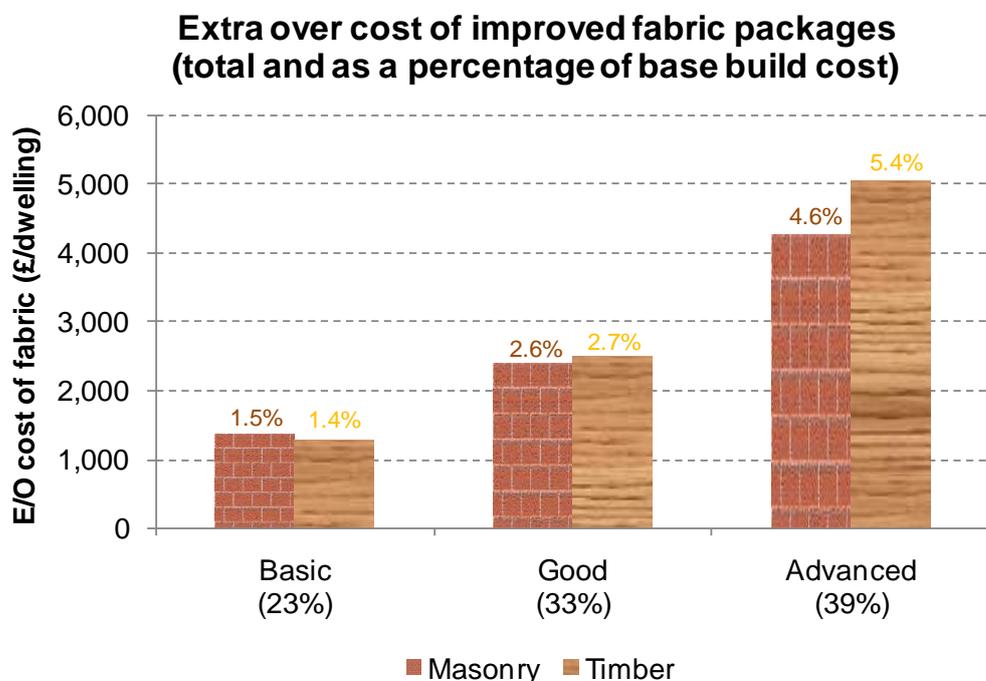
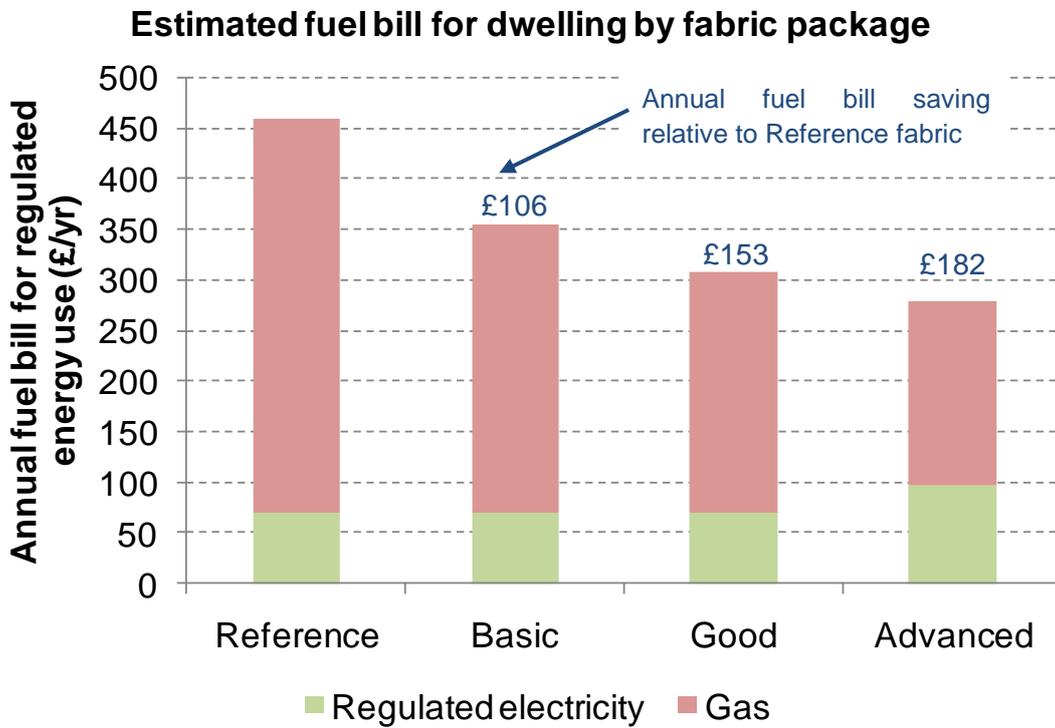


Figure 11: Additional capital cost of improved fabric packages

These results suggest the additional capital expenditure for the fabric packages considered range from c.£1,200 to c.£5,000 per dwelling. As mentioned above, these costs apply to generic new build dwellings and the financial impacts in individual cases will vary. The law of diminishing returns is evident from the graph above. For example, while the Advanced level of fabric gives roughly double the improvement in CO<sub>2</sub> emissions compared to the Basic package, the additional cost is 3-4 times for Advanced relative to Basic fabric. The results also suggest that there is little difference in the percentage increase in cost between the two methods of construction considered.

<sup>22</sup> The standard assumption in SAP is that where an MVHR system is specified the specific fan power (SFP) is 2W/litre/second. However, fans of higher efficiency are available and in this example a SFP value of 1W/litre/second has been assumed.

An obvious advantage of a more efficient home is reduced fuel bills for the occupants. The energy demands predicted by the energy modelling (SAP) were translated into approximate fuel bills, from which estimations of annual savings can be made.



**Figure 12: Representative fuel bills (regulated energy demands only) by fabric package for the end of terrace house considered**

The results presented above are based on thermal demands met by an 85% efficient gas boiler, with gas and electricity prices of 4p/kWh and 10p/kWh respectively. These are indicative current prices, and clearly the fuel bill savings would be greater if energy prices were to rise (and lower if they fall).

#### 5.2.4 Practical implications of fabric improvement

The results presented above show that there is considerable opportunity to improve on current building standards in terms of thermal performance of dwellings. However, a number of associated issues with improving a building’s fabric must also be considered. This section gives an overview of some of the main considerations.

#### Space requirements of increased insulation

Achieving the increasingly low U values summarised in Table 3 involves specifying thicker insulation in the case of the ground floor, walls and roof, and selecting higher performing windows and doors. The impact in cost terms of the increased space required, particularly for the external wall insulation, is not included in the above analysis. With traditional insulating materials lower U values means thicker insulation, which necessitates thicker walls. The effect of this is to either reduce the internal floor area of the building or reduce the number of dwellings that can be accommodated on a site. The following figures show the increase in insulation thickness required to achieve the stated U values.

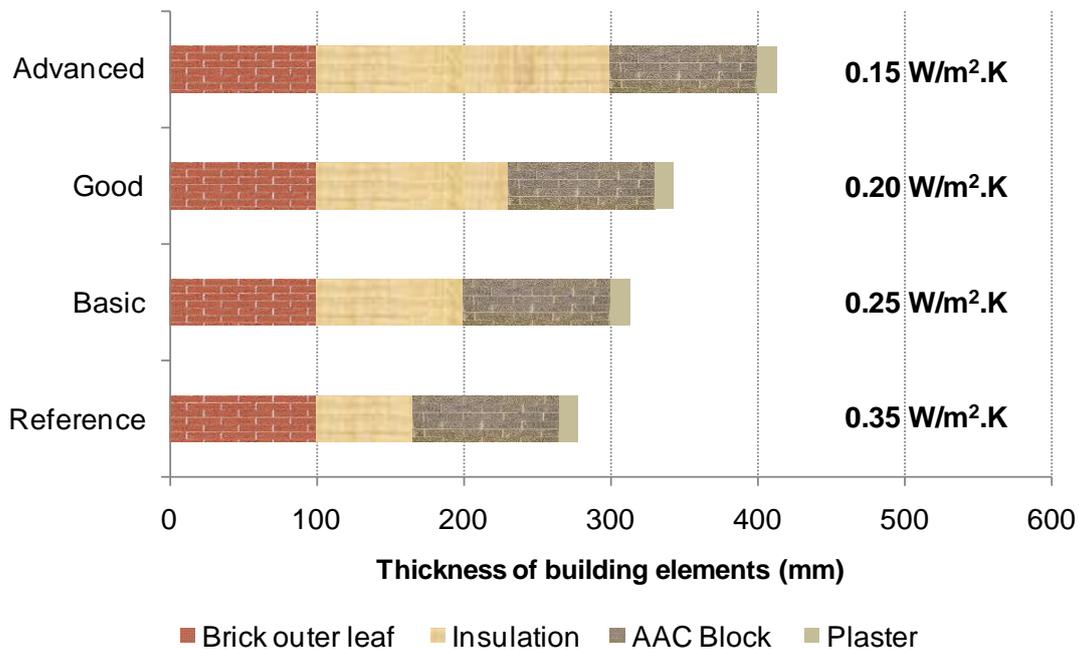


Figure 13: Masonry cavity wall insulation cross sections<sup>23</sup>

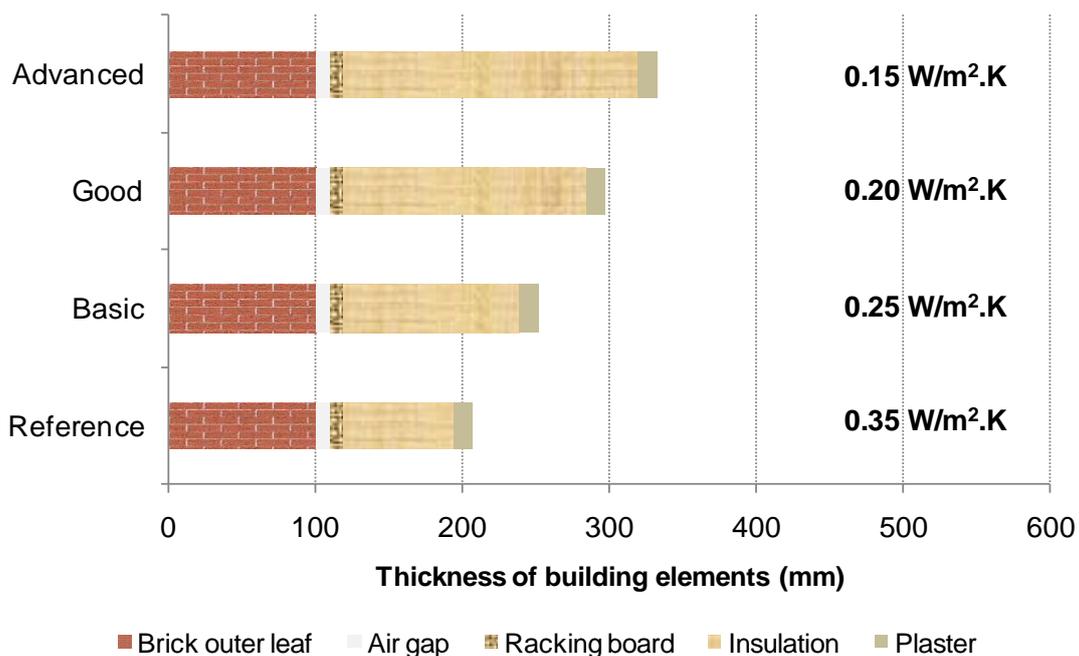


Figure 14: Timber frame construction – wall insulation cross sections

For the dwelling type considered in this analysis (an 88m<sup>2</sup> end of terrace house), the impact of improving the U values from the Reference fabric to Basic, Good and Advanced could be to reduce the dwelling’s internal floor area by around 2%, 4% and 5.5% respectively.

<sup>23</sup> AAC block refers to autoclaved aerated concrete blocks.

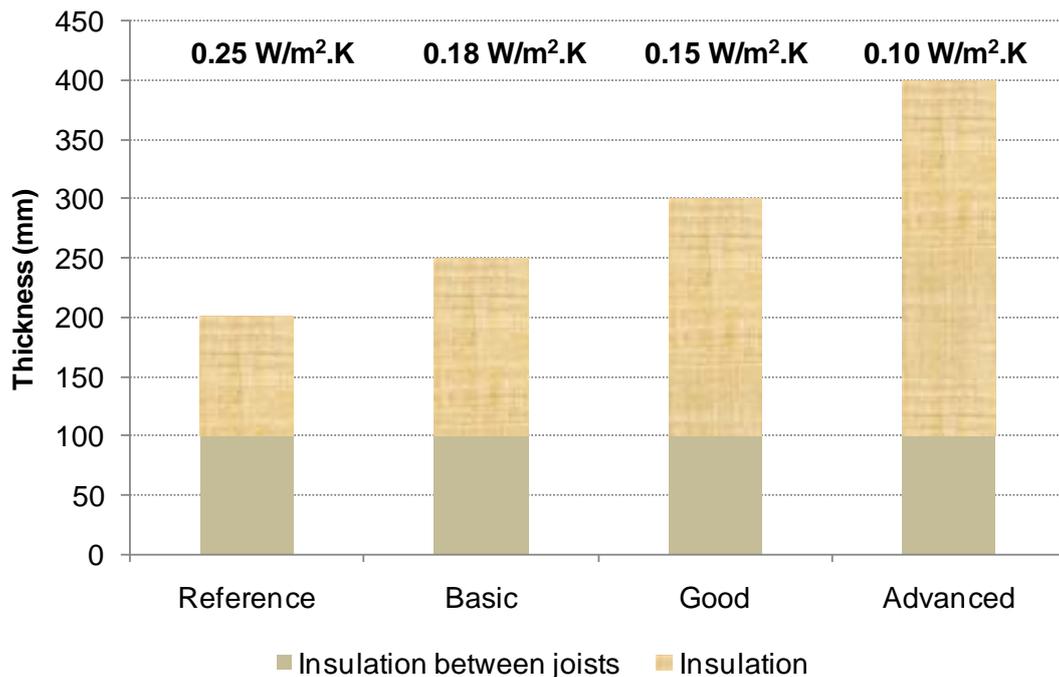


Figure 15: Thickness of loft insulation (based on cold loft construction) for each fabric package

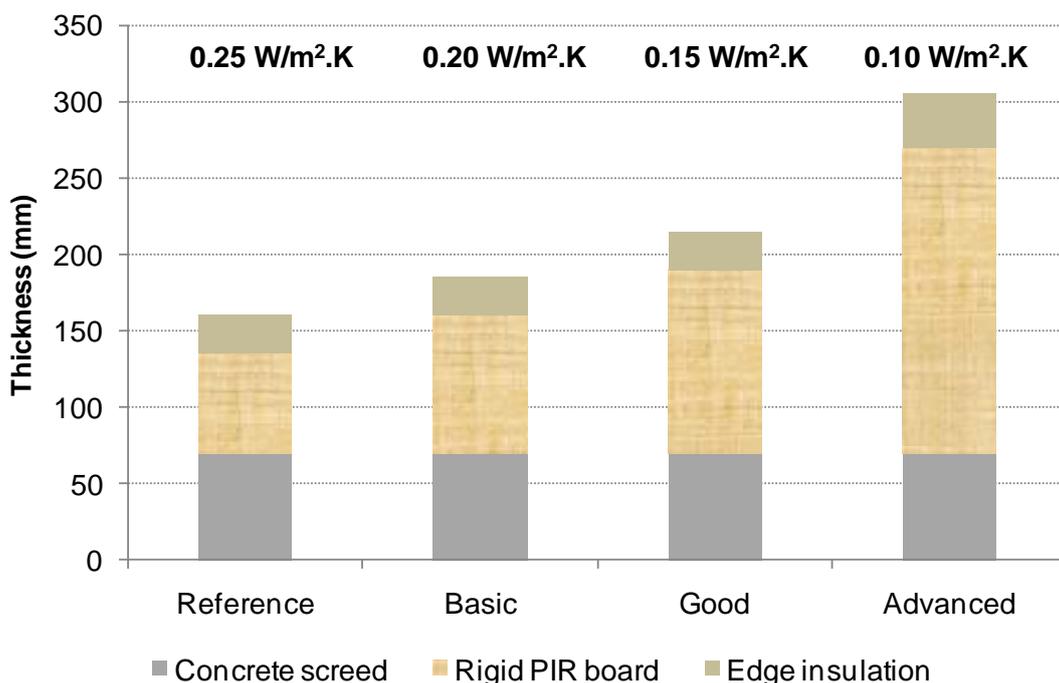


Figure 16: Thickness of floor insulation for each fabric package<sup>24</sup>

Greater space requirements for floor and roof insulation can in general be more easily accommodated than the additional wall thickness required to achieve low U values. Incorporating thicker walls in a new building with no impact on internal floor area can be achieved by using a greater area of land (i.e. higher building footprint). However, the opportunities to employ this approach are more limited in urban areas, where space is at a premium and the economics of development projects may be highly sensitive to the number of dwellings that can be built on a site.

<sup>24</sup> PIR is polyisocyanurate (a rigid thermal foam used for thermal insulation).

## Buildability and installation issues

The term 'buildability' refers to the extent to which a design is realisable in practice. In construction a potential gap exists between the building as designed and the finished structure. This is particularly true with aspects such as air permeability and thermal bridging, for which it can be difficult to achieve the exact design value. The gap between as-designed and as-constructed performance must be minimised for mass market solutions.

Where U values of building elements are to be lowered with thicker insulation no particular installation challenges exist.<sup>25</sup> However, a change in installation practice may be required for some building elements, notably windows and doors of very low U values. Triple glazing adds significant weight to windows, which means mechanically assisted installation may be required. This represents a change from traditional installation practices but is not an insurmountable barrier.

## Other issues

Further issues that should be considered when specifying an approach to energy saving and CO<sub>2</sub> reduction in new buildings include the impacts on the internal environment and on-going maintenance burdens. For example, in highly air tight homes thought must be given to air circulation to avoid potentially negative health impacts of inadequate fresh air exchange. In terms of maintenance, improving the building fabric will not generally lead to a higher burden on the occupiers. This makes emissions reduction through fabric improvement an attractive solution relative to LZC technologies from an on-going operation and maintenance point of view.

### 5.2.5 The role of energy efficiency: conclusions

The analysis presented above shows that significant energy demand and CO<sub>2</sub> emission reductions are possible through improvements to building fabric. While there is an additional capital cost associated with realising these savings, the increase relative to baseline build costs is relatively modest (of the order of a few percent). Advocating improved energy efficiency levels through enhanced building fabric is appropriate for the following reasons:

- Energy demand reduction is a logical first step in any low carbon building strategy. This is recognised by Government, for example by the proposed energy efficiency backstop measures proposed for Code level 4 and above of the Code for Sustainable Homes.<sup>26</sup>
- Construction represents the prime opportunity to influence how a building will perform throughout its lifetime. Improving building fabric buffers occupants from fluctuations in fuel prices (energy demand reduction is beneficial from this point of view irrespective of the fuel used to meet the demands).
- Energy efficiency measures are amongst the most cost effective means of saving CO<sub>2</sub>.

Practical and economic considerations mean that the level of building fabric improvement appropriate will vary on a site-by-site basis. It is therefore not appropriate for the level of improvement through building fabric to be specified in planning policy. Having said this, adopting policies that require new development to comply with the CSH (see Proposed Option 2, section 9.2.1), for example, could implicitly demand a certain level of fabric improvement with the proposed changes to the CSH (in terms of energy efficiency backstop levels for level 4 and above).

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<sup>25</sup> Provided that studs of appropriate dimensions can be sourced in the case of timber frame construction, for example.

<sup>26</sup> See the DCLG consultation on the Code for Sustainable Homes, and the work by the Zero Carbon Hub on energy efficiency backstop levels.  
[www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/codesustainable/](http://www.communities.gov.uk/planningandbuilding/buildingregulations/legislation/codesustainable/)  
[www.zerocarbonhub.org/news\\_details.aspx?article=5](http://www.zerocarbonhub.org/news_details.aspx?article=5).

## 6 Local low carbon and renewable energy resource assessment

### 6.1 Opportunities for district heating

#### 6.1.1 Introduction

District heating refers to using centralised heating plant to meet the thermal demands of a number of buildings. The economies of scale gained by this approach lead to potential advantages, including:

- Improved economic viability of low carbon heating plant such as biomass boilers.
- Potential to use combined heat and power (CHP), whereby carbon benefits can be achieved by generating electricity locally and making use of the associated heat produced.

An important part of any district heating system is the heat distribution network, which typically consists of insulated heat pipes buried in the ground. Such a network typically involves a substantial capital outlay, and costs must be recouped through on-going heat sales. The economic viability of district heating is therefore sensitive to heat density, which is typically measured in terms of annual demand for heat per unit area (e.g. MWh/m<sup>2</sup>.yr). A second consideration for community heating schemes is the mix of heat consumers, which affects the diversity of demand.<sup>27</sup> The economics of large scale heating plant, particularly CHP, are favoured when a reliable base heat load is present.

#### 6.1.2 Estimating heat demand density in Cambridge: methodology

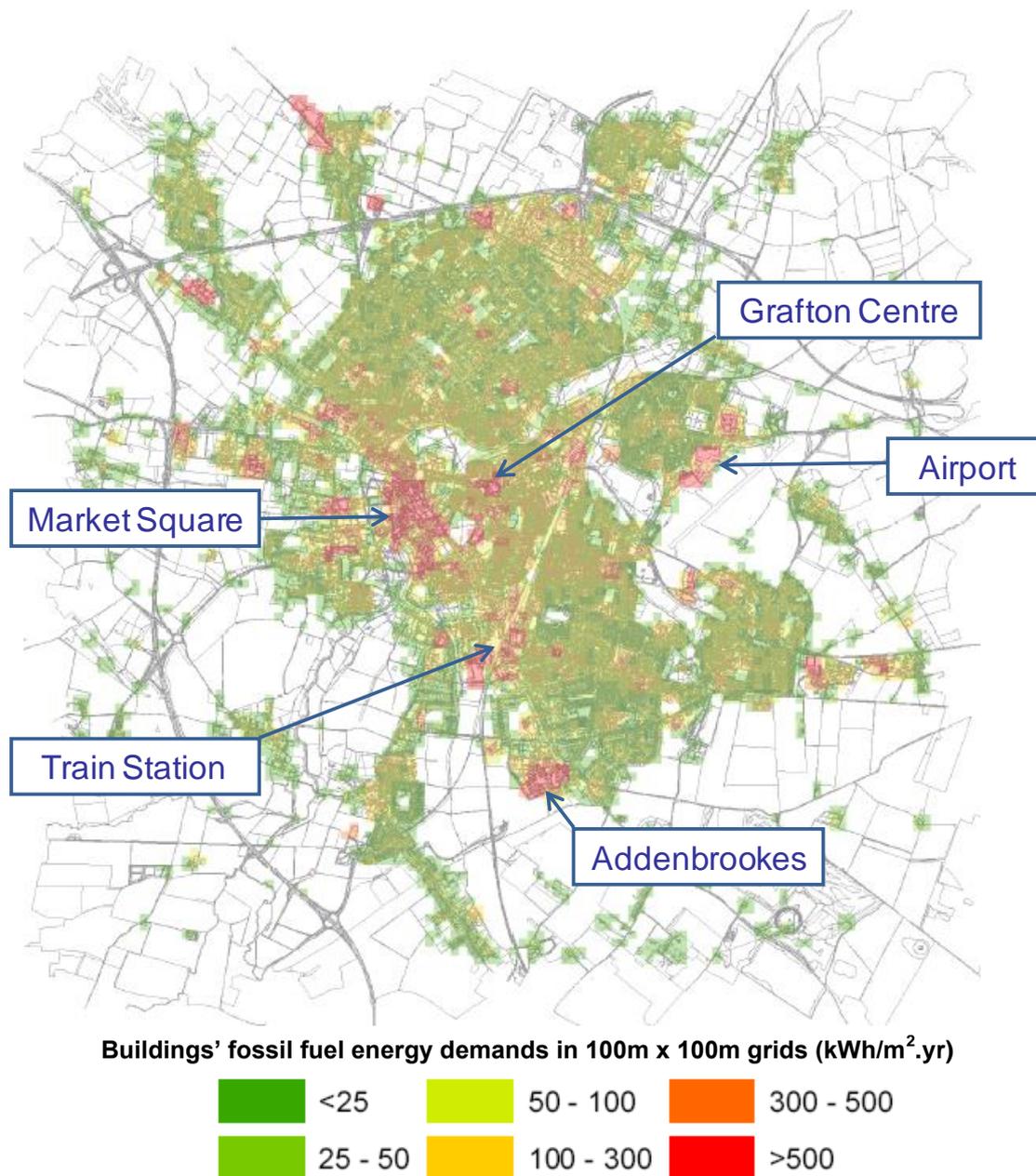
An estimation of heat demand density for existing buildings in the city was made from OS Address Point data, i.e. a database of every address in the study area. Each address was assigned a usage type in order to differentiate between different energy consumers (e.g. a domestic home has a different thermal demand from commercial premises). The database includes plan area of each building type, and combined with estimations of the number of storeys and specific thermal demands (kWh/m<sup>2</sup>.yr), total thermal demands of each building can be estimated. Summing demands from buildings in a given grid square using GIS software allows an assessment of heat demand density at a given level of resolution. Further methodological details can be found in the appendix, section 11.5.

#### 6.1.3 Results of heat mapping exercise

The following maps show estimations of the demand for heat from buildings in Cambridge. Full details of the methodology behind the production of these maps are given in the appendix, section 11.5.

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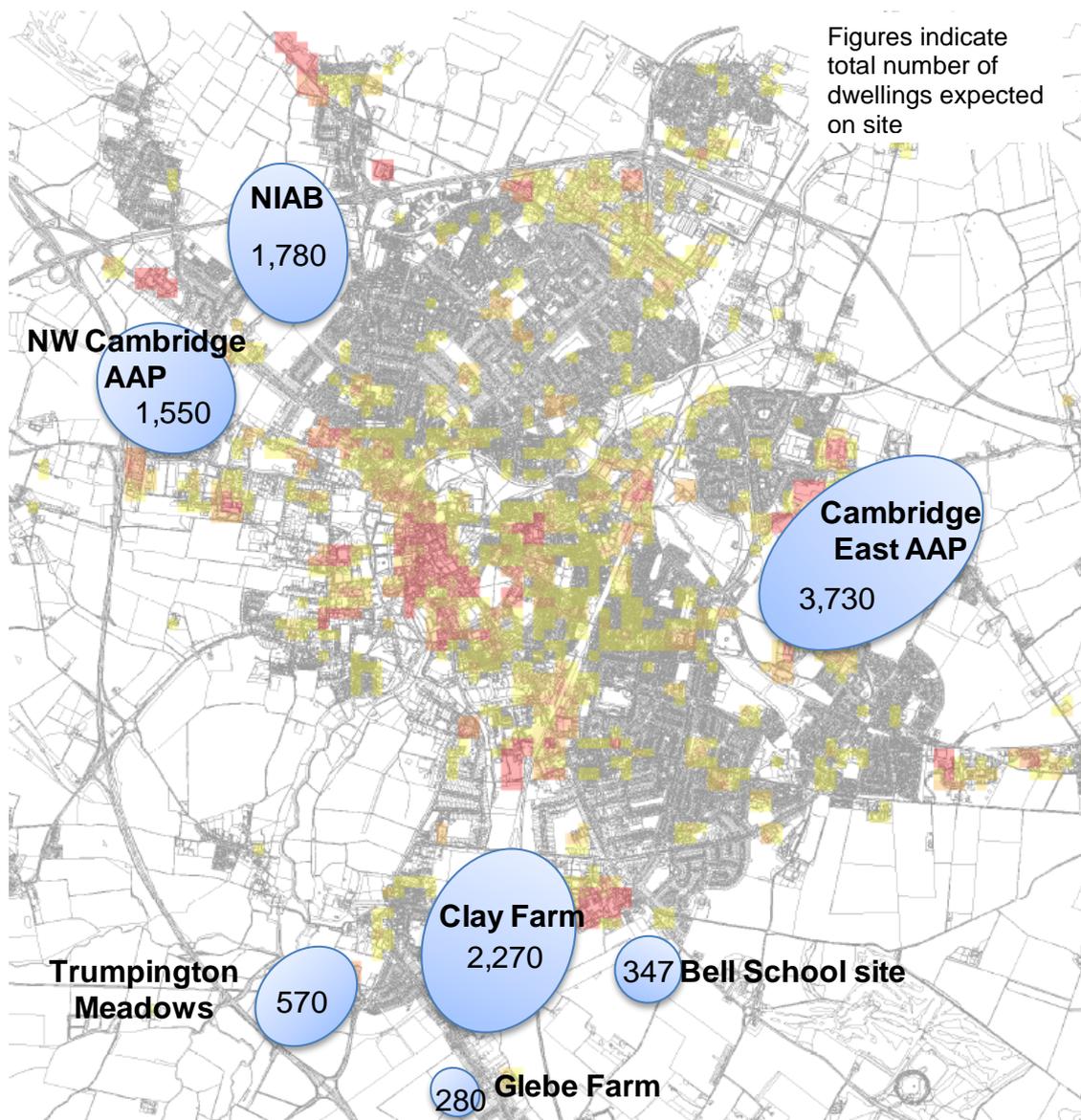
<sup>27</sup> Diversity in this context refers to when demand for heat occurs throughout the day.



**Figure 17: Heat density map for Cambridge**

This map demonstrates that much of the City Council area is characterised by relatively low heat density (indicated by the green areas). A heat density of at least 100 kWh/m<sup>2</sup>.yr is required to generate a potentially attractive return from investment in a district heating system.

In the following map the scales of fossil fuel (and therefore heat) demand density are adjusted to reveal the areas of potential interest for district heating.



Buildings' fossil fuel energy demands in 100m x 100m grids (kWh/m<sup>2</sup>.yr)



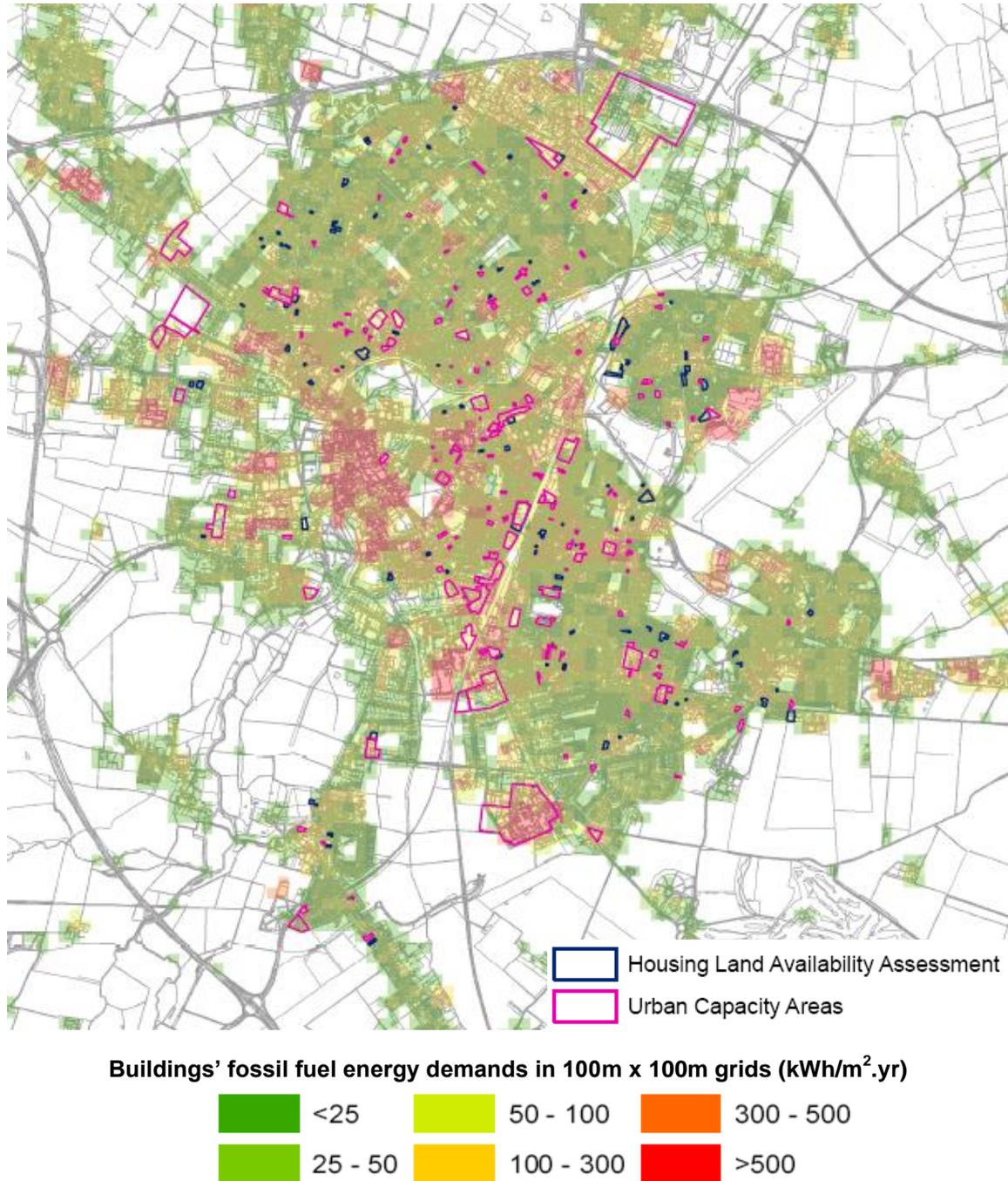
Figure 18: Areas of high heat density and urban extension sites in Cambridge

As expected, a high heat density is evident in the city centre. There are also areas of high demand around the station area, near the airport, at the Addenbrookes hospital site, and in a number of other isolated areas.

From practical and economic perspectives district heating is preferred in new developments due to the costs and disruption associated with the installation of heat distribution pipework. It is more cost effective and less disruptive to install this infrastructure in parallel with other utilities and services during the early stages of construction on a new build site. Major new development areas are also plotted on the map above to allow assessment of any potential opportunities to link a district heating system in a large new development to an existing heat load. Figure 18 suggests that such opportunities are limited in Cambridge, with the only potential area of interest being the proximity of

the Bell School site to the area of high heat density around Addenbrookes hospital. Up to around 350 new homes are proposed at the Bell School site (7.88 hectares) at a density of 48 dwellings per hectare.

Given the relatively limited opportunity to link the urban extension sites to areas of high heat density, smaller sites have also been considered.

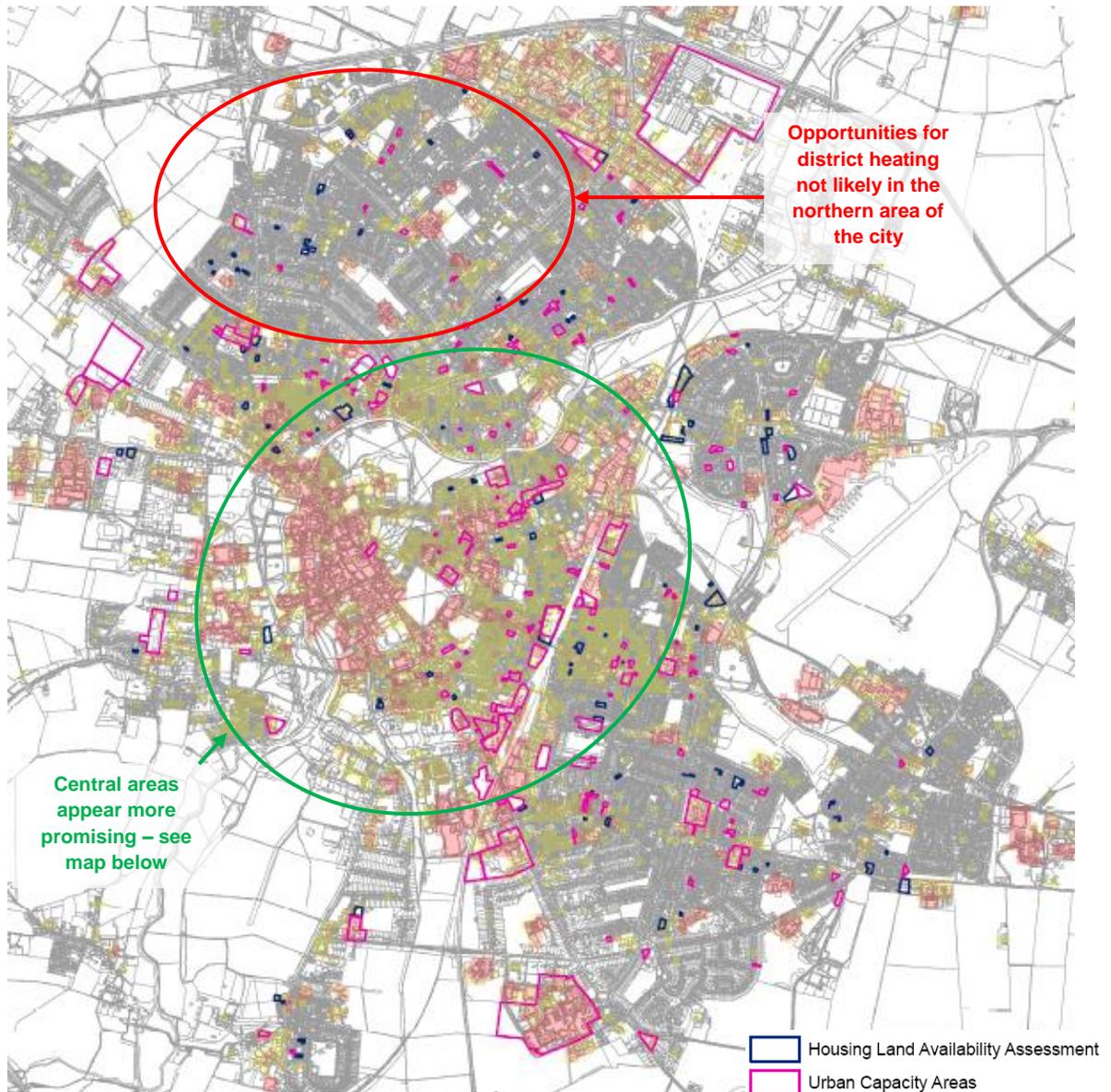


**Figure 19: Heat map with SHLAA and Urban Capacity Areas**

Figure 19 shows the areas identified with potential for development relative to the areas of different existing heat demand density. The housing sites plotted are taken from the emerging Strategic Housing Land Availability Assessment (SHLAA), which is currently being prepared by the City Council. The sites are still in the process of being assessed by officers in order to determine their suitability and availability for development, and will be subject to further consultation with Members

and other key stakeholders. As such the sites illustrated on the heat maps will be subject to change and should not be viewed as providing a definitive answer as to whether or not a site is considered to be suitable for development. Further sites could be identified through the consultation on the draft SHLAA and it is also anticipated that other sites may be put forward for development as part of consultation on development plan documents, notably the Site Specific Allocations document. The draft SHLAA sites have therefore been plotted on the heat maps for illustrative purposes only, in order to highlight the potential for district heat networks in Cambridge. The heat maps will be updated accordingly as more definitive views on sites for housing become available.

