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This strategy is intended to provide general guidance only. It has been written at a time when policy and guidance is in a transitional state. To the best of our knowledge the assumptions and interpretations of national, regional and local policy are correct, but it is not a substitute for the application of professional expertise. Anyone using this publication must make their own assessment of the suitability of its content.

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Introduction
This Strategy gives a detailed overview and provides recommendations for how the proposed Truro and Threemilestone urban extension can be sustainable. It is based upon the principles of creating sustainable communities that have a low impact on the environment and bring social and economic wins for local residents and the Council.

Vision
By 2026 Truro and Threemilestone will have grown to accommodate new low impact, future proofed, sustainable communities that integrate well with existing areas. The urban extension will have well designed buildings and infrastructure, resilient to climate change, that support the four pillars of sustainable development. It will meet the needs for new and affordable housing, linked to fully integrated transport networks, close to areas of work, amenities and services. Residents will have access to open space, in desirable places to live and the opportunity to grow their own food. High levels of energy efficiency and decentralised energy supply will result in buildings that are affordable to run, easy to manage and comfortable to live in, whilst reducing the potential impact of peak oil and improving energy security.

The two principal tools to enable this vision to happen are the sustainable development framework and the energy hierarchy.

Sustainable Development

- Economic
- Environmental
- Social
- Governance

Energy Hierarchy

- Mean
- Lean
- Sustainable Urban Extension
- Green
- Clean

This Strategy is a starting point for creating a sustainable future. It sets out the targets that developers will need to achieve, covering sustainable construction and local energy generation. It requires high design standards for individual buildings and considers the wider needs for sustainable communities. Not only will this reduce the impact of the new development, but will also support existing communities within Truro and Threemilestone. To be realised, the local community needs to be fully engaged with the issues and opportunities that exist, and play a role in shaping a resilient development that provides economic, social and environmental benefits now, and for future generations.

With appropriate planning and decision-making this vision can be delivered and the Council can create a lasting legacy for Truro and Threemilestone.
1. Executive Summary

Purpose
This Energy and Sustainability Strategy was commissioned by Carrick District Council for the planned urban extension in Truro and Threemilestone. It provides an overview of the mechanisms that can be used to reduce the impact of the development in terms of climate change and considers how to ensure the principles of sustainable development are adhered to.

It is a detailed report that describes the key issues facing communities and considers how these can be addressed through the use of sustainable construction, energy efficiency, renewable energy and wider sustainability. It describes the opportunities to design and construct buildings that are affordable to run, easy to control and comfortable to occupy. There is a real opportunity to create a zero carbon, low impact development that is designed to meet the needs of existing and new communities in a sustainable, future proofed way.

Context and Drivers
It is important for the Council to consider how to create sustainable new communities that effectively link to the existing communities within the development area. Decisions and targets to inform the new Area Action Plan (AAP), should take account of the key drivers that are set out in chapter two of this strategy, which include:

- addressing climate change in terms of mitigation and adaptation;
- balancing environmental, economic, social and governance issues;
- reducing the current ecological and carbon footprints;
- increasing energy security and reducing the risks of peak oil;
- engaging the local community in decision making.

Chapter three provides an overview of mechanisms that can be used to address the key drivers, providing a framework to reduce the overall impact of the urban extension. This can be achieved firstly with the use of sustainable energy, based on the energy hierarchy, which is a key tool for reducing the demand for energy and its associated carbon emissions. The starting point is good spatial planning which will support the principle reason behind the urban extension in terms of locating housing close to employment, transport links and services. Steps can then be taken to reduce energy demand further, through good building orientation and measures to improve the thermal efficiency of buildings. The remaining energy needs should then be met in clean and efficient ways. This will reduce the reliance on fossil fuels, reduce the threat of climate change and reduce energy security and peak oil risks.

An overview of how to encourage the creation of more sustainable communities is also provided in terms of:

- balancing and integrating the social, economic and environmental components of the community;
- meeting the needs of existing and future generations;
- respecting the needs of other communities.
Energy and Sustainability Strategy for Truro and Threemilestone Urban Extension

Planning Framework and Targets
Chapters four and five provide an overview of the planning framework in relation to energy and sustainability at national, regional and local levels; providing a context for the targets and standards that should be applied to the urban extension.

National policy has made sustainable development and climate change central to the planning process. This includes policies to improve Building Regulations, linked to Energy Performance Certificates and the Code for Sustainable Homes (CSH), and ongoing consultations for further improvements to them. Overviews of each of these are provided; together with links to relevant Planning Policy Statements.

Regionally, the draft spatial strategy (RSS) provides a strong and clear framework for ensuring new development incorporates the principles of sustainable construction, energy efficiency, renewable energy and the broader principles of sustainable development. It reflects the needs and aspirations for development and land use to 2026, building upon national policies, and provides the overall development context for the Local Development Framework (LDF). Two of the key policies used to inform this Strategy are Development Policy G and Policy RE5.

Policy G covers sustainable construction and requires local authorities and developers to ensure that their strategies, plans and programmes achieve best practice in sustainable construction. Policy RE5 deals specifically with renewable energy generation, setting a minimum requirement for 20% of regulated carbon emissions to be saved from on-site renewables.

Locally, an overview of county and district policy is included to ensure that the targets within this Strategy link effectively to local policy.

Carrick need to be ambitious in setting targets for the urban extension, based on the principles of sustainable development and the mitigation of, and adaptation to, climate change. The energy hierarchy should be the main tool to reduce emissions, linking to Policy G and Policy RE 5 of the draft RSS. The targets also link to the CSH and BREEAM in terms of emissions and sustainable construction.

The targets recommended within this Strategy follow those set out within the draft RSS which include:

- building to level 3 of the CSH in terms of sustainable construction for homes;
- reducing emissions in line with the CSH at levels 4, 5 and 6 to the timescales below;
- building to the BREEAM 'very good' standard in non-domestic buildings;
- reducing emissions in non-domestic buildings to the levels and timescales below;
- generating 20% on-site renewable energy for all development types;
- meeting the wider sustainability criteria of Policy G.
The energy targets for *residential* buildings in the urban extension can be summarised as:

<table>
<thead>
<tr>
<th>Timescale</th>
<th>% reduction compared to 2006 BR Part L (Policy G)</th>
<th>% requirement for on-site renewable energy generation (Policy RE 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 to 2010</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td>20% regulated emissions</td>
</tr>
<tr>
<td>2011 to 2015</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td>20% regulated emissions</td>
</tr>
<tr>
<td>2016 onwards</td>
<td>100% regulated emissions (for developments up to 50 dwellings)</td>
<td>20% regulated emissions</td>
</tr>
<tr>
<td></td>
<td>100% total emissions for more than 50 dwellings</td>
<td>20% regulated emissions</td>
</tr>
</tbody>
</table>

The energy targets for *non-residential* buildings (greater than 1000 m²) in the urban extension can be summarised as:

<table>
<thead>
<tr>
<th>Timescale</th>
<th>% reduction compared to 2006 BR Part L (Policy G)</th>
<th>% requirement for on-site renewable energy generation (Policy RE 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 to 2010</td>
<td>25% regulated emissions</td>
<td>20% regulated emissions</td>
</tr>
<tr>
<td>2011 to 2015</td>
<td>34% regulated emissions</td>
<td>20% regulated emissions</td>
</tr>
<tr>
<td>2016 onwards</td>
<td>44% regulated emissions</td>
<td>20% regulated emissions</td>
</tr>
</tbody>
</table>

**Approach**

**Energy Efficiency**

An overview of the mechanisms for both reducing the need for energy and for using energy efficiently are set out in chapter six. These are the first steps to reduce carbon emissions based on the energy hierarchy. Energy demand can be reduced, through good design and construction, considering a range of issues such as orientation, air tightness and ventilation, improved u-values of materials, improving the building envelope, efficient heating and lighting. It will be cheaper and easier for a developer to reduce carbon emissions by considering energy efficiency before the use of renewable energy generation. It will result in buildings that help to mitigate against climate change, are adapted to the changes that are now inevitable, whilst addressing the wider social, economic and environmental aspects of sustainable development.

**Renewable and Low Carbon Energy Generation**

Chapter seven provides an overview of the options for generating the remaining energy demand in clean and efficient ways. This reduces the reliance on fossil fuels, reduces the carbon emissions that are driving climate change, and increases energy security. A resource assessment has been provided, along with detailed information on a range of technologies that can be used to provide heat and power within the urban extension. These include building-integrated approaches that can provide energy for an individual building, larger scale applications that can supply communal buildings or clusters of buildings, and technologies that could provide heat and/or power to large parts, or the whole, of the site.

In terms of large scale technologies, it would be beneficial to take a strategic approach to meeting the energy needs of the urban extension, as this will enable better integration of technologies, larger amounts of clean energy generation, lower carbon emissions and more cost effective solutions. Based on the technologies
considered, it seems likely that large scale wind is the only technology that could be used to supply the whole development with large amounts of carbon free energy, enabling Carrick to meet its zero carbon aspiration. Biomass heating could be used to provide space and water heating and district CHP could provide heat and power in the mixed-use development areas in Gloweth/Treslike.

In addition, consideration has also been given to the options for integrating energy production into buildings. These include solar hot water, PV, smaller scale biomass, ground and air source heat pumps and smaller scale CHP. These could be used across the sites.

Basic modelling was carried out for a range of housing types which suggests that, whilst it is possible to meet the 20% renewable target relatively easily for most homes, it is difficult to reach level 5 and 6 of the Code. This could require developers to select a combination of building-integrated technologies if no large scale options are available. This will add to the cost and will be difficult for apartments and flats where there are major constraints in terms of roof space. For different CSH levels it was suggested by the modelling that:

- level 4 could be achieved for most technologies, in most housing types;
- level 5 is more difficult to reach and will require a combination of technologies;
- level 6 is extremely difficult to meet with building-integrated technologies. It is therefore likely that large scale generation options will need to be considered to achieve this target.