Again, filtering out areas of low heat density shows potential areas of interest for district heating.

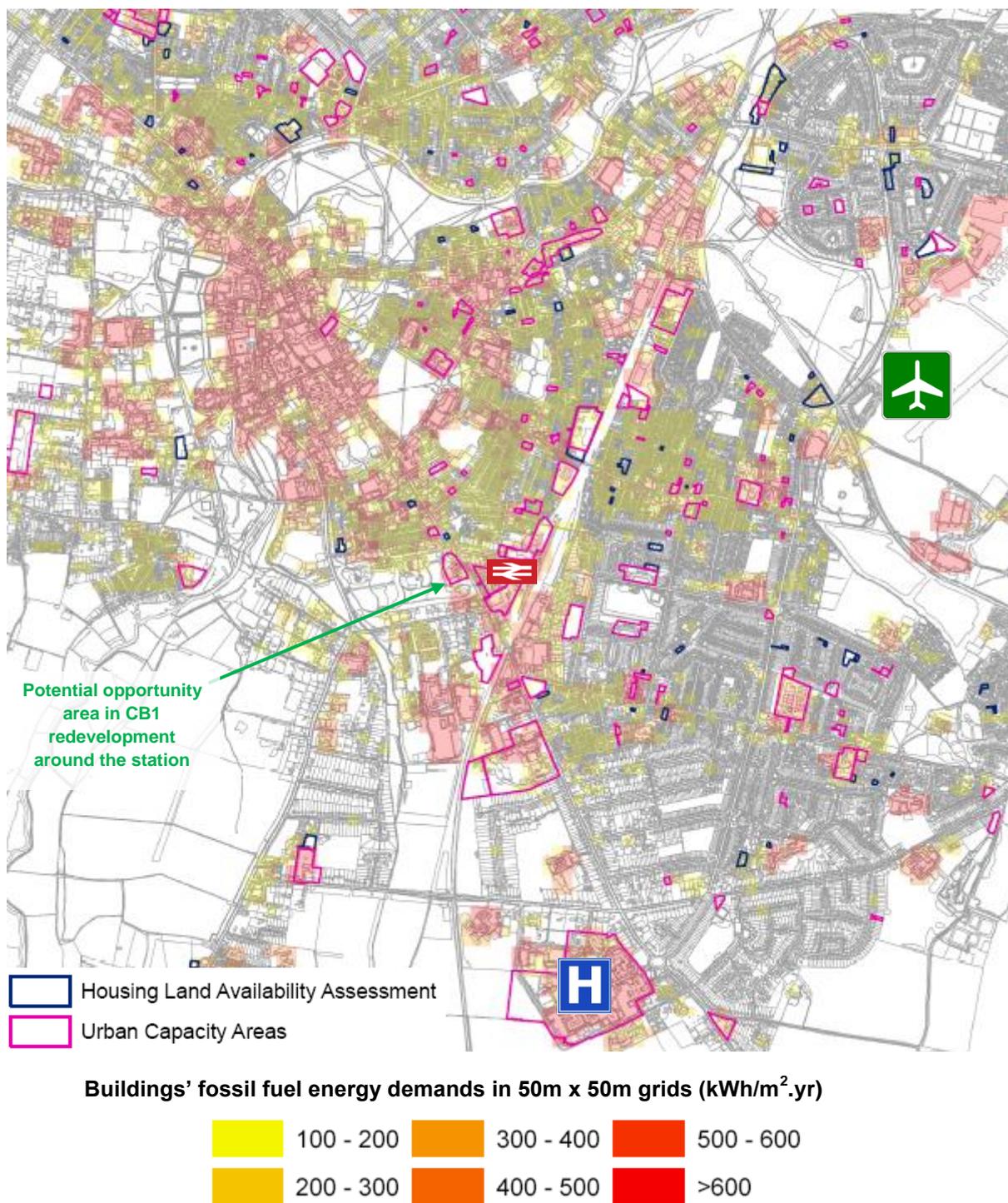


**Buildings' fossil fuel energy demands in 50m x 50m grids (kWh/m<sup>2</sup>.yr)**



**Figure 20: Areas of high heat density relative to SHLAA and Urban Capacity Areas**

There are a relatively large number of mostly quite small sites identified as possibly having development potential. These are spread throughout the city and the majority do not fall within areas of existing high heat density. However, there may be opportunities to link new development to existing heat loads in certain central and east city areas. These areas are shown in more detail below.



**Figure 21: Areas of high heat demand: central Cambridge**

The above map shows that a significant number of sites identified as suitable for housing fall within areas of reasonably high heat density. Depending on the nature of the development proposed at these specific sites, opportunities for district heating may arise. However, the carbon benefits of community heating systems are greatest when a low carbon fuel source can be used, which is not likely to be feasible in relatively central city areas due to other constraints (air quality, fuel transport etc (see following section)).

In terms of retrofit district heating opportunities, the largest area of high heat density is in the city centre. There are very few new development sites in the centre of Cambridge, which means that opportunities to link new developments to existing heat loads are limited. However, the city centre is

one of the more promising areas for community heating on the basis of heat density. Realising carbon savings through the installation of a low carbon district heating network will be subject to overcoming a number of technical, economic and practical issues.

#### 6.1.4 Opportunities for district heating: conclusions

- Outside of the city centre areas of high heat demand are relatively dispersed.
- The main opportunity for district heating is likely to be in the urban extension sites, of which only the Bell School site is in close proximity to an area of existing high heat density (Addenbrookes). The approaches to meeting energy demands at these sites are covered by specific area action plans.
- There may be opportunities for district heating in the city centre on the basis of heat density. Exploitation of these opportunities will be subject to overcoming the technical, economic and practical barriers that retrofitting a community heating network in a historic city centre presents.
- Mapping areas of high heat demand with proposed development sites suggests that there could be an opportunity for cost-effective community heating in the redevelopment of CB1, around the station area.
- Most areas of highest heat demand are in the air quality management area (AQMA) (see following section). District heating is an attractive means of CO<sub>2</sub> reduction when combined with plant fed by renewable fuel such as biomass. However, biomass combustion is likely to be restricted in and around the AQMA, which presents a conflict.

## 6.2 The role of biomass

### 6.2.1 Maximum available resource

The term ‘biomass’ refers to a range of biologically derived material, including wood (which for heating may be in the form of logs, chips or pellets), straw, and a range of energy crops. Biomass is potentially of interest for low carbon development since burning biomass for energy production releases far less CO<sub>2</sub> into the atmosphere than fossil fuel combustion. The total amount of biomass available in a region ultimately depends on the land area of forests / woodland and area of arable land used to cultivate energy crops.

The following table summarises the estimated maximum biomass resource available in Cambridgeshire based on relevant data from published studies.

**Table 4: Estimated maximum biomass resource in Cambridgeshire from published data**

| Fuel source           | Estimated resource (kt/yr) | Estimated resource (GWh/yr) <sup>28</sup> | Data source   |
|-----------------------|----------------------------|---|---|
| Waste wood            | 115                        | 427                                       | East of England biomass foundation study (2005) (EoE figure adjusted for Cambridge based on relative land area) |
| Straw                 | 97.5                       | 317                                       | South Cambridgeshire renewable energy resource assessment (2008)  |
| Energy crops          | 7.4                        | 27  | South Cambridgeshire renewable energy resource assessment (2008)  |
| Forestry derived fuel | 0                          | 0   | East of England biomass foundation study (2005)   |
| Wood chip             | 4.6                        | 16  | South Cambridgeshire renewable energy resource assessment (2008)  |

Based on standard energy density conversion factors, the total resource of these biomass fuel sources in Cambridgeshire is around 790 GWh/yr. To put this maximum resource figure in context, the domestic gas consumption in Cambridge in 2007 was 715 GWh. These figures suggest the maximum biomass resource is around 1.1 times current domestic gas consumption in the city. However, the data presented in Table 4 represent the theoretical resource, rather than available supply.<sup>29</sup> Furthermore, these figures are for the whole of Cambridgeshire, which means that even if this resource became available there would be other consumers competing for it.<sup>30</sup> A discussion of the local fuel supply chain and related issues is given in the following section.

<sup>28</sup> Resource in GWh/yr found from estimated mass of material per year and energy density (kWh/t). The following energy densities are assumed: Waste wood = 3,778kWh/t (25% moisture content), Straw = 3,257kWh/t (25% moisture content), Energy crops = 3,600kWh/t, Wood chip = 3,500kWh/t (30% moisture content).

<sup>29</sup> The availability of biomass for bioenergy schemes relies on woodland owners allowing management of their land for biofuel production and a woodfuel supply company being prepared to extract the resource. Also, not all woodland is necessarily suitable for biofuel production – factors such as access, stocking density and ground conditions should be considered.

<sup>30</sup> Cambridge city contains about 19% of the total number of dwellings in Cambridgeshire and around 20% of Cambridgeshire’s population (based on data published in each councils’ AMR).

### 6.2.2 Local biomass availability and fuel supply chains

Given the relatively low energy density of biomass fuels (e.g. relative to fossil fuels), the energy and carbon costs of biomass transportation are important considerations for the fuel supply chain. Biomass fuel supply therefore tends to be on a local or regional basis. The relevant regional area for Cambridge is the East of England, which includes a large number of small-scale suppliers. A review done by Woodfuel East found that there were at least around 120 independent wood fuel suppliers in the area.<sup>31</sup> This is a highly fragmented market, which makes assessing the actual available resource extremely difficult.

In practice the amount of biomass resource available to bioenergy schemes will be dictated primarily by economic factors. Woodland owners and fuel supply companies must find sufficient financial incentive to produce woodchip or pellet fuel for the biofuel market. Fuel availability therefore depends on fuel price; higher biomass fuel prices will give greater incentive for woodland owners to consider managing their woods for fuel production.

Local biomass fuel supply companies typically engage in other activities such as forest management, farming, fence supply etc. – i.e. few are dedicated biomass suppliers. The profile of their activities is likely to be a response to external market forces (e.g. biomass price). Furthermore, many biomass fuel suppliers already have ample demand for their product and operate with a core set of customers. Access to additional raw resource (e.g. woodlands) will depend on the attitudes of woodland owners regarding use of their lands.

The use of woodlands for fuel production should also be considered in the context of other demands for the resource. For example, the majority of the c.160kt/yr of wood from Thetford forest in Norfolk goes into timber production (and is secured in medium to long term contracts). Demand for timber for construction is expected to increase in the coming years with an emphasis on using timber to offset concrete and steel in the building industry. A similar consideration applies for energy crops, which may compete with land that could otherwise be used for food production, for example.

Clearly there are significant uncertainties in estimating available biomass resource in the region. However, Woodfuel East, which is working to increase heat production from biomass and to develop the supply chain, has a regional target to achieve 110kt/yr of 'green biomass' supply in the East of England by the end of 2013. According to Woodfuel East, this represents a 50% increase on the region's current production.<sup>32</sup> This suggests that the existing supply is of the order 220kt/yr for the East of England. If each of the counties in the region contributes to this in proportion to its woodland area, Cambridgeshire produces around 20kt/yr (this is around 17% of the total available resource estimate presented in Table 4).

The following table summarises estimations of the available biomass resource in Cambridgeshire based on data for the East of England from Woodfuel East adjusted for relative woodland areas in the counties in the East of England.

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<sup>31</sup> Personal communication with Woodfuel East. The actual number of suppliers is likely to be rather higher since many operate with a set number of core customers and therefore do not advertise.

<sup>32</sup> See [www.woodfueleast.org.uk/AboutUs.aspx?ID=4](http://www.woodfueleast.org.uk/AboutUs.aspx?ID=4).

**Table 5: Estimated available biomass resource in Cambridgeshire from Woodfuel East data**

| Date    | Estimated resource (kt/yr) | Estimated resource (GWh/yr) <sup>33</sup> | Data source / notes   |
|---------|----------------------------|---|---|
| 2008/09 | Unknown                    | Unknown                                   | Current total wood production (for all uses) in East of England is c.220kt/yr. This equates to c.20kt/yr for Cambridgeshire based on relative woodland areas. |
| 2013/14 | 30                         | 84  | Woodfuel East (assuming target for biomass supply in East of England is met and Cambridgeshire makes a proportional contribution)                             |

The total wood production figure for the East of England (220kt/yr) is based upon wood produced by operators with a felling licence. This includes all commercial scale wood producers and the figures relate to wood for all end uses. It is not known exactly how much of this total currently feeds into bioenergy schemes.

If the biomass fuel supply target is met the estimated resource in Cambridgeshire available in 2013/14 will be c.12% of the current domestic gas demand in Cambridge (715 GWh/yr).

In practice any new biomass-fuelled heating scheme requiring significant quantities of fuel would require a long-term agreement with a fuel supplier, which would have to be agreed as part of the scheme design.

### 6.2.3 Barriers to use of biomass as a heating fuel

While biomass is potentially a useful fuel as part of cost effective strategies to deliver low carbon development, numerous barriers to the use of biomass exist. These must be considered both when assessing the suitability of biomass for any particular site and when setting policies and targets for low carbon development. The main considerations are summarised in the following figure.

<sup>33</sup> Based on an energy density of 2,800 kWh/t for converting ‘green’ tonnes into available energy.

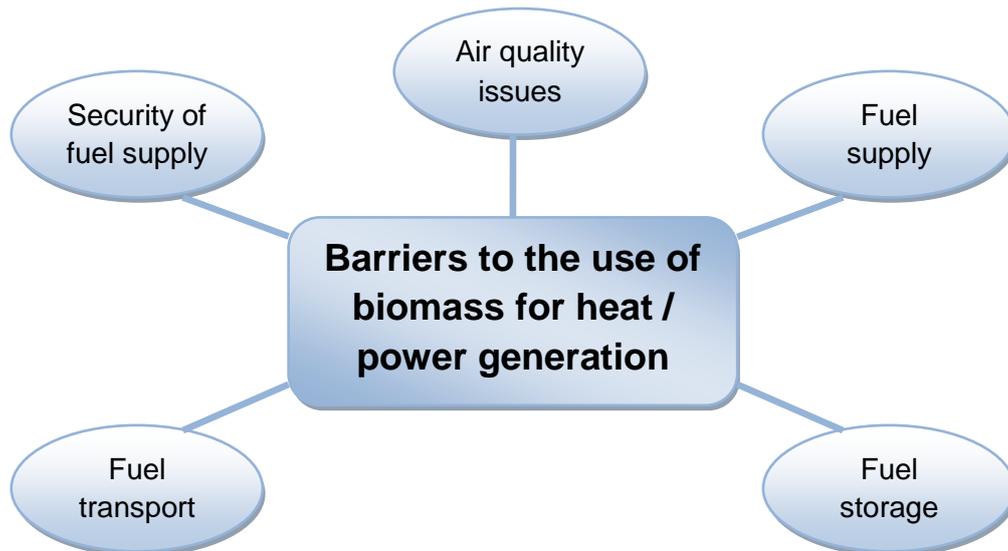


Figure 22: Barriers to biomass use

### Biomass fuel supply chain

The potential available resource identified in the previous section will only become available for generation of low carbon heat and/or power if fuel supply chains are developed.

- Although there might be quite a large available resource, the supply chain in the area is not well developed.
- Even if/when it becomes more developed there may be competing uses (e.g. for feeding large scale power stations) and security of fuel supply could be an issue.
- Also, competition for land – farming for food production vs. biofuel production...
- Need long-term contracts with established companies that can guarantee fuel supply.

### Transport and storage issues

The carbon benefits of using biomass in place of fossil fuels are well recognised. However, given the low carbon nature of biomass, energy used for fuel transportation and the associated CO<sub>2</sub> impact should be considered. In general the carbon saving benefit of using biomass is greatest when transportation distances are minimised. Any large-scale biomass heating scheme will likely require fuel deliveries by lorry. Access and vehicle movements (including associated impacts on local noise and traffic pollution) are therefore important considerations.

A potential issue specific to Cambridge relates to the existing traffic congestion in the city. At least one of the larger local biomass fuel suppliers imposes an additional surcharge on delivery to Cambridge to compensate for the fact that vehicles often become delayed in traffic, which can have consequences for the supply of fuel to other customers.

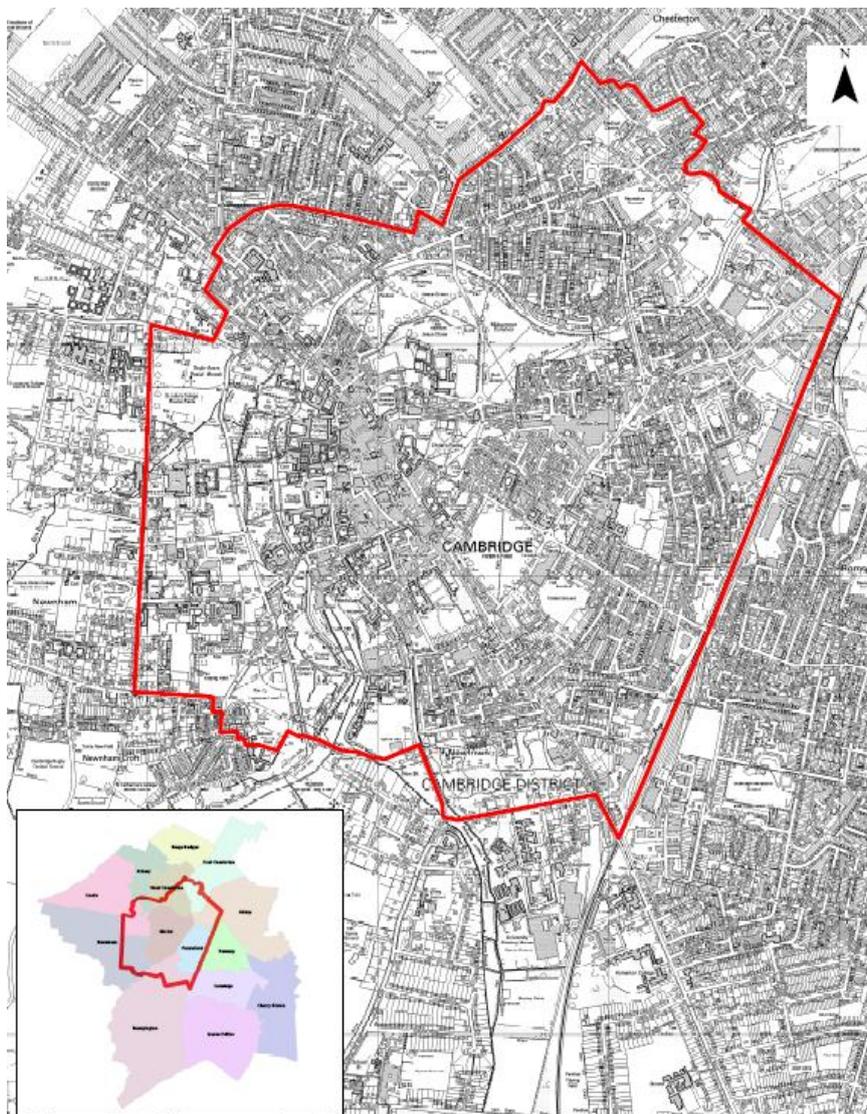
Biomass fuel storage systems are often bespoke solutions, designed for the particular site. While the technical challenges of fuel storage and delivery system design are relatively well understood, adequate space must be allocated to store a reasonable fuel reserve. In areas of high land value allocating space to fuel storage is often not an economically attractive proposition.

### Air quality considerations

Replacing fossil fuels with biomass offers significant potential for carbon savings. However, compared to natural gas, biomass combustion leads to increased pollutant emissions. This fact is recognised by

Cambridge City Council’s Environmental Services Team, which produced a document that sets out air quality guidelines for new development in Cambridge.<sup>34</sup>

Cambridge experiences problems with air quality, particularly NO<sub>x</sub> emissions, mostly due to traffic emissions. The Council defined an Air Quality Management Area (AQMA) in 2004 in response to national objectives for NO<sub>2</sub> being exceeded. South Cambridgeshire District Council also declared an AQMA for NO<sub>2</sub> and PM<sub>10</sub> on the northern edge of Cambridge, associated with emissions from the A14 and M11, as shown below.

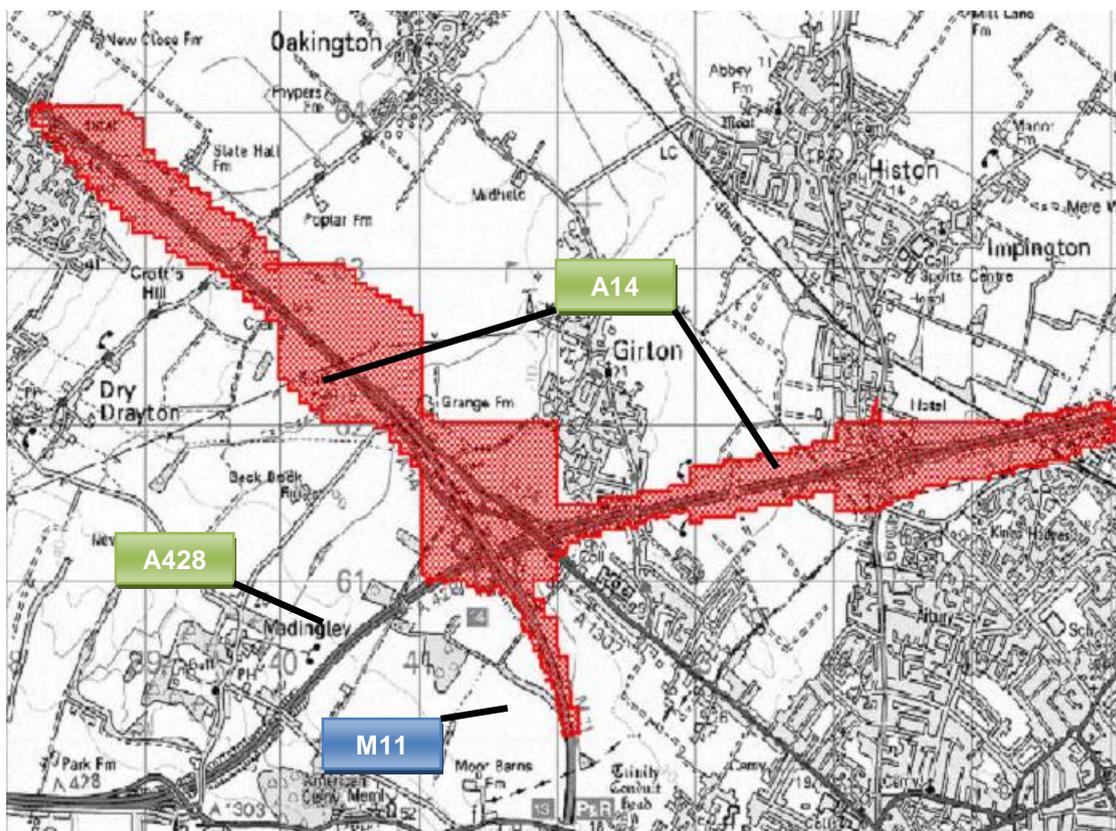


**Figure 23: Cambridge City Council Air Quality Management Area<sup>35</sup>**

This map shows the Cambridge City Council AQMA, which covers the city centre and surrounding areas. The AQMA defined by South Cambridgeshire District Council is shown on the following map.

<sup>34</sup> *Air Quality in Cambridge: Developers’ Guide* (September 2008).

<sup>35</sup> Graphic produced by Jo Dicks (2004).



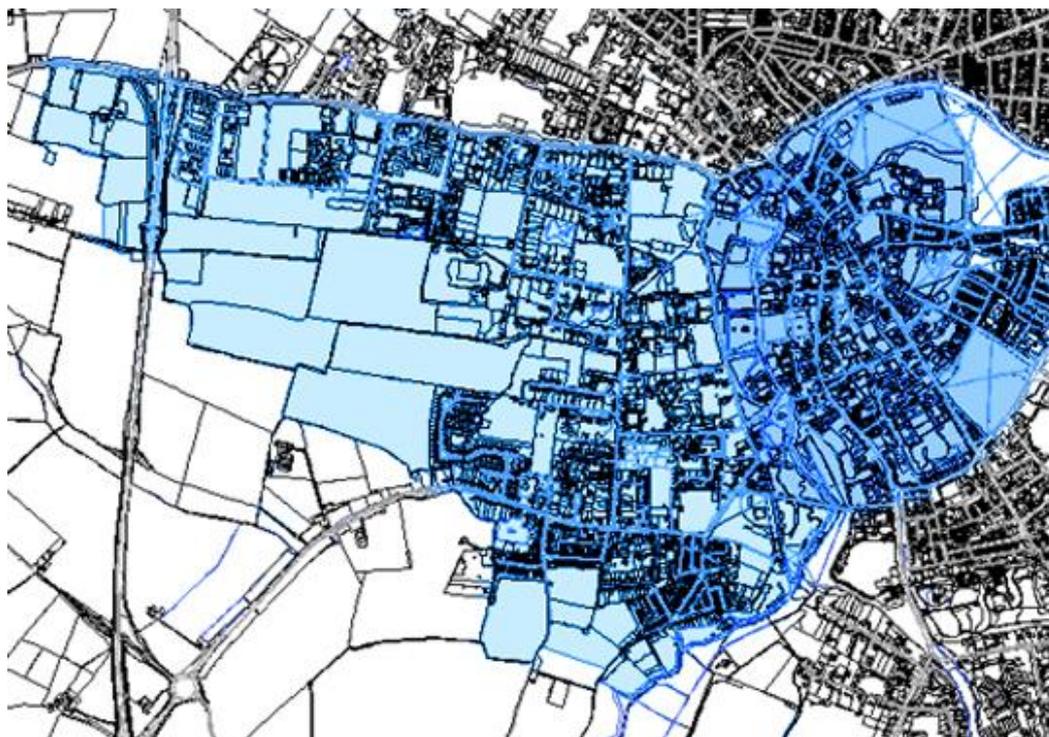
**Figure 24: South Cambridgeshire District Council Air Quality Management Area**

To achieve national air quality objectives local authorities are obligated to measure air quality and attempt to predict how it might change in their region. AQMAs are declared in areas where any objectives are not likely to be achieved. A Local Air Quality Action Plan is then developed to combat the issue(s).

Within Cambridge stricter controls are placed on what is permitted in terms of development in or around the AQMA. This includes requiring an assessment of the impact of development on air quality. Further details are available in the Developers’ Guide.<sup>36</sup>

The Clean Air Act (1993) allows local authorities to declare the whole or parts of the district to be a smoke control area. The smoke control area in Cambridge covers the whole of the city centre and areas to the west of the centre as shown on the following map.

<sup>36</sup> *Air Quality in Cambridge: Developers’ Guide* (September 2008).



**Figure 25: Smoke control area in Cambridge**<sup>37</sup>

There are strict regulations relating to fuels that may be burnt and the emission of smoke in smoke control areas. The Clean Air Act stipulates that only the following may be burned:

- Authorised fuels (i.e. approved smokeless fuels).
- Other fuels in an authorised ('exempt') appliance.

No wood type (logs, woodchip, pellets or briquettes) is classified as a smokeless fuel. Exempt appliances are those which have been exempted by Statutory Instruments under the Clean Air Act 1993 (i.e. pass tests to show they can burn 'unauthorised' fuel without emitting smoke).

To burn unauthorised fuels (e.g. biomass) in a smoke control area the appliance must be on the exempt appliance list.<sup>38</sup> Furthermore, The Clean Air Act requires an approved chimney height if the heating appliance is >366.4kWth or burns pulverised fuel, or burns any fuel at a rate above 45.6kg/hr.

Unregulated biomass combustion poses a potential threat to human health through increased particulate emissions. According to the air quality guide for developers, installation of new biomass boilers is unlikely to be suitable in or adjacent to the AQMA. The impact of biomass combustion may be acceptable where it is used in larger schemes, particularly if they are located away from the AQMA, where abatement equipment could be installed cost effectively.<sup>39</sup>

<sup>37</sup> Graph taken from Cambridge City Council website: [www.cambridge.gov.uk](http://www.cambridge.gov.uk).

<sup>38</sup> The list of exempt appliances in England can be found here: <http://www.uksmokecontrolareas.co.uk/appliances.php?country=e>.

<sup>39</sup> *Air Quality in Cambridge: Developers' Guide* (September 2008), p.46–47.

#### 6.2.4 Biomass resource assessment: conclusions

- Whilst the maximum theoretically available biomass resource in the region is relatively large, there is significant uncertainty surrounding the resource currently available.
- The local biomass fuel supply chain is highly fragmented – i.e. the industry is characterised by a large number of small suppliers. Discussions with local biomass suppliers suggest that some aim to increase the mass of biomass fuel available, but ultimately woodland owners and fuel suppliers require sufficient incentive to develop the supply chain.
- Biomass price is a key determining factor in the economic argument for managing woodland for fuel production.
- Many barriers exist to using biomass, particularly in urban environments. These include fuel sourcing, security of fuel supply, transportation costs, impacts on traffic congestion, fuel storage issues, and air quality concerns around biomass combustion.

## 6.3 Waste to energy

### 6.3.1 Context

The potential for recovering energy from waste must be considered in the broader context of national and local waste strategy. In the Waste Strategy for England (2007), published by DEFRA, there is strong emphasis on reducing the amount of waste generated, as highlighted by the Waste Hierarchy.

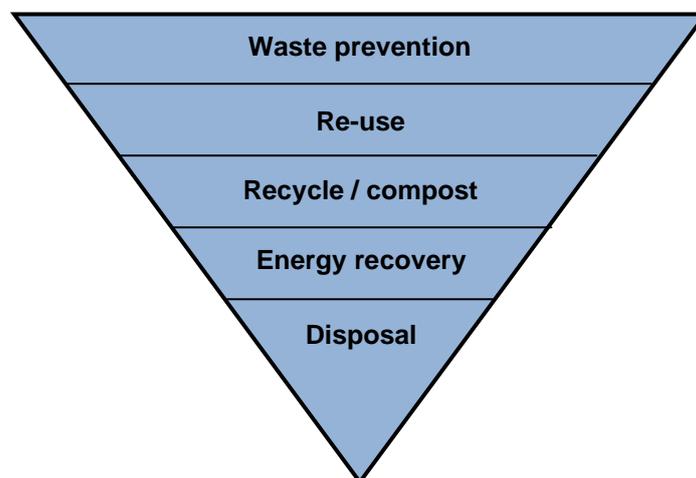


Figure 26: The Waste Hierarchy<sup>40</sup>

At the regional level, the Cambridgeshire and Peterborough Waste Partnership (RECAP) has produced a Joint Municipal Waste Management Strategy to deal with waste up to 2022. Part of this strategy includes the Waste Prevention Plan for Cambridgeshire and Peterborough, which gives a thorough overview of the national and local context.<sup>41</sup> Incentives to reduce waste at the local and regional level come from national and EU directives, including:

- **Thematic Strategy on the prevention and recycling of waste** (European Commission strategy) – member states must establish waste prevention programmes.
- **EU Landfill Directive** – sets specific targets for reduction of biodegradable municipal waste going to landfill.
- **National Waste Strategy for England** – specific targets for reducing mass of household waste generated.
- **Landfill taxes** – costs of disposal of waste by landfill have been increasing rapidly in recent years. The rate for ‘active waste’ in 2009/10 is £40/tonne, up from £32/tonne in 2008/09. This rate is set to increase by £8/tonne on the 1<sup>st</sup> of April each year to 2013.

Waste generated in Cambridge is covered under the Cambridgeshire and Peterborough Joint Municipal Waste Strategy.<sup>42</sup> The latest revision to the strategy was in 2008 and it covers waste management in the period to 2022. Some key features include:

- Waste prevention is recognised as a key area and actions are being taken to reduce waste generation.

<sup>40</sup> Figure from the Executive Summary of the Waste Strategy for England 2007, p.1. [www.defra.gov.uk/environment/waste/strategy/strategy07](http://www.defra.gov.uk/environment/waste/strategy/strategy07).

<sup>41</sup> The Waste Prevention Plan can be found here: [www.cambridgeshire.gov.uk/environment/waste/about/policies/the\\_strategy.htm](http://www.cambridgeshire.gov.uk/environment/waste/about/policies/the_strategy.htm).

<sup>42</sup> The strategy can be found here: [www.cambridgeshire.gov.uk/environment/waste/about/policies/the\\_strategy.htm](http://www.cambridgeshire.gov.uk/environment/waste/about/policies/the_strategy.htm).

- Maximising recycling and composting to reduce volumes of waste sent to landfill, including aspirational household waste recycling targets of 45–50% by 2010 50–55% by 2015 and 55–60% by 2020.
- Levels of residual waste (after reduction, re-use, recycling and composting) to be reduced via an Energy from Waste facility in Peterborough and a Mechanical Biological Treatment facility for Cambridgeshire County Council.

### 6.3.2 Dealing with Cambridge's waste: Donarbon

Donarbon Waste Management Limited is Cambridgeshire County Council's main waste contractor, having entered into £731m Private Finance Initiative (PFI) contract with the Council in March 2008. Under the contract Donarbon are responsible for managing all municipal waste in the county for a 28 year period, including construction of new waste management facilities.

A key aspect of the PFI contract is a Mechanical Biological Treatment (MBT) plant in Waterbeach. The £41m plant which opened in November 2009, is set to take all of the county's residual black bag waste and separate out elements for recycling and composting, thus helping the councils meet recycling and landfill diversion targets.<sup>43</sup>

### 6.3.3 Potential for energy from waste

Donarbon's MBT plant in Waterbeach takes black bag waste and separates out the inorganic materials for recycling (including tins, cans, plastic bottles, glass etc). This leaves an organic fraction, classified as a 'compost-like output', which goes into the 'composting hall' where it is turned for a period of seven weeks. The main potential for energy recovery is from this 'compost-like output', as it can be made into a refuse derived fuel (RDF), which can be used to produce heat and/or electricity.<sup>44</sup>

Accurate assessments of the resource available from this process are not possible at this stage due to the immaturity of the plant. The total potential mass of RDF out will depend on mass and composition of waste that feeds the plant. The plant has been designed to handle all of Cambridgeshire's municipal solid waste arisings and has a capacity of 200kt/yr of waste input. Estimations of the energy available from RDF can be made from a few basic assumptions. For example, from discussions with Donarbon, the mass of RDF produced could be around 100kt/yr. Testing is currently underway to determine the calorific value of the fuel produced but an indicative figure for this type of fuel is around 18.5MJ/kg (5,000kWh/t). These two figures combined suggest that the maximum raw resource in terms of RDF from the plant could be of the order 500GWh/yr. To put this in context, 500GWh is c.70% of current domestic gas consumption in Cambridge.

Whilst the potential resource from energy recovery from waste is relatively large compared to the domestic gas consumption of Cambridge for example, this resource comes from the whole county's waste and it is likely that there will be competing demands for it. One of the more efficient uses for RDF is as a fuel in a combined heat and power plant. However, cost effective use of the heat relies on the generating plant being in close proximity to the heat consumer. Given the social/political issues around locating RDF-burning plant close to residential development, such plant is more likely to be acceptable in a commercial / industrial setting.

Another important consideration is that the combustion of RDF is controlled by strict legislation such as the Waste Incineration Directive, which sets stringent emission monitoring and control requirements. This means that using such fuels is only likely to be economically feasible in relatively large-scale plants. Alternative methods of using RDF to produce electricity include pyrolysis (see

<sup>43</sup> For further details of the plant, see [www.donarbon.com](http://www.donarbon.com).

<sup>44</sup> The MBT plant is currently being commissioned (a process that is due to finish by November 2010). At present the compost-like output from the process is going to landfill.

section 6.6.3), and plasma arc gasification (a type of waste treatment technology).<sup>45</sup> Development of the use of these processes for commercial renewable energy production is on-going and there is currently limited commercial experience of these technologies.

#### 6.3.4 Waste to energy: conclusions

- The new MBT facility, which will handle all of Cambridgeshire's black bag waste, could produce up to around 500GWh/yr of refuse derived fuel (RDF), which is equivalent to around 70% of current domestic gas consumption in Cambridge in energy terms. Note that this is an estimation based on data currently available; at the time of writing the MBT plant is in its first year of operation and exact potential RDF outputs are unknown.
- Combustion of fuels from waste facilities is only likely to be feasible in large-scale plants where strict emissions control of the Waste Incineration Directive can be met economically.
- Using RDF in a CHP application relies on a heat demand in relatively close proximity to the power plant. This is more likely to be acceptable in non-residential developments.

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<sup>45</sup> For example *Advanced Plasma Power* is a UK company established in 2005 to commercialise Gasplasma technology. This new process combines three existing technologies (fluidised bed gasifier, plasma converter, and gas engine) to convert waste into a 'clean' syngas, which fuels a gas engine to produce heat and power. Advanced Plasma Power built a Gasplasma test facility in Faringdon and has commissioned a commercial test facility in Swindon.

## 6.4 Wind resource in Cambridge

### 6.4.1 Introduction

The economics of wind turbine development depend strongly on available resource in terms of average annual wind speed. The physics of electricity generation from wind turbines means that the power output scales with the cube of wind speed, hence higher wind speeds are highly desirable. Wind speed increases with height above the ground and larger turbines are typically mounted on higher masts or towers, which means they benefit from higher average wind speeds and are often able to achieve higher load factors than smaller turbines.<sup>46</sup>

Average annual wind speed is not the only consideration in wind turbine siting. For example, turbines must be a set distance away from buildings and other man-made obstacles, access (for installation and maintenance) must be considered, as should distance from the electricity grid as this will impact grid connection costs. The potential impact of any proposed turbines on the local environment (e.g. wildlife, local residents) is also an important consideration.

Having said this, for the purpose of the wind resource assessment, the primary factor of interest in the first instance is the wind speed. Estimations of the wind resource available in terms of mean annual wind speed were made using the NOABL wind speed database, which gives average wind speed in square kilometre grids.<sup>47</sup>

### 6.4.2 Restrictions to wind turbine development

As mentioned above, there are a number of restrictions to wind turbine siting. In the wind resource mapping exercise 100m exclusion zones around buildings in Cambridge have been included.<sup>48</sup> Similarly, a buffer zone of 100m around main roads is also assumed. Other restrictions mapped are ancient woodlands and sites of special scientific interest (SSSIs).

Further restrictions include separation distances from power and communication lines, railway lines, and airport exclusion zones. While these are the principal physical constraints on wind turbine siting, any turbine or wind farm must gain planning consent, which can be a significant obstacle.

### 6.4.3 Available wind resource

The following map shows the mean annual wind speed in 1km grid squares for Cambridge, based on data from the NOABL wind speed database.

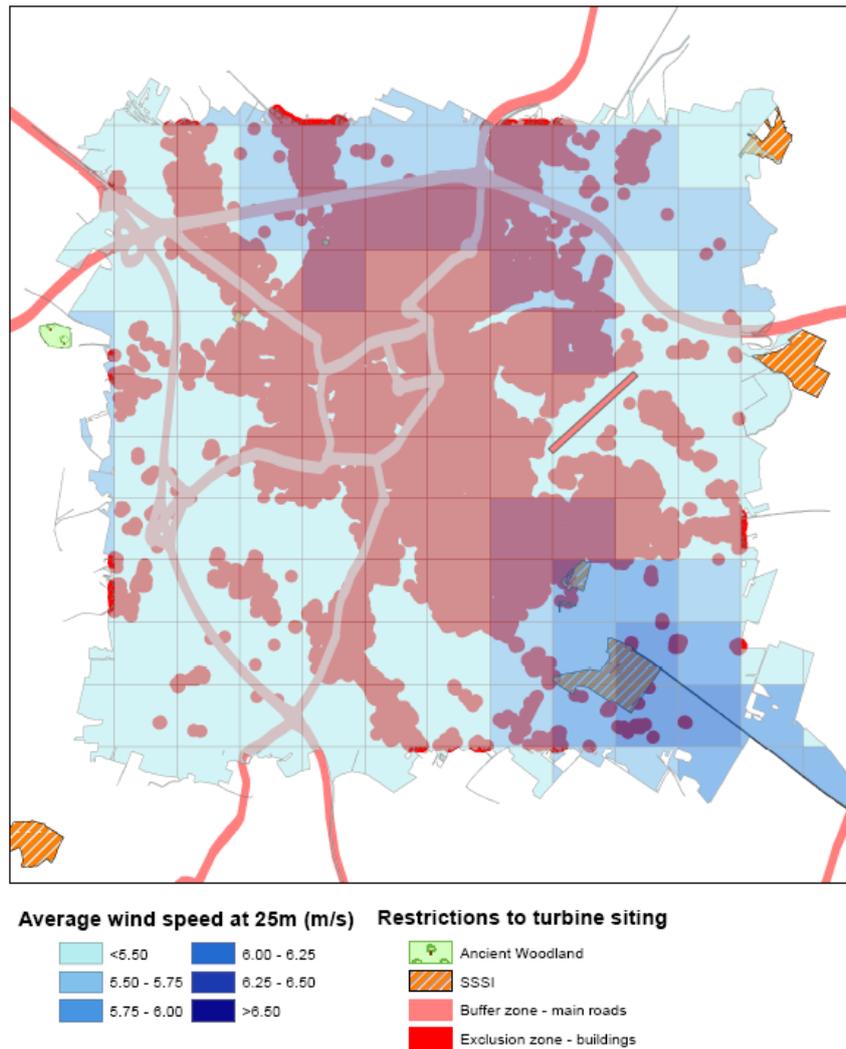
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<sup>46</sup> Load factor refers to the proportion of time through the year that a turbine produces its rated output power. For example a 1MW turbine with a load factor of 25% outputs 2,190MWh/yr (0.25 x 8,760 hours/yr).

<sup>47</sup> Note that the NOABL database gives indicative wind speeds, but does not account for thermally driven winds (sea/mountain/valley breezes) and takes no account of topography on a small scale or local surface roughness (e.g. due to buildings, trees etc). Detailed measurements would be required at specific sites considered potentially feasible for turbine development.

<sup>48</sup> Note that in general a buffer zone of 400m is recommended for residential buildings to mitigate the visual impact, noise, flicker and blade glint that can be associated with large turbines.

Wind resource at 25m agl: Cambridge City



**Figure 27: Wind resource in Cambridge at 25m above ground level**

As expected for an urban environment the wind resource in and around the city is highly constrained. The highest wind speeds are to the south east of the city, near the Gog Magog Downs, areas of which are also designated as sites of special scientific interest due to the chalk grassland habitat.

Given the highly restricted opportunities for wind turbine development in and immediately around the city, the wind resource was also mapped for the wider region, extending into South Cambridgeshire District Council's area.

Wind resource at 25m agl: wider Cambridge area

Wind resource at 45m agl: wider Cambridge area

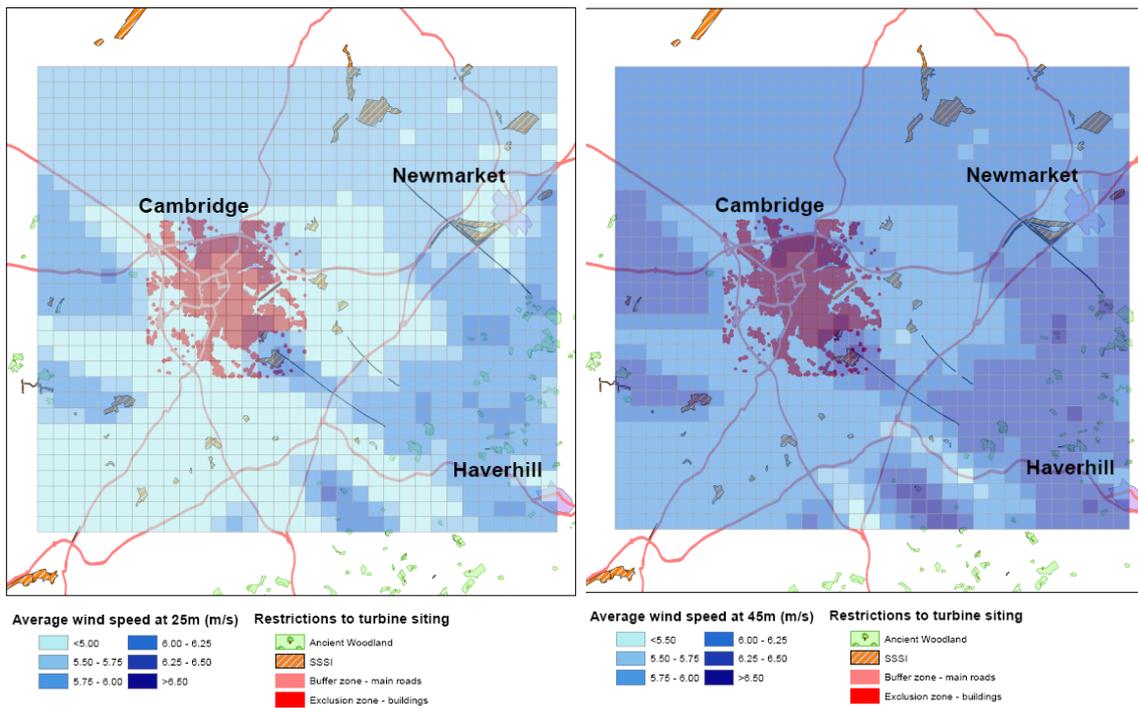
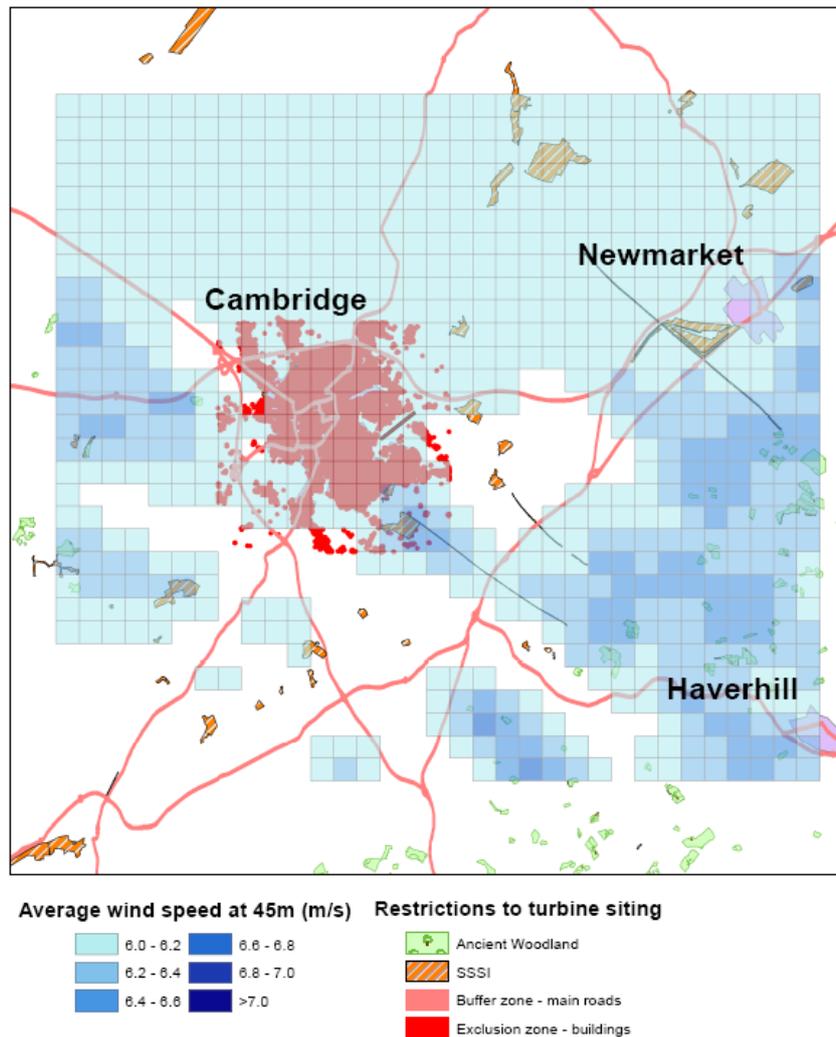


Figure 28: Wind resource around Cambridge at 25m and 45m above ground level

Small to medium scale turbines can be mounted with hub heights from around 10m upwards.<sup>49</sup> Large turbines typically have hub heights above 40m, which allows access to the higher average wind speeds found at higher altitudes. Taking the map on the right from Figure 28 and excluding areas where the mean wind speed is below 6m/s, the areas of greatest potential for wind can be identified.

<sup>49</sup> In this context 'small' refers to turbines up to 100kW rated power output (i.e. the first three bands of the feed-in tariff for wind).

Wind resource at 45m agl: wider Cambridge area  
 (1km squares with mean wind speed < 6m/s excluded)



**Figure 29: Areas of high wind resource around Cambridge at 45m above ground level**

Looking wider still, the wind speeds across Cambridgeshire have also been mapped, revealing the locations with the highest average wind speeds (see figure below).

Wind resource at 45m agl: Cambridgeshire

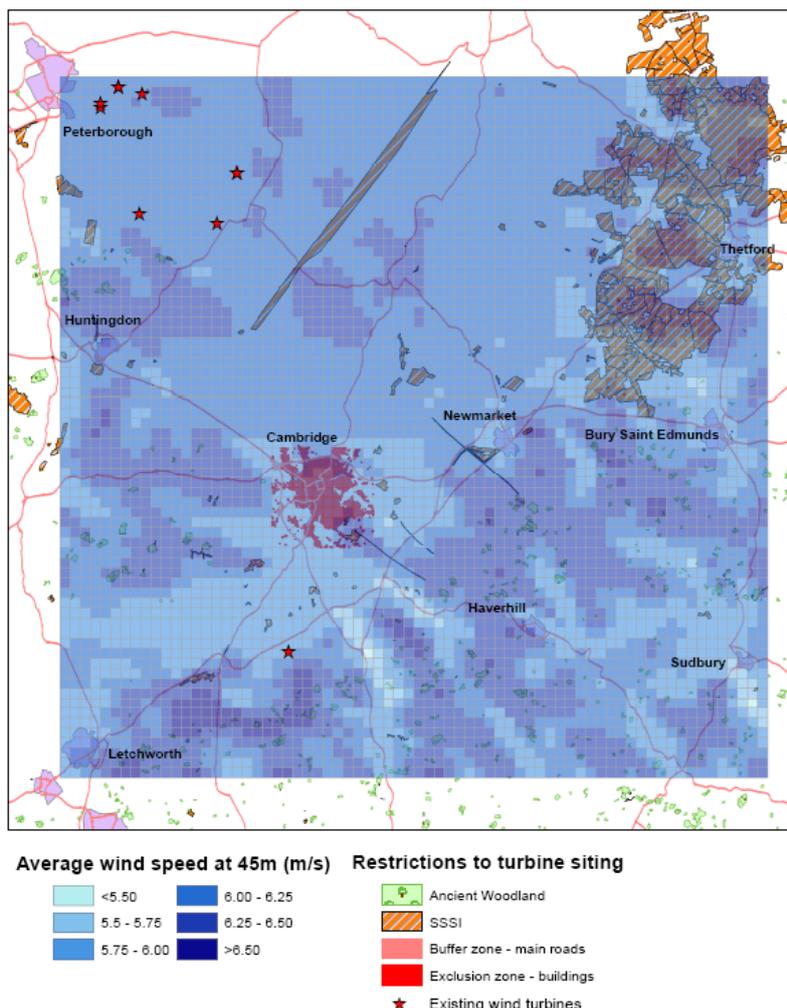


Figure 30: Cambridgeshire wind resource at 45m above ground level

The maps presented in this section reveal that opportunities for wind turbine development in Cambridge are highly constrained. Furthermore, greater wind resource (higher wind speeds, which improve the economics of any wind project) exists in the wider Cambridgeshire area.

6.4.4 Wind resource: conclusions

- The wind resource in Cambridge is highly constrained due to the relatively modest raw resource and the urban characteristics of the area.
- The wider Cambridgeshire area has higher wind speeds, which suggests that opportunities for wind turbines / farms lie outside of Cambridge City Council’s area.
- The use of wind power to offset carbon emissions from new development in Cambridge is therefore most likely to be via some form of offset fund. Close cooperation would be needed between Cambridge City Council and neighbouring authorities (e.g. South Cambridgeshire District Council).

## 6.5 Solar technologies

The main solar technologies of potential interest in Cambridge are solar photovoltaics (PV) and solar thermal technology. These two technologies are briefly introduced below.

### Solar photovoltaics

Solar PV panels are made from semi-conductor materials and convert sunlight into electricity. Systems are typically roof-mounted and most effective when orientated to be south-facing and at an angle of around 30° from the horizontal. Solar PV is a relatively expensive technology, however costs are falling over time and the technology now benefits from support from the feed-in tariff, with support levels set such that a system owner could expect to achieve a return on investment.

*(Image: Building integrated photovoltaics in a domestic roof)*



### Solar thermal

Solar thermal systems are also most often roof-mounted but rather than producing electricity, they capture energy from sunlight to meet a portion of the building's hot water demands. Domestic systems are typically sized to meet around 50–60% of a home's hot water demands over the year and cost in the region £3,000–£5,000. In the past, grants have been available to cover some of the capital cost of solar thermal systems (e.g. the Low Carbon Buildings Programme), although this programme has now ended. It is expected, however, that the Renewable Heat Incentive (RHI) will be introduced in 2011 and that this programme will offer relatively generous support for solar thermal technology.

*(Image: Flat plat (upper) and evacuated tube (lower) solar thermal systems)*



The technical potential for installation of solar technologies is constrained by the availability of roof space for installation of panels. It is important for both PV and solar thermal technologies, that the panels are well-orientated and able to receive direct sunlight for as long as possible (overshading can significantly impair performance). In the case of PV, the panels can be fixed to or incorporated within the building façade, but the productivity of the panels drops in this orientation and the installations tend to be more expensive (due to more elaborate installation systems).

In order to provide an estimate of the potential for renewable energy generation via solar technologies, an assessment of the availability of roof area is required. The Generalised Land Use Database (GLUD), published by Communities and Local Government, provides figures for the land area taken up by a variety of uses, including domestic and non-domestic buildings, across the UK,

disaggregated at Census Ward level. Based on the land area (assuming this approximately equates to roof footprint area), an estimate of the technical potential for installation of solar technologies can be derived by applying rule of thumb factors for the proportion of roof area architecturally available for installation of panels and the proportion of that area that is likely to be favourably oriented for collection of solar irradiation<sup>50</sup>. Using GLUD statistics for Cambridge and based on typical rules of thumb roof availability factors, the technical potential for installation of solar technologies in Cambridge has been estimated, as summarised in the table below.

**Table 6: Technical potential for installation of solar PV and solar thermal technologies, based on estimates of available roof area in Cambridge**

|   | Solar Photovoltaics | Solar Thermal |
|---|---------------------|---------------|
| <b>Domestic building stock</b><br>(Thousands m <sup>2</sup> )                 | 2,470               |               |
| <b>Non-domestic building stock</b><br>(Thousands m <sup>2</sup> )             | 1,570               |               |
| <b>Total roof area</b><br>(Thousands m <sup>2</sup> )                         | 4,040               |               |
| <b>Roof area suitable for solar technology</b><br>(Thousands m <sup>2</sup> ) | 1,200               |               |
| <b>Power density (kW/m<sup>2</sup>)</b>                                       | 0.125               | 0.7           |
| <b>Potential for installed capacity (MWp)</b>                                 | 150                 | 840           |
| <b>Specific energy generation potential (MWh/MWp)</b>                         | 750                 | 750           |
| <b>Annual renewable energy output (MWh)</b>                                   | 112,500             | 630,000       |
| <b>Annual CO<sub>2</sub> reduction potential (tCO<sub>2</sub>/yr)</b>         | 47,500              | 133,000       |

Note that the technical potential figures shown in the table above are not additive, solar thermal and photovoltaic technologies will compete for roof space. It is also important to note in the case of solar thermal technologies, that in reality the installed capacity would not be constrained by the availability of roof space but in most cases the installed capacity would be dictated by the demand for hot-water in the particular building. The demand for electricity does not constrain the installation of photovoltaics in the same way, as any excess electricity generation will simply be exported to the electricity grid.

The uptake of solar thermal and PV technology to-date has been limited, due to the high capital costs associated with the systems and long pay-back periods. A number of capital grant schemes have operated in the past, such as the Low Carbon Building Programme and Major Photovoltaic Demonstration Programme, but these funds have been limited and have proved insufficient to stimulate any large-scale uptake of the technologies.

This is expected to change with the advent of the Clean Energy Cashback Scheme (or feed-in tariff). The tariff paid for each unit of renewable electricity generated by photovoltaics is sufficiently generous (more than 40p/kWh for domestic scale retrofit systems), to provide an economic incentive for householders and commercial organisations to invest in installation of PV in the existing stock. A

<sup>50</sup> Potential for Building Integrated Photovoltaics, International Energy Agency, 2002

number of commercial organisations have already been established to capitalise on the feed-in tariff, offering to install PV systems in domestic properties at heavily discounted prices, in return for the feed-in tariff revenue (the householders will benefit from the saving on their electricity bills due to direct use of the electricity generated in their homes). A similar scheme to the Clean Energy Cashback scheme has operated in Germany for many years and has fostered the growth of the world’s largest market for photovoltaics.

The economics of a retrofit PV system, supported by the feed-in tariff, is shown in the table below for a typical domestic property (in two orientations).

**Table 7: Economics of investment in a domestic retrofit PV system with support under the feed-in tariff**

|   | Orientation |             | Notes   |
|---|-------------|-------------|---|
|   | South       | East / West |   |
| <b>PV system size (kW<sub>p</sub>)</b>        | 2.5         | 2.5         | Typical domestic system size  |
| <b>Total installed cost (£)</b>               | 12,500      | 12,500      | Based on capital cost of £5,000/kW <sub>p</sub>   |
| <b>Electricity produced (kWh/yr)</b>          | 2,146       | 1,826       | Calculated based on SAP 2009 methodology  |
| <b>Proportion of electricity used in home</b> | 50%         | 50%         | This assumption affects the benefit derived from reduced demand for grid electricity                                |
| <b>Price of grid electricity (p/kWh)</b>      | 10          | 10          | Typical value   |
| <b>Export tariff (p/kWh)</b>                  | 3           | 3           | Defined in FiT legislation  |
| <b>FiT (p/kWh)</b>                            | 41.3        | 41.3        | Applies for sub-4kW <sub>e</sub> retrofit systems   |
| <b>Total annual income from system (£/yr)</b> | 1,026       | 873         | Consists of reduced grid demand, export tariff and FiT  |
| <b>Average annual on-going costs (£/yr)</b>   | 110         | 110         | Based on check & clean by qualified professional every five years and one inverter replacement over system lifetime |
| <b>Net annual benefit (£/yr)</b>              | 916         | 763         | Difference between revenues and costs   |
| <b>Simple payback period (years)</b>          | 13.6        | 16.4        | Capital cost divided by net annual benefit  |
| <b>Effective return on investment</b>         | 5.6%        | 3.8%        | From cashflow analysis over 25 years  |

The Renewable Heat Incentive (RHI) is anticipated and, based on the government consultation on the scheme, would offer a similarly generous incentive for the installation of solar thermal systems. At the present time, however, the RHI has not been confirmed as a policy commitment by the coalition government.

## 6.6 Other technologies

### 6.6.1 Anaerobic digestion

The process of anaerobic digestion (AD) involves the decomposition of organic materials by microorganisms in the absence of oxygen. Anaerobic digestion is often used as part of waste management strategies and can convert waste streams into useful forms of energy. The overall AD process is represented in the diagram below.

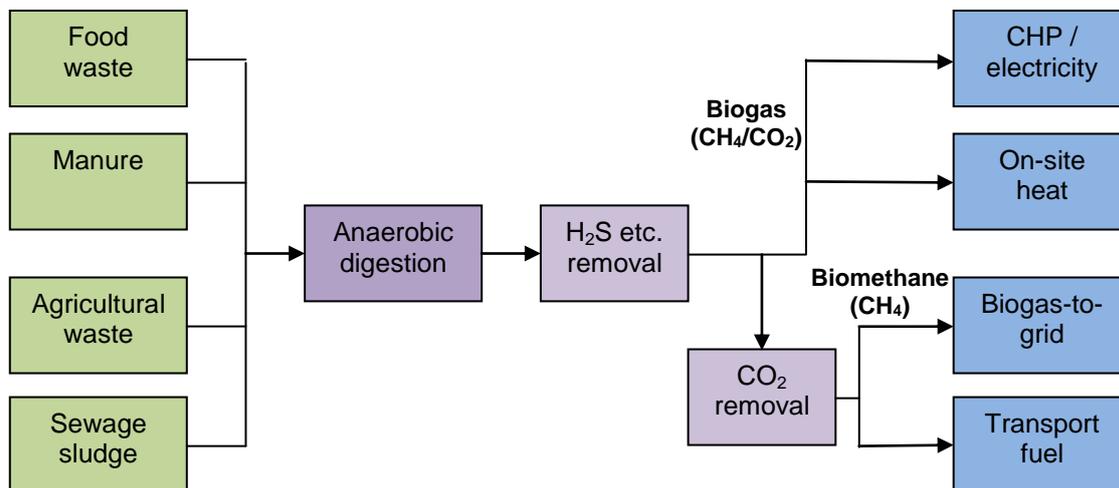


Figure 31: Schematic representation of anaerobic digestion process<sup>51</sup>

Figure 31 shows the range of feedstocks that can be used and the potential uses of the products. The main outputs of the anaerobic digestion process are a CO<sub>2</sub>-rich biogas and a nutrient-rich digestate, which can be used as a fertilizer. The biogas can be burnt in a gas engine CHP unit to produce heat and electricity (often some of the heat is used to maintain the digester at an optimum temperature). Further processing (CO<sub>2</sub> removal) is required if the output is to be fed into the natural gas grid or used as a transport fuel.

Biomass in the form of wood chips or pellets is not suitable for processing via anaerobic digestion as it is far drier than the typical AD plant feedstock. Most AD plants are wet systems based on a continuous process, which means the feedstock must be pumpable. A further obstacle to using wood chips or pellets in an AD process is the carbon to nitrogen ratio, which is typically far higher than standard feedstocks and could upset the bio-chemical conditions required for biogas production. However, certain types of energy crops (e.g. rye grass, miscanthus) may be used in an AD process, provided they are suitably balanced with other feedstocks.

It is highly unlikely that AD plants would be suitable for supplying energy to new developments in Cambridge City. However, this technology could be relevant for sites outside or on the edge of the urban area, provided that sufficient feedstock could be sourced, impacts associated with vehicle movements to and from the site could be mitigated, and an appropriate disposal route for the digestate produced could be found.

### 6.6.2 Gasification

Gasification is a thermochemical process that converts any carbon-containing material (coal, petroleum, biomass etc) into synthesis gas (syngas, a mixture of mainly carbon monoxide and

<sup>51</sup> Diagram based on Figure 1 of the Carbon Trust report *Biogas from anaerobic digestion: CO<sub>2</sub> saving and economics*.

hydrogen). The conversion is achieved by reacting the raw materials with controlled amounts of oxygen and/or steam at high temperature.<sup>52</sup> Syngas is a fuel that can be burned to produce electricity or further processed to manufacture chemicals, fertilizers, liquid fuels, substitute natural gas (SNG), or hydrogen.

Some of the advantages of gasification include:

- A clean, combustible gas fuel is produced, which offers the advantages of clean combustion, compact burning equipment, and high thermal efficiency (relative to solid fuel combustion).
- Syngas is a more flexible fuel than the organic feedstock materials. For example higher electrical efficiencies may be possible by using syngas in a fuel cell or through combustion at higher temperatures.
- Gasification can be used to extract value from materials that are not otherwise useful fuels, such as organic waste.

The technology is proven in that gasification of fossil fuels is widely used on industrial scales throughout the world to generate electricity. It is of interest from a renewable energy point of view due to the wide range of organic materials that can be used as a feedstock for the process, which produces a relatively clean combustible gas.

However, there is currently very limited experience of industrial scale biomass gasification. Disadvantages of and challenges to the implementation of the technology include:

- Power consumption to drive the process can be high, which reduces the environmental and economic advantages.
- Feedstock demands can be very high, which creates a challenge in terms of managing the biomass feeding process.
- Tar formation – the formation of unwanted hydrocarbon compounds, which can decrease the quality of the syngas and deposit on equipment, leading to fouling and maintenance issues.
- Achieving acceptable load factors, i.e. obtaining reasonably long service intervals between plant shutdown events.

The potential applicability of gasification in Cambridge is not currently clear. Further work would be required to understand in detail the scales at which the technology might be deployed, the feedstock requirements in the context of what is locally available, and the wider environmental and economic implications.

### 6.6.3 Pyrolysis

Pyrolysis is the chemical decomposition of organic materials by heating without oxygen or other agents, although steam is used in some cases (hydrous pyrolysis). In general terms the process produces gas and liquid products, leaving a solid residue. It is typically the first chemical reaction that occurs in the burning of solid organic fuels (the visible flames are actually due to combustion of the gases released by pyrolysis of the solid fuel). Pyrolysis is also an important process in a range of cooking methods, including baking, caramelizing, frying and grilling. The chemical industry makes extensive use of pyrolysis for the production of charcoal, methanol and other products from wood and to convert ethylene dichloride into polyvinyl chloride (PVC), for example.

Like gasification, pyrolysis can be used to turn organic materials (include organic wastes and biomass) into energy-rich fuels through heating under controlled conditions. Whereas standard incineration (an alternative waste treatment method) fully converts waste into energy and ash,

<sup>52</sup> There are three broad categories of gasification technology: Fixed Bed, Fluidized Bed, and Novel Designs, see [www.bioenergywiki.net/Gasification](http://www.bioenergywiki.net/Gasification).

gasification and pyrolysis limit conversion so that direct combustion does not occur. This creates '*valuable intermediates that can be further processed for materials recycling or energy recovery*'.<sup>53</sup>

Potential pyrolysis products include syngas, bio-oil, and char, a solid material that can be combusted for energy production or used as a fertilizer. Experience of using pyrolysis in waste treatment and as a biomass conversion technology is limited in the UK. Pilot schemes and demonstration projects will provide further evidence of the technical, economic, and environmental viability of this technology.

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<sup>53</sup> [www.wastereports.com/information\\_sheets/Pyrolysis%20and%20Gasification%20Factsheet.pdf](http://www.wastereports.com/information_sheets/Pyrolysis%20and%20Gasification%20Factsheet.pdf).

## 7 Barriers to low carbon development in Cambridge

### 7.1 Development site characteristics

As discussed in section 4.2, around three quarters of the new homes in Cambridge expected in the period to 2026 will come from urban extension sites. Two of these sites (North West Cambridge and Cambridge East) already have Area Action Plans, while development at the Southern Fringe and NIAB sites, which do not have AAPs, are too far advanced for the results of this study to influence their CO<sub>2</sub> reduction targets, although it is recognised that Area Action Plans could be reviewed in the future. The remaining sites, which are expected to be influenced by policies resulting from this work, are typically relatively small and not expected to be very high density. This suggests that opportunities for significantly exceeding the minimum requirements of Building Regulations could be limited given the review of LZC technologies (see analysis in section 8).

### 7.2 Stakeholder workshop

#### 7.2.1 Introduction

A key aim of this study is to provide the evidence base for planning policies relating to decentralised renewable and low carbon technologies in new development sites, and to recommend appropriate policies for inclusion in the emerging LDF documents. New planning policies will directly impact local developers and could have wider effects on the local community in the medium to long term. It was therefore appropriate to consult with a wide range of stakeholders to capture the views of those likely to be impacted by the outcomes of this work.

Preliminary findings from this study were presented to local stakeholders in a workshop held in Cambridge at the beginning of February 2010. Group discussion sessions were held to gather input to the study, specifically to identify barriers to low carbon development and explore the planning and non-planning policies that could be used to overcome them.

#### 7.2.2 Key findings

Key barriers that must be addressed to realise the ambitions of decarbonising Cambridge are summarised in Table 8 below. Full details of the barriers identified and proposed solutions are given in the appendix.

Table 8: Barriers to low carbon development in Cambridge

|                    | Key barriers   | Potential solutions  |
|--------------------|--|--|
| Technical barriers | <ul style="list-style-type: none"> <li>• Lack of trust in new technology.</li> <li>• Overwhelming choice of technology and suppliers.</li> </ul>   | <ul style="list-style-type: none"> <li>• Local demonstration projects.</li> <li>• Provision of information and advice, e.g. to demonstrate which technologies are available and most suitable for certain households.</li> </ul>   |
| Economic barriers  | <ul style="list-style-type: none"> <li>• High capital cost of LZC technologies.</li> <li>• Average tenure of householders too low to realise a return on investment in LZC technology.</li> <li>• No incentive for landlords to invest in energy efficiency measures or LZC technologies.</li> </ul> | <ul style="list-style-type: none"> <li>• Simplify the message around CO<sub>2</sub> reductions and make financial argument to home owners.</li> <li>• Promote support schemes such as the Feed-in Tariff (FiT) and Renewable Heat Incentive (RHI).</li> <li>• Innovative business models (e.g. companies to rent technologies to homeowners, who can benefit from the energy generated).</li> <li>• Other economic incentives could include lower council tax for more efficient homes, stamp duty allowances for investing in energy efficiency measures etc.</li> </ul>  |
| Other barriers     | <ul style="list-style-type: none"> <li>• Lack of consumer awareness and lack of leadership.</li> <li>• Energy infrastructure projects are high risk (many uncertainties), so ESCOs demand a high return on investment.</li> <li>• Lack of joined up policy at national and local level.</li> </ul>   | <ul style="list-style-type: none"> <li>• Council to show leadership – e.g. by driving improvements in existing stock. Opportunities include when a house is purchased and when planning permission for building work is sought.</li> <li>• Force public buildings close to new developments to offer a guaranteed heat load to improve viability of low carbon community heating.</li> <li>• Public sector to take risk of low carbon energy system development – e.g. energy cooperatives which can take a longer term view.</li> <li>• Local planning policy should be consistent with national targets / metrics and should also be future proofed for technology development.</li> </ul> |

Another relevant piece of work that considers the obstacles to low carbon development is a study undertaken by the UK Green Building Council and Zero Carbon Hub. The Sustainable Community Infrastructure report contains the findings of this joint task group, which looked at what is required to achieve cost and carbon effective community scale infrastructure solutions. The scope of this work was not limited to energy supply and CO<sub>2</sub> reduction, but also encompassed water, waste and communications infrastructure. Among the nine key strategic recommendations are<sup>54</sup>:

- Public sector buildings to provide anchor loads for heat networks, including connecting existing buildings to networks at next available opportunity.
- Local authorities should develop a ‘Sustainability Options Plan’, which will identify availability, location and type of all relevant resource flows (water, waste and energy).
- Local authorities to take lead role in facilitating and initiating projects, and encouraging integrated delivery.

<sup>54</sup> Source: **Sustainable Community Infrastructure**, a joint report by the UK Green Building Council and Zero Carbon Hub, February 2010.

For further details, see the full report, which can be downloaded from the UK Green Building Council website.<sup>55</sup>

### 7.2.3 Barriers to low carbon development: conclusions

- Discussions with a range of stakeholders allowed identification of the principal barriers to low carbon development in Cambridge. Potential solutions to the barriers were also discussed (see above).
- Some of barriers will naturally diminish over time (e.g. lack of trust in new technology), and some are being address by national government policy (e.g. support for technologies through tariff schemes). Further detail on actions the planning team could consider are provided in the appendix, section 11.6.3.
- Local action could help overcome the barriers to delivering carbon saving projects in the local area. For example, through pooling financial contributions from developers and making investments in local projects through a Carbon Offset Fund. The opportunities for such a fund are currently being explored by Cambridgeshire Horizons.

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<sup>55</sup> See [www.ukgbc.org/site/resources/show-resource-details?id=642](http://www.ukgbc.org/site/resources/show-resource-details?id=642).

## 8 Low carbon policy development

In this section the options for meeting the onsite CO<sub>2</sub> reduction requirements of various local policy options relevant to development in Cambridge are explored. This assessment is focused on residential development and so considers the requirements of the changes to Part L of the Building Regulations, Zero Carbon Homes policy and the Code for Sustainable Homes. The cost implications of achieving these CO<sub>2</sub> reduction targets are assessed for a range of development types that are expected to be typical of development in Cambridge. Based on an understanding of the costs associated with achieving various energy strategies and the CO<sub>2</sub> reduction delivered, a range of potential development management policies and their impact on build costs are considered.