It would be possible to combine large scale, and building-integrated, options to enable the targets to be met more effectively at each level of the Code.

A range of delivery options are available. Building-integrated technologies can be installed by the developer as part of the construction. For large individual buildings the energy production equipment could be installed and managed by a local utility or energy company. Bigger schemes that meet the needs of part, or the whole, of the site, are likely to require and an Energy Service Company (ESCo) to be established that would deliver, operate, maintain and bill customers. Although complex to set up, ESCos can bring a wider range of environmental, social and economic benefits for local communities.

In order to fully assess the viability of the various options highlighted within chapter seven, a more detailed financial and technical feasibility study will be required. This should be started as soon as practicable, once the final: housing densities; the likely mixed of housing types at these densities; the scale and type of non-domestic buildings; and the time-scale of build, are known. This should be done on a site by site basis to develop a full picture of the most sustainable way forward. It should include an assessment of:

- large scale wind and district CHP;
- the potential benefits, and role, of creating a local ESCo;
- how large scale and building-integrated approaches could work together;
- the likely energy and carbon baseline of each development site;
- the potential local and sustainable biomass resource.
A potential source of funding for this study is Growth Area Funding.

It will also be important to consider the wider social and economic benefits to ensure these technologies support the development of sustainable communities. This includes consideration of running costs for local communities, as some technologies can significantly reduce fuel bills, whilst others could add to them, in comparison to gas central heating. It will also be important that local communities are fully consulted on the possible choices for renewable energy, particularly in the case of the large scale options that could be used within the urban extension.

**Wider Sustainability**
Chapter eight provides an overview of the wider sustainability opportunities that could be considered. Many of these go beyond the scope of individual buildings, which is the focus of the CSH, and as such will have a wider role in reducing the impact of the development. Many of the themes that are discussed can be designed-in to make it easier for people to live more sustainably and this can be supported by providing information to encourage greener choices and behaviour. Collectively, these can make sustainability an everyday part of people’s lives.

The opportunities highlighted include:
- the sustainable use and disposal of water;
- sustainable food policies that increase security, reduce environmental and social impacts and support the local economy;
- transport policies based upon good place making, walking and cycling networks, reliable and affordable public transport and ways to accommodate the car;
- ways to minimise waste from homes;
- construction techniques to reduce waste, encourage good site management, reduce the impact of construction and to use sustainable materials;
- quality of life in term of health and well-being;
- providing new and existing communities with relevant and timely information on living sustainably;
- consulting and working with the community to ensure that vibrant, diverse and inclusive new communities are created that fully integrate with existing communities.

**Financial Considerations**
Chapter nine provides an overview of the financial implications of meeting the required targets. It is clear that the targets will add to build cost and this will need to be absorbed somewhere within the development process. Ultimately, some of this cost could be passed on to the buyers of new homes which is not the most desirable solution and is not an option for affordable housing. In the long term, it is expected that a reduction in land values may help to offset some of these costs.

An overview of the potential additional build cost is provided in terms of meeting the energy and wider sustainability targets. These are primarily based on evidence from other national and regional studies. The actual costs will depend on a range of site conditions and the decisions developers take to meet the targets.
It is estimated that the cost of meeting the required targets in homes could result in an additional build cost of:

- level 4 - £3,400 to £15,550;
- level 5 - £4,000 to £31,500;
- level 6 - £7,200 to £15,200.

Of these costs, only £1,500 to £2,000 is associated with meeting the wider sustainability criteria of level 3 of the CSH. The remaining costs relate to the required energy targets and the large range is based on the assumptions they have taken for both the housing type, and choice of technologies, that are applied. Although these provide some indication of the additional cost, further work would be needed to establish the actual local costs.

The basic modelling carried out within this Strategy, suggests that if large scale wind was used, and houses used electricity to meet the heating and hot water demand, then it may be possible to reach level 6 in terms of carbon reductions, as well as the wider requirements of sustainable construction at level 3 of the Code, for as little as £5,000 per dwelling.

The detailed technical and policy papers used to support the energy targets within the RSS clearly state that for large scale developments the requirements of building to levels 4, 5 and 6 of the CSH in terms of carbon emissions, within the proposed timescales, will not cause undue burden. So this should not be an issue in terms of local policy. The additional costs of reaching CSH level 3, in terms of sustainable construction, appear to be insignificant so this should also not be a burden issue.

A range of ways to reduce the potential additional build cost are provided within chapter nine. This includes practical measures such as bulk discounts, learning curves, technology advances, site-wide approaches, new building techniques and possible reductions in land value.

There are also a range of possible procurement opportunities that developers could consider to cover, or pass on, the costs associated with some technologies. This could include agreements with licensed energy utility companies or existing ESCos that may be willing to finance building-integrated renewables. In these sorts of models they would cover the capital costs of installing, managing and maintaining the energy generation equipment and would recoup their investment and make a profit from the sale of heat and/or power to the occupiers of buildings.