### 8.1 Energy strategies

A range of energy strategies has been defined to meet the percentage improvements of Dwelling Emissions Rate (DER) required by the various policies and proposed regulatory changes. These energy strategies are described in the table below. In each case the energy strategy comprises an energy efficiency improvement (the ‘Good’ fabric package, as described in Section 5.2, unless stated) with a low or zero carbon energy generation technology. These energy strategies represent the most cost effective solutions in the majority of cases, with the assumption that mid to large-scale onsite wind is not appropriate to the bulk of development in Cambridge City.

| Part L / Code level | % improvement DER on TER | Short-name        | Description of strategy   |
|---------------------|--------------------------|-------------------|---|
| L2010 / CL3         | 25%                      | Improved fabric   | Improved fabric measures in line with the ‘Good’ package  |
| L2013 / CL4         | 44%                      | ASHP              | Good fabric package and air source heat pumps in each dwelling  |
|                     |                          | Gas CHP/DH        | Good fabric package. Gas-fired CHP providing heat over a community heating system                                     |
|                     |                          | Biomass Boiler    | Good fabric package. Individual biomass boilers in each dwelling or a communal biomass boiler in blocks of flats      |
| Zero Carbon Policy  | 70%                      | Gas CHP/DH + PV   | Good fabric package. Gas-fired CHP providing heat over a community heating system, plus PV (around 150W per dwelling) |
|                     |                          | Biomass Boiler/DH | Good fabric. Centralised biomass boiler plant providing heat over a community heat system                             |
|                     |                          | ASHP + PV         | Good fabric package and air source heat pumps in each dwelling, plus PV (1.2 kW to 2 kW, depending on dwelling type)  |
|                     |                          | Biomass boiler    | Good fabric package. Individual biomass boilers in each dwelling or a communal biomass boiler in blocks of flats      |

|      |                              |                        |  |
|------|------------------------------|------------------------|--|
| CL 5 | 100%                         | Gas CHP/DH+PV (CL5)    | Gas-fired CHP providing heat over a community heating system, with increased PV (1.2 kW per dwelling)  |
|      |                              | Bio Boiler/DH+PV (CL5) | Centralised biomass boiler plant feeding a community heating system, plus PV (around 1.2kW per dwelling)   |
|      |                              | ASHP+PV (CL5)          | Advanced fabric improvement. ASHP plus 2 – 4 kW of PV per dwelling (depending on dwelling type)  |
|      |                              | Bio boiler + PV (CL5)  | Individual biomass boiler (communal in blocks of flats) plus 1 to 1.7kW of PV, depending on dwelling type  |
|      |                              | Bio CHP/DH (CL5)       | Biomass CHP system providing heat over a community system. (Only relevant in large-scale developments)   |
| CL 6 | 100% + Unregulated emissions | Bio CHP/DH+PV (CL6)    | Advanced fabric improvement. Biomass CHP system providing heat over a community system, plus around 1.7 kW of PV per dwelling. (Only relevant in large-scale developments) |
|      |                              | Bio Boiler/DH+PV (CL6) | Advanced fabric improvement. Centralised biomass boiler plant feeding a community heating system, plus PV (around 3.5 kW per dwelling)                                     |

**Figure 32: Energy strategies for meeting the onsite CO<sub>2</sub> reduction targets of the proposed changes to the Building Regulations, Zero Carbon Homes policy and the Code for Sustainable Homes (CSH levels 3 to 6)**

The additional capital costs associated with each of these energy strategies have been assessed and are presented in the chart in Figure 33. In each case the cost of energy strategy is presented as an extra-over cost (E/O cost) compared to building to Part L 2006 standards (i.e. a Part L 2006 fabric package in combination with a condensing gas boiler) and include the cost of the improved fabric package (given in Figure 11) and the capital cost of all low/zero carbon technologies and heat distribution infrastructure. E/O costs are given for the average dwelling in each of the development scenarios, i.e. the total E/O cost for the whole development has been averaged across the total number of dwellings.

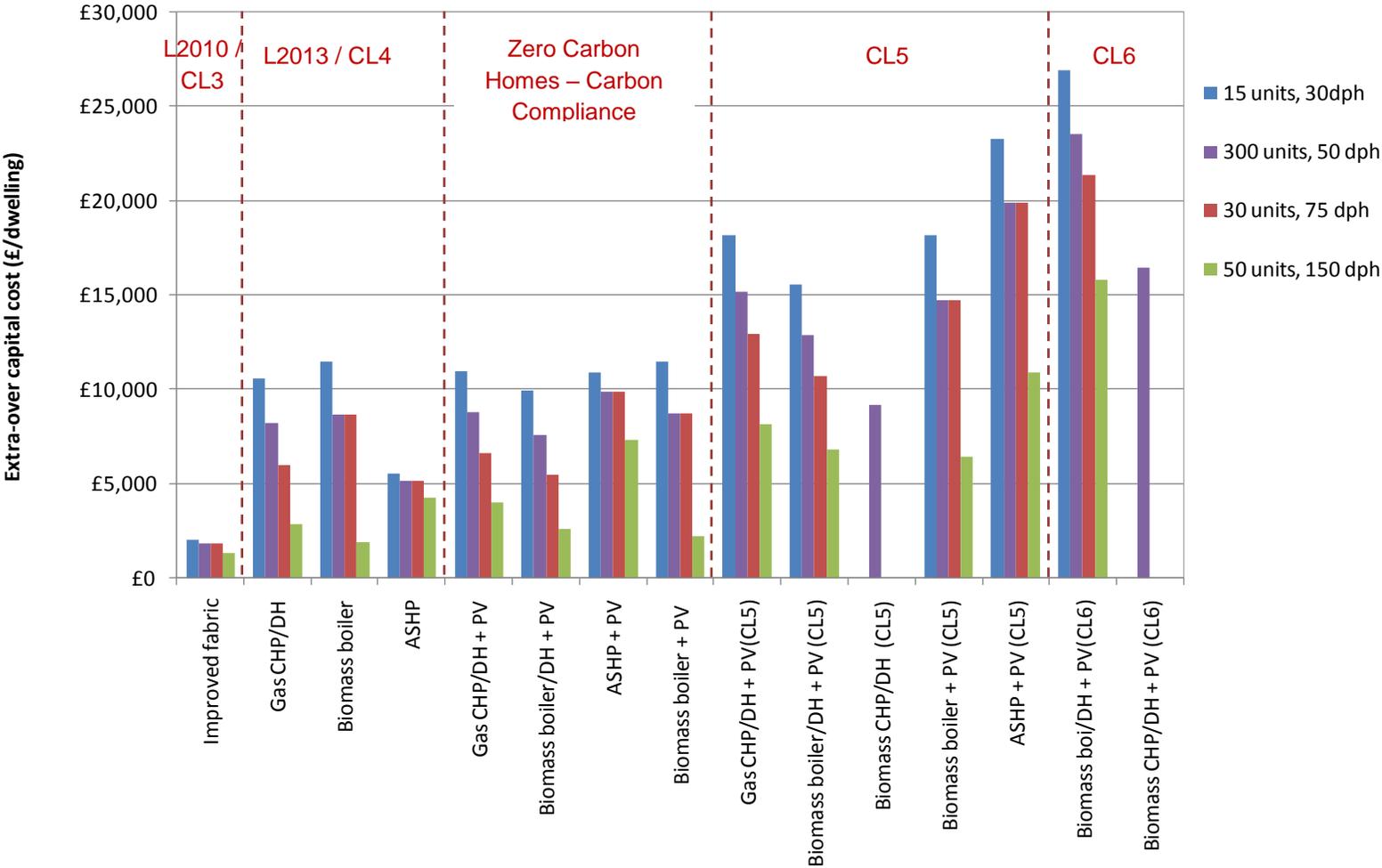


Figure 33: Extra-over costs (compared with Part L 2006 compliance) associated with a range of energy strategies, suitable for meeting the improvements on DER required by relevant policies

Based on the analysis of E/O costs shown above, the lowest cost approaches to meeting the mandatory onsite CO<sub>2</sub> reduction requirements can be identified. These lowest cost approaches are shown in the table below. Note these are the lowest cost approaches of the energy strategies defined in Figure 32. This is not exhaustive, as there are many combinations of energy efficiency improvements and low/zero carbon technologies that could be used to achieve the various CO<sub>2</sub> reduction targets. The intention, however, is that those energy strategies defined in Figure 32 represent some of the common strategies that developers are likely to choose when attempting to meet the tightening standards.

|  | Part L2010 / CL3 | Part L2013 / CL4        | Zero carbon Carbon Compliance | CL5                          | CL6                          |
|--|------------------|-------------------------|-------------------------------|------------------------------|------------------------------|
| Improvement of DER                       | 25%              | 44%                     | 70%                           | 100%                         | 100% + unreg.                |
| Blocks of flats                          | Improved fabric  | Communal biomass boiler | Communal biomass boiler       | Communal biomass boiler & PV | Communal biomass boiler & PV |
| Small-scale development / modest density |                  | ASHP                    | Biomass boiler / DH & PV      | Biomass boiler / DH & PV     | Biomass boiler / DH & PV     |
| Small-scale / high density               |                  |                         |                               |                              |                              |
| Large-scale / modest density             |                  |                         |                               | Biomass CHP / DH             | Biomass CHP / DH             |

**Figure 34: Lowest cost approaches to achieving the DER improvements required by the Code for Sustainable Homes and changes to Part L**

The strategies selected in Figure 34, above, rely heavily on the use of biomass combustion to meet the Carbon Compliance level of the Zero Carbon policy and to achieve the highest levels of the Code.<sup>56</sup> Use of biomass in Cambridge City developments could be restricted, by air quality concerns and due to supply chain constraints. In recognition of potential constraints on biomass use, it is unlikely that all development in Cambridge post-2016 will have a biomass-based energy strategy, the least cost strategies among those that do not rely on biomass have also been identified, tabulated below.

<sup>56</sup> Carbon Compliance level refers to the reduction in CO<sub>2</sub> emissions that must be achieved through on-site means. The latest definition of zero carbon homes includes a Carbon Compliance level of 70%, which means that a reduction of 70% of Part L 2006 regulated emissions must be achieved on site. The remaining emissions (up to 30% of Part L 2006 regulated emissions and all unregulated emissions) may be offset through other means (e.g. investment in allowable solutions). The CSH as currently defined does not include the concept of Carbon Compliance, which means that all emissions must be dealt with through on-site means. However, the latest consultation on the CSH (December 2009) sought views on aligning the Code with Building Regulations, which implies that the Carbon Compliance concept would become relevant for Code levels 5 and 6.

|  | Part L2010 / CL3 | Part L2013 / CL4 | Zero carbon Carbon Compliance | CL5          | CL6           |
|--|------------------|------------------|-------------------------------|--------------|---------------|
| Reduction of DER/TER                     | 25%              | 44%              | 70%                           | 100%         | 100% + unreg. |
| Blocks of flats                          | Improved fabric  | Gas CHP          | Gas CHP & PV                  | Gas CHP & PV | Not achieved  |
| Small-scale development / modest density |                  | ASHP             | ASHP & PV                     |              |               |
| Small-scale / high density               |                  |                  | Gas CHP / DH & PV             |              |               |
| Large-scale / modest density             |                  |                  |                               |              |               |

Figure 35: Lowest cost approaches to achieving the required DER improvements assuming that biomass use is restricted

In the case that biomass combustion is not permitted, gas CHP and air source heat pumps are expected to play a greater role. In order to meet the DER improvement targets when using a fossil fuel based heating source, increased reliance on photovoltaics is also necessary. Without a biomass combustion heating source and assuming that onsite wind is not feasible, the onsite CO<sub>2</sub> reduction requirements of Code level 6 are not practically achievable – the amount of PV required to mitigate all electricity and residual heating emissions is too large.

## 8.2 Target setting methodology

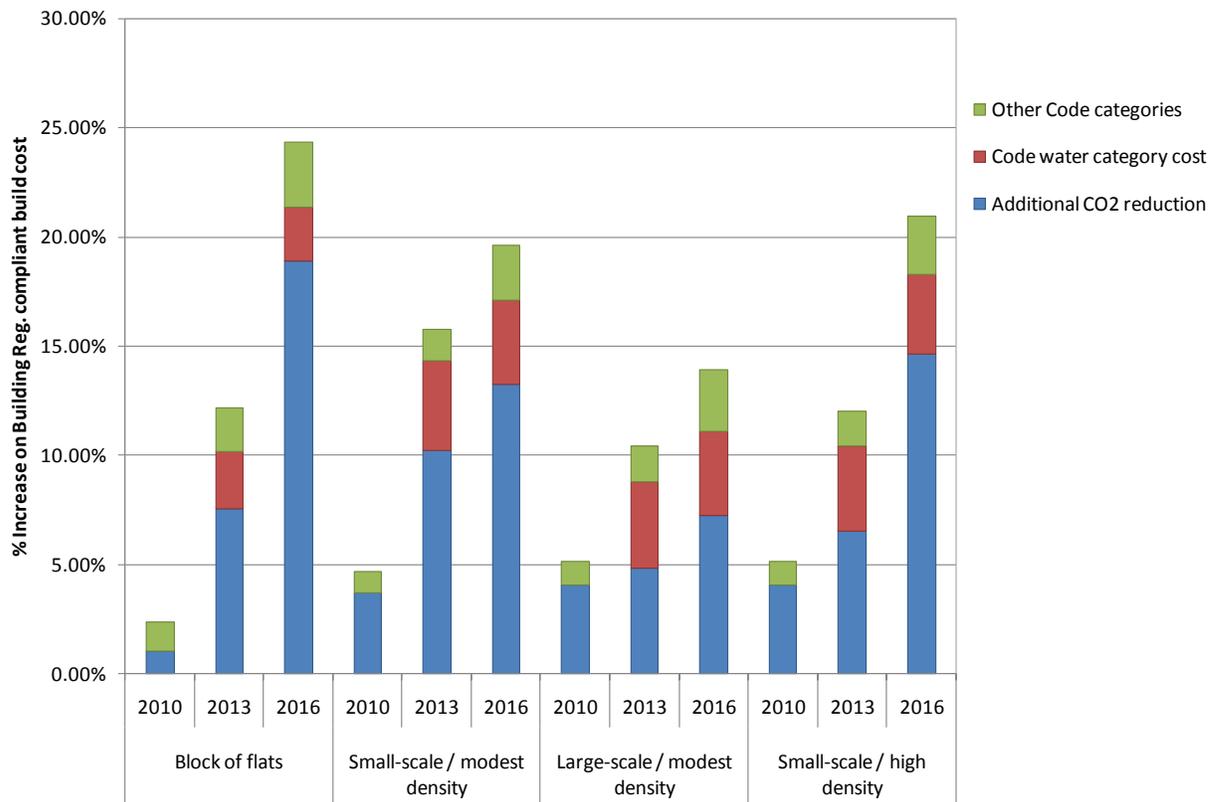
The viability of potential targets for onsite CO<sub>2</sub> reduction and sustainability standards have been assessed in terms of their impact on build cost. The targets are expressed in terms of a requirement to achieve a certain improvement on DER (% reduction of regulated emissions compared to Part L 2006 compliance) and a requirement to achieve an overall Code for Sustainable Homes rating (i.e. to achieve the necessary overall Code score, in addition to achieving a certain mandatory energy standard).

Increases in build cost due to each set of targets are expressed as a percentage extra-over cost compared to the cost of construction to meet the relevant Building Regulations in force in each period. Note that in each case, the cost implications have been assessed assuming that developers select the most cost-effective means of achieving each standard (assuming that use of biomass is permitted, but that onsite wind is not feasible).

Example 1 – High Code level requirement

| Target   | 2010–2013 | 2013–2016 | 2016 onward |
|--|-----------|-----------|-------------|
| CO <sub>2</sub> reduction standard (% reduction regulated emissions) | 44%       | 100%      | Zero Carbon |
| Overall Code standard  | 4         | 5         | 6           |

This is an example of a policy expressed in terms of an increasing Code for Sustainable Homes rating requirement, up to a requirement for Code level 6 from 2016 (a requirement for net zero carbon through onsite measures). Note that a similar approach to this has been taken at the North West Cambridge site, where the Area Action Plan requires at least Code level 4 for new dwellings approved up to 31<sup>st</sup> March 2013 and Code level 5 for new dwellings approved thereafter (this AAP does not go as far as to require Code level 6, as assessed in this example set of targets.).



The extra-over costs associated with this policy are high – up to a 20–25% increase on Building Regulation compliance once the Code level 6 standard is introduced. Note that this is the increased cost in addition to achieving Zero Carbon Homes standard from 2016, which is already a 10–15% cost increase on current Building Regulation compliant build costs. It is also important to note that, as discussed above, on sites where biomass combustion is not feasible, the Code level 6 requirement will be very difficult to achieve (this assumes the current definition of Code level 5 & 6, should the Code be amended to reflect zero carbon homes

policy, as discussed above, then the additional costs associated with meeting these higher Code levels will be significantly reduced<sup>57</sup>).

**Example 2 – Maintaining a higher standard than regulatory minimum**

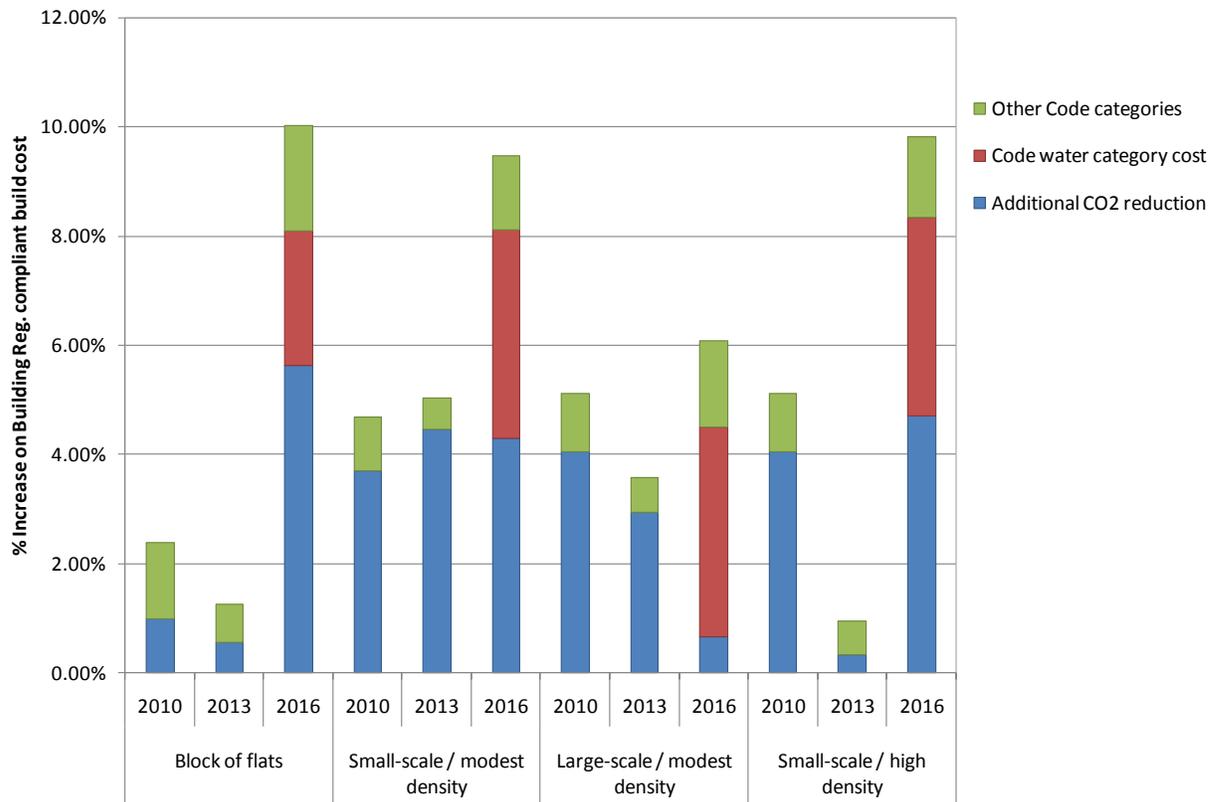
| Target   | 2010–2013 | 2013–2016 | 2016 onward |
|--|-----------|-----------|-------------|
| CO <sub>2</sub> reduction standard (% reduction regulated emissions) | 44%       | 70%       | 100% *      |
| Overall Code standard  | 4         | 4         | 5           |

\* This is the level of CO<sub>2</sub> reduction to be required by onsite means (including supply of directly connected low carbon heat), i.e. it is the Carbon Compliance level. Investment in Allowable Solutions will still be required to mitigate unregulated emissions, as required by zero carbon homes policy.

This policy maintains a requirement for onsite CO<sub>2</sub> reduction that is more advanced than the regulatory minimum at any particular time. In effect, the Part L 2013 CO<sub>2</sub> reduction requirement of 44% reduction of regulated emissions is brought forward to 2010 (when the regulatory requirement will be a 25% reduction). In 2013 a level of CO<sub>2</sub> reduction of 70% of regulated emissions is required by this policy, which is equivalent to early introduction of the Carbon Compliance level set out in Zero Carbon Homes policy. From 2016, the policy requires that a Carbon Compliance level of 100% of regulated emissions is achieved, which exceeds the standard that Zero Carbon Homes policy is expected to require (note that this would not relieve developers of their obligation to mitigate all remaining emissions through allowable solutions, as zero carbon policy will demand, but requires a higher level of CO<sub>2</sub> mitigation to be achieved through onsite means).

In addition to the CO<sub>2</sub> reduction targets, the policy sets a CSH level requirement of Code level 4, increasing to Code level 5 overall post-2016.

<sup>57</sup> The impact of the proposed amendment to the Code on costs of achieving Code level 5 & 6 is discussed in some detail in the Impact Assessment that accompanies the ‘Sustainable New Homes: The Road to Zero Carbon’ consultation document. The impact Assessment can be found at: <http://www.communities.gov.uk/publications/planningandbuilding/codeimpactassessment2009>.

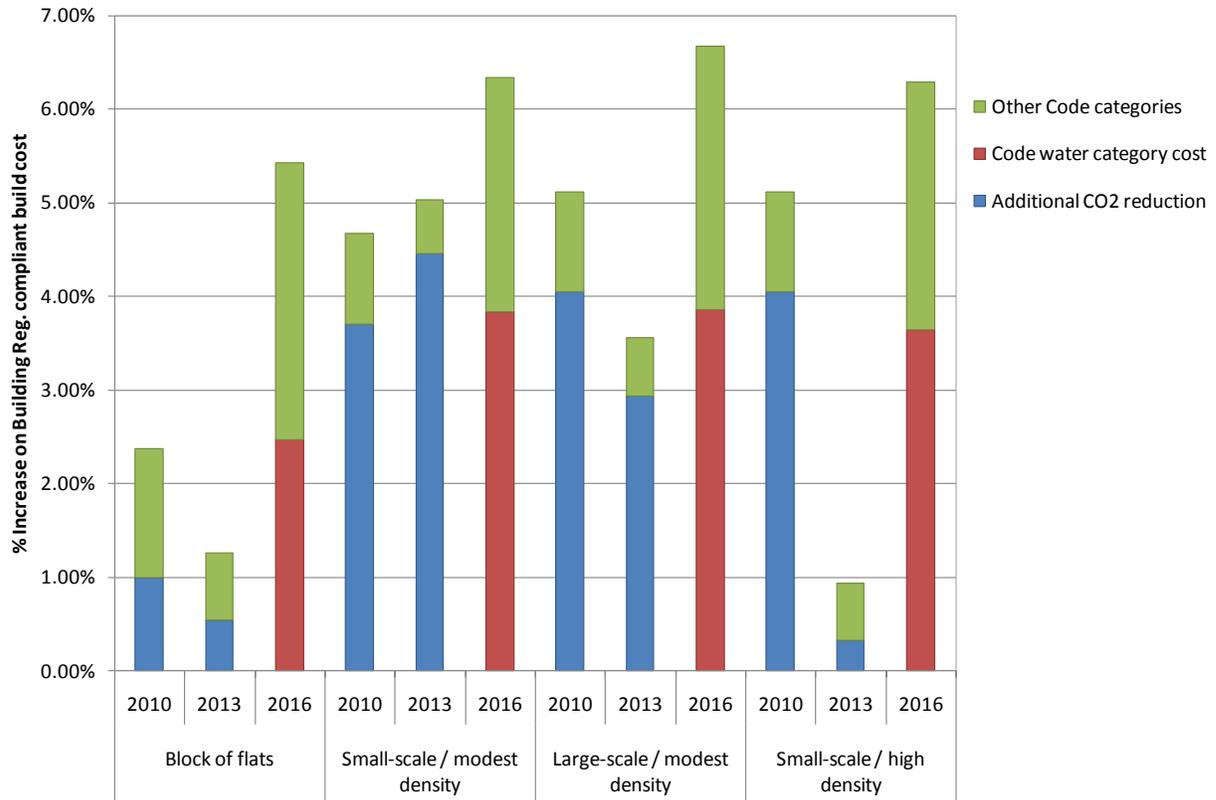


In this case the E/O costs are more modest, but still reach a 10% increase over the cost of achieving the regulatory minimum by 2016. The E/O costs for 2016 assume that zero carbon policy will require investment in Allowable Solutions at 50 £/tonne to cover 30 years of a dwelling’s residual emissions. The greater onsite CO<sub>2</sub> reduction achieved in order to meet the Code level 5 requirement reduces the investment needed in Allowable Solutions.

**Example 3 – Early adoption of the Zero Carbon policy ‘Carbon Compliance’ level**

| Target   | 2010–2013 | 2013–2016 | 2016 onward |
|--|-----------|-----------|-------------|
| CO <sub>2</sub> reduction standard (% reduction regulated emissions) | 44%       | 70%       | 70%         |
| Overall Code standard  | 4         | 4         | 5           |

In this example the 70% Carbon Compliance level that is expected to form part of Zero Carbon Homes policy is introduced early, from 2013. The requirement to invest in Allowable Solutions is not assumed to be introduced until 2016, in line with national policy. Note that the policy tabulated above requires Code level 5 to be achieved from 2016, even though the reduction on regulated emissions is only 70% (rather than the 100% required by Code level 5). This assumes that the Code for Sustainable Homes is modified to reflect zero carbon policy’s CO<sub>2</sub> reduction hierarchy (a modification currently being consulted on in Government’s ‘Sustainable New Homes – the road to zero carbon’ consultation).



Under this policy the E/O costs are relatively limited, up to around a 6.5% increase on compliance with 2016 regulations. Post 2016, the policy does not require any CO<sub>2</sub> reduction beyond that required by Zero Carbon policy, so the E/O cost is wholly associated with addressing other Code categories. The costs of achieving the internal water consumption standards (80 litres/person/day) dominate this cost.

Based on this assessment of the cost implications of various policies, a policy following Example 3 would appear to be reasonable, in terms of the additional cost burden on developers. Note that if Government elect to maintain the current definition of the Code for Sustainable Homes at levels 5 and 6, i.e. require a higher level of onsite CO<sub>2</sub> reduction than set-out by the Carbon Compliance level of the Zero Carbon policy, then the cost burden post 2016 increases (in line with Example 2 above). This is still achievable on the larger sites, where biomass combustion and community heating are achievable, but may create a larger additional cost burden on those sites where biomass is not feasible or not permitted.

The analysis above has shown that the level of additional cost burden associated with a particular policy, in terms of on-cost per unit, is likely to vary significantly depending on the development type (i.e. the scale, density, whether there is a mix of uses etc.). To ensure that certain types of development are not unreasonably burdened by a particular policy, the policy could define certain thresholds, for example on numbers of units or build density, below which the policy would not apply. Policies setting targets in advance of national regulations could also be linked to a site-by-site feasibility assessment, whereby developers would be exempted if they demonstrated that the implications of the policy for their site were particularly onerous.

The development of a local carbon offset fund could provide a useful mechanism to ensure the cost impacts of a particular policy are more equitable across the range of development types. In this scenario, where a developer could demonstrate that the level of onsite CO<sub>2</sub> reduction required by a particular policy cannot be achieved at reasonable cost, a commuted payment into the offset fund would be accepted. The size of this payment would be based on the shortfall between the carbon emissions reduction required by the policy and that feasibly achieved onsite and an agreed tariff for carbon offsetting (£/tonne of CO<sub>2</sub>). The funds collected by this offset fund would then be invested in CO<sub>2</sub> reduction projects elsewhere in the region.

### 8.2.1 Non-domestic targets

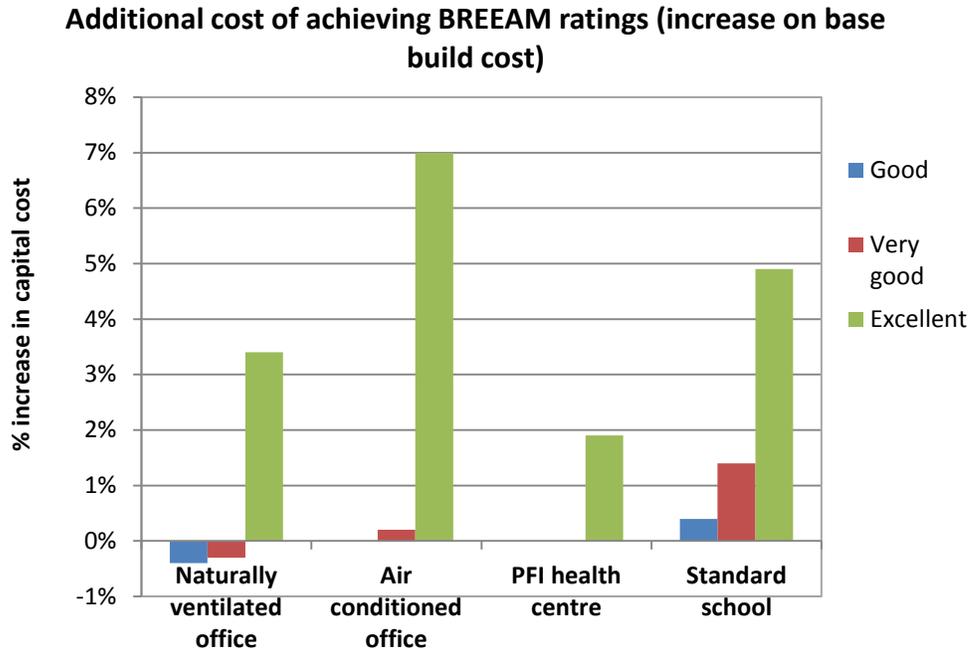
The BREEAM standard provides a nationally recognised system for rating the sustainability of non-domestic buildings. The BREEAM rating system is similar to the Code for Sustainable Homes, in that it a building is scored against a number of sustainability criteria and a BREEAM level is awarded on the basis of the overall score. There are five BREEAM levels that can be attained – Pass, Good, Very Good, Excellent or Outstanding. The categories against which non-residential buildings are assessed under BREEAM share similarities with those set-out in the Code for Sustainable Homes, such as Energy, Materials, Water etc., although there are a number differing categories, such as transport (access to public transport) and proximity to amenities, that place greater emphasis on a building's location.

There is a lack of publicly available research into the costs of achieving sustainability standards in the non-domestic sector, compared to the wealth of research focussed on the residential sector. Cost consultants Cyril Sweett, working in partnership with the BRE, published assessments of typical costs of achieving various BREEAM standards for three building types - a naturally ventilated office building, an air-conditioned office and PFI health Centre<sup>58</sup>. This research dates to 2005, so does not include any assessment of the costs of reaching the 'Outstanding' rating, which was not introduced into BREEAM until 2008. A further study by cost consultancy Faithful & Gould considered the cost of compliance with BREEAM standards in schools<sup>59</sup>. The findings of these studies are presented in the figure below (note that the costs associated with the office and health centre building type relate to developments in 'typical' locations).

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<sup>58</sup> Costing Sustainability: How much does it cost to achieve BREEAM and EcoHomes ratings?, Cyril Sweett and BRE, 2005

<sup>59</sup> 'Schools for the future: Cost of BREEAM compliance in schools', Faithful & Gould, [http://www.fgould.com/media/files/schools\\_for\\_the\\_future.pdf](http://www.fgould.com/media/files/schools_for_the_future.pdf)



**Figure 36, Additional cost of compliance with BREEAM ratings for a range of building types (extracted from research by Cyril Sweett, BRE and Faithful & Gould).**

The findings of these studies suggest that a BREEAM rating of ‘Very Good’ can be achieved at a zero or modest cost increase. There is, however, a sharp increase in the cost of achieving the ‘Excellent’ standard in all cases. No data is available on the cost of achieving the ‘Outstanding’ standard, however, it appears that the lowest cost measures are exploited in achieving the very good standard and that increasing expensive measures have to be adopted in order to reach the excellent rating. Even more costly measures would need to be exploited to achieve the higher score required by the outstanding rating, which would be expected to result in a substantial further cost increase.

In terms of sustainability targets for new developments in Cambridge, it appears that a ‘Very Good’ rating could be applied to all non-residential development without significant impact on the cost to developers. The ‘Excellent’ standard does have a more substantial cost increase and it may not be appropriate to apply the standard to all development. The ‘Excellent’ standard may be applied on a site specific basis, for example in the case of the major sites.

### 8.2.2 Impact of financial incentives on targets

The preceding analysis of cost impact of various targets has focussed entirely on the capital cost implications. Typically this has been of most concern to developers as increases in construction costs due to enhanced sustainability measures have not been met by increased sale or rental values of properties. This can put pressure on land values or developer profit margins.

The largest component of the cost of meeting a Code for Sustainable Homes standard (and the higher BREEAM ratings) is the cost of achieving the CO<sub>2</sub> reduction requirements. At the higher levels of the Code, i.e. Code Level 4 and above, energy strategies that involve an

element of onsite, low carbon energy generation are required and the energy strategy costs increase (particularly sharp increases in the energy strategy costs are encountered in moving from Code Level 4 to 5 and from 5 to 6). The costs associated with delivering CO<sub>2</sub> reduction in new developments will increasingly become a part of complying with Building Regulations as the Regulations are tightened. If the local planning authority sets a target in advance of the Regulations, however, additional onsite low carbon generation is likely to be required to meet the higher standard.

The government has recently announced a range of financial incentives aimed at encouraging the uptake of renewable energy systems. The Clean Energy Cash-back Scheme (also known as the feed-in tariff or FIT) was introduced in April 2010. This incentivises investment in a range of renewable electricity generation technologies (up to a maximum of 5 MWe installed capacity), by offering a payment for every unit (kWh) of electricity generated, guaranteed over a fixed period of time (the period of the payment is 20 years or 25 years in the case of PV). The payment under the clean energy cash back scheme is in addition to the income that can be derived from selling the electricity to an electricity supply company (note that payments under the clean energy cash back scheme cannot be received for a generator that is claiming Renewables Obligation Certificates). A similar scheme is proposed to incentivise investment in renewable heat generating technologies, such as solar thermal, heat pumps and biomass heating technologies. The Renewable Heat Incentive (RHI) is expected to offer a payment for every kWh of useful renewable heat generated from an eligible technology (in the case of the RHI there is no upper limit on the capacity of the technology), again over a fixed period, which varies between the technologies. The eligibility of various technologies, proposed levels of tariffs and lifetimes of support were the subjects of a recent government consultation on the RHI<sup>60</sup> and are expected to be refined further as the policy develops. The policy is expected to be introduced during 2011.

The intention of the Clean Energy Cash Back Scheme and the Renewable Heat Incentive is to greatly accelerate the rate of uptake of renewable electricity and heating technologies, toward the UK's 2020 targets for renewable energy supply. The levels of tariff and lifetimes of support are typically selected in order to generate a rate of return on investment in the technologies that will be attractive to the various types of investor (the 'investor' could be a householder, commercial property owner, energy company, developer etc.). The attractive rates of return that can be gained from investment in renewable energy technologies under these schemes should change developer attitudes toward incorporating these technologies in the energy strategies for developments, such that they are no longer seen purely as additional capital cost items.

These energy-based incentives are paid over a period of time, as the generator operates and generates renewable energy. Developers may in some cases retain an ongoing management role in a development, but will often look to sell the properties and ownership of the assets and will therefore look to capitalise the value of these ongoing incentive payments. There are a variety of mechanisms for this. In the case of an energy strategy that is based on a centralised energy centre with a district heating system, then the developer will be able to attract third-party investors (for example ESCOs) to provide finance to develop the energy system on the back of the revenues from sales of heat and incentives. In cases where the energy generating technology is installed in an individual property, such as a home, then the

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<sup>60</sup> Renewable Heat Incentive: Consultation on the proposed RHI financial support scheme', DECC, February 2010

value of ongoing revenues from financial incentives could be capitalised as an increased sale price. Developers currently tend to be sceptical that a higher sale price can be gained as a result of renewable generating technologies installed within the property, although this may change as the value of such incentive schemes become more widely recognised. A further mechanism may be for developers or other organisations to retain ownership of energy generating technologies installed within properties and to sell the energy services (i.e. heat and power) and to benefit from the incentive regime. The social housing sector, where housing associations often already have experience of billing tenants for their energy consumption and of maintaining plant installed within tenant's properties, may be the most likely sector for trialling this latter model.

## 9 Conclusions and policy recommendations

### 9.1 Conclusions

#### 9.1.1 Low carbon and renewable energy resource assessment

##### District heating

- Large areas of Cambridge are characterised by relatively low density housing. This means that outside of the city centre areas of high heat density, required for economically viable district heating schemes, are relatively dispersed.
- The main opportunity for district heating is likely to be in the urban extension sites, of which only the Bell School site is in close proximity to an area of existing high heat density (Addenbrookes hospital). The approaches to meeting energy demands at these sites are covered by specific area action plans.

##### Biomass

- Whilst the maximum theoretically available biomass resource in the region is relatively large, there is significant uncertainty surrounding the resource currently available.
- The local biomass fuel supply chain is highly fragmented – i.e. the industry is characterised by a large number of small suppliers. Regional targets to increase the mass of biomass fuel available exist, but ultimately woodland owners and fuel suppliers require sufficient incentive to develop the supply chain.
- Biomass price is a key determining factor in the economic argument for managing woodland for fuel production.
- Many barriers exist to using biomass as a heating fuel, particularly in urban environments. These include fuel sourcing, security of fuel supply, transportation costs, impacts on traffic congestion, fuel storage issues, and air quality concerns around biomass combustion.

##### Waste to energy

- The new MBT facility, which will handle all of Cambridgeshire's black bag waste, could produce up to around 500GWh/yr of refuse derived fuel (RDF), which is equivalent to around 70% of current domestic gas consumption in Cambridge in energy terms. Note that this is an estimation based on data currently available; at the time of writing the MBT plant is in its first year of operation and exact potential RDF outputs are unknown.
- Combustion of fuels from waste facilities is only likely to be feasible in large-scale plants where strict emissions control of the Waste Incineration Directive can be met economically.
- Using RDF in a CHP application relies on a heat demand in relatively close proximity to the power plant. This is more likely to be acceptable in non-residential developments.

## Wind power

- The wind resource in Cambridge is highly constrained due to the relatively modest raw resource and the urban characteristics of the area.
- The wider Cambridgeshire area has higher wind speeds, which suggests that opportunities for wind turbines / farms lie outside of Cambridge City Council's area.
- The use of wind power to offset carbon emissions from new development in Cambridge is therefore most likely to be via some form of offset fund. Close cooperation would be needed between Cambridge City Council and neighbouring authorities (e.g. South Cambridgeshire District Council).

## Other technologies

- Other technologies for extracting energy from waste include **gasification** (a thermochemical process that converts carbonaceous materials into syngas), **pyrolysis** (decomposition of organic materials through heating) and **anaerobic digestion** (decomposition of organic materials by microorganisms in the absence of oxygen).
- Gasification and pyrolysis can also be used to convert biomass (wood waste, energy crops etc) into a cleaner burning fuel and therefore represent potential alternative biomass conversion technologies.
- Anaerobic digestion is unlikely to be suitable within an urban area such as Cambridge but could find application on sites on the edge of or outside the city.
- Experience of using pyrolysis in waste treatment and as a biomass conversion technology is limited in the UK. The technical, economic and environmental viability of this process is therefore somewhat uncertain.
- The potential applicability of gasification in Cambridge is not currently clear. Further work would be required to understand in detail the scales at which the technology might be deployed, the feedstock requirements in the context of what is locally available, and the wider environmental and economic implications.
- There are numerous other low carbon and renewable energy technologies that may be deployed at the individual dwelling scale in Cambridge. In particular, the uptake of technologies such as solar PV, solar thermal, and heat pumps is expected to increase over the coming years.

### 9.1.2 Low carbon policy development

- It is important to ensure that the impact of policies that require advanced levels of CO<sub>2</sub> reduction from new development is adequately tested, especially in terms of additional cost burden on developers.
- The cost impacts of meeting more stringent CO<sub>2</sub> emission targets have therefore been evaluated for a range of development types expected to come forward in Cambridge over the coming years.
- The total additional cost relative to building to current standards depends on target improvement level, energy strategy and development characteristics (scale, density etc). The most cost effective energy strategy can vary by development type and the

additional cost burden associated with a particular policy, in terms of on-cost per unit, is likely to vary significantly depending on the development type.

- The on-site CO<sub>2</sub> reductions required by the highest level of the Code for Sustainable Homes (as currently defined) may not be practically achievable in certain development types (e.g. where use of a low carbon heating fuel such as biomass is not feasible). However, this may change if the requirements of the CSH are brought into line with the definition of Zero Carbon Homes policy (i.e. introducing the concepts of Carbon Compliance and Allowable Solutions into the Code).
- The development of a local carbon offset fund could provide a useful mechanism to ensure the cost impacts of a particular policy are more equitable across the range of development types. This is being considered in detail in a separate study for Cambridgeshire Horizons.

### 9.1.3 Implications for policy option recommendations

On the whole the technical studies undertaken suggest that there are relatively few opportunities to provide significant levels of onsite DLCRE outside of the major development sites currently identified. Accordingly, whilst the suggested policy framework is focussed on the types and scale of development likely to come forward elsewhere in the city, sight should not be lost of the potential for the major sites to make a contribution to carbon emissions reductions.

***Recommended options for consideration for Cambridge City Council’s emerging LDF are given in the following section. A concise description of each option is provided along with supporting text that could be included to give further context and justification.***

The suggested options detailed below take into account the very recent consultation on PPS1 Supplement: *Planning for a Low Carbon Future in a Changing Climate*. The emerging PPS1 Supplement proposes that some policies within existing and emerging plans will not be required given the future changes to Building Regulations. However, the Cambridge City Core Strategy will be in place prior to the implementation of these changes and it is therefore appropriate that the following policy options are considered.

#### The role of the Local Development Framework

The emerging LDDs contained in the LDF can exercise only limited influence on the behaviour and use of existing buildings. They do, however, present opportunities to influence new development, enabling it to respond to the challenges and opportunities presented by climate change, including the need to reduce carbon emissions.

Existing and emerging national planning policy and policy relating to renewable and low carbon energy clearly support the development of a robust framework of local planning policies aimed at increasing energy generation from renewable energy and reducing the carbon emissions arising from development.

## 9.2 Policy option recommendations

### 9.2.1 Proposed options for policy development

In light of Cambridge City Council's commitment to carbon emissions reductions, which is a key driver in planning for development, we recommend that the following are considered as part of developing the Core Strategy and other development plan documents.

#### Proposed Option 1: Targets for carbon emissions in Cambridge

In order to work towards the long-term target of a reduction in carbon dioxide emissions of 89% by 2050 from 2005 levels, the Council should seek to achieve the following minimum reductions against a 2005 baseline; these will be monitored and kept under review:

- 23% by 2020
- 65% by 2030

Accordingly, all development proposals should, as far as possible, contribute towards reducing CO<sub>2</sub> emissions. Planning policies related to the provision of Decentralised and Renewable or Low Carbon Energy set out within the Core Strategy are therefore broadly scoped.

#### Suggested supporting text

The range of sustainability and climate change challenges that Cambridge must tackle through policies within its LDF include:

- Reducing Cambridge's contribution to climate change.
- Adapting to the potential effects of climate change.
- Making new development more energy efficient.
- Increasing the use of low carbon and decentralised energy.
- Increasing generation of renewable energy.

Policy Option 1 includes targets that developments should contribute to for Cambridge to meet its commitments contained in the Cambridge Climate Change: Strategy and Action Plan 2008-12 and meet national targets for carbon emissions reductions. The targets would be applied to developments in an integrated fashion so that the fullest and most appropriate contributions can be identified in the context of each proposal.

The minimum carbon dioxide reduction targets in this plan, whilst challenging, are feasible with the full commitment and collaboration of all stakeholders. They will be kept under review so that factors such as technological and behavioural change can be reflected.

Forthcoming decades will see a reduced dependence on fossil fuels and greater reliance on renewable and other low carbon and decentralised energy sources. Buildings, plant and equipment should be designed, wherever possible, to accommodate changes in fuels and technology.

A range of measures will be required to meet the above targets, some of which lie outside the planning arena. There are, however, a number of ways in which planning for the future development of Cambridge can help to meet these targets:

- Provision of development in the most sustainable locations.
- Encouraging the consideration of carbon emission reductions at the earliest stage of development proposals.
- Promoting the energy hierarchy in development proposals.
- Providing positively for stand-alone renewable energy schemes.

**Justification**

In addition to meeting the target established in the 2008 Cambridge Climate Change Strategy, this policy is in line with national targets to reduce carbon emissions. The national target is for an 80% reduction by 2050 whilst the Regional Economic Strategy for the East of England has already set the objective for the Region to achieve a reduction in CO<sub>2</sub> emissions of at least 60% by 2031 and 26–32% by 2020, against a 1990 baseline. The local exceedance of these targets is based on evidence produced for the Cambridge Climate Change Strategy as to the need and desire to reduce its carbon footprint.

## Proposed Option 2: Sustainable design and construction

Option 2 proposes that all development should meet the highest practicable standards of sustainable design and construction, including resource and energy efficiency and should aim to maximise reductions of carbon emissions.

All development, including major refurbishment, should be required to demonstrate that:

- It makes effective use of resources and materials through sustainable construction, minimises water use, provides for waste reduction / recycling and reduces carbon emissions.
- It uses an energy hierarchy that seeks to
  - use less energy, in particular by adopting sustainable design and construction measures,
  - supply energy efficiently, including by prioritising decentralised energy generation using low carbon or renewable technologies, and
  - make use of renewable energy.
- It is sited and designed to withstand the long-term impacts of climate change, particularly the effect of rising temperatures on mechanical cooling requirements.

### Suggested supporting text

Sustainable design and construction can reduce the consumption of resources, cut greenhouse gas emissions and contribute to good health. It is based on principles that are intended to ensure that buildings make efficient use of resources, acknowledge the context within which they are sited, are healthy, adaptable and responsible in protecting the environment and make the most of natural systems, for example, passive solar design.

It is likely that transport in the future will be less dependent on fossil fuels. Facilities should be designed into new developments to support different transport modes such as the provision of secure cycle parking and charging points for electric vehicles. In order to encourage the use of cycle facilities, shower and changing facilities should be provided within non-residential developments.

With continuing climate change and changes in long-term climatic conditions development should take account of expected changes in climate over its expected lifetime or be capable of adaptation. This should include consideration of the following:

- Flexible design of buildings (including heating, lighting and ventilation systems) so that they can be adapted and updated and do not become obsolete.
- Creation of flexible spaces within buildings.
- The potential for incorporating renewable energy generation in the future.
- The incorporation of green space and landscaping as part of a development to reduce heat around buildings, provide shelter from cold winds thus reducing the need for heating, provide open space for occupiers to use and enhance local biodiversity.

The Council expects new homes and commercial development provided within Conservation Areas, close to Listed Buildings or in locations where the appearance of a building is important

to still be of sustainable construction, which can often be achieved through principles of high quality design.

### **Justification**

Much can be done to reduce demand for energy and other resources through good design and intelligent materials selection. This is best achieved (both in terms of cost and ease of implementation) at the design stage. Reducing demand for energy is a cost effective carbon saving measure (see Section 5.2 for example), and good design offers numerous benefits to home owners: more pleasant living environment, reduced energy bills etc.

Given that many of the buildings constructed today will be standing in fifty or more years' time, consideration should be given to mitigating the potential impacts of climate change. The design stage represents a unique opportunity to influence how a building will perform throughout its lifetime and good design principles should therefore be encouraged from the earliest stage in new development projects.

### Proposed Option 3: Sustainability standards

This option sets out proposals for specific sustainability standards for new development in Cambridge, defined in terms of nationally recognised standards. In light of the assessments carried out in section 6 of this report, proposals for residential development or schemes which include residential development should consider the requirements of the Code for Sustainable Homes, whilst non-residential proposals shall consider the requirements of BREEAM, or any requirements that supersede it.

Proposals for all residential and non-domestic development should demonstrate that they will meet the following targets:

| Development type         | Standard                             | Up to 2013 | 2013–2016 | 2016 onwards |
|--------------------------|--------------------------------------|------------|-----------|--------------|
| Residential development  | Carbon Compliance level <sup>1</sup> | 44%        | 70%       | 70%          |
|                          | Code for Sustainable Homes           | Level 4    | Level 4   | Level 4      |
| Non-domestic development | BREEAM                               | Very Good  | Very Good | Very Good    |

<sup>1</sup>Carbon Compliance level is defined as the reduction of Regulated emissions from a Part L 2006 baseline (TER) via onsite measures (including directly connected low carbon heat)

In cases where the developer argues that these targets place an unreasonable burden on costs of development, the planning authority should make a judgement on a case-by-case basis whether to agree to a lower standard. The onus will be on developers to robustly justify why full compliance with policy requirements is not viable.

The Council will promote and support individual schemes that showcase best practice in sustainable construction and renewable energy generation where appropriate.

If proposals to develop a Cambridgeshire Carbon Offset Fund are taken forward, then developments that fail to meet the required levels of carbon emissions reductions may be required to make a one-off financial contribution to the fund. This will be used to make equivalent emissions savings through off-site measures. The amount of this payment, where applicable, will be determined on a site-by-site basis and calculated in line with a methodology to be set out in an updated Sustainable Design and Construction SPD.

Individual targets for new allocated developments may be set through the Site Specific Allocations DPD where these can be justified by local circumstances taking account of economic viability.

The Council will develop through current and future Development Plan Documents, policies that set the highest standards of carbon emissions reductions, having regard to site circumstances and will seek to ensure that development adapts to climate change. To this effect, sustainability requirements will be tightened to ensure that development takes account of expected further changes in climate and to ensure that the commitments contained in the

Cambridge Climate Change Strategy are met. Where standards are set beyond those contained in this policy, the higher standards will apply.

### **Suggested supporting text**

Building Regulations will require increased standards in respect of the reduction of carbon emissions. The zero carbon standards are expected to be introduced for domestic and non-domestic buildings in 2016 and 2019, respectively. To support this through the planning system in Cambridge the Council wishes to see the highest level of CO<sub>2</sub> emissions reductions in every proposal, and zero carbon development will be encouraged where appropriate. The carbon reduction requirements for residential development (Carbon Compliance level) set a trajectory of reducing emissions that is one step ahead of the minimum requirements expected to be set through Building Regulations and zero carbon policy. In addition to the meeting the Carbon Compliance level, Level 4 of the Code for Sustainable Homes should be met to ensure high levels of sustainability are incorporated into other aspects of the design and construction of residential developments. For non-residential buildings, the levels of carbon reduction set through changes to Part L of the Building Regulations should be met. In addition, a BREEAM Very Good standard should be achieved for non-residential developments.

It is important that the need to reduce emissions is considered at the earliest opportunity; much can be done at the design stage to achieve such reductions, before other measures such as low carbon energy, renewable and decentralised energy supply are considered.

Developers will be expected to consider all energy efficiency, low carbon, decentralised and renewable energy technologies, selecting the most appropriate solution taking into account site characteristics, impact on surrounding area, carbon reduction potential, and capital and on-going costs.

Where major development schemes are expected to take several years to build out, increasing sustainability standards will be set through policies contained in Area Action Plans, site development briefs or other appropriate documents. The Council will review these standards on a regular basis to ensure that future phases of development keep in step with the most up-to-date requirements.

### **Justification**

The study recognises that the majority of opportunities to reduce carbon emissions will arise from the urban extensions around the edge of Cambridge. However, in most cases AAPs have been adopted or outline planning permission granted, reducing opportunities to influence the sustainability targets for these developments. However, sight should not be lost of the potential for future reviews of adopted documents and for developers to seek to either renegotiate existing planning consents or submit reserved matters for individual phases following adoption of the Core Strategy. Accordingly provision has been made within the above policy to capture those larger sites, whether directly through this policy or through future amendments to AAPs.

Other development in the city is likely to be small-scale where viability issues, both in terms of technology and economics are likely to be of greater significance. Such development should make a contribution to carbon emissions reductions wherever possible, but account has been taken of viability issues with respect to achieving higher levels of carbon reduction through measures adopted within the site boundaries.

In terms of alignment with the proposed new policies of the Planning for a Low Carbon Future consultation, policy LCF9 is relevant. This states that local requirements should be specified in terms of nationally described sustainable building standards. Alignment with this policy is achieved by setting the targets in terms of CSH and BREEAM standards. LCF9 further states that local requirements should relate to development area or specific sites except where an energy/CO<sub>2</sub> standard is justified. The cost analysis in section 8.2 indicates that the cost increment of complying with the policy is reasonable across a broad range of development types consistent with expected development in the area.

Provided that zero carbon homes policy is brought forward in the timescales proposed by Government, all new housing delivered after 2016 will be net zero carbon. The carbon compliance level expected to be required by zero carbon policy is 70%, although this is still subject to change. The cost analysis presented in section 8.2 suggests that this level of carbon compliance although demanding, should be achievable. To ensure high levels of carbon reduction are achieved, this policy recommends that the 70% carbon compliance level is adopted one stage earlier than its introduction through national regulations. Enshrining the 70% carbon compliance level in local planning policy will also provide the opportunity to maintain a high onsite CO<sub>2</sub> reduction requirement, should zero carbon policy be amended to dilute the ambition in terms of onsite reduction.

At this time, it is recommended that the Code level requirement is maintained at Code Level 4. A policy requiring a higher Code Level standard (5 or 6) would increase the carbon compliance level required and would be difficult to achieve in many of Cambridge's smaller sites. In the longer term, an amendment to the Code for Sustainable Homes policy may be made, in order to bring the highest levels of the Code into line with the zero carbon policy (i.e. to harmonise the carbon compliance standards required by Code Levels 5 & 6 with that required by zero carbon policy). If such a change were made, a revision of this local policy to require a higher Code Level from 2016 might be considered. Under these circumstances, a higher Code level requirement would no longer impose a higher CO<sub>2</sub> reduction standard, but would require developers to go further in terms of the other sustainable design and construction criteria.

In line with Government policy we suggest that priority is given to on-site measures in the first instance with energy efficiency a priority. Other on-site or wider site measures should then be considered, including low carbon, renewable energy and decentralised energy schemes. Where it can be shown that the level of carbon reduction achieved by these means on a particular site does not meet the targets set out under this policy, then the potential for a one-off contribution towards offsetting a development's carbon reduction requirement should be considered. This will potentially be of benefit to the small-scale developments likely to come forward within the city.

Contributions generated by development will need to be calculated based on the particular characteristics of the development and would benefit from a simple formulaic approach, as used in Milton Keynes. A standard sum required per tonne of carbon emissions that a development is not able to reduce would be appropriate and could be collected via the existing Section 106 mechanism identified above. The Council would need to consider how this money would be spent. At present Cambridgeshire Horizons is considering the potential to set up a Carbon Offset Fund, which could potentially take such contributions and use them to provide carbon savings either in Cambridge or the wider area.

### Proposed option 4: The provision of community energy networks

In order to promote the use of community energy schemes including where a CO<sub>2</sub> benefit can be realised and these are deemed to be feasible in economic and technological terms, the following option is proposed:

- Applications for major developments should show that the potential for community energy networks has been explored.<sup>61</sup>
- Regardless of the number of homes in a proposal, where an existing local community energy network is established, developments will be expected to connect to the network, if feasible.

Where community heating schemes are proposed within the city centre consideration shall be given to the means by which such schemes are fuelled, having regard to the presence of the existing air quality management area.

### Suggested supporting text

District heating involves the use of centralised heating plant to meet the thermal demands of a number of buildings. The economies of scale gained by this approach lead to potential advantages, including:

- Improved economic viability of low carbon heating plant such as biomass boilers.
- Potential to use combined heat and power (CHP), whereby carbon benefits can be achieved by generating electricity locally and making use of the associated heat produced.

Larger scale developments have the greatest potential to incorporate CHP schemes, particularly where there is a diversity of heat requirements whether on site or in the surrounding area that can be connected to the network. Studies have shown that the main opportunities for CHP schemes are within the urban extensions. A number of these areas have or are expected to give consideration to the incorporation of such schemes.

### Justification

This study shows that the potential for district heating systems is relatively limited in Cambridge, with relatively few areas identified as having potential. This is in part due to the location of most areas of high demand within the city's AQMA. Notwithstanding this, where there is potential the above policy will ensure that developers as a minimum consider the feasibility of providing a community energy system. Where this is put in place (or exists already) opportunities to connect to it should be capitalised upon, where feasible. Accordingly it is considered that a community heating policy is appropriate.

The majority of the urban extension sites either have adopted AAPs or planning permissions in place, which reduces the potential for CHP to be encouraged at this stage. However, should reserved matters or revised proposals be submitted, an AAP be updated, or a new AAP prepared, the above policy provides an opportunity to justify the inclusion of district heating networks, subject to the usual viability issues.

<sup>61</sup> Large developments referred to in this policy include developments of ten or more dwellings or 1,000m<sup>2</sup> of commercial or mixed-use space.

### Proposed Option 5: Renewable energy

Opportunities for stand-alone renewable energy schemes within Cambridge are limited and new projects within the city are likely to be relatively small scale. Even so, the Council wishes to support renewable energy projects that will contribute towards overall carbon reduction targets for Cambridge, without an unacceptable impact on the local environment. This option relates to proposals for renewable energy developments, including ancillary infrastructure or buildings, which should be permitted where applicants can demonstrate that:

- Adverse impacts on the environment or on amenity have been minimised as far as possible.
- Where any localised adverse environmental or amenity effects remain, that these are outweighed by the wider environmental, economic or social benefits of the proposal.

Where suitable sites for renewable energy are identified, they will be brought forward through the Site Specific Allocations DPD.

#### Suggested supporting text

Renewable sources of energy can contribute to increasing the diversity and security of supply of energy and can reduce harmful emissions to the environment. The Government's target is to generate 10% of UK electricity from renewable sources by 2010, with an aspiration for 15% of the UK's energy use to come from renewables by 2020.<sup>62</sup>

The Council recognises that the opportunities for stand-alone renewable energy schemes within Cambridge are relatively limited. However, it is keen to support opportunities where they arise, in particular small-scale and community schemes that are most likely to be viable within the city. The proposed urban extensions offer a more realistic opportunity for renewable energy schemes, which should be capitalised upon wherever possible.

Applicants are expected to have taken appropriate steps to mitigate any adverse impacts through careful consideration of:

- Location, scale, design and other measures, including those necessary to minimise noise impacts.
- Cumulative impacts.
- Impacts on landscape, the built environment, biodiversity and cultural heritage.

Potential impacts may be acceptable if they are minor, or are outweighed by wider benefits, including the need for energy from non-fossil fuels, which will contribute to reducing CO<sub>2</sub> and other emissions.

Other policies in this DPD concern safeguarding of the environment and the protection of international, national or locally designated sites with further protection offered by national policy. Although such sites should be avoided if alternative sites exist, each application will be judged on its merits, and renewable energy schemes will not automatically be ruled out at these sites.

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<sup>62</sup> The 15% target refers to all energy and comes from the overall EU target of 20% of energy from renewables in the EU by 2020.

Renewable energy schemes within the Green Belt will often comprise inappropriate development, which may impact on the openness of the Green Belt. Applicants will be required to demonstrate that development is either appropriate, or where it is inappropriate, that there are special circumstances for development in this location. Special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources.

### **Justification**

The existing policy (8/17 – Renewable Energy) set out within the adopted plan provides adequate support for the development of stand-alone renewable schemes that can make a valuable contribution to cutting carbon emissions within Cambridge. It is recognised that the contribution will not be direct, as with building or scheme integrated energy efficiency, low carbon, renewable or decentralised energy schemes, as the energy produced by stand-alone schemes will generally be fed into the national grid. However, this forms another part of the holistic approach to reducing carbon emissions nationally.

We have suggested a number of amendments to bring the policy more in line with current Government thinking, and to make more explicit reference within the supporting text to the issues that should be considered, the benefits that may outweigh any residual adverse effects and to the particular issues that Cambridge faces in terms of the Green Belt and the historic environment. It is envisaged that the DPD will contain other policies that relate to these and other issues and make reference to appropriate national planning policy statements, thereby obviating the need to explain these issues at length.

## 9.2.2 Other suggested local planning authority actions

### Proposed housing sites

In assessing the suitability of sites for development, for example through the SHLAA or when producing the Site Specific Allocations DPD, Cambridge City Council should adopt criteria to account for carbon and climate change impacts. For example, the potential for decentralised energy at a new site and the potential for new development to contribute heat demand to enhance the viability of community heating.

### SPD on sustainable design and construction

The current SPD on Sustainable Design and Construction provides detailed information to applicants on the Council's requirements to support existing policies. In light of the above options, if these were to be developed into policies in the Core Strategy or other development plan documents, the SPD would need to be updated. This would ensure that it reflects these policies and provides greater detail in respect of the energy requirements of the Core Strategy, and is updated to reflect the state of national policy. More detailed guidance could be provided on the measures that should be considered in respect of the energy hierarchy and any particular issues that these might raise.

The SPD should also provide more detailed information of the Council's approach to offsetting carbon emissions through the provision of a financial contribution, potentially into a Carbon Offset Fund. This should draw upon the work undertaken for Cambridgeshire Horizons in relation to the potential for a regional Carbon Offset Fund.

We suggest that consideration is given to the content of those SPDs referred to in Appendix 11.2, which provides a useful guide as to what may be included in a revised SPD.

### Planning obligations SPD

In respect of the proposed policy requirement for financial contributions to be made where development is not able to meet the carbon emissions reductions required by policy, further details should be provided within an updated planning obligations SPD in line with Circular 05/05. We understand that a revised SPD has been published and it is acknowledged that further updates of this document may not be possible in the short term.

### Community Infrastructure Levy (CIL)

Since 2008 Cambridgeshire Horizons has been developing proposals for the introduction of a variable rate tariff (VRT) across the county. This would have been introduced through the individual authorities within the County. This was intended to ensure that the costs of mitigating the impact of development on its surrounding through the improvement of existing or provision of new infrastructure were properly dealt with. Following publication of the detailed proposals and draft regulations for CIL in 2009 the Cambridgeshire local authorities, in particular Huntingdonshire and East Cambridgeshire District Councils, has been moving towards the implementation of CIL rather than VRT, although the proposals are similar.

CIL is intended to ensure that costs incurred in providing infrastructure to support the development of an area can be funded (wholly or partly) by owners or developers of land. This could include the provision of more strategic low carbon or renewable energy infrastructure within Cambridge, or potentially beyond Cambridge.

If Cambridge City Council is to take CIL forward the following will be required:

- A county-wide infrastructure plan (the Integrated Development Programme), supported by an evidence base, that identifies low carbon or renewable energy projects or types of projects
- A local authority infrastructure plan that also identifies low carbon projects or types of projects,

In addition consideration should be given to the following:

- Including reference to the use of CIL within the Core Strategy, either separately or through the provision of a comprehensive policy that deals with developer contributions
- Setting out details on the application of CIL within SPD, supplementing the Council's charging schedule

### Micro-renewable energy guidance

It is acknowledged that the micro-renewable energy guidance has only recently been published. We recommend, however, that it be reviewed in light of emerging policies to confirm whether or not any changes are required.

### Local list requirements

Local list requirements set out the information required by the planning team in order to evaluate an application. Some of the local requirements adopted by Cambridge City Council include:

- Air Quality Assessment
- Biodiversity Survey and Report
- Environmental Statement
- Flood Risk Assessment
- Lighting Assessment
- Noise Impact Assessment
- Transport Assessment

The full list includes 27 separate requirements and is available from the Council's website.<sup>63</sup> The Council should review its local list requirements to tie in with emerging policy requirements.

### Model planning conditions and Section 106 obligations clause

To assist with delivery of low carbon and renewable energy generation and the provision of financial contributions, where this is appropriate, it would be beneficial to put in place model planning conditions and Section 106 obligations. These would make the process of determining applications, including negotiations with applicants, easier and would provide developers with greater clarity as to the Council's requirements. Conditions used could be

<sup>63</sup> [www.cambridge.gov.uk/public/pdfs/planningapplications/Local\\_List.pdf](http://www.cambridge.gov.uk/public/pdfs/planningapplications/Local_List.pdf).

along the lines of those used by Ashford Borough Council and Bedford Borough Council, whilst Milton Keynes uses a standard Section 106 as the basis for developer contributions.

**Monitoring of policy option impacts**

An important consideration is the monitoring of the proposed options detailed above. The Council must produce an Annual Monitoring Report under the Planning and Compulsory Purchase Act 2004. It contains information about the city and how it is changing each year in relation to planning policies used to determine planning applications.

The Council produces information based on national indicators and local indicators. In respect of the former this includes renewable energy generation which will continue to provide an appropriate means of monitoring proposed Policy 5. Local indicators currently in use are as follows:

| Site           | Indicator number | Indicator                          | Indicator type | Related preferred policy option | Targets  |
|----------------|------------------|------------------------------------|----------------|---------------------------------|--|
| NW Cambridge   | NWC10            | Renewable energy installed by type | Core           | NW24                            | 1) Percentage of the development's energy requirements provided by renewable energy (at least 20% required), and (2) Percentage of the development served by a Combined Heat and Power (CHP) plant or a district heating scheme fuelled by renewable energy sources. |
| Cambridge East | CE07             | Renewable energy installed by type | Core           | CE/24                           | Renewable energy to provide at least 10% of predicted energy requirements.   |

Taken from NW Cambridge Area Action Plan (p.61) and Cambridge East Area Action Plan (p.144).

Additional indicators are likely to be required in respect of the proposed policies above. We suggest that the following are considered:

| Policy reference  | Indicators   | Notes   |
|---|--|---|
| Proposed option 1:<br>Targets for emissions in Cambridge  | Number of homes and non-residential buildings completed by improvement on minimum mandatory emission rate. This could be banded – e.g. 0-5%, 5-10%, 10-20%, 20-30%, 30-50%, 50-70%, 70-100%, >100% improvement on regulated emissions. | This would require the Council to record details of the energy statements (and / or SAP / SBEM outputs), which would show the level of improvement achieved. This would require good communications between the planning team and other relevant parties such as the Building Control Body.   |
| Proposed option 2: Sustainability, design and construction and option 3: Sustainability standards | Number of homes completed by Code standards and non-residential floor area completions by BREEAM level.  | Recording completions by CSH and BREEAM levels will provide a useful indication of the effectiveness of proposed options 2 and 3.   |
| Proposed option 4: The provision of community energy networks                                     | Number of sites and homes / buildings connected to low carbon district heating networks.   | These data should be put in context by comparison with the total number of completions to show the extent to which community heating systems are being developed.   |
| Proposed option 5: Renewable energy   | Number of low carbon and renewable energy installations by technology type.<br>Total installed capacity of low carbon and renewable energy technologies by technology type.  | Recording the uptake of low carbon technologies will provide the Council with valuable data on the effectiveness of proposed option 5. A further desirable metric to record would be energy produced by renewables (which could be compared to energy consumption data for the city), but collecting this level of data is a significant challenge. |

## 10 Summary of Delivery Mechanisms

Cambridge City is expected to experience significant growth in the coming years. A component of the city's strategy for reduction of the carbon emissions footprint must therefore be to ensure that carbon emissions associated with this growth are minimised. The City Council can influence this in a number of ways. The Local Planning Authority can set development control policies requiring certain levels of CO<sub>2</sub> reduction or renewable energy generation, as discussed in Section 9.2. The City Council may also be able to take an active role in delivering the low carbon energy infrastructure that will enable low carbon growth, for example community heating systems.

Controlling the emissions from new developments will be important and is an area that the local authority can clearly influence. There are, however, significant opportunities to reduce emissions by improving the condition of the existing stock. Although the local authority's role here is less clear (outside of improving their own stock) there may be actions that the council can take to accelerate the rate of improvement to the existing stock and reduce its carbon emissions footprint.

In this section, the range of delivery mechanisms to ensure low carbon growth, aid delivery of key low carbon infrastructure and promote improvements to the existing stock are summarised, with particular emphasis on those mechanisms where the local authority has a role to play.

### 10.1 New developments

The housing stock in Cambridge is expected to grow by 14,000 new homes between now and 2026. This is equivalent to a 28% increase on the current housing stock and is likely to be accompanied by an increase in the quantity of employment and community space in similar proportions. This is a period of very significant growth for the city and it is therefore vital to ensure that opportunities for low carbon development are capitalised upon.

The strongest driver for low carbon growth in the city over this period will be changes to the Building Regulations and introduction of zero carbon policies for both homes and non-domestic buildings, as described in Section **Error! Reference source not found.** The standards of CO<sub>2</sub> emissions reduction set out in these regulations will have to be achieved as a minimum in all new development in the city. The local planning authority may be able to push for deeper carbon reductions, or assist developers in meeting the regulatory requirements in the optimum fashion. The key delivery mechanisms for carbon reduction in new development are summarised below.

#### 10.1.1 Key delivery mechanisms

##### Building Regulations and Zero Carbon Homes and Non-domestic Buildings policy

These will be key drivers for change in CO<sub>2</sub> emissions performance of new developments, which must be met in all development. Following the introduction of zero carbon policies in 2016 and 2019 for domestic and non-domestic sectors respectively, developers will be required to act to reduce or offset all emissions from their development, such that no further intervention from the local planning authority (in terms of carbon emissions) should be

required. There may be a role for the local authority in achieving carbon reductions through allowable solutions, however, as discussed below.

### Allowable Solutions

Under zero carbon policy only part of the CO<sub>2</sub> emissions of a development is expected to be reduced through measures taken on site, the remainder is to be delivered through investment in allowable solutions, which may include offsite measures (allowable solutions are introduced in Section 3.5.2). The Local Authority could assist developers to identify local opportunities for delivering carbon reduction, which could be contribute to meeting their allowable solutions commitments. This assistance could be at a number of levels. At the most basic level, the Local Authority may simply work with developers to identify local opportunities for investments that would deliver carbon reductions and that would offset the emissions from their developments. Potential carbon reduction projects could be based on local authority land or properties, in which case the authority could grant a lease or a license to operate a project in which the developers make their allowable solutions investment.

There are a number of further routes whereby the local authority can play a role in delivering CO<sub>2</sub> reductions through allowable solutions. The potential role of a Carbon Offset Fund (COF) was described in Section 3.6 and is the subject of a detailed scoping study by Cambridgeshire Horizons. Essentially the COF would be a fund that developers pay their allowable solutions contributions in to and in so doing discharge their obligation under zero carbon policy. It would then be the responsibility of the COF to identify and invest in suitable project opportunities to deliver the carbon reductions. The COF would most likely be a partnership between a number of local authorities, for example Cambridge City and the four other district councils in Cambridgeshire plus the County Council, in order to generate a fund of significant scale and to increase the geographical scope for developing carbon reduction project opportunities (i.e. it would be the intention of the fund that monies collected in relation to development in each of the partnering local authority areas are pooled and spent anywhere within the participating districts). A special purpose vehicle would be set up to administer the COF, managed separately from the participating authorities, but accountable in terms of the CO<sub>2</sub> reduction its investments deliver per pound invested. The COF would basically act as a conduit for the allowable solutions investments of developers into the most cost-effective and highest potential projects in the participating authority areas. As an example, investment from the many small sites across Cambridge City could be pooled in the fund, together with investment from other participating authorities, in order to deliver low carbon energy infrastructure in the Urban Extensions, where the scale of development means that CO<sub>2</sub> reduction can be delivered more cost-effectively.

To deliver larger-scale low carbon energy infrastructure, such as district heating systems or large renewables projects will require the involvement of private sector partners. The COF may invest in joint ventures with private sector partners in order to deliver these projects, for example by establishing project ESCOs. In order to attract private sector investment these would need to be projects that provide an attractive rate of return (although the element of public sector investment would help to de-risk these projects for the private sector). The returns to the COF would enhance the size of the fund, for subsequent re-investment in other low carbon projects.

## Local Planning Policy

As discussed, Building Regulations will impose increased carbon reduction requirements on new developments on the path to zero carbon policy. In certain cases, it may be justified for the local authority to set targets for carbon reduction that are in advance of the standard required by Building Regulations. These targets should be set in the form of nationally recognised standards such as the Code for Sustainable Homes. The implications for development costs of setting standards in advance of Building Regulations in the period leading up to introduction of zero carbon policy is discussed in Section 8.2 and the form of potential policies is discussed in Section 9.2.

A planning policy that requires a level of carbon reduction in advance of Building Regulations could be linked to a Carbon Offset Fund and may provide an income into the fund prior to 2016 and the introduction of allowable solutions. The local policy could be framed such that developers are required to achieve a certain level of CO<sub>2</sub> reduction that is higher than required by the Building Regulations in force at the time, but that also allows a commuted payment into the offset fund if the developer can show that the onsite CO<sub>2</sub> reduction requirement is particularly onerous in the case of the particular development.

## Financial Incentives

Government is committed to meeting EU 2020 targets for renewable energy supply and is putting a supportive policy framework in place to foster rapid acceleration of uptake of renewables. These policies include financial incentives such as the Clean Energy Cashback Scheme, more commonly known as the feed-in tariff (FiT), and the proposed Renewable Heat Incentive (RHI). The availability of these incentives is expected to influence the methods adopted by developers in meeting high carbon reduction requirements and may have implications for the ways that onsite generation is financed.