For larger scale part, or whole, site technologies, it is likely a local ESCo would need to be established. This could bring a wider range of benefits to the development area and provide a more complete approach to energy generation. The advantage of an ESCo is that the financial risk and the capital costs for energy generation can be transferred to this company. They can also bring a wider range of local benefits to the community and consider the full sustainable development agenda. They could also have a role in supporting micro-generation.

The Council’s aspiration for creating zero carbon homes in the urban extension is likely to be challenging without the use of large scale wind because of the high cost
associated with reducing all emissions. It will take time for developers to skill up and will also take time for the required supply chains to get in place. There will also be a short term gap before any adjustment in land values takes account of the additional build costs. There are a number of mechanisms the Council could consider to secure higher targets that include:

- supporting site-wide approaches first;
- reducing land value on any land that the Council owns within the development areas;
- encouraging developers to offer optional extras to the ‘able to pay’ market;
- encouraging developers to make use of the current stamp duty relief for zero carbon homes;
- making use of the grants that are currently available for homeowners, community buildings and public sector buildings.

**Recommendations**

This Strategy is a starting point for making the urban extension as sustainable as possible. Detailed recommendations have been provided against each chapter of this Strategy. These are mainly for the Council, but links to the master plan have also been drawn out, where appropriate. The key recommendations are set out in chapter 10 and they fall under five key headings:

1. Place climate change and sustainability at the heart of local policy.
   - In terms of other LDF documents, strategies and the new AAP.

2. Set strong and meaningful targets for developers.
   - Based upon the principles of sustainable construction and sustainable energy.

3. Create a sustainable urban extension.
   - By considering sustainable communities, local governance, energy efficiency, renewable energy and wider sustainability issues.

4. Do this in the most efficient way.
   - By considering the opportunities to maximise the local benefits in the most cost effective way.

5. Consider the risks and opportunities.
   - By keeping up to date on changes to national and regional policy.
2. Context and Drivers
This Energy and Sustainability Strategy was commissioned by Carrick District Council for the planned urban extension for Truro and Threemilestone. The Council considers that it is essential that the development contributes to the sustainability aspirations of the Council and has as low a carbon impact as possible in terms of energy efficiency and renewable energy.

The aspirations of the Council include:
- working to the principles of sustainable development;
- helping mitigate against, and adapt to, climate change;
- using resources as efficiently as possible;
- creating sustainable communities;
- making the development zero carbon neutral by ensuring that energy is used efficiently and generated in clean and efficient ways;
- using good quality design, local materials, and sustainable construction techniques.

The brief for this work focussed on research and outcomes relating to sustainable energy in the context of the urban extension. These are addressed within this Strategy and wider opportunities, in reference to sustainability, are also provided. The findings of this Strategy will help to inform the new master plan and revised Area Action Plan (AAP).

The rest of this chapter considers the context and the principal drivers that set the overarching need to consider sustainability in its broadest sense, for the new urban extension.

2.1 Overview of the Urban Extension
The policies within the Cornwall Structure Plan and Regional Spatial Strategy seek to resolve the mismatch between homes and jobs. The approach is to focus significant areas of development in locations where major employers and services are concentrated. As a Strategic Urban Centre, Truro is an area that is seen as needing development to support the future of the City and its important sub-regional role. This is supported by the Cornwall Towns Study and the ‘The Way Ahead’ Sustainable Communities Plan submission. It was anticipated that around 5,000 additional homes will be needed up to 2025, which includes an urban extension of around 4,000 dwellings to the south west of the city. As highlighted in the draft RSS this should include:

“Integrating housing, employment and transport infrastructure in ways which will minimise congestion, reduce the demand for commuting into the City and provide for enhanced public transport links with neighbouring towns. An urban extension should respect the important landscape, environmental assets, and the setting of the City and avoid areas susceptible to flooding. Employment provision should reflect Truro’s current strengths and potential relating to the CUC and Peninsula Medical School, well integrated with housing development.”

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1 It should be noted the EiP on the draft RSS released in January 2008 suggests that this figure should rise to 5,400 dwellings and Carrick have indicated that this strategy should work to this increased figure.
There is also a need for affordable housing in the area to allow those on a lower income to access suitable housing in the private market. This is particularly an issue in the urban extension for key workers at the hospital, as well as student accommodation and the wider community. The policy for affordable housing is set out in Carrick’s approved Balancing Housing Markets document. It is anticipated that within the urban extension at least 35% of new homes on sites greater than 15 dwellings (or 0.5 ha) will be affordable to help meet local needs.

The urban extension will also include non-residential development, although the scale and detail of much of this is not known at the time of writing. It is likely to include some retail, one or two new primary schools, development at the hospital, a new innovation centre linked to the medi-park, a medium sized food store and an expansion of Truro College. The lack of detail on non-residential has lead to a predominant focus within this study on domestic buildings.

The earlier draft of the AAP included a number of preferred options that made up an overall package of development within the proposed urban extension. These were predominantly south of the A390 in the Highertown corridor and included mixed-use developments with a residential focus. There were two sites to the North of the A390 linked to the Treliske Industrial Estate and Langarth which contained more non-residential buildings related to the development of the hospital and college.

At the time of writing, there is an ongoing consultation and master planning process to help finalise the possible development areas within the urban extension. This still focuses on the Highertown corridor, with the possibility of additional land coming forward at either, or both, Kenwyn and Higher Newham. In order to complete this Strategy a decision had to be taken about the possible location for new housing, and it was decided, in agreement with Carrick, to focus on the main Highertown Corridor. Based on draft information from the master planners this area could accommodate much of the proposed level of housing. If other areas do come forward in the future many of the broad principals set out in this Strategy would equally apply to these areas. However, development areas outside the Highertown Corridor are unlikely to effectively link with any large scale decentralised energy networks that may come forward, so in terms of energy sustainability theses site may struggle to meet the higher targets for reducing emissions.

The possible development locations considered within this Strategy are set out below. All are close to main areas of employment, services and main transport networks, so will support some of the key requirements for the urban extension.

**Gloweth/Treliske**
This is identified as a major employment growth area that will include housing and student accommodation. As well as a growth in employment, health and education the draft master plan indicates that this area could accommodate up to 1,500 dwellings in the Treliske area and around 400 student flats linked to the college.

**North Langarth**
This area of land, between the new park and ride and the Gloweth/Treliske growth area could accommodate around 1,000 dwellings and offers an opportunity to relate to the Threemilestone local centre.
Threemilestone
A development is proposed south-east of Threemilestone based on a new village community. It could include around 1,500 new dwellings with associated local facilities and possibly small scale employment space.

Hightown
Development in the Hightown area will link with existing communities, helping to support and expand local facilities. The draft master plan indicates this area could accommodate up to 1500 dwellings.

Other Areas (including Kenwyn, Higher Newham and East of the City)
This Strategy has focussed on the Hightown corridor, but recognises that pressure for development may lead to applications for sites in other areas such as Kenwyn, Higher Newham or East of the City. The focus on the Hightown corridor relates to the better opportunities this offers in terms of the potential for decentralised energy, links to existing good transport networks and the creation of more sustainable communities that are close to areas of employment, services and amenities.

2.2 Climate Change
A principal driver in considering how and where to build new homes is climate change. As the latest PPS on climate change\(^2\) states “There is a compelling scientific consensus that human activity is changing the world’s climate. The evidence that climate change is happening, and that man-made emissions are its main cause, is strong and indisputable. The Intergovernmental Panel on Climate Change highlights that we are already experiencing the effects of climate change and if these changes deepen and intensify, as they will without the right responses locally and globally, we will see even more extreme impacts.”

The planet is surrounded by a mixture of greenhouse gases that keeps the surface of the earth warm and able to sustain life. This naturally occurring process is referred to as the greenhouse effect and is summarised below in figure 1. However, human activity such as changing land use and burning fossil fuels has started to change the composition of the atmosphere resulting in the levels of greenhouse gases increasing. These changes have resulted in the atmosphere trapping more heat energy leading to a gradual increase in average observed land temperatures on the planet.

\(^2\) PPS1 (supplementary): Planning and Climate Change, DCLG, 2007
Carbon dioxide tends to be the main focus of concern as it is released in the biggest quantities, but concentrations of other greenhouse gases such as methane and nitrous oxide have also increased as a result of human activity. Every tonne of greenhouse gases emitted into the atmosphere commits the world to more warming, but it is not too late to stop the worst effects, as every tonne of emissions avoided reduces the threat of future climate change.

The need to reduce emissions in the domestic sector is important as, currently, around 27% of the UK’s carbon emissions come from homes, from the energy used in heating, hot water, lighting and appliances. The breakdown in emissions for a typical house is shown in figure 2. For new build the progressive tightening of Building Regulations will result in a reduction in energy use from space heating and hot water, whilst the energy use for lighting and particularly appliances will rise.
Due to the slow rate in which new housing is added to the overall stock and because of the high cost and long lifetime of new buildings, it is essential that new housing is designed and built to reduce carbon emissions. Work has been going on nationally and locally for many years to try and cut emissions from existing housing and this needs to continue. However, this is difficult and costly compared to improving energy efficiency in new buildings. It is for this reason that the Government is proposing that Building Regulations will be tightened towards an aim of all new homes being zero carbon by 2016.

The overwhelming scientific evidence that climate change is happening and will worsen has lead to an increasingly stronger policy framework within the UK to tackle it. The Government consider it to be the greatest long-term challenge facing the world today. Even with policies and priorities to tackle climate change, we cannot avoid it, as the changes we will see in the next 30 to 40 years will be based on emissions we have already produced. These changes are likely to have far reaching and adverse effects on the environment, society and the economy. It is therefore vital that new development, and the planning system, take action on climate change.

The aim for development within the urban extension should be to ensure that carbon emissions from homes are reduced as much as possible and that new homes are adapted for the changes in the climate that are now inevitable.

2.2.1 Predicted Changes to the Climate
It is currently difficult to quantify the exact changes we will see to our climate. International and national research provides broad indications of the likely changes.

Global Climate Impacts
The Intergovernmental Panel on Climate Change (IPCC) produced its Fourth Assessment Report on climate change in 2007. It included work from three different working groups, one of which focussed on the Physical Science Basis of Climate Change which provides an assessment of current scientific knowledge of the natural and human drivers of climate change. Key points from this report include:

- **Warming of the climate system is unequivocal.** The Earth has warmed by 0.74°C over the last century and about 0.4°C of this warming has occurred since the 1970s. The rate of warming over the last 50 years is nearly twice that for the last 100 years. Eleven of the last twelve years rank among the 12 warmest years in the instrumental record of global surface temperature. This warming is now evident throughout the climate in many other components of the climate system.

- **The role of human activities in the observed changes is now clearer than ever.** The AR4 report concludes that most of the observed increase in globally averaged temperatures since the mid-20th century is very likely due to the increase in anthropogenic greenhouse gas concentrations.

- **Future warming is strongly dependent on our emissions.** For a low emissions scenario, temperatures are projected to rise by 1.7°C, with a likely range of 1.1 to 2.9°C by 2090 - 2099, with respect to 1980 - 1999. For a high emissions scenario, this increases to 4.0°C, with a likely range of 2.4 to 6.4°C.

- **Globally-averaged sea level is projected to continue to rise,** reaching 0.18 - 0.38 m above the 1980 – 1999 level for a low emissions scenario, and 0.26 - 0.59 m for a high emissions scenario, by the end of the 21st century.
- The world’s oceans are expected to become more acidic as carbon dioxide concentrations continue to increase. This will have detrimental effects on ocean ecosystems.

- Rising global mean temperatures are expected to be accompanied by many other changes in the climate system including weakening of some large-scale ocean currents and shifts in rainfall patterns.

A good summary of the implications of predicted temperature rise is summarised in the 2006 Stern Review, reproduced below.

![Figure 3: Potential impacts from temperature rise](image)

**Source:** Section 13.5 of Stern Review, 2006, HMSO

**UK Climate Impacts**

The PPS1 on Planning and Climate Change provides a useful summary of the possible impact of climate change at a national level: “In the UK, we are likely to see more extreme weather events, including hotter and drier summers, flooding and rising sea-levels increasing the risk of coastal erosion. There will be permanent changes in the natural environment but also, and increasingly, substantial challenges to national prosperity and social cohesion.” The PPS also recognises that the impacts of climate change are likely to be felt first, and disproportionately so, by the most vulnerable in society.
Regional Climate Impacts
At a regional level, the UK Climate Impacts Programme (UKCIP) using 2002 data provides a range of scenarios for 2025, 2050 and 2080 and most summary reports in the region focus on 2050. Currently sub-regional data is not easily accessible. However, UKCIP are due to publish a new set of scenarios in October 2008 which will allow user-specified climate change information to better enable risk-based decision making. Once this data is available, Carrick should re-assess the likely impacts and risk for the urban extension.

A summary of the likely changes to the climate in the South West by 2050 include:

<table>
<thead>
<tr>
<th>Likely change (the range of figures indicates Low and High emissions scenario results)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
</tr>
<tr>
<td>• Annual warming of 1.0 to 2.5°C (annual warming of 1.5 to 4.5°C in the 2080s)</td>
<td></td>
</tr>
<tr>
<td>• Greater warming in summer and autumn than in winter and spring</td>
<td></td>
</tr>
<tr>
<td>• Greater night-time than day-time warming in winter</td>
<td></td>
</tr>
<tr>
<td>• Greater day-time than night-time warming in summer</td>
<td></td>
</tr>
<tr>
<td>• Years as warm as 1999 (+1.2°C hotter than average) more common</td>
<td></td>
</tr>
<tr>
<td><strong>Precipitation</strong></td>
<td></td>
</tr>
<tr>
<td>• Winters 5 to 15% wetter (winters 10 to 30% wetter by the 2080s)</td>
<td></td>
</tr>
<tr>
<td>• Summers 15 to 30% drier (summers 25 to 50% drier by the 2080s)</td>
<td></td>
</tr>
<tr>
<td>• Heavy rainfall in winter becomes more common</td>
<td></td>
</tr>
<tr>
<td>• Greater contrast between summer (drier) and winter (wetter) seasons</td>
<td></td>
</tr>
<tr>
<td>• Summers as dry as 1995 (37% drier than average) become more common</td>
<td></td>
</tr>
<tr>
<td>• Winter and spring precipitation becomes more variable</td>
<td></td>
</tr>
<tr>
<td>• Snowfall totals decrease significantly</td>
<td></td>
</tr>
<tr>
<td><strong>Cloud cover</strong></td>
<td></td>
</tr>
<tr>
<td>• Reduction in summer and autumn cloud and increase in radiation</td>
<td></td>
</tr>
<tr>
<td>• Small increase in winter cloud cover</td>
<td></td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td></td>
</tr>
<tr>
<td>• Specific humidity increases throughout the year</td>
<td></td>
</tr>
<tr>
<td>• Relative humidity decreases in summer</td>
<td></td>
</tr>
<tr>
<td><strong>Soil moisture</strong></td>
<td></td>
</tr>
<tr>
<td>• Decreases in summer</td>
<td></td>
</tr>
<tr>
<td>• Slight increase in winter soil moisture</td>
<td></td>
</tr>
<tr>
<td><strong>Storm tracks</strong></td>
<td></td>
</tr>
<tr>
<td>• Winter depressions become more frequent including deepest ones</td>
<td></td>
</tr>
<tr>
<td><strong>North Atlantic Oscillation</strong></td>
<td></td>
</tr>
<tr>
<td>• North Atlantic Oscillation may become more positive in the future, bringing more wet, windy and mild winters</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Likely changes to the climate in the South West
Source: UKCIP, 2002

Local Climate Change Impacts
The above table provides a broad overview on some of the implications that will be seen regionally, but currently there is little local climate change impact data available. Instead we have listed below some likely implications based on regional estimates for Truro and Threemilestone given the landscape characteristics of the area.

Higher Temperatures
We are already seeing a rise in average temperatures and predictions for the South West from UKCIP suggest a rise of up to 2.5°C by 2050, with hotter summers and greater night and day time temperatures. This will have implications for the way we currently live and it is likely that the most vulnerable in our society will be most at risk from increased temperatures.

New buildings can and should be built to take account of future climate change and this must include good design and construction techniques that avoid uncomfortable internal temperatures. This suggests that the impact of higher temperatures may be more an issue for existing buildings and infrastructure. This could lead to an
increased demand for cooling in these buildings, which will result in an increased demand for energy, although, conversely, warmer winters could reduce the demand for space heating.

It is also likely that higher summer temperatures will lead people to seek more access to open space and shading. This will link to the planned development of a green infrastructure plan.

**Flood Risk**

Flood risks will increase from rising sea levels, an increase in the amount of winter precipitation, and the likelihood of rainfall duration and intensity increasing. Predictions for the South West from UKCIP suggest, by 2050, winters will be 5 to 15% wetter and that heavy rainfall in winter will become more common.

The South West Regional Flood Risk Appraisal (Feb 2007) provides local information on possible flood risks in and around Truro. The report identifies Truro as an area which suffers from a significant flood risk from fluvial and tidal flooding.

In terms of sea level rise, as a result of climate change, there is a suggestion that the frequency of severe tidal flooding events will increase significantly. The report states that *'It is estimated that climate change and sea level rise will mean that severe tidal flooding events will be fourteen times more likely to occur by 2060'*(i.e. a 1 in 200 year event now will become a 1 in 14 year event).

The report also highlights that much of the current proposed development area for the urban extension sits within the Tinney catchment area that is described as *'a problem drainage catchment with flashy urbanised run-off leading to local flooding hotspots.'*

Careful planning will be needed to avoid flooding downstream from the development area, particularly at Calenick.

The risk of flooding from rivers, sea level rise and tides is shown on the map below.

![Figure 4: Existing floodplain, flood defences and estimated line of sea level rise by 2060](image)

Source: South West Regional Flood Risk Appraisal, 2007
An initial flood risk assessment has been carried out for Carrick, and some flood defences are already in place. Plans to review and improve this should be completed. The use of sustainable urban drainage (SUDs) should help to reduce the impact that new development has, if this is made a condition of development. The SUDs Strategy that is being developed identifies what measures may be possible and includes further information on flood risk.

It should be noted that even with improved flood defences and the use of SUDs the risk from flooding below the development and within Truro itself will still exist. This could be as a result of the predicted increase in extreme weather events or a failure of the defences that are put in place.

**Water Resources and Water Quality**
The predicted changes in rainfall will impact both water resources and water quality. Drier summers will lead to increased demand for water and lower river flows will mean they are less able to dilute pollutants, with impacts such as algae blooms.

In addition, more severe weather events such as exceptional high rainfall can also impact water quality as the existing storm drains and sewage network may not cope with prolonged and heavy rainfall. This could lead to localised pollution incidents resulting from the discharge of untreated waste into water courses.

**Storm Damage**
There is little data on the likely increase in storms and the damage this may cause at a local level. Regionally it is expected that winter depressions will become more frequent and this will increase storm tracks. This could result in more violent storms and more gusting and this may become an issue for the buildings in the urban extension, particularly those on along the ridge line on the A390. Arup\(^3\) suggest stronger winds will have little effect on engineered structures, but could affect fixings and non-engineered components such as roof tiles, etc.

**Ground Conditions**
Not considered in the UKIP scenarios, but highlighted in other reports, is the potential impact on ground conditions and land stability. Changes will occur as a result of temperature, rainfall, winds and wave action and other factors such as mining, road building and vegetation changes. The level of risk would depend upon the local soil types, but could include issues such as landslips, subsidence, heave and erosions. A soil analysis would be required in the urban extension to assess the possible level of risk from changing ground conditions.

**2.3 Sustainable Development**
Another principal driver for the urban extension is sustainable development. The classic view of this was produced by the Brundtland Commission in 1987 for the World Commission on Environment and Development. It defined sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'. It also set

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3 Chris Twinn from Arup, presentation at Sustainable Design 2007 (5/12/07)
the context for the three central pillars of sustainable development, namely the need to balance environmental, economic and social issues.

In the UK the first national strategy on sustainable development was produced in 1994 following the Rio Summit. This was formalised in 1999 with the production of ‘A Better Quality of Life’, which outlined the proposed UK approach for delivering sustainable development and provided headline indicators for measuring progress. More recently the Government published ‘Securing the Future’ which is the Government’s Sustainable Development Strategy. Within this the Government state that:

‘The goal of sustainable development is to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life, without compromising the quality of life of future generations.’

Securing the Future also identifies four key priorities for immediate action:

- **Sustainable Consumption and Production** – achieving more with less. It considers the whole lifecycle of goods and services and helps to break the link between economic growth and environmental degradation.
- **Climate Change and Energy** – working towards ways to mitigate the effects of energy generation and use, and adapt to the changes in the climate that are now inevitable.
- **Natural Resource Protection and Environmental Enhancement** – recognising resources are vital to our existence and the need to work within the natural environmental limits we have.
- **Sustainable Communities** – the creation of communities that embody the principles of sustainable development at a local level.

Sustainable development is a fundamental tool that is used internationally, nationally, regionally and locally, across policies and strategies. This includes the draft RSS and Cornwall Structure Plan, which both include it as a central cross-cutting theme. It is now at the heart of the planning process and if adhered to will ensure that sustainable communities are created in the future. To ensure this happens in the urban extension, Carrick need to take an integrated, action led approach that simultaneously supports environmental, economic and social goals. This will result in a sustainable future that maintains and advances a good quality of life for local communities.

Opportunities for ensuring sustainable development is central to the urban extension are considered in more detail in the rest of this report.

### 2.4 Ecological and Carbon Footprints

The concept of ecological and carbon footprints is a rapidly developing area. In 2005, ‘Stepping Forward – a Resource Flow and Ecological Footprint Analysis for the South West of England’ was published. It provided a comprehensive analysis for the region. In addition, Ecological Budget UK, a partnership between WWF, The Stockholm Environment Institute (SEI) and The Centre for Urban and Regional Ecology, has been working to provide a complete, UK wide, database of resource use and

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4 Securing the Future - delivering UK sustainable development strategy, HMSO, 2005
environmental impacts. Both recognise that globally there is finite availability of natural resources to meet our needs and that in order to develop sustainably we must ensure that we do not consume these at a faster rate than the planet can replenish them.

**Ecological Footprints**
In simple terms, an ecological footprint is a measure of the impact of human activities on the natural environment. WWF describe this as 'the area of land and sea that is required to feed us, provide resources, produce energy, assimilate waste, and to re-absorb the greenhouse gases produced by our use of fossil fuels. This approach uses land as its currency, and provides a notional figure – the global hectare (an area equivalent to a normal hectare but adjusted for average global productivity) – to quantify the area required to support an individual, a community or a nation’s population at its present standard of living'\(^5\).

The global hectare is derived by assessing the total availability of productive space (land and sea) at average world productivity. If space is equally and fairly divided by the world’s population, WWF suggest that each person should have access to 1.8 global hectares per person (gha). However, the evidence suggests that the world average ecological footprint is currently 2.2 gha, suggesting globally we are already living beyond the ability of the planet to sustain us. The picture for the UK is worse still, with the current average UK ecological footprint estimated at 5.4 gha – WWF point out that if everyone in the world lived like we do in the UK we would need three planets to support these lifestyles. Figure 5 clearly indicates that we are exceeding the earth’s ecological capacity.

![Humanity’s Ecological Footprint exceeds Earth’s Biological Capacity](image)

*Figure 5: Ecological footprints in relation to ecological capacity
Source: Living Planet Report, WWF, 2004*

**Carbon Footprints**
Carbon footprints just focus on the impact that human activity has on the environment in reference to carbon emissions and specifically carbon dioxide. With growing awareness and concern over climate change it has been an area that has seen the emergence of a variety of tools to calculate individuals’ or a household’s carbon footprint and guidance on how to reduce it. It is suggested that in order to

\(^5\) Ecological Footprints - the journey so far, WWF, 2006
tackle climate change an average allowance of 2 tonnes per person per year should be set.

Currently, different assumptions are made within the range of tools currently available. Many just consider direct carbon dioxide emissions resulting from our daily actions that require fossil fuels, such as heating our homes, driving, flying, using appliances, etc. Others also take into account the indirect carbon dioxide emissions associated with the whole life cycle approach for manufacture, transport, use, and