The relatively high level of incentives offered under the FiT for renewable electricity generators of less than 5MW is likely to provide a driver for incorporating larger amounts of onsite renewable energy generation. Under zero carbon homes policy, for example, this may have the effect of reducing the amount of investment going into allowable solutions, as developers seek to achieve higher levels of CO<sub>2</sub> reduction using onsite technologies. The high levels of support offered for photovoltaics (PV) in particular may drive developers to maximise the amount of PV incorporated into developments.

In order for the FiT to change developers approaches to achieving high levels of CO<sub>2</sub> reduction, such as the zero carbon standard, then a model will need to be developed that allows them to benefit from the incentives. Either the developers will seek to capitalise the value of the incentives that will be accrued over the lifetimes of technologies installed or, potentially, developers make consider models whereby they retain ownership of the generators installed within the developments. Given that continued ownership of renewable energy generating equipment is well outside the developers exiting businesses, it is likely that their preferred option would be to capitalise the value of the revenues. One way to do this would be to increase the sale value of the property. There is little evidence at the current time that property-buyers, particularly home-buyers, are prepared to pay a premium for renewable energy technologies installed in the properties. This may change, however, as the potential income generated under the feed-in tariff becomes more widely recognised. Even if increased sale price is not a commercially acceptable option for developers, it is likely that third party organisations will enter the market to offer finance for installation of technologies such as

photovoltaics, within new development. These organisations will finance the whole or part of the cost of the installation on the basis of revenues received from the feed-in tariff.

The RHI policy is running behind the FiT and is expected to be introduced in 2011. The RHI is not expected to be limited in terms of the scale of the technologies that are eligible for support, such that a tariff will be available for installations ranging from domestic scale all the way to large-scale renewable-fuelled plant serving district heating networks or industrial sites. The levels of tariffs that will be offered to various technologies across the size bands are currently under review as government further develops the policy. Until the details of the policy are better defined, it is uncertain what impact the policy will have on the approaches developers take. It is likely, however, that the incentive will improve the economics of community-based heating systems served by biomass-fuelled energy centres. The incentive may also stimulate the development of third-party financing for technologies installed at the individual property scale, similarly to those expected to form around the FiT.

## 10.2 Improvements to the existing stock

Cambridge City Council has recently performed a housing condition survey, which has provided a wealth of information on the condition and scope for improvement of the housing stock. The survey found that of a total stock of 41,500 dwellings, there is scope for improvement in 95% (39,400 dwellings). The energy efficiency measures that could be carried out are tabulated below:

**Table 9: Summary of opportunities for energy efficiency improvements in Cambridge’s housing stock, based on the Housing Condition Survey**

| Measure                    | Dwellings | Percent of stock |
|----------------------------|-----------|------------------|
| <b>Loft insulation</b>     | 37,100    | 89.5%            |
| <b>Wall insulation</b>     | 12,100    | 29.2%            |
| <b>Double glazing</b>      | 12,300    | 29.7%            |
| <b>Cylinder insulation</b> | 20,000    | 48.2%            |
| <b>New boiler</b>          | 7,500     | 18.1%            |
| <b>New central heating</b> | 500       | 1.2%             |
| <b>Any measures</b>        | 39,400    | 95.0%            |

The Housing Condition Survey states that the total cost of all improvement measures tabulated above is estimated at £115million. The great majority of this potential improvement is in households that are not in fuel poverty – £110m of the total.

Energy efficiency improvements typically provide relatively cost-effective CO<sub>2</sub> reduction. Encouraging householders to act to improve the energy efficiency of their homes, however, is notoriously difficult, particularly in the case of the owner-occupier and private rented sectors.

Applying assumptions for the average CO<sub>2</sub> reduction delivered by each measure (for the average measure), results in an estimated total lifetime CO<sub>2</sub> saving of these measures of 625,000 tonnes.

## 10.2.1 Key delivery mechanisms

### Carbon Emissions Reduction Target (CERT) / Supplier Obligation

One of the principle mechanisms to incentivise energy efficiency improvements in the existing stock has been the CERT scheme, which has been running in some form since 2001 (earlier phases were known as the Energy Efficiency Commitment). The scheme is an obligation on the major energy supply companies to deliver a certain amount of CO<sub>2</sub> reduction by investing in energy efficiency improvements in their customers' homes. This has been provided in the form of relatively generous grants to householders, particularly 'Priority Group' householders (those on some form of income support or with elderly household members), to undertake measures such as loft and cavity wall insulation, lagging cylinders, draught-proofing and switching to low energy light bulbs. The current phase of the CERT scheme will run until 2011, but some form of supplier obligation is expected to continue to run to at least 2020.

The local authority can potentially assist energy suppliers in encouraging homeowners to take up the opportunity of funding under the CERT or its successor scheme. The authority could also provide a further financial incentive for homeowners to take up CERT funding. An example of this is the British Gas Council Tax Scheme, initially trialled by Braintree Council but now extended across many more local authorities, whereby householders that invest in cavity wall insulation, subsidised by CERT, receive a further council tax rebate of up to £100. Alternatively, a model could be developed to enable funding from a Carbon Offset Fund to be used to match-fund the subsidy that householders receive under CERT.

### Salix Finance

Salix Finance was set up in 2004 to accelerate public sector investment in energy efficiency technologies through invest to save schemes. Salix provides low interest loans to local authorities and other public bodies, to cover the capital costs of energy efficiency improvements and small-scale renewables projects.

### Financial Incentives

The financial incentives for renewables will encourage increased uptake of retrofit of renewable energy generation in the existing stock. The Renewable Heat Incentive in particular, if it goes ahead as currently proposed, may encourage fuel switching from gas to biomass or efficient electric heating technologies (i.e. ground source and air source heat pumps, although these technologies are currently less proven). The FiT is expected to encourage a large increase in the uptake of retrofit PV systems and already companies are offering low cost installations to homeowners in deals where the homeowner benefits from the electricity and the financing company takes the feed-in tariff revenue. The incentives offered under these policies and the activity likely to be stimulated in the private market means that no intervention, in terms of funding, is likely to be required from the local authority. The local authority may play a role in providing information on the existence and benefits of the incentive regime.

### 10.3 Low carbon energy infrastructure

The assessment of low carbon energy opportunities and resources in Cambridge has confirmed that the opportunities for large-scale low carbon energy infrastructure are somewhat limited. There are potential opportunities for district heating systems in the large urban extension sites around the city centre, which should be explored. In the case of the Bell School site, its proximity to some existing substantial heat loads, such as the Addenbrookes Hospital, presents a potential opportunity for extension of a district heating system originating in the new development to be extended and export heat to the existing stock.

The opportunities for wind energy development within Cambridge City are highly constrained, although better opportunities do exist in the neighbouring local authority areas. Biomass has been identified as potentially playing an important role in the low carbon growth of Cambridge. Potentially there is a significant local resource, although the supply chain is under-developed and fragmented.

#### 10.3.1 Delivery mechanisms

There are a number of policies that the city council can include in the local development framework to support the development of low carbon energy infrastructure, as follows:

- Renewable energy projects should be encouraged through a generally supportive set of local planning policies, in line with PPS1 and PPS 22. Potential forms of appropriate policies are discussed in Section 9.2.
- In some cases, local planning policy might specifically identify areas of priority for renewable energy development and potentially encourage development of projects on Council-owned land (although it is not clear that there is an opportunity for this kind of intervention within Cambridge City area).
- The main opportunities for new district heating systems are in the urban extension sites. The best retrofit opportunities are in and around the city centre. Planning policy should require developers to explore the potential of district heating and connect into or develop systems where appropriate. An appropriate policy option is discussed in Section 9.2. Revision to the Area Action Plans for the urban extension sites may be considered to ensure opportunities for district heating are fully explored.
- Where there are opportunities to extend a district heating system into the existing stock, for example around the Bell School site, the local authority can make commitments that public sector buildings will connect.

In addition to supportive planning policy, the local authority could take a more active role in facilitating the development of low carbon infrastructure. Projects such as developing district heating systems in the urban extensions are the kind of project that a carbon offset fund may support, using allowable solutions investments from projects across the city and the other participating authorities to support the most beneficial and cost-effective carbon reduction initiatives. In order to develop infrastructure such as district heating, the offset fund would most likely enter into joint ventures with private sector companies, forming project ESCOs to deliver the projects.

Even in the absence of an offset fund, there may be mechanisms for the public sector to provide financial support to develop infrastructure projects. The Low Carbon Development

Initiative (LCDI), for example, has been set up with public sector funding and a remit to instigate low carbon infrastructure projects. The LCDI will provide early investment in projects, developing them to a stage where they are sufficiently de-risked, such that the private market is prepared to invest. The LCDI's involvement is intended to be short term, accepting the early development risk before selling the project on to commercial developers. The LCDI is a not-for-profit community interest company, such that any profit from investments is reinvested in further opportunities.

The Community Infrastructure Levy, if adopted by the city council, could also provide a source of funding for low carbon infrastructure projects, as discussed in Section 9.2.2. The local authority would need to identify projects that they would like to fund, for example district heating systems in the urban extension sites, and ensure they are identified in the Strategic Infrastructure Programme and Local Infrastructure Framework. In principle this would allow CIL contributions to be used to fund these projects. It is important to note, however, that based on the initial consultation on zero carbon homes and non-domestic buildings, CIL has not been favoured as a type of allowable solutions. Opportunities to invest CIL revenues in low carbon infrastructure will therefore compete with the other types of infrastructure development that the local authority may wish to fund through CIL.

## 11 Appendices

### 11.1 Details of emerging national planning policies

#### 11.1.1 Planning Policy Statement 1 Supplement: Planning for a Low Carbon Future in a Changing Climate consultation

Consultation on the replacement of the PPS1 Supplement and PPS22 with a new Planning Policy Statement: **Planning for a Low Carbon Future in a Changing Climate** commenced in March 2010. The following policies are relevant:

##### 11.1.2 Policy LCF 1

Policy LCF1.4 concerns the need for local authorities to assess their area for opportunities for decentralised energy. The focus is intended to be on opportunities at a scale, which could supply more than an individual building and include up-to-date mapping of heat demand and possible sources of supply. Local authorities will be expected to look for opportunities to secure:

- i. *“decentralised energy to meet the needs of new development;*
- ii. *greater integration of waste management with the provision of decentralised energy;*
- iii. *co-location of potential heat suppliers and users; and,*
- iv. *district heating networks based on renewable energy from waste, surplus heat and biomass, or which could be economically converted to such sources in the future.”*

At the regional level, the regional strategy will need to set ambitious targets for renewable energy, which are to be regarded as minima. These will need to be taken into account in preparing LDFs.

##### 11.1.3 Policy LCF 4

Policy LCF4 sets out the local planning approach for renewable and low carbon energy and associated infrastructure. It is of key importance to how policies concerned with delivery through development management should be set out. It states:

*“LCF4.1 Local planning authorities should:*

- i. *design their policies to support and not unreasonably restrict renewable and low carbon energy developments;*
- ii. *ensure any local criteria-based policies, including local approaches for protecting landscape and townscape, that will be used to assess planning applications for renewable and low-carbon energy and associated infrastructure:*
  - a. *provide appropriate safeguards, so that any adverse impacts are addressed satisfactorily, but do not preclude the development of specific technologies other than in the most exceptional circumstances;*

- b. *expect the scale and impact of developments in nationally recognised designations to be compatible with the purpose of the designation;*
- c. *are informed by the approach and policies set out in the National Policy Statements for nationally significant energy infrastructure;*
- iii. *ensure the development of renewable energy in any broad area set out in the regional strategy for where the substantial development of renewable energy is anticipated is not prejudiced by non-energy developments;*
- iv. *set out how any opportunities for district heating (to supply existing buildings and/or new development) identified through heat mapping will be supported;*
- v. *set out the decentralised energy opportunities that can supply new development proposed for the area; and,*
- vi. *support opportunities for community-led renewable and low carbon energy developments, including the production, processing and storage of bioenergy fuels.*

*LCF4.2 Strategic sites which are central to delivering the local planning approach for decentralised energy should be allocated in the core strategy.”*

#### 11.1.4 Policy LCF 6

In selecting sites for new development Policy LCF6 requires local authorities to assess their suitability for new development in respect of a range of low carbon and climate change issues, for example, the potential for decentralised energy and the potential to contribute heat demand.

#### 11.1.5 Policy LCF 7

Policy LCF7: Local planning approach to setting requirements for using decentralised energy in new development states:

*LCF7.1 Local requirements for decentralised energy should be set out in a development plan document (DPD) and be derived from an assessment of local opportunities in line with LCF1.4. Local requirements for decentralised energy should:*

- i. *relate to identified development areas or specific sites;*
- ii. *be consistent with giving priority to energy efficiency measures; and,*
- iii. *focus on opportunities at a scale which developers would not be able to realise on their own in relation to specific developments.*

*LCF7.2 Local requirements should be consistent with national policy on allowable solutions set out in support of the zero carbon homes and buildings policy.*

Where there are existing or firm proposals for decentralised energy supply systems with capacity to supply new development, LCF7.3 provides for local planning authorities to place an expectation on proposed development to connect to an identified system, or be designed to be able to connect in future. In allocating land for development, DPDs should set out how the

proposed development would be expected to contribute to the decentralised energy supply system.

LCF7.4 specifies how local targets for the use of decentralised energy in new development should be expressed, that is either as:

- the percentage reduction in CO<sub>2</sub> emissions to be achieved. In doing so, local planning authorities should set out how the target relates to standards for CO<sub>2</sub> emissions set by Building Regulations; or,
- an amount of expected energy generation expressed in kWh.

LCF7.5 states that *“Where a local requirement relates to a decentralised energy supply system fuelled by bioenergy, local planning authorities should not require fuel sources to be restricted to local sources of supply.”*

### 11.1.6 Policy LCF 8

Given the forthcoming revisions to Part L of the Building Regulations, Policy LCF8<sup>64</sup> states that post 2013 the setting of targets across a local authority area will be unnecessary. In the interim the Secretary of State will support such targets in a development plan.

### 11.1.7 Policy LCF 9

In respect of the approach to setting requirements for sustainable buildings Policy LCF9 establishes a need for any local requirement for a building’s sustainability to be set out in a DPD. It should:

- i. *“relate to a development area or specific sites and not be applicable across a whole local authority area unless the justification for the requirement can be clearly shown to apply across the whole area;*
- ii. *not require local standards for a building’s performance on matters relating to construction techniques, building fabrics, products, fittings or finishes, or for ensuring a building’s performance; and,*
- iii. *be specified in terms of achievement of nationally described sustainable buildings standards. In the case of housing, this means a specific level of the Code for Sustainable Homes. Where local circumstances do not support specifying compliance with an entire Code level (because of the range of environmental categories covered) – or envisaged development could not attain the relevant Code level on all environmental categories – a local requirement can be stipulated solely in relation to the energy/CO<sub>2</sub> emissions standard and/ or water standard in an identified level of the Code.”*

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<sup>64</sup> Policy LCF8: Local planning approach to setting authority-wide targets for using decentralised energy in new development.

### 11.1.8 Policy LCF 13

Policy LCF13.2 states that local planning authorities should expect proposals to be designed to, amongst other things, reduce greenhouse gas emissions through a variety of measures including those related to:

- Site design.
- Building design.
- Adopting opportunities to support decentralised energy, to connect to an existing supply or be designed for future connection.

Proposals for major development (10 or more dwellings or 1,000sqm or more of commercial space) will be expected to demonstrate in their Design and Access Statement how the above requirements have been met. Where a proposal fails to meet criteria contained in LCF13.2 planning applications should be refused unless it can be demonstrated that meeting a criteria is not feasible. Under LCF13.4 innovation which secures well-designed, sustainable buildings is supported. It states that:

*“Planning permission should only be refused where the concern relates to a heritage asset protected by an international or national designation and the impact would cause material harm, or removal of significance in relation, to the asset and this is not outweighed by the proposal’s wider social, economic and environmental benefits.”*

### 11.1.9 Policy LCF 14

Policy LCF14 sets out a range of requirements for local planning authorities when considering proposals for renewable energy. These are:

- i. *“expect applicants to have taken appropriate steps to mitigate any adverse impacts through careful consideration of location, scale, design and other measures, including through ensuring all reasonable steps have been taken, and will be taken, to minimise noise impacts;*
- ii. *give significant weight to the wider environmental, social and economic benefits of renewable or low-carbon energy projects whatever their scale, recognising that small-scale projects provide a valuable contribution to cutting greenhouse gas emissions, and not reject planning applications simply because the level of output, or number of buildings supplied, is small;*
- iii. *not require applicants for energy development to demonstrate the overall need for renewable or low-carbon energy;*
- iv. *expect developers of decentralised energy to support the local planning approach for renewable and low-carbon energy set out in the local development framework and, if not, provide compelling reasons consistent with this PPS to justify the departure; but, otherwise, not question the energy justification for why a proposal for renewable and low carbon energy must be sited in a particular location;*
- v. *not refuse planning permission for a renewable energy project because a renewable energy target set out in the RS has been reached; but where targets have not been*

*reached this should carry significant weight in favour of proposals when determining planning applications;*

- vi. take great care to avoid stifling innovation, including by rejecting proposals for renewable energy solely because they are outside of a broad area identified in a RS for where substantial development of renewable energy is anticipated;*
- vii. where the proposed development is for a renewable energy technology included in the National Policy Statement for Renewable Energy Infrastructure, or associated infrastructure, expect applicants to follow the approach to assessment and apply themselves as far as practicable the approach to decision making and mitigation set out in National Policy Statements; and,*
- viii. recognise that when located in the Green Belt elements of many renewable energy projects will comprise inappropriate development, which may impact on the openness of the Green Belt. Careful consideration will therefore need to be given to the visual impact of projects, and developers will need to demonstrate very special circumstances that clearly outweigh any harm by reason of inappropriateness and any other harm if projects are to proceed. Such very special circumstances may include the wider environmental benefits associated with increased production of energy from renewable sources.”*

#### 11.1.10 Policy LCF 15

Policy LCF15 requires local planning authorities to consider the likely impacts of proposed development on:

- i. “existing or other proposed development and their supply of, or potential for using, decentralised energy; and,*
- ii. existing, or proposed, sources of renewable or low carbon energy supply and associated infrastructure.”*

Where proposed development would prejudice renewable or low carbon energy supply, amendments to a proposal should be considered, to make it acceptable. Where this is not achievable planning permission should be refused.

## 11.2 Details of examples of local planning policy

Details of the planning policies used by other councils summarised in section 3.3 are given below.

### 11.2.1 London Borough of Merton

The London Borough of Merton was the first local authority to include renewable energy targets in its adopted Unitary Development Plan (UDP), setting the target for all new non-domestic major developments in the borough to generate ten per cent of their energy through on-site renewable energy technologies. This became known as the ‘Merton Rule’, a planning requirement for developers to incorporate on-site renewables to generate a proportion of a development’s energy use. This can be measured through either a reduction of the development’s energy use or carbon dioxide emissions.

In 2003 Policy PE 13 of the UDP stated that:

*“All new non-residential development above a threshold of 1,000 sqm will be expected to incorporate renewable energy production equipment to provide at least 10 per cent of predicted energy requirements.”*

In May 2007, the council made two important revisions to this policy to increase the range of development affected by this policy and to relate the policy to carbon dioxide emissions. The updated policy now states:

*“The Council will require all developments, either new build or conversion, with a floorspace of 500m<sup>2</sup>, or one or more residential units, to incorporate on-site renewable energy equipment to reduce predicted CO<sub>2</sub> emissions by at least 10%”.*

The change from meeting a development’s energy use to a development’s carbon emissions was made to ensure that developers avoid installing carbon intensive technologies, such as electric heating. In addition, it is important to note that this renewables target relates to both regulated and unregulated emissions.

It should be noted that Merton Council is currently enforcing policies (4A.1-4A.13) contained in the London Plan 2008 in respect of carbon emission reductions, these being more up to date.

Merton is currently progressing its LDF. The draft Core Strategy was published for consultation in 2009. It includes updated policies to assist with mitigating climate change through a reduction in the area’s carbon dioxide emissions. Policy 9 states:

*“All minor and major development, including major refurbishment, will be required to demonstrate the following:*

- a) How it makes effective use of resources and materials, minimises water use and CO<sub>2</sub> emissions;*
- b) Use of the London Plan energy hierarchy concept;*
- c) How it is sited and designed to withstand the long term impacts of climate change, particularly the effect of rising temperatures on mechanical cooling requirements;*
- d) The adaptation of the building form and construction to make installation of sustainability measures viable. The onus will be on developers to robustly justify why full compliance with policy requirements is not viable.*

*Residential Development*

- e) We will require all new development comprising the creation of new dwellings to meet the highest commercially viable level of Code for Sustainable Homes (or any subsequently adopted set of national sustainable construction standards). Viability is defined as an increase in cost of no greater than 3% of predicted unit sales price. We will calculate this using the Merton Carbon Code Costs Calculator (MC3).*

*Commercial Development*

- h) *All minor and major commercial development will be expected to be built to a minimum of BREEAM (Building Research Establishment Environment Assessment Method) Very Good standard, and incorporate renewable energy generation in line with the requirements of the London Plan or national policy, whichever is the greater.*

The above policy is justified on the basis of supporting policies contained in the London Plan and the fact that due to its relatively dense urban nature 60-65% of CO<sub>2</sub> emissions arise from building stock. Supporting text to this policy outlines how technical and economic viability will be taken into account through the Merton Carbon Code Costs Calculator (MC3). The MC3 has been designed to assess the cost implications of achieving levels of Code for Sustainable Homes for different development types, sizes and locations across the borough. It allows factors such as resale values, housing market conditions and fluctuations in technology costs to be taken into account when setting Code level targets. It is intended to be used to inform the timescale of increases in Code level requirements across the borough as well as, where necessary, to assess the economic viability of individual developments.

Developments that fail to meet the required levels of sustainable design and construction will be expected to make a financial contribution to the Merton Carbon Reduction Fund (MCRF). The Council envisages that carbon growth resulting from new development will be minimized by requiring on-site carbon reduction measures. In residential development this will be driven by the requirements laid out in the Code for Sustainable Homes whilst in commercial development, on-site carbon reduction measures will be delivered through a combination of energy efficiency measures and on-site renewable energy generation targets in line with London Plan or national standards, whichever is the greater.

Where on-site renewable energy generation is proved to be impractical or result in an unacceptable impact on viability, a one-off payment in lieu may be made to the Merton Carbon Reduction Fund. The amount of this payment will be determined on a site-by-site basis and calculated in line with the methodology used to determine the size of Allowable Solutions contributions, as set out in the consultation document, "Definition of Zero Carbon Growth" (CLG, 2008).

It is understood from officers that amendments to the policies provided above are likely to be made in light of emerging policies contained in the consultation on the London Plan. These are detailed below.

A Sustainable Design and Construction SPD will be prepared to support the above policy and is expected to be available in November 2010. Merton intend to produce a Development Control DPD between 2011 and 2014 within which will be further detailed policies aimed at carbon emissions reduction and renewable energy development.

### 11.2.2 The London Plan

The London Plan provides the policy context for the whole of London. As such it forms part of the development plan for London. It was revised in 2008 and includes a range of planning policies concerned with climate change.

Supporting text contained in the plan recognizes that while planning policy can have a limited impact on existing buildings, it can strongly influence the way in which new development responds to the need for mitigation and adaptation. It suggests that the most cost effective way of incorporating sustainable design and construction methods is consider the need to

incorporate such measures at the earliest stage of planning and design.

Policy 4A.1 of the London Plan ‘Tackling Climate Change’ outlines the requirements for London Borough DPDs to adopt the following hierarchy in assessing applications to order to maximize a development’s contribution to the mitigation and adaptation to climate change and to minimize CO2 emissions:

- *“using less energy, in particular by adopting sustainable design and construction measures (Policy 4A.3)*
- *supplying energy efficiently, in particular by prioritising decentralized energy generation (Policy 4A.6), and*
- *using renewable energy (Policy 4A.7)”*

Further supporting text states that there will be a presumption that the targets will be met in full except where developers can demonstrate that in the particular circumstances of a proposal there are compelling reasons for the relaxation of the targets.

Policy 4A.2 sets out the Mayor’s targets to reduce CO2 emissions as follows:

*Policy 4A.2 Mitigating climate change*

*“The Mayor will work towards the long-term reduction of carbon dioxide emissions by 60 per cent by 2050. The Mayor will and boroughs and other agencies should seek to achieve the following minimum reduction targets for London against a 1990 base; these will be monitored and kept under review:*

- *15% by 2010*
- *20% by 2015*
- *25% by 2020*
- *30% by 2025.”*

These reductions are to be achieved in new development through Policy 4A.7.

Sustainable design and construction requirements are detailed in Policy 4A.3 as follows:

*“The Mayor will, and boroughs should, ensure future developments meet the highest standards of sustainable design and construction and reflect this principle in DPD policies. These will include measures to:*

- *make most effective use of land and existing buildings*
- *reduce carbon dioxide and other emissions that contribute to climate change*
- *design new buildings for flexible use throughout their lifetime*
- *avoid internal overheating and excessive heat generation*
- *make most effective and sustainable use of water, aggregates and other resources*
- *minimise energy use, including by passive solar design, natural ventilation, and vegetation on buildings supply energy efficiently and incorporate decentralised energy systems (Policy 4A.6), and use renewable energy where feasible (Policy 4A.7)*
- *minimise light lost to the sky, particularly from street lights*

- *procure materials sustainably using local suppliers wherever possible*
- *ensure designs make the most of natural systems both within and around the building*
- *reduce air and water pollution*
- *manage flood risk, including through sustainable drainage systems (SUDS) and flood resilient design for infrastructure and property*
- *ensure developments are comfortable and secure for users*
- *conserve and enhance the natural environment, particularly in relation to biodiversity, and enable easy access to open spaces*
- *avoid creation of adverse local climatic conditions*
- *promote sustainable waste behaviour in new and existing developments, including support for local integrated recycling schemes, CHP and CCHP schemes and other treatment options*
- *encourage major developments to incorporate living roofs and walls where feasible (Policy 4A.11)*
- *reduce adverse noise impacts.*

*The Mayor will and the boroughs should require all applications for major developments to include a statement on the potential implications of the development on sustainable design and construction principles. This statement should address demolition, construction and long-term management. Boroughs should ensure that the same sustainability principles are used to assess other planning applications.*

*The Mayor will and boroughs should ensure that developments minimize the use of new aggregates and do not use insulating and other materials containing substances which contribute to climate change through ozone depletion.*

*Developers should use best practice and appropriate mitigation measures to reduce the environmental impact of demolition and construction.”*

Policy 4A.3 is supported by the Sustainable Design and Construction SPG which provides a context for all development and provides a mechanism for addressing climate change through new developments. The standards in the SPG are expected to be addressed in statement on sustainable design and construction.

Sustainable energy is addressed in Policy 4A.4:

*“Policy 4A.4 Energy assessment*

*The Mayor will, and boroughs should, support the Mayor’s Energy Strategy and its objectives of improving energy efficiency and increasing the proportion of energy used generated from renewable sources.*

*The Mayor will, and boroughs should, require an assessment of the energy demand and carbon dioxide emissions from proposed major developments, which should demonstrate the expected energy and carbon dioxide emission savings from the energy efficiency and renewable energy measures incorporated in the development, including the feasibility of CHP/CCHP and community heating systems. The assessment should include:*

- *calculation of baseline energy demand and carbon dioxide emissions*
- *proposals for the reduction of energy demand and carbon dioxide emissions from heating, cooling and electrical power (Policy 4A.6)*
- *proposals for meeting residual energy demands through sustainable energy measures (Policies 4A.7 and 4A.8)*
- *calculation of the remaining energy demand and carbon dioxide emissions.*

*This assessment should form part of the sustainable design and construction statement (Policy 4A.3).*

*The Mayor will explore with the government and boroughs the means of extending assessments to include all greenhouse gases.*

*All development should contribute to improving the integration of land use and transport policy and reducing the need to travel, especially by car (see Policy 3C.1). Such issues will not be part of the energy assessment.”*

The London Energy Strategy is based on the principles of using less energy, supplying energy efficiently and using renewable energy. Part L of the current Building Regulations is to be used as the minimum benchmark and the starting point for assessment. The Energy Strategy and Sustainable Design and Construction SPG require consideration of a development’s whole energy use when calculating the CO2 emissions baseline for the assessment.

The London Energy Partnership’s (LEP) Carbon Scenarios report demonstrates that a Combined Heat and Power (CHP) led approach is the most cost-effective mechanism for delivering carbon dioxide reductions in London. Accordingly Policy 4A.5 sets out requirements for London Boroughs to establish a policy framework that enable this to take place.

*“Policy 4A.5 Provision of heating and cooling networks*

*Boroughs should ensure that all DPDs identify and safeguard existing heating and cooling networks and maximise the opportunities for providing new networks that are supplied by decentralised energy. Boroughs should ensure that all new development is designed to connect to the heating and cooling network. The Mayor will and boroughs should work in partnership to identify and to establish network opportunities, to ensure the delivery of these networks and to maximise the potential for existing developments to connect to them.”*

There are a number of studies available to help boroughs in developing this policy approach:

- Mayor of London: The London Community Heating Development Study (May 2005) provides indications of heat densities, and the main opportunities for community heating.
- LEP: ‘Making ESCos work’ Guidance and advice on setting up and delivering ESCos (February 2007).
- LEP/London Renewables: ‘Towards zero carbon; supportive information for boroughs’ (July 2006) covers a range of planning and non-planning issues.

Policy 4A.6 decentralised Energy: Heating, Cooling and Power states as follows:

*“The Mayor will and boroughs should in their DPDs require all developments to demonstrate that their heating, cooling and power systems have been selected to minimise carbon dioxide emissions. The need for active cooling systems should be reduced as far as possible through passive design including ventilation, appropriate use of thermal mass, external summer shading and vegetation on and adjacent to developments. The heating and cooling infrastructure should be designed to allow the use of decentralised energy (including renewable generation) and for it to be maximised in the future.*

*Developments should evaluate combined cooling, heat, and power (CCHP) and combined heat and power (CHP) systems and where a new CCHP/CHP system is installed as part of a new development, examine opportunities to extend the scheme beyond the site boundary to adjacent areas.*

*The Mayor will expect all major developments to demonstrate that the proposed heating and cooling systems have been selected in accordance with the following order of preference:*

- *connection to existing CCHP/CHP distribution networks*
- *site-wide CCHP/CHP powered by renewable energy*
- *gas-fired CCHP/CHP or hydrogen fuel cells, both accompanied by renewables*
- *communal heating and cooling fuelled by renewable sources of energy*
- *gas fired communal heating and cooling.”*

Supporting text to this policy identifies that decentralised energy schemes make more efficient use of primary energy than large-scale generation via the national grid. CCHP and CHP will need to be sized to minimise carbon dioxide emissions. They can be suitable for all scales of development and can incorporate the use of renewable sources of energy. The supporting text also recognizes the goal of establishing fuel cells using renewable and low CO<sub>2</sub> hydrogen but acknowledges the role of other technologies in the transition to the hydrogen economy. Accordingly the London Plan considers that it is important that the design of infrastructure associated with fuel cells does not preclude links being made to additional uses. Investment in heat and power distribution infrastructure should be considered in all developments.

The provision of localised energy systems is identified as offering an opportunity to involve and benefit local residents through community schemes. Where a district CHP/CCHP scheme provides only a proportion of a development’s power, and/or heating and/or cooling demand, the scheme is expected to address the remainder utilising renewable energy technologies where feasible. The required renewable energy contribution should be established in line with Policies 4A.4 and 4A.7.

*“Policy 4A.7 Renewable Energy*

*The Mayor will, and boroughs should, in their DPDs adopt a presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from on site renewable energy generation (which can include sources of decentralised renewable energy) unless it can be demonstrated that such provision is not feasible. This will support the Mayor’s Climate Change Mitigation and Energy Strategy and its objectives of increasing the proportion of energy used generated from renewable sources by:*

- *requiring the inclusion of renewable energy technology and design, including: biomass fuelled heating, cooling and electricity generating plant, biomass heating, renewable*

*energy from waste (Policy 4A.21) photovoltaics, solar water heating, wind, hydrogen fuel cells, and groundcoupled heating and cooling in new developments wherever feasible*

- *facilitating and encouraging the use of all forms of renewable energy where appropriate, and giving consideration to the impact of new development on existing renewable energy schemes.”*

*Boroughs in their DPDs should identify broad areas where the development of specific renewable energy technologies is appropriate. These should encourage the fullest realisation of the potential for renewable energy having regard to the environmental and transport policies of the London Plan. These should include:*

- *identifying sites for zero carbon development*
- *identifying suitable locations for wind turbines in developments*
- *encouraging at least one large wind power scheme in London*
- *encouraging applications for new street appliances (such as bus shelters, bus stops, parking ticket machines and road signs) to incorporate off-grid solar power and other renewable energy sources where feasible.”*

Supporting text to the above policy states that London should become more energy efficient. This applies to both new development and the existing built form. It goes on to confirm that energy efficient measures and renewable energy technology should not be precluded in areas of heritage, but should be designed sensitively.

To assist with the implementation of the above and other policies the London Plan points boroughs and developers to The London Renewable Energy Toolkit<sup>6</sup> which has been developed to assist in assessing the feasibility and viability of renewable technologies. Developments not initially incorporating solar technologies should, where practicable, be of a suitable design and orientation to support them later. Applications proposing prestige cladding should incorporate photovoltaics wherever feasible.

The Plan also advises of ongoing work by The London Energy Partnership to develop a low carbon design toolkit to provide support on all aspects of sustainable energy, including energy efficiency. This is intended to be applicable to the assessment of micro-generation for small developments as well as major ones.

Supporting text makes further links with the Mayor’s Energy Strategy which contains targets in relation to the installation of types of renewable energy schemes to increase London’s generation of power and heat from renewable energy schemes up to 2020. Further work on assessing the renewable energy potential in London, including the potential for retrofitting development with renewables, is to be undertaken to review these targets. These will be included in the Mayor’s Climate Change Mitigation and Energy Strategy and in further reviews of the London Plan.

Paragraph 4.29 also states that in support of these London wide targets the Energy Strategy includes policies requesting boroughs to set consistent targets, for the generation of renewable energy in their areas, to install at least one zero carbon development and to identify Energy Action Areas. The principle of Energy Action Areas is that they set higher standards for new build and retrofit and showcase best practice for integrating sustainable energy. The

Mayor strongly encourages boroughs and developers to work in partnership to establish these areas.

It is of note that paragraph 4.30 states that:

*“Where land is needed for the provision of renewable energy technologies, such as anaerobic digesters and biomass plants, as part of appropriate developments, boroughs should encourage this provision through their inclusion in development briefs and area development frameworks.”*

To supplement the London Plan a Renewable Energy SPG is to be produced which will set out broad guidelines to define locations where stand-alone renewable energy schemes would be appropriate and set criteria both for the assessment of such schemes and for their application to individual technologies. Use of the full range of renewable energy technologies is encouraged, which should be incorporated wherever site conditions make them feasible. The London Plan states that off-site renewable contributions to developments are acceptable only where they are directly connected and supplied by private wire arrangement. Further information regarding these circumstances is to be contained in the forthcoming Renewable Energy SPG.

Policy A4.8 supports and encourages the more widespread use of hydrogen as an alternative to fossil fuels.

In October 2009 the Mayor published the Consultation draft replacement plan. It continues the emphasis on incorporating relevant design and technological measures at the earliest design stage. A number of fundamental changes to policy are outlined, which are detailed below.

Policy 5.1 sets even more stringent targets for the reduction of CO2 emissions in London, seeking to achieve an overall reduction in emissions of 60% below 1990 levels by 2025, as compared with the current London Plan date of 2050. It is acknowledged that this target is extremely challenging but it is considered to be achievable with the full commitment of all stakeholders.

Support for the established energy hierarchy for reducing emissions is continued under Policy 5.2. This policy goes on to establish new targets for minimizing CO2 emissions as follows:

*“As a minimum, all major development proposals should 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.*

**Residential buildings:**

| <b>Year</b> | <b>Improvement on 2006 Building Regulations*</b> |
|-------------|--|
| 2010 – 2013 | 44 per cent                                      |
| 2013 – 2016 | 55 per cent                                      |
| 2016 – 2031 | Zero carbon                                      |

*\* To be calculated using a ‘Flat 25 per cent’ approach for new homes in accordance with the final 2010 Part L Building Regulations.*

**Non-domestic buildings:**

| <b>Year</b> | <b>Improvement on 2006 Building Regulations*</b> |
|-------------|--|
| 2010 – 2013 | 44 per cent                                      |
| 2013 – 2016 | 55 per cent                                      |
| 2016 – 2019 | As per building regulations requirements         |
| 2019 – 2031 | Zero carbon                                      |

\* To be calculated using an ‘Aggregate 25 per cent’ approach new non-domestic buildings in accordance with the final 2010 Part L Building Regulations

*C Major development proposals should include a detailed energy assessment to demonstrate how the minimum targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.*

*D As a minimum, energy assessments should include the following details:*

*a Calculation of baseline energy demand and carbon dioxide emissions on a ‘whole energy’ basis, showing the contribution of emissions both from uses covered by building regulations and those that are not (see paragraph 5.22);*

*b Proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services;*

*c Proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP); and d Proposals to further reduce carbon dioxide emissions through the use of onsite renewable energy technologies.*

*e The carbon dioxide reduction targets should be met onsite. Where it is clearly demonstrated that the specific targets cannot be fully achieved onsite, any shortfall may be provided offsite or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.”*

Supporting text confirms that the targets outlined above conform to the code levels of the Government’s Code for Sustainable Homes. It also confirms that the highest levels of CO<sub>2</sub> emissions reduction will be sought in every proposal, and the Mayor will encourage zero carbon development where appropriate. Overall carbon emissions reductions are expected to reflect the context of each proposal, taking account of its size, nature, location, accessibility and expected operation.

Requirements for an energy assessment for major development are now contained in the supporting text. These are expected to demonstrate how minimum CO<sub>2</sub> reduction targets will be met within the framework of the energy hierarchy. The requirement for energy assessments is widened under the emerging plan such that Boroughs may require energy assessments for other development proposals where appropriate. Whilst the current plan refers to consideration of “a development’s whole energy use” the consultation draft clarifies that the energy assessment should set out emissions related to both regulated and non-regulated emissions along with a strategy of how non-regulated energy and CO<sub>2</sub> emissions will be reduced.

Paragraph 5.23 of the consultation draft states that:

*“Where it is demonstrated that the specific targets for carbon dioxide emissions reduction cannot be fully achieved onsite the shortfall may be provided offsite, but only in cases where there is an alternative proposal identified and delivery is certain, or where funding can be pooled to support specific carbon dioxide reduction projects or programmes. Further guidance on the criteria for offsite provision, the types of acceptable projects and programmes and a London wide funding scheme will be set out in future supplementary guidance.”*

Draft Policy 5.3 Sustainable design and construction provides an updated version of Policy 4A.3 of the current plan.

The draft plan introduces a new policy concerning retrofitting as follows:

**“Strategic**

*A The environmental impact of existing urban areas should be reduced through policies and programmes that bring existing buildings up to the Mayor’s standards on sustainable design and construction. In particular programmes should reduce carbon dioxide emissions, improve the efficiency of resource use (such as water) and minimise the generation of pollution and waste from existing building stock.*

**LDF preparation**

*B Within LDFs boroughs should identify opportunities for reducing carbon dioxide emissions from existing building stock and develop detailed policies and proposals regarding the sustainable retrofitting of existing buildings. Boroughs should identify potential synergies between new developments and existing buildings particularly through the retrofitting of energy efficiency measures, decentralized energy and renewable energy opportunities (refer to Policies 5.5 and 5.7).”*

Supporting text acknowledges that retrofitting buildings can make a significant contribution to climate change. It identifies that London’s existing domestic buildings contribute 38% of the regions CO<sub>2</sub> emissions. Further programmes for retrofitting will be found in the forthcoming draft Climate Change Mitigation and Energy Strategy and in the London Climate Change Adaptation Strategy together with the draft London Housing Strategy.

Policy concerned with decentralized energy networks is evolving with the draft plan proposing the following policy:

*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 localized decentralised energy systems by 2025. In order to achieve this target the Mayor prioritises the development of decentralized heating and cooling networks at the development and area wide level, as well as larger scale heat transmission networks. The Mayor has developed a London Heat Map tool to help boroughs and developers identify decentralised energy opportunities in London.*

**LDF preparation**

*B Within LDFs boroughs should develop policies and proposals to identify and establish decentralised energy network opportunities. Boroughs may choose to develop this as a supplementary planning document and work jointly with neighbouring boroughs to realise wider decentralised energy network opportunities.*

As a minimum boroughs should:

*a Identify and safeguard existing heating and cooling networks*

*b Identify opportunities for expanding existing networks and establishing new networks.*

*Boroughs should use the London Heat Map tool and consider any new developments, planned major infrastructure works and energy supply opportunities which may arise*

*c Develop energy master plans for specific decentralised energy opportunities which identify:*

- *major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)*
- *major heat supply plant*
- *possible opportunities to utilise energy from waste*
- *possible heating and cooling network routes*
- *implementation options for delivering feasible projects, considering issues of procurement, funding and risk and the role of the public sector.*

*d Require developers to prioritise connection to existing or planned decentralized energy networks where feasible.”*

Supporting text comments that the use of decentralized systems can help London become more self-sufficient and secure in relation to its energy needs. It also identifies a range of tools and further work to be undertaken to support the development of such systems.

In relation to the use of decentralized energy in development proposals Policy 5.6 sets out the following requirements:

**“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 draft plan, whilst including a policy in respect of renewable energy, no longer makes reference to the need to achieve a particular emissions reduction. Instead it refers to the need to achieve minimum targets in respect of a variety of technologies set out in the plan. The full text of Policy 5.7 is as follows:

**“Strategic**

*A The Mayor seeks to increase the proportion of energy generated from renewable sources, and expects that the minimum targets for installed renewable energy capacity outlined in Table 5.1 will be achieved in London.*

**Planning decisions**

*B Within the framework of the energy hierarchy, major development proposals should provide a reduction in carbon dioxide emissions through the use of onsite renewable energy*

generation, where feasible.

**LDF preparation**

*C Within LDFs boroughs should, and other agencies may wish to, develop more detailed policies and proposals to support the development of renewable energy in London. In particular, to identify broad areas where specific renewable energy technologies, including large scale systems and the large scale deployment of small scale systems, are appropriate. The identification of areas should be consistent with the guidelines and criteria outlined in the Mayor’s forthcoming supplementary guidance on Renewable Energy.*

*D All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets.”*

Supporting text to this policy notes that energy generated from waste provides a particularly significant opportunity for London. It also expresses a preference for advanced conversion technologies that have the potential to achieve greater efficiencies and CO<sub>2</sub> emissions savings. The emerging London Plan contains updated targets for different renewable energy technologies to increase London’s generation of electricity and heat from such sources to 2025. There is an expectation that London will be able to supply approximately 5% of its energy needs from renewables (not including transport) by 2020.

The draft Plan continues to refer to proposed SPG on Renewable Energy that is to be published.

Reference to the need to reduce CO<sub>2</sub> emissions by at least 20% through on site renewable generation for major developments is now contained in the supporting text to Policy 5.7. As in the current plan encouragement is given to consideration of the full range of technologies.

The emerging plan contains a new policy, Policy 5.8 on Innovative energy technologies. This seeks to:

- a) maximise the uptake of electric and hydrogen fuel cell vehicles,
- b) plan hydrogen supply and distribution infrastructure and
- c) maximise the uptake of advanced conversion technologies such as anaerobic digestion, gasification and pyrolysis for the treatment of waste.

Boroughs may wish to develop more details policies and proposals within their LDFs to support alternative energy technologies.

**11.2.3 London Borough of Croydon**

Croydon’s UDP was revised in 2006, with a number of policies saved under a direction issued by Government Office for London in 2009. Policy EP16 encourages developers to incorporate renewable energy technologies to reduce a development’s carbon dioxide emissions by at least 10%.

**Policy EP16**

*“EP16 The Council will encourage all developments to incorporate renewable energy, but will require proposals for non-residential developments exceeding 1,000 square metres gross floorspace, and new residential developments comprising 10 or more units, whether new build*

or conversion, to incorporate renewable energy production equipment to off-set at least 10% of predicted carbon emissions, except where:

- a) The technology would be inappropriate;
- b) It would have an adverse visual or amenity impact that would clearly outweigh the benefits of the technology; and
- c) Renewable energy cannot be incorporated to achieve the full 10%.

Where the 10% requirement cannot be achieved on major developments, a planning obligation will be sought to secure savings through the implementation of other local renewable energy schemes.”

Supporting text to the above policy advises that “a *planning obligation can be used to address the impact of major developments. The contribution will be negotiated on a case by case basis dependent on the scale and impact of the development and the costs of providing the energy schemes.*”

The above policy is supported by a dated SPG on renewable energy from 2004 that outlines what the council expects from major applications. It is also supported by a planning advice note prepared in May 2008 on ‘Preparing Environmental Performance Statements - a guidance note for applicants and agents’. This document provides advice on the standards the council is looking for in new developments in accordance with local planning policy EP16 and policies UD1-UD3 that relate to design matters.

The planning advice notes states that Croydon’s requirements are:

- “For residential developments of 10 or more units, Code for Sustainable Homes Level 4;
- For residential developments between 4 and 9 units, in an area with a PTAL (Public Transport Accessibility Level) rating of 3 or above, and with a density of over 200 habitable rooms per hectare, Code for Sustainable Homes Level 4;
- For non-residential developments  $\geq 1000m^2$ , BREEAM Excellent, and
- All major developments require onsite renewable energy production to off-set 10% of carbon emissions.”

A major development would include proposals for ten or more units. Therefore, a major housing development must attain the standards set out in the Code for Sustainable Homes, including a 44% reduction in the development’s Dwelling Emission Rate (DER), with the ten per cent renewable energy target as part of this reduction. It should be noted that the renewables target relates to both regulated and un-regulated emissions.

At present this policy is an SPD, however the council is looking to place this policy in the forthcoming LDF, which will require an Examination in Public by the Planning Inspectorate.

Croydon is currently consulting on its Core Strategy Issues and Options which, together with other DPDs, will take forward the policy framework for the borough. The following are currently proposed:

- Identify areas suitable for district-wide energy networks and require new and existing buildings to connect to them where possible.
- Require major new developments to offset 50% of their CO<sub>2</sub> emissions and at least 20% through renewable energy technologies.
- Require all major non-residential sites to achieve a BREEAM “Excellent” rating and all residential sites to achieve a Code for Sustainable Homes level 4 rating prior to 2013, with a suitable timetable for requiring higher standards to be determined at a later stage.

The above proposed policies are supported by the Croydon District Energy Study, the Interim Study of which was published in October 2009.

### 11.2.4 Milton Keynes

The current Local Plan, which was adopted in 2005, contains a number of saved policies of relevance. These include:

| <b>POLICY D4 Sustainable Construction</b>  |
|--|
| <p><i>All new development exceeding 5 dwellings (in the case of residential development) or incorporating gross floorspace in excess of 1000 sq m (in the case of other development) will be required to include the following:</i></p> <ul style="list-style-type: none"> <li>(i) <i>Energy efficiency by siting, design, layout and buildings’ orientation to maximize sunlighting and daylighting, avoidance of overshadowing, passive ventilation;</i></li> <li>(ii) <i>Grouped building forms in order to minimize the external wall surface extent and exposure;</i></li> <li>(iii) <i>Landscape or planting design to optimise screening and individual buildings’ thermal performance;</i></li> <li>(iv) <i>Renewable energy production e.g. external solar collectors, wind turbines or photovoltaic devices;</i></li> <li>(v) <i>Sustainable urban drainage systems, including rainwater and waste water collection and recycling</i></li> <li>(vi) <i>Significant use of building materials that are renewable or recycled;</i></li> <li>(vii) <i>Waste reduction and recycling measures;</i></li> <li>(viii) <i>Carbon neutrality or financial contributions to a carbon offset fund to enable carbon emissions to be offset elsewhere.</i></li> </ul> |

Supporting text to this policy refers to the need to achieve energy efficiency which may include an NHER rating 10, passive solar design, sheltered microclimate, high levels of insulation, heat recovery, passive ventilation, combined heat and power, better heating controls, condensing boilers, less wasteful street lighting and illuminated signs. Renewable energy such as solar water heating or photovoltaic panels, biomass fuel heating, wind turbines or ground

source heating may be used with the renewable element providing at least 10% of building energy use.

Policy D5 specifically concerns renewable energy:

*Planning permission will be granted for proposals to develop renewable energy resources unless there would be:*

- (i) *significant harm to the amenity of residential areas, due to noise, traffic, pollution or odour;*
- (ii) *significant harm to a wildlife species or habitat;*
- (iii) *unacceptable visual impact on the landscape.*

*Wind turbines should, in addition, avoid unacceptable shadow flicker and electro-magnetic interference and be sited at least 350m from any dwellings.*

Supporting text refers to a regional study that has identified a number of potentially favourable locations for renewable energy projects within Milton Keynes.

Policy D4 is supported by an SPD on Sustainable Construction adopted in 2007. It sets out requirements for the submission of a Sustainability Assessment for all full or reserved matters planning applications that exceed the thresholds. Where an application is submitted in outline a sustainability statement will be required at the reserved matters stage and a S106 agreement will provide for the carbon offset payment. The SPD refers to the need for applicants to demonstrate, where full policy compliance cannot be achieved, why this the case, the proportion that is viable and the options explored.

The SPD sets out a checklist against which developments must be assessed (unless it is intended to achieve an Excellent Rating using Ecohomes/BREEAM). This sets out the minimum carbon reduction standards of 25% compared to current Building Regulations Part L standards (2006), as well as the generation of 10% of the development’s energy requirements from on-site renewable energy technologies to achieve a ‘pass’. Higher standards exist to achieve good and excellent.

To ensure that developments are carbon neutral, the council also operates an offset fund into which developers have to pay £200 for every tonne of carbon dioxide their development is predicted to emit in its first year. The SPD states that “*The carbon offset fund will be managed by a The MK Energy Agency on behalf of and monitored by the Council & MK Partnership. The fund will be used elsewhere in MK to reduce carbon emissions by cutting energy use or producing renewable energy. The fund will be spent on carbon reduction measures with a lifespan of at least 20 yrs equivalent to the increased carbon output from new development*”

Milton Keynes is currently bringing forward its LDF, which replace the local plan. Due to the large number of dwellings to be built in the area, the council would like to develop an exemplar sustainability planning policy to minimise the increase in carbon emissions from the forecasted growth areas and to increase the amount of renewable energy generated across the Milton Keynes area. The council believes that the scale of growth in the area justifies setting standards of energy efficiency and renewable energy generation for particular development

areas, through the economies of scale it brings. These principles were confirmed Impetus Consulting during their initial meeting with Milton Keynes planning officers, which informed a study of energy efficiency and renewable energy potential in the Borough.

The Milton Keynes Core Strategy – Pre-submission publication version was published in January 2010. It sets out the following policies:

Policy CS 14

*Sustainable Construction*

*Developments of over 5 dwellings or 1,000 sq m of non-residential floorspace will be expected to achieve at least the following standards, or any new standards set out in a future DPD, unless the Local Planning Authority is satisfied that the application demonstrates the requirement would not be technically or financially viable.*

|   | Area                       | Older Town Centres (90) | City estates, including CMK (91) | Strategic Development Areas | Rural Area (92) | Conversion or alteration of existing buildings |
|---|----------------------------|-------------------------|----------------------------------|-----------------------------|-----------------|--|
| A   | Code for Sustainable Homes | Code level 4            | Code level 4                     | Code level 4                | Code level 4    | EcoHomes Very Good                             |
| B   | BREEAM                     | Very good               | Excellent                        | Excellent                   | Very good       | Very good                                      |
| <i>Minimum carbon dioxide reduction through renewable energy and/or low carbon technologies</i> |                            |                         |                                  |                             |                 |  |
|   |                            | 10%                     | 20%                              | 20%                         | 10%             | 10%  |

*To achieve the Council's objective of carbon neutrality, all developments over 5 dwellings or 1,000 sq m will be expected to make a contribution into the Milton Keynes Carbon Offset Fund.*

Policy CS 15

Community Energy Networks and Large Scale Renewable Energy Schemes

The Council wishes to promote the use of renewable energy schemes where it can be demonstrated that there will be no negative social, economic or environmental results from the scheme. Therefore, it has the following requirements:

- For developments of more than 100 homes, applications should show that the potential for community energy networks has been explored.
- For development of more than 200 homes, applications will require community energy networks, unless it can be proven that this is not feasible on technical or economic grounds.

- Regardless of the number of homes in a proposal, where an existing local energy network is established, developments will be expected to connect to the network, if feasible.

Supporting text advises that supporting guidance on how Policy CS 14 'Sustainable Construction' will be delivered and managed is to be set out in a revised Sustainable Construction SPD. This will consider how the standard of construction will be maximised in cases of uncertain viability. There is an expectation that planning applications to which the policy applies must be accompanied by an early Code for Sustainable Homes design stage report or BREEAM Pre-assessment. Certification, showing the required performance level has been achieved, will be required as evidence to discharge the planning condition. Carbon Offset contributions will be secured through the use of s106 agreements.

The draft Core Strategy confirms that where new national requirements exceed those set out in this Core Strategy, the national standards will take precedence.

In respect of large-scale standalone renewable energy projects and small-scale installations the proposed Development Management DPD is intended to include policies on these.

Milton Keynes has a number of key expansion areas, each of which has its own SPD, which refer back to the requirements of the local plan.

### 11.2.5 Central Bedfordshire

Central Bedfordshire covers the former Mid Beds, Luton and the former South Bedfordshire area. In November 2009 the Core Strategy and Development Management Policies for the North Area (covering Mid Beds) was adopted. It contains a range of policies aimed at reducing carbon emissions and increasing the amount of renewable energy. The Council identifies a range of challenges in respect of sustainability and climate change that are tackled through the policies within the DPD. These include:

- Reducing Mid Bedfordshire's contribution to climate change;
- Adapting to the potential effects of climate change;
- Making new development more energy efficient;
- Increasing generation of renewable energy.

The Council is seeking to reduce CO<sub>2</sub> emissions throughout the district through the application of LDF policy, Building Regulations and the Council's Sustainable Communities Strategy. Policy CS13 is the Core Strategy and Development Management DPD's overarching policy on climate change which states:

*"Policy CS13: Climate Change*

*The Council working with other stakeholders will secure new development including new housing, new commercial development (including substantial extensions to existing commercial buildings) and new community and leisure facilities, which incorporate measures to take account of climate change.*

*Individual targets for new allocated developments may be set through the Site Allocations DPD where these can be justified by local circumstances taking account of economic viability.*

*The range of measures to be considered will include:*

- *The use of renewable energy options to provide energy requirements of new development including on-site and near-site low-carbon technologies.*
- *The use of sustainable design and construction and high efficiency standards for all developments and refurbishments with residential schemes referring to the ‘Code for Sustainable Homes’ and all non residential schemes referring to BREEAM ratings (or its successor);*
- *Contributions to waste minimisation, reuse and recycling. Adequate facilities to store materials for recycling must be part of the design of new housing;*
- *Provision for walking and cycling, access to public transport and the production of green travel plans*
- *Tree planting and other carbon-offsetting measures to help mitigate the impact of carbon emissions produced by the production of building materials, the construction process and use of new development;*
- *Provision for conserving water resources and recycling water as well as limiting any adverse effects on water quality;*
- *Minimising the risk of flooding and management of residual risks; and*
- *Provision of sustainable water supply and drainage infrastructure.*

*The Council will consider positively energy generating proposals with low carbon impact.”*

This policy is supplemented by development management policies including:

- Policy DM1: Renewable Energy.
- Policy DM2: Sustainable Construction of New Buildings.
- Policy DM3: High Quality Development.

Policy DM1 states:

*“The Council will consider favourably proposals for renewable energy installations.*

*Proposals should satisfy the following criteria:*

- *Have good accessibility to the transport network;*
- *Not be harmful to residential amenity, including noise and visual amenity;*
- *Be located and designed so as not to compromise the landscape and scenic beauty of the Chilterns AONB;*
- *In other areas identified through the Landscape Character Assessment as having high sensitivity, be located and designed so as to respect the character of the landscape.*

*Proposals for all new development of more than 10 dwellings or 1,000 square metres of non-residential buildings should contribute to renewable energy targets by incorporating on-site or near-site renewable or low carbon technology energy generation. Developments should*

*achieve 10% or more of their own energy requirements through such sources, unless it can be demonstrated that this would be impracticable or unviable.”*

Supporting text recognises that on-site solutions may not always be feasible or viable. In such cases, it allows for consideration of near-site solutions to allow greater flexibility to the developer and increase the feasibility and viability of renewable energy developments. It identifies a range of potential renewable energy measures depending on the nature of development. The plan states that Individual targets for specific developments may be pursued through the Site Allocations DPD. The Council intends to prepare SPD and/or technical guidance to help guide developers achieve the policy objectives.

In addition to the above the Council is also exploring the potential for a wider range of renewable energy measures to be promoted including a local strategic project (or projects) that may include, for example, a grant scheme for fitting microgeneration technologies to existing properties, support for community schemes or the provision of new renewable energy installations. In addition, the Council is considering whether to set a local target or lower the threshold as compared to the Regional target. If local justification exists to do this the Council will consider producing a topic specific DPD or an early revision of the Core Strategy and Development Management DPD.

Supporting text in the plan establishes a requirement for development to meet or exceed the regional target for renewable energy production, with details of proposals to form part of the Design and Access Statement accompanying planning applications. The Plan accepts that there may be proposals that due to their design, small-scale or the need for remediation work have viability issues. In such circumstances, applicants are required to demonstrate that meeting the targets would render the proposals unviable.

In respect of sustainable construction the plan sets out the following policy:

*“Policy DM2: Sustainable Construction of New Buildings*

*All proposals for new development should contribute towards sustainable building principles. Where the minimum standards are not met, evidence will be required to demonstrate why this would not be feasible or viable.*

- *Future new housing development will be expected to comply with mandatory standards in relation to the Code for Sustainable Homes.*
- *Non-residential buildings should comply with building regulations. The Council will encourage and support the design and implementation of features that will increase the environmental credentials of a building including green roofs.*
- *Major developments and developments which will have high water consumption should incorporate measures to minimise their use of ‘white’ water.*
- *The provision of Sustainable Urban Drainage Systems for the disposal of surface water within and leading from development sites will be expected.”*

Supporting text recognises that sustainable construction of buildings, in terms of design, materials and technologies, is a major factor in reducing CO<sub>2</sub> emissions. It sets out an expectation that new homes provided within Conservation Areas, close to Listed Buildings or in locations where the appearance of the dwelling is important will still be of sustainable construction, which can often be achieved through principles of high quality design. A SPD

sets out the Council's requirements in this respect is proposed (Design in Central Bedfordshire: A Guide for Development SPD).

New housing development is encouraged to meet or exceed level 3 of the Code for Sustainable Homes from 2010, although it is recognised that this level is likely to be raised. The Plan states that "The Council may develop local standards through a Development Plan Document, or require specific levels of the Code for individual sites through the Site Allocations DPD. Developers will be expected to design their schemes to comply with these requirements."

In respect of non-residential buildings supporting text encourages new development and refurbishments to meet or exceed the rating of 'Excellent' or 'Good' respectively. Similar requirements in respect of viability to those noted above will be applied. The Council intends to specify the rating that may be required for some development through the Site Allocations DPD. Further details on design will be provided through the Design SPD.

Policy DM3: High Quality Development applies to all proposals for new development, including extensions and requires, amongst other things, energy efficiency.

Policy CS2 concerns developer contributions which are expected from any development which would individually or cumulatively necessitate additional or improved infrastructure, or exacerbate an existing deficiency. Under the summary of types of obligations likely to be sought for residential development, environmental impacts including climate change and carbon impact contribution are identified. Obligations may also be sought from commercial development. Further details on how planning obligations will be sought are set out in the Planning Obligations Strategy.

The Planning Obligations Strategy SPD concludes that, in light of the intention to achieve zero carbon homes by 2016 through changes to the Building Regulations and to secure similar standards for commercial developments a carbon offset charge is not proposed.

Interestingly in contrast to the above SPD, the Preferred Options document of the Core Strategy for the South Area of Central Bedfordshire, which is a joint document prepared with Luton Borough Council, intends to maximise and encourage other measures to increase resource efficiency including exploring the potential for a carbon offset fund to help implement 'retro-fitting' of energy and water efficiency measures within existing development.

### 11.2.6 Bedford Borough Council

Bedford adopted its Core Strategy and Rural Issues DPD in April 2008. The DPD introduced a 10% decentralised and renewable or low carbon energy policy and a 10% carbon reduction policy to reflect guidance given in the East of England Plan to encourage policy to mitigate against climate change.

Policy CP26 states that unless it can be demonstrated that the policy requirements are not feasible or viable all new residential developments and non-residential developments over 500m<sup>2</sup> must reduce carbon emissions by a minimum of 10% against Building Regulation requirements. The policy goes on to state that for developments of 50 dwellings or more or over 1,000m<sup>2</sup>, 10% of the energy consumed in the new development must be provided by decentralised, renewable or low carbon technologies.

This policy also requires development to:

- Minimise the emission of pollutants into the wider environment.
- Have regard to cumulative impacts of development proposals on air quality, in particular in relation to air quality management areas.
- Minimise the consumption and use of energy, including fossil fuels by design and choice of materials.
- As a minimum, meet the national standards for building performance set by the current Building Regulations. Through the Allocations and Designations DPD process the Council may identify local development or site-specific opportunities which justify the adoption and application of higher standards of building performance as set out in the Code for Sustainable Homes. Such higher standards may also be required by the Council where justified by changes in national guidance.
- Utilise sustainable construction techniques.
- Incorporate facilities to minimise the use of water and waste.
- Limit any adverse effects on water quality, reduce water consumption and minimise the risk of flooding.

Developers will be expected to submit a sustainability statement and energy audit with proposals for development.

This policy is supplemented by a Climate Change and Pollution SPD, which gives detailed guidance on the implementation of Policy CP26. It provides guidance on the minimum standards expected to be achieved compliance with the Council's policy, whilst encouraging applicants to go beyond the minimum. Sustainability statements, including an energy audit where required, will be expected to be submitted.

The SPD states whilst the Core Strategy policy was intended to be more challenging. Comments made by the Inspector at the Examination into the Core Strategy provide for further policy development as part of the forthcoming Site Allocations and Designations DPD. Bedford Council is in the process of assessing the scope for more ambitious climate change policy requirements for individual sites allocated in the Plan.

The SPD sets out how building design and layout can affect the consumption and use of energy, providing minimum standards and the means to go forward as follows:

Minimum standard:

- Design buildings to maximise solar gain.
- Design buildings to maximise natural light.
- Design buildings to make use of natural ventilation and cooling.
- Design buildings to maximise energy efficiency.

Going further:

- Take account of expected climate change over the expected lifetime of the development in the design of buildings and their surroundings

It goes on to set out in more detail how these standards can be achieved, for example, through orientating buildings so that they broadly run east-west and face south, locate the main rooms on the south side of the building. Issues associated with lighting of non-residential building such as offices are examined in more detail due to the large proportion of energy used for lighting of such buildings. Accordingly the SPD advises that design measures that provide shade in the summer without reducing daylight should be considered. The use of energy efficiency measures which reduce carbon emissions and offer savings in running costs during the life of the building are outlined:

- Extra insulation of walls, roofs and floors
- Advancing glazing systems
- High energy efficiency heating boilers with advanced temperature controls which respond to solar gain and have separate zone temperature control
- Low energy lights and lighting controls which automatically switch off when not needed
- The use of sun pipes to increase daylight in poorly lit areas inside buildings
- The SPD sets out a hierarchy of means by which carbon emissions should be reduced:
- Reduce energy consumption by increasing building insulation and other sustainable design techniques.
- Increase the efficiency of energy generation through the use of combined heat and power (CHP) and district heating (DH) systems. Producing energy close to the point of use reduces transmission losses from the national grid.
- Generate energy from renewable sources such as: solar water heaters, photovoltaic (PV) arrays, wind turbines, air or ground source heating/cooling and biomass heating/power plants.

The Council acknowledges that not all of these will be suitable or viable for every development and a careful assessment of the contribution of each of these will be necessary to meet the Council's requirements. The SPD sets out minimum standards in line with Policy CP26, with the additional point that all other development should minimise carbon emissions. To go further all development should exceed the minimum standards to achieve carbon neutrality in line with government targets, carry out an energy audit to demonstrate reduction of carbon emissions and provide guidance to building occupiers to optimise use of heating and lighting systems.

It is recognised by the Council that on some sites it may not be practicable to meet the policy requirements through on-site measures alone and connection may need to be made to neighbouring DLCRE infrastructure by direct wire or heat transmission conduit.

The SPD recognises that energy consumption can be reduced through building design (as outlined above), through the behaviour of individuals, through designed-in features such as automatic lighting and through measures such as energy efficient appliances and the fitting of smart meters. In residential development the provision of external space for drying washing naturally can assist in reducing energy consumption.

The SPD outlines the benefits from increasing energy generation efficiency, through using systems such as CHP, which are now available even for small-scale developments. It also sets out the range of technologies that may be suitable for on-site and decentralised power generation in the Borough, providing information on issues associated with each technology. These are:

- Solar water heating
- Ground/air source heating/cooling
- Wind turbines
- Photovoltaics
- Biomass heating/power

The benefits of providing local area energy networks through DLCRE are set out in the SPD:

- Energy suppliers can run under optimum conditions due to evening out of the total energy load arising from the requirement for power at different times of the day from businesses and residents.
- Carbon saving potential and cost effectiveness increases with scale.
- Individual developments can connect to the network rather than provide their own on-site renewable energy or rely on the national grid.

The SPD recognises that a third party organisation, whether an energy service company or ESCo, will be required.

The Council recognises through the SPD that there may schemes where it can be demonstrated that the requirements of Policy CP26 are not feasible or viable. However, its view is that there will be few occasions where an exception can be justified. Developers are expected to provide detailed evidence, including a technical and financial appraisal of alternative approaches to justify why the requirements cannot be met. Buildings located within or near to conservation areas, listed buildings and other historic assets are still expected meet the requirements of the policy but special care will be needed to establish how the requirements of Policy CP26 can best be met.

The SPD recognises that there is a need to adapt to climate change, including a need to future proof developments against expected further changes in climate change. A range of minimum standards are set out that developers should take into account:

- Design development that adapts to and mitigates expected changes in climate.
- Design buildings for flexible use during their expected lives.
- Design-in facilities for bicycles and electric vehicles.
- Ensure that future phases of major developments which take several years to build out are able to keep step with the most up-to-date sustainability requirements.

The SPD sets out a minimum requirement that development should meet the national standards for building performance set by current Building Regulations. It goes on to outline the means by which development can go further:

- All residential development to achieve a Code for Sustainable Homes rating which would exceed the requirements of the current Building Regulations.
- All non-residential development to achieve a BREEAM rating which would exceed the energy requirements of the current Building Regulations.

The SPD acknowledges that Government is considering introducing a national code for non-residential buildings to replace BREEAM.

Arising from all of the above is a requirement from the Council for all planning applications to be accompanied by a sustainability statement, which should include where there is a requirement, an energy audit, to demonstrate the reduction of carbon emissions. Bedford Borough Council allows for the calculation of carbon emissions using either the London Renewables Toolkit, BRE's Standard Assessment Procedure (SAP) or Simplified Building Energy Method (SBEM) or the Code for Sustainable Homes or BREAAM for non-residential buildings. Using CSH the Council identifies that achieving level 1\* is likely to meet the current minimum requirements of the Council's policy. (Note: this is a very low standard compared with current developments, many of which are meeting Code level 3 as a minimum).

The SPD contains a range of model planning conditions that may be used to ensure compliance with the Council's policy and SPD, through a requirement for an energy audit.

### 11.2.7 North Northamptonshire

The North Northamptonshire Joint Planning Unit adopted its Core Spatial Strategy in 2008. It includes an energy target and specifies a Code level for new developments. This is in recognition not only of the national targets to reduce carbon emissions but also as stated at paragraph 4.20 of the plan:

*“Given the level of growth earmarked for North Northamptonshire, it is imperative that a realistic and serious response to meeting climate change obligations is made in respect of planning for new development. A key objective of the Plan for North Northamptonshire is for the area to be a beacon of best practice, becoming a benchmark for green living through using high standards of design, sustainable construction methods and green technology.”*

The strategy contains a policy that requires a target of at least 30% of the demand for energy to be met on site (the actual figure to depend upon technical and economic viability), and renewably and/or from a decentralised renewable or low-carbon energy supply.

“Policy 14: Energy Efficiency and Sustainable Construction

Development should meet the highest viable standards of resource and energy efficiency and reduction in carbon emissions. In particular:

- a) Proposals for large developments<sup>65</sup> including the Urban Extensions, should demonstrate that:
  - i. residential units to be delivered 2008–2012 will meet the Code for Sustainable Homes (CSH) level 3 as a minimum; those delivered 2013–2015 will meet

<sup>65</sup> Large developments referred to in this policy include developments of 200 or more dwellings.

CSH level 4 as a minimum; and those delivered from 2016 onwards will meet CSH level 6 as a minimum<sup>66</sup>

- ii. non-residential development will be compliant with a BREEAM/Eco-building assessment rating of at least 'very good'<sup>66</sup>
- iii. a target of at least 30% of the demand for energy will be met on site (the actual figure to depend upon technical and economic viability), and renewably and/or from a decentralised renewable or low-carbon energy supply<sup>67</sup>

b) Elsewhere, development proposals should demonstrate that:

- i. the development incorporates techniques of sustainable construction and energy efficiency
- ii. there is provision for waste reduction/recycling
- iii. there is provision for water efficiency and water recycling
- iv. residential development involving 10 or more dwellings or 0.5 hectares or more of land, and non-residential development involving 1,000 square metres gross floor area or 1 hectare or more of land should demonstrate that at least 10% of the demand for energy will be met on-site and renewably and/or from a decentralised renewable or low-carbon energy supply<sup>67</sup>

Supporting text recognises that larger scale developments including the Sustainable Urban Extensions proposed provide the opportunity to secure exemplary standards of sustainable design and renewable or low carbon energy generation. This should be planned from the start but it is recognised that environmental performance is likely to improve progressively. Policy 14 requires large new residential developments to meet the levels of the Code necessary to deliver the three steps to achieving zero carbon emissions by 2016.

The Joint Planning Unit recognises that the targets in Policy 14 are challenging and intends to monitor the implementation of the policy to ensure that it does not deter investment, particularly in respect of commercial development. However, it is stated in the Core Strategy that it is not anticipated that this will be the case.

The Joint Planning Unit produced Supplementary Planning Document on Sustainable Design to help developers comply with Policy 14, which was adopted in 2009. It provides advice on the types of projects where a Sustainable Design and Energy Statement will be necessary. In this regard changes of use, full planning applications for commercial development, planning applications for residential and for mixed use require such a statement to be submitted whereas residential extensions, conservation area consent and listed building consent are not required to submit a statement.

The SPD establishes an energy hierarchy to be considering in all proposals as follows:

<sup>66</sup> Or an equivalent or better rating in any new or additional assessment method that may be implemented during the period of this Core Spatial Strategy.

<sup>67</sup> Unless alternative measures such as off-site generation elsewhere within North Northamptonshire can be demonstrated to achieve the same or greater levels of carbon savings.

1. The design of the building must minimise the need for energy in its operation, including reducing heat loss through effective insulation, avoiding cooling requirements and improving air quality through natural, passive ventilation and utilising natural daylight for lighting.
2. The operation of the building must minimise the need for energy and provide the building users with energy saving measures e.g. low energy light bulbs and A rated appliances are essential low carbon measures, as well as the behaviour of the buildings occupants.
3. On-site renewables from any source can be considered.

In calculating energy assessments the SPD specifies that Part L of the Building Regulations (SAP) and BREDEM should be used. It also states that the renewable energy equipment to be provided "will for practical reasons usually need to be located on-site but nearby off-site locations may be possible, district heating or CHP will be required to meet the higher Code levels". London Renewables Toolkit is recommended for further information on estimating energy needs, outputs and costs but system design and sizing is a specialist activity and expert guidance should be sought.

It also intends to prepare an energy strategy for North Northamptonshire to identify local opportunities to promote renewable, low carbon and decentralised energy systems. In the meantime Policy 14 identifies minimum targets for the provision of energy from these sources that will be sought having regard to the viability of individual developments.

### 11.2.8 Ashford

Ashford Borough Council is one of four growth areas established by the Government to tackle housing supply in the wider South East. Ashford in Kent is expected to double in size and population by 2031. Ashford Borough Council adopted its Core Strategy in 2008. The strategy includes:

- Policy CS8: Infrastructure Contributions;
- Policy CS9: Design Quality, and
- Policy CS10: Sustainable Design and Construction.

*“POLICY CS8: Infrastructure Contributions*

*A 'strategic tariff' will be used to secure contributions to help fund the strategic physical infrastructure and other facilities needed to support the sustainable growth of the Ashford Growth Area. Amongst other things, the tariff may be used to facilitate the establishment of community organisations in accordance with Policy CS18.*

*All residential development in the Ashford Growth Area will pay the tariff - including schemes on allocated LDF sites, in-fill sites and 'windfalls'. Residential development on brownfield sites will be encouraged by a reduction in the full residential tariff rate, as will changes of use of existing buildings or conversions of existing houses to create additional homes.*

*Employment and retail proposals will not be required to pay the strategic tariff. However, within the Town Centre contributions from such proposals will be sought to help provide for the programme of major public realm improvements needed to regenerate the town. This*

*approach will be set out in the Town Centre Area Action Plan and Infrastructure Contributions SPD.*

*The tariff will be payable in stages from commencement to completion of the development, related to the scale of development – details of which shall be set out in SPD.*

*The tariff will be set at a rate, currently envisaged to be about £14,000 per dwelling which should not undermine the viability of development. The rate will be reviewed at least every 3-5 years, following consultation with providers, landowners and developers. Where developers consider that paying the standard tariff would have serious implications for the viability of developments, the Council will encourage an ‘open book’ approach and where necessary will operate the policy flexibly.*

*The tariff rates, the processes involved and the levels of any reductions in the full tariff rate will be set out in a Supplementary Planning Document. Detailed specifications of the on-site contributions needed will be set out in site policies in the relevant site allocation DPDs.*

*Site specific requirements will be tackled using dedicated planning agreements to provide the range of facilities needed. Such facilities will normally be provided on-site but may exceptionally be provided in an off-site location or via in-lieu contributions. Detailed clarification of the facilities that it is expected will be provided on-site and those that are to be provided through the strategic tariff will be set out in SPD.*

*Outside the Ashford Growth Area, residential development will be required in principle to make contributions towards the infrastructure and community facility requirements of their local town or village based on an assessment of local requirements. Details will be set out in the site allocation policies in the Tenterden & Rural Sites DPD.”*

The Core Strategy describes the uses that strategic tariff contributions will be put as including “strategic renewable energy projects such as CHP and biomass”. In respect of site-specific provision (to be provided through conditions or a Section 106 agreement) the following are envisaged: renewable energy measures to meet the targets in Policy CS10. It goes on to say that where sites are too small for on-site provision to be practicable or efficient an ‘in lieu’ contribution to off-site provision may be acceptable. This is intended to be outside the tariff system.

“POLICY CS9: Design Quality

Development proposals must be of high quality design and demonstrate a positive response to each of the following design criteria:

- a) Character, Distinctiveness and Sense of Place
- b) Permeability and Ease of Movement
- c) Legibility
- d) Mixed use and Diversity
- e) Continuity and Enclosure
- f) Quality of Public Spaces

- g) Flexibility, Adaptability and Liveability
- h) Richness in Detail
- i) Efficient use of Natural Resources”

In respect of the efficient use of natural resources, Ashford’s Core Strategy states that “Buildings and landscapes should be designed to minimise and make efficient use of natural resources during construction, operation and maintenance”. It goes on to say that:

*“Developments which make efficient use of natural resources can also contribute to climate change mitigation and adaptation, and reduce the ecological footprint of Ashford’s growth (14). New buildings should be designed in a way that makes efficient use of natural resources, this can include minimising the need for energy and water consumption, utilises renewable energy sources, provides for sustainable drainage, supports water re-use and incorporate facilities which encourage reuse and recycling of waste and resources. The use of local sources, recycled or sustainably managed resources can contribute to this approach. Sunlight and energy efficiency should be considered as an integral part of the layout through passive solar design, however this should not have an adverse impact on urban design qualities outlined above.*

*New developments should also consider whole-life performance and costs. Developments which reduce energy demand and are highly insulated can also reduce the effect of light pollution and noise pollution.*

*Many of the principles of making efficient use of natural resources are dealt with in detail in Policy CS10 which applies to major developments. However it will be expected that those sustainability principles should be considered where appropriate to all types of development.”*

Policy CS10 aims to deliver zero carbon growth in Ashford. It states that:

“All major developments (as defined in paragraphs 9.56 and 9.57) must incorporate sustainable design features to reduce the consumption of natural resources and to help deliver the aim of zero carbon growth in Ashford.

Unless it can be demonstrated that doing so is not technologically practicable, would make the scheme unviable or impose excessive costs on occupiers developments are expected to:

- A. Achieve the standard set out below, or specified in a later DPD, or an equivalent quality assured scheme, with a strong emphasis on energy, water and materials. These requirements will be met through:
  - a. Energy and water efficiency,
  - b. Sustainable construction materials, and
  - c. Waste reduction.
- B. Reduce carbon dioxide emissions through on-site sustainable energy technologies at the percentage set out below or at such other level as may be specified in a subsequent DPD.

- C. Be carbon neutral which can be met through a combination of (A) and (B) above, with any shortfall being met by financial contributions to enable residual carbon emissions to be offset elsewhere in the Borough.”

Within this policy the council has specified that particular levels of the Code for Sustainable Homes, Ecohomes (in the case of existing refurbishments) and BREEAM should be met, as set out below. It is also important to note that the council has also specified that particular levels of BREEAM criteria should be attained. Minimum CO<sub>2</sub> reduction standards are also set out, ranging between 10% and 30% depending on the nature of the area. Policy text advises that revised standards for 2015 onwards will be set in a review of the Core Strategy. It also states that sites that come forward in piecemeal fashion will be required to meet the targets in the plan, as if they had come forward as a single site.

**Table 10: Ashford LDF, 2007-2014**

|                                   |                  | (CS3)<br>Town Centre &<br>(CS4)<br>Brownfield<br>Urban Sites | (CS5)<br>Urban<br>Extensions<br>& (CS4)<br>Greenfield<br>Urban Sites | (CS6)<br>Tenterden,<br>The<br>Villages | Existing and<br>refurbishmen<br>t |
|-----------------------------------|------------------|--|--|--|-----------------------------------|
| BREEAM                            | Residential      | Code level 3   | Code level 4   | Code level 2                           | EcoHomes 'Very Good'              |
|                                   | Overall level    | Very Good  | Excellent  | Good                                   | Very Good                         |
|                                   | Energy Credits   | Excellent  | Excellent  | Excellent                              | Excellent                         |
|                                   | Water Credits    | Maximum  | Maximum  | Excellent                              | Excellent                         |
|                                   | Material Credits | Excellent  | Excellent  | Very Good                              | Very Good                         |
| Minimum CO <sub>2</sub> reduction |                  | 20%  | 30%  | 10%                                    | 10%                               |

Supporting text advises that standards have been set by development area to reflect the types of development expected to come forward within them. The level at which they are set is a balance between their economic viability, social acceptability and environmental impact.

The thresholds for which Policy CS10 is applicable are set out in the supporting text as follows:

Major developments

- Ten or more dwelling units or on residential sites of 0.5 hectares or more in area.
- For non-residential developments, any scheme of at least 1,000 sq m gross external floorspace or, any development on a site 1 hectare or more in area.

(These are the types of development likely to make up a large proportion of the housing growth in the LDF period, and are the suggested threshold for the inclusion of renewable energy in the draft South East Plan Policy EN1).

Development in Tenterden and the Villages, and the Countryside:

- Major development will be defined as five or more dwelling units.
- For non-residential units 500 sq m or sites of 0.5 hectares or more.

All thresholds defined above apply to cumulative development within the site, even if development is brought forward in separate applications or on separate parcels.

With regard to CO<sub>2</sub> reduction targets the Core Strategy states that *“the percentages set in Policy CS10 are based on a balance between economic viability, the Council’s ambitions to minimise the environmental impact of new development and the target for onsite renewables that is needed to deliver a reduction in carbon dioxide emissions if the UK as a whole is to move towards meeting the Energy White Paper target to reduce the UK’s emissions of Carbon Dioxide by 60% by 2050”* (paragraph 9.59). The percentages are a target through on-site renewable above that required by Building Regulations.

Supporting text to the Policy CS10 recognises that energy efficiency is often the most cost effective route to reducing carbon emissions. This can include the siting, design, layout and building orientation to maximise sunlighting and daylighting, avoidance of overshadowing and passive ventilation. Other examples include the NHER (National Home Energy Rating) rating, passive solar design, sheltered microclimate, high levels of insulation, heat recovery and combined heat and power.

It states that sustainable energy will be delivered by reducing a percentage of the CO<sub>2</sub> emissions through on-site renewable energy, such as solar thermal and micro-wind. Major developments are expected to consider how the integration of Combined Heat and Power (CHP), including mini and micro-CHP, and district heating infrastructure in major developments) could be used in meeting the policy requirement. Use of traditional coppice woodland as a source of biomass fuel will also be encouraged.

The Core Strategy makes specific reference to ‘C. Financial contributions or carbon offsetting to make developments carbon neutral’ stating that *“Any remaining emissions from a development will need to be offset in order to make developments carbon neutral. This will be through a financial contribution and/or off-site renewable energy facilities, energy efficiency schemes and tree planting as part of Ashford’s Green and Blue Grid”*. A Supplementary Planning Document is to be prepared that will set out how the carbon offsetting will be administered and delivered, which will be informed by a study assessing the opportunities in the Borough and the approach taken by Milton Keynes.

Two key documents were produced to justify and evidence the need for a strong prescriptive energy policy in Ashford. A Sustainable Design and Construction Background Paper explains the rationale behind each part of CS9 and CS10, an analysis of legality and costs associated with higher sustainability standards. During development of the Core Strategy, the Code for Sustainable Homes was introduced. As a result Topic Paper related to design sustainability details how the policy was modified to accommodate the change from the EcoHomes standard to the Code.

Ashford Borough Council has subsequently adopted a Sustainable Design and Construction SPD (2009). In respect of energy and carbon developers are advised to apply the energy hierarchy as follows when developing proposals:

- Reduce the need for energy.

- Use energy efficiently.
- Supply energy efficiently.
- Use renewable energy.

The SPD recognises that the opportunity for developments to contribute will vary as the potential for integrating sustainable energy technologies differs between different developments and sites. Applicants are expected to include design considerations of installing sustainable energy technologies within their Design and Access Statements.

Compliance with the requirements of Policy CS10 is expected to be demonstrated by applicants through the provision of appropriate documentation. It is recommended that a Sustainability Statement setting out the measures to be taken to achieve the required CSH/BREEAM is submitted in respect of full planning applications. Within this statement should be set out details of the proposed carbon reduction strategy, any residual carbon emissions and a commitment to Part C of the policy.

The SPD confirms that planning conditions will be used to ensure that any commitments in terms of sustainable design and construction standards, including sustainable energy commitments are implemented.

Technical feasibility and financial viability are addressed in the SPD. It recognises that there may be some sites where the standards required by Policy CS10 may not be achieved. Clear evidence and justification as to why a development cannot meet either in whole or in part the standards set out will be required. A high purchase price for development land will not be regarded as sufficient justification. The SPD clearly states that contributions into a fund through Part C of the policy will not be acceptable, and compliance with Parts A and B must be met in the first instance. If full policy compliance cannot be provided, contributions under Part C of the policy will be negotiated on an individual basis to ensure that development is a carbon neutral as possible. The SPD sets out the basis on which a one off contribution into the Ashford Carbon Fund will be sought on completion of a development. It will be managed and monitored by Ashford Borough Council with monies from the fund used to pay for carbon savings through energy efficiency schemes, and tree planting as part of Ashford's Blue and Green Grid. Energy efficiency schemes are favoured by the Council as they are the most cost effective method for reducing CO<sub>2</sub> being released into the atmosphere, from energy use in existing dwellings.

### 11.2.9 Dover

Dover District Council adopted its Core Strategy in February 2010. It states that due to the District's particular sensitivities to the likely impacts of climate change combined with water resource issues, the opportunities for renewable energy production and the scale of development required by the Strategy sustainable construction requirements in advance of the proposed national programme are justified. It recognises that while Policy CP5 set out below will apply to all new development the scale and character of the Strategic Allocations within the district provides scope for additional requirements.

*"Policy CP 5 Sustainable Construction Standards*

*New residential development permitted after the adoption of the Strategy should meet Code for Sustainable Homes level 3 (or any future national equivalent), at least Code level 4 from 1 April 2013 and at least Code level 5 from 1 April 2016.*

*New non-residential development over 1,000 square metres gross floorspace permitted after adoption of the Strategy should meet BREEAM very good standard (or any future national equivalent).*

*Where it can be demonstrated that a development is unable to meet these standards, permission will only be granted if the applicant makes provision for compensatory energy and water savings elsewhere in the District.*

*The Council will encourage proposals for residential extensions and non-residential developments of 1,000 square metres or less gross floorspace to incorporate energy and water efficiency measures."*

Developers are expected to demonstrate their compliance with the above policy through the development of energy and water strategies that may form part of Design and Access Statements. They will also be required to submit appropriate post-construction certificates to demonstrate that measures proposed have been implemented.

Where schemes are unable to comply with Policy CP5 supporting text allows for commensurate energy and water savings to be made elsewhere in the District through a financial contribution to the Council to enable it to help fund schemes that would make the savings. The Council intends to publish updates of energy and water efficiency schemes that will be eligible and the cost per tonne of carbon dioxide and per cubic metre of water saved.

The Core Strategy considers four Strategic Allocations in the district, and sets out sustainability requirements in respect of each of them as follows:

- Dover Docks (a 12.2 ha mixed use scheme) - Making a contribution to the advancement of sustainable construction through the inclusion of a district heating system, ensuring that non-residential buildings meet BREEAM excellent standard and that residential buildings achieve at least 75% of the sound insulation credits under the Code for Sustainable Homes
- Mid Town, Dover (a 5.9ha mixed use scheme) - A district heating system is incorporated into the development, non-residential buildings meet BREEAM excellent standards and residential buildings should achieve 75% of sound insulation credits under the Code for Sustainable Homes;
- Connaught Barracks, Dover (a 56ha site for residential development that incorporates a scheduled monument, playing fields and wildlife site) - An energy and water strategy is developed that will be capable of enabling the development throughout its lifetime to meet proposed national stepped requirements for sustainable construction under the Code for Sustainable Homes and the development achieves at least 80% of the ecology credits using the Code for Sustainable Homes and BREEAM assessments, as appropriate;

- Managed expansion of Whitfield (residential development supported by community and other infrastructure) -- an energy and water strategy is developed that will be capable of enabling the development throughout its lifetime to meet proposed national stepped requirements for sustainable construction under the Code for Sustainable Homes but enables residential buildings to achieve a minimum of Code for Sustainable Homes level 4 with immediate effect from adoption of the Core Strategy, non- residential buildings to achieve BREEAM excellent standard and schools to achieve zero carbon rating;

### 11.3 Forecast development in Cambridge – data sources

The table below summarises the data sources behind the graphs of population, housing stock and non-residential building growth in Cambridge presented in section 4.

**Table 11: Building stock growth in Cambridge – key assumptions**

|                                       |              | Data  | Data source  | Notes  |
|---------------------------------------|--------------|---|--|--|
| Population growth                     |              | Forecast population in the city in 2011, 2016 and 2021.   | Cambridge City Council AMR, 2009. Paragraph 2.3, p.9.  | Growth in intervening years based on linear interpolation between these data points. |
| Housing stock growth                  |              | New additions by site type to 2026.   | Cambridge City Council AMR, 2009, appendix C.  | -  |
| Non-residential building stock growth | Office space | Capacity for new office space (B1 use) up to 2021.  | Cambridge City and South Cambridgeshire Employment Land Review, July 2008 (p.57).                  | Growth in intervening years based on linear interpolation.                           |
|                                       | Retail space | Capacity of new floor space for convenience and comparison goods given for 2011, 2016 and 2021. | Cambridge Sub Region Retail Study (2008). Data from Table 18, appendix 5 and Table 12, appendix 6. | Growth in intervening years based on linear interpolation between data points.       |
|                                       | Schools      | Growth in net floor area of schools in Cambridge.   | Assumed growth tracks population growth.   | Data on current stock provided by Cambridge City Council.                            |

### 11.4 Fabric improvement analysis – cost data

The energy efficiency cost analysis presented in section 5.2 is based on the data summarised below. Extra over costs relative to the 'Reference' fabric were calculated based on these data.

**Table 12: Cost data for residential fabric packages (costs in £/m<sup>2</sup> of building element)<sup>68</sup>**

| Element         | U value (W/m <sup>2</sup> .K) | Cost of building element (£/m <sup>2</sup> ) |              |
|-----------------|-------------------------------|--|--------------|
|                 |                               | Masonry                                      | Timber frame |
| Windows & Doors | 2.5                           | 250  | 250          |
|                 | 1.5                           | 260  | 260          |
|                 | 1.1                           | 281  | 281          |
|                 | 0.7                           | 333  | 333          |
| Ground floor    | 0.25                          | 107  | 107          |
|                 | 0.20                          | 110  | 110          |
|                 | 0.15                          | 114  | 114          |
|                 | 0.10                          | 123  | 123          |
| External wall   | 0.35                          | 115  | 128          |
|                 | 0.25                          | 121  | 133          |
|                 | 0.20                          | 123  | 137          |
|                 | 0.15                          | 126  | 148          |
| Roof            | 0.18                          | 10   | 10           |
|                 | 0.15                          | 12   | 12           |
|                 | 0.13                          | 14   | 14           |
|                 | 0.10                          | 17   | 17           |
| Party wall      | 0.20                          | 123  | 123          |
|                 | 0.00                          | 127  | 127          |

The costs of improving air permeability from a baseline of 10m<sup>3</sup>/m<sup>2</sup>.hr to values of 7, 4 and 1 were taken as £500, £850 and £1,300 respectively. These are indicative figures and costs can vary on a project-by-project basis.

<sup>68</sup> From cost data held by Element Energy and used in recent reports for Government, e.g. in assessing the costs of building to the Code for Sustainable Homes. All U values in W/m<sup>2</sup>.K.

## 11.5 Renewable energy resource assessment – methodology

### 11.5.1 Heat mapping

The methodology for generating the heat density maps presented in section 6.1 is summarised below.

- Buildings in Cambridge were provided by Cambridge City Council as GIS-compatible files, from which an estimate of the internal floor area of each building could be made.
- Each buildings was assigned a type, from residential to retail, office, hotel etc (a total of twenty building types were used). Each building type was allocated a specific energy consumption figure (kWh/m<sup>2</sup>.yr), based on published benchmark data.
- Hence estimates of the energy consumption of each building were made. These estimates were checked against published data on the gas consumption by MLSOA in Cambridge in order to calibrate the results.<sup>69</sup>
- The demands of buildings within defined grids (e.g. 50m x 50m) were summed to find average heat demand at certain levels of resolution. This allows identification of areas of high heat density and hence potential opportunity for district heating networks.

### 11.5.2 Wind resource mapping

The wind speed maps presented in section 6.4 are based on results from the NOABL (National Oceanic and Atmospheric Administration Boundary Layer Model) database, which are available from DECC.<sup>70</sup> These data give estimates of mean annual wind speed in 1km square grids throughout the UK, based on an air flow model which estimates the effect of topography on wind speed. Data are held at heights of 10m, 25m and 45m above ground level. It should be noted that these data give an estimation of wind speeds and should not be relied upon for assessing the suitability of a site for wind turbine development.

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<sup>69</sup> See, for example:

<http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/whatwedo/energy/statistics/regional/mlsoa-electricity-gas/page50221.html>.

<sup>70</sup>

[www.decc.gov.uk/en/content/cms/what\\_we\\_do/uk\\_supply/energy\\_mix/renewable/explained/wind/windsp\\_databas/windsp\\_databas.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/explained/wind/windsp_databas/windsp_databas.aspx)

## 11.6 Decarbonising Cambridge workshop – outputs

This section summarises the full list of issues discussed at the workshop held in Cambridge on February 8<sup>th</sup> 2010. Barriers are classified as technical, economic or other and potential solutions to the barriers identified fall into one of two categories: planning policy or non-planning policy.

### 11.6.1 Barriers to low carbon development in Cambridge

#### Technical barriers

Technical barriers to delivering low carbon building include:

- Lack of technical skills in the building sector in relation to emerging LZC technologies. However, as more experience is gained this should become less of an issue.
- Complexity: the high number of technological options available makes it difficult for builders to select the optimal solution and confusing for householders. Lots of complex, novel technology in a home is likely to be off-putting to many consumers.
- Trust in technology: lack of understanding of how new technology might perform and whether it will meet the needs of the consumer.
- There are many technology choices and suppliers, which can be somewhat overwhelming. Until solutions become more standardised expert advice is required to assist in making the right technology choice.

#### Economic barriers

Creating low carbon developments involves higher capital expenditure relative to traditional building approaches. This was recognised in the workshop discussions, with the following key points identified:

- High capital cost of low carbon technologies remains a barrier to uptake. Even incentives such as the feed-in tariff (FiT) may not prove sufficient in every case. The FiT levels are based on certain economic assumptions. There is a risk to a householder if, for example, the mortgage is increased to pay for LZC technology, and most homeowners do not have spare cash to pay for such technologies.
- Microgeneration technologies are relatively expensive and there is little to no evidence that such technologies increase the value of a home.
- Microgeneration technologies may offer a return (especially with support such as FiT/RHI) but the average tenure of householders is around seven years (too short a period to realise the return).
- There is insufficient financial incentive for building/buying 'low carbon' homes for developers and most house buyers.
- A major barrier to retrofitting district heating networks is the capital cost and disruption involved.
- On-going maintenance and managements costs of district heating networks were highlighted as a concern. These are potentially high and uncertainty is also an issue.
- Landlords of rented properties have no incentive to reduce energy bills for tenants.

### Other barriers

Discussions at the workshop were wide-ranging and a number of other barriers to low carbon development were identified, including:

- A lack of leadership in reducing carbon emissions and a lack of consumer awareness. For example, the only examples of successful community heating in the UK are when the Council shows leadership and acts as a catalyst to initiate the scheme.
- There is a concern that consumers become 'locked in' with one supplier if connected to a district heating network.
- There are many uncertainties (therefore risk) around energy infrastructure. A community energy company (e.g. ESCO) requires a high rate of return on investment (e.g. 20%) given the high risk of such projects.
- Air quality considerations are a barrier to the use of some low carbon heating fuels (such as biomass).
- There is potentially a conflict between optimising dwelling orientation etc for low carbon design and urban design principles. Visual / aesthetic considerations must also be taken into account.
- There is a lack of 'joined up' policy from the national to the local level.

### 11.6.2 Potential solutions to barriers identified

#### Planning policy measures

Suggestions as to how the planning policy could be used as part of the solution to the barriers to low carbon development included:

- The need to improve existing properties was recognised. Consideration should therefore be given to seeking consequential improvements to properties arising from planning consent for extensions and/or alterations.
- An off-site (offset) fund has a potential role to play. However, there are many issues to address, including how such a fund would be administered, what sort of projects it might invest in etc. It was suggested that community scale measures can provide more cost effective means of saving carbon.
- The role of building fabric improvements is very important but potential human health issues of sealed houses must be considered and adequate ventilation provided. Having said this, passiv haus type standards should be considered as part of the solution.
- Planning policy should be future proofed for technology development. Policies need to provide a level of certainty to developers and should be aimed at dealing with commercial as well as residential development.
- Listing status should not necessarily preclude the installation of renewable energy or LZC technology.
- Planning and Building Control departments must work together to achieve carbon reductions. Policies should also be linked to national measuring systems.

- New buildings should be ready for RE / LZC technologies even if not fitted during their construction.
- Flexibility should be retained in terms of the range of technologies that are able to meet the policy requirements. It was also suggested that conditions should be imposed that seek the provision of smart meters.
- The Community Infrastructure Levy is expected to be implemented in April. It was noted that current CIL proposals do not include carbon reduction but the potential for it to aid in delivering renewable energy should be considered. For example, could local authorities collect funds from developers towards infrastructure projects that reduce carbon?
- The viability of any planning policies must be considered. There is a need for open discussion with applicants and experts within the Council to ensure that the developer's position is understood and that negotiations are fair.
- The city must be careful not to drive developers away to more remote areas where the carbon impact of increased travel will be higher. Clarity on the level of contributions expected is very important for developers. These can then be factored into costs when developing their financial models. Transparency is also important and is not good at present.
- It was suggested that the Code for Sustainable Homes goes some way to encouraging sustainable living.
- The size of many new build apartments means people cannot work at home. Cambridge should consider imposing minimum standards regarding storage space etc.
- Densification was identified as a potentially beneficial. For example if the council could encourage densification in the centre.
- One suggestion for using the planning system to encourage sustainability was for fast tracking planning applications for sustainable / low carbon projects.
- A more holistic approach is required, encouraged through spatial planning – carbon and energy can be viewed as rather boring, whereas biodiversity, water, materials etc can increase marketability.

### Non planning policy measures

During the workshop the following potential solutions to the barriers discussed above were identified:

- Provision of information and advice as to which technical options are available and most suitable for particular householders.
- Local demonstration projects to address the issues of lack of trust in technology and concerns of complexity of technology.
- Simplify the message of what it means to make CO<sub>2</sub> reductions and make the financial argument to home owners.
- Some stakeholders believed that support through the FiT and RHI should be effective in dealing with the capital cost barrier of LZC technologies. Developers would expect

to be able to pass on additional capital cost of low carbon homes to purchasers if low fuel bills and revenues from low carbon technologies were guaranteed.

- The council should show leadership and take opportunities to drive improvements in the existing housing stock – e.g. at the point when a house is purchased/sold and when a householder applies for planning permission for building work.
- Possible economic incentives suggested include cheaper mortgages in return for improving energy efficiency, lower council tax rates for more efficient homes, or stamp duty allowances for investing in energy efficiency improvements / LZC technologies.
- Public buildings close to new development sites could be obliged to offer a guaranteed heat load to improve the viability of low carbon community heating. All organisations with a long-term interest have a role to play. The universities also represent an area of opportunity for carbon emission reductions.
- Investigate how the public sector could take the risk of low carbon energy system development. For example, energy cooperatives might help. Such cooperatives could take the long-term view, provide the capital for new technologies, collect revenues from support schemes and redistribute income streams to members to deliver fuel bill savings. (Pay as you save type schemes).
- Some of the additional cost of building low carbon homes could be absorbed through lower land prices.
- There is an opportunity for innovative business models – e.g. solar thermal company installs panel on home for free and householder pays a rental charge and gets benefit of energy produced.
- Key mechanisms that local authority has at its disposal were identified as:
  - Housing improvement grants for private sector housing – national budget administered through local authority.
  - Improvement to council owned housing stock and public sector buildings.
- Demonstrate ‘art of possible’ in range of examples (showing best practice).
- Benefits of scrappage schemes, such as boiler scrappage, were questioned. For example, new boilers that last only 10 to 15 years are replacing boilers that have run for 30+ years – is the embodied energy offset by savings in use?
- Behavioural change was identified as a key issue. The local authority attempts to drive behavioural change. Providing advice on energy efficiency and low carbon technologies would be useful.
- Council should lead through their own procurement (whilst maintaining value for money): buildings, vehicles, driving behavioural change. The potential for the Council to act as a bulk procurer and pass cost savings on to public should be considered.
- Approved contractor lists could be used to give people reassurance in the products they are investing in.
- Council tax was identified as one potential lever that the City Council could use to incentivise energy efficiency / carbon reduction. The Council is able to manipulate this, within limits.

- Carbon Reduction Commitment was identified as a potentially effective mechanism to reduce emissions – provides a financial incentive but also a reputational issue.
- Need to achieve increased public awareness of energy efficiency of homes, such that it has an effect on sale price – EPCs could provide an incentive to improve the standard of a home before sale.
- Actions taken by the Local Authority must not cause too great an increase on the cost of development in Cambridge, or else developers will go elsewhere.
- Local authority should work to facilitate partnership with private sector – required for delivery of larger projects and also aligned with economic agenda.
- Policies should concentrate on transport as well as buildings.
- Pay as you save schemes are an attractive means of addressing the existing stock.
- ESCOs were identified as a potentially useful mechanism for delivery and operation of CHP schemes.
- City council should take the lead, for example on procurement of electric vehicles and developing infrastructure. Also by creating exemplars, for example to demonstrate best practice to people refurbishing their homes.
- A high level of private rented accommodation in Cambridge was identified as an issue – can landlords be incentivised or required to improve standards at point of change of tenant?
- Transport impacts of new development needs to be considered. Developments that will result in substantial increase in vehicle trips should be required to meet a higher degree of sustainability, i.e. offset the transport emissions by delivering greater reductions of building emissions.
- Improving facilities for home working was also identified as a means of limiting transport emissions. It was also noted, however, that the potential impact of this is somewhat limited as people will still want to regularly interact in person, which means travel. Increased home-working potentially resulting in longer heating hours for homes was also identified as a potential offset against reduced transport emissions.
- Green mortgages identified as a financial incentive that could encourage people to purchase sustainable homes or invest in energy efficiency improvements in existing homes they move into. However, questions remain as to who would provide the finance.
- Tax / credits were also identified as a potential mechanism, but it was noted that councils have only limited ability to change rates.
- Involvement in community owned or public-private ESCO could be of interest, but more information is required – for example, does the Woking model work? Are there project opportunities in Cambridge for a community ESCO?
- Energy study findings suggest limited opportunities for ESCOs in Cambridge City (with the possible exception of urban extensions).
- Cambridge Water Company is looking at setting-up a MUSCO (with partners).
- A number of other possible opportunities to affect the existing stock were identified:

- Working alongside CRC to address commercial and public buildings.
- Potential of using stamp duty relief to incentivise improvements at the point of sale / purchase.
- Or other grants (similar effect but easier to do).
- RSL could be exempt from meeting a certain standard on new homes if they made comparable investment in the existing stock.
- County Council – Farms Estate – owns a lot of land that could be used for renewable energy projects, e.g. wind turbine installations, development of biomass supply. These projects could be publicly-owned (possibly County Council / EEDA) – this would be preferable in order to retain local benefit.
- In terms of new build, Local Authority should take the lead in Council stock – e.g. must achieve CSH level 4 in RSL stock.
- HCA already requires CSH level 3 for grants. Local targets could be ahead of this.
- An advice survey would be useful, for example to identify which technologies are most efficient / cost-effective.
- Quality of construction is a key issue. Post construction monitoring should be used to ensure that standards required are met. Ensuring compliance is critical to achieving carbon reductions in practice.

### 11.6.3 Implementation of proposed solutions to barriers

Successful implementation of the recommended solutions to the barriers discussed in section 7.2.2 will require coordinated efforts from various parties. Whilst the powers of the City Council's planning team are restricted, planning has a role to play in promoting low carbon development and addressing the barriers identified.

The principal measures available to planners to help overcome the barriers identified are discussed in more detail below.

#### Provide information and advice on energy efficiency improvement measures and LDC technologies

The planning team could produce case studies of a selection of representative homes in Cambridge that have advanced levels of energy efficiency and/or LDC technologies installed. This could include new and existing buildings and should give an idea of capital costs, on-going savings / revenues, and any other relevant facts (e.g. impact of energy efficiency improvements on comfort in the building). Publishing the case studies on the City Council's website would serve to disseminate the information and promote energy and carbon saving measures.

The case studies could be supplemented with documentation summarising the full range of energy saving measures, approximate costs and effectiveness. The Energy Saving Trust provides this sort of information and advice to home owners and could therefore be a useful information source for such work.

### Promote schemes which support renewable energy technologies

The feed-in tariff (introduced in 2010) and renewable heat incentive (due from 2011) are designed to make investment in renewable energy technologies an economically attractive proposition. The planning team could play a role in awareness-raising by publishing summary documents to introduce the schemes, explain how they operate (for a non-technical audience) and outline the benefits. There is potential overlap here with the case studies (above), where real-life examples of local residents / business benefiting from the FiT could act as a catalyst to further action by others. With interest rates still at an all-time low, now is a good time to promote alternative options for investment.

### Demonstrate leadership by improving the performance of existing Council owned buildings

Improving Council owned property offers the double advantage of reducing the impact of the Council's activities (and thus contributing towards the targets in the Climate Change Strategy and Action Plan) and showing leadership, therefore encouraging others to take action. The first stage should be a review of energy use in and CO<sub>2</sub> emissions from Council's property to identify carbon saving opportunities. Expressing energy demand, for example, in terms of demand per unit floor area or per head of staff in the building would allow comparison between different buildings (of similar usage) and therefore identification of the best and worst performers. Specific energy demands (i.e. energy per unit floor area) can also be compared against standard benchmark figures such as BRE benchmarks for typical, good and best practice. The review should be followed by an assessment of the opportunities to reduce energy consumption in all buildings, but particularly the worst performing, which will allow action to be targeted to achieve the most cost and carbon effective savings. Most opportunities are likely to require some level of capital investment and it is therefore necessary to consider the financing opportunities available and to build the business case for investment, i.e. through calculation of the payback period.

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## 11.8 Glossary

|       |  |
|-------|--|
| AAC   | <b>Autoclaved aerated concrete</b><br>A lightweight, precast building material that provides structure, insulation, fire and mould resistance. Standard AAC products include blocks, wall, floor, and roof panels, and lintels.  |
| AAP   | <b>Area action plan</b><br>A Development Plan Document that forms part of a Local Development Framework. AAPs establish proposals and policies for the development of a specific area.   |
| AGL   | <b>Above ground level</b><br>Height above ground level, which is relevant for the wind resource assessment in this study since wind speed increases with height.   |
| AMR   | <b>Annual Monitoring Report</b><br>A compulsory Development Plan Document that forms part of a Local Development Framework. AMRs must be submitted to Government via the Regional Government office at the end of December each year. Their primary purpose is to report on the progress and effectiveness of the LDF.   |
| ASHP  | <b>Air source heat pump</b><br>A type of highly efficient heating technology that extracts thermal energy from / rejects heat to the ambient air for internal heating / cooling.   |
| CHP   | <b>Combined heat and power</b><br>The simultaneous generation of usable heat and power.  |
| CSH   | <b>Code for Sustainable Homes</b><br>National standard for the sustainability of new homes in England.   |
| DCLG  | <b>Department for Communities and Local Government</b><br>Government department responsible for planning, building , and the environment, amongst other roles.   |
| DCLRE | <b>Decentralised low carbon and renewable energy</b><br>Refers to the generation of energy from renewable or low carbon sources at a local level.  |
| DER   | <b>Dwelling emission rate</b><br>A key metric used in assessing whether or not a dwelling complies with Part L of the Building Regulations. DER, expressed as mass of CO <sub>2</sub> per unit floor area per year (kgCO <sub>2</sub> /m <sup>2</sup> .yr), gives an indication of the expected carbon impact of a new home as a result of regulated energy use. |
| DHW   | <b>Domestic hot water</b><br>Hot water consumed in a home.   |
| EfW   | <b>Energy from waste</b><br>A generic term used to refer to the process of extracting useful energy from discarded materials (which may be achieved via one of a number of alternative technologies).  |
| FiT   | <b>Feed-in tariff</b><br>A financial support mechanism that provides guaranteed tariff payments to generators of renewable electricity through systems under 5MW <sub>e</sub> . FiT payments began from April 2010.  |

|            |  |
|------------|--|
| GIS        | <p><b>Geographic Information System</b></p> <p>Refers to computer software designed to capture, store, analyse and present data linked to locations.</p>   |
| GSHP       | <p><b>Ground source heat pump</b></p> <p>A type of highly efficient heating technology that extracts thermal energy from / rejects heat to the earth for internal heating / cooling.</p>   |
| kW         | <p><b>Kilowatt</b></p> <p>This is a standard unit of power, which measures the rate of conversion of energy from one form to another. One watt represents one joule per second and a kilowatt is one thousand watts.</p>   |
| kWh        | <p><b>Kilowatt hour</b></p> <p>This is a unit of energy that corresponds to 3.6 million joules (equivalent to the energy produced by a generator with a steady output of 1kW operating for one hour).</p>  |
| LDF        | <p><b>Local Development Framework</b></p> <p>LDF refers to a collection of local development documents which together outline how planning is managed in a local area.</p>   |
| MBT        | <p><b>Mechanical biological treatment</b></p> <p>A form of waste processing that combines a sorting facility with some form of biological treatment such as anaerobic digestion or composting.</p>   |
| MW         | <p><b>Megawatt</b></p> <p>A unit of power. 1MW = 1,000kW.</p>  |
| MWh        | <p><b>Megawatt hour</b></p> <p>A unit of energy. 1MWh = 1,000kWh.</p>  |
| MVHR       | <p><b>Mechanical ventilation with heat recovery</b></p> <p>Mechanical ventilation is an active system of achieving air movements around a building, i.e. it requires an energy input. However, by incorporating a heat exchanger to transfer heat from the extracted air to the incoming air, space heating energy demands can be reduced during the heating season.</p> |
| PassivHaus | <p><b>PassivHaus</b></p> <p>Refers to a specific construction standard for buildings designed to minimise heating and cooling demands. The standard includes a benchmark of total energy for space heating and cooling of &lt;15kWh/m<sup>2</sup>.yr and total primary energy use for all appliances, DHW, space heating and cooling of &lt;120kWh/m<sup>2</sup>.yr.</p> |
| PPS        | <p><b>Planning Policy Statement</b></p> <p>Statements prepared by Government (following public consultation) to explain statutory provisions and provide guidance on planning policy and the operation of the planning system.</p>   |
| PV         | <p><b>Photovoltaics</b></p> <p>Solar PV is a technology that converts sunlight into electricity.</p>   |
| RDF        | <p><b>Refuse derived fuel</b></p> <p>A fuel produced from municipal solid waste.</p>   |
| RHI        | <p><b>Renewable heat incentive</b></p> <p>A proposed financial support mechanism for generators of renewable heat.</p>   |

Currently still under development, the RHI is scheduled to be introduced in Great Britain in 2011.

SAP **Standard assessment procedure**

The Government's standard methodology for assessing the environmental impact of homes.

SH **Space heating**

Refers to the energy demands of a building to maintain a comfortable internal temperature.

SHLAA **Strategic housing land availability assessment**

An assessment of land available for development that must be carried out by local authorities in accordance with PPS3 (Housing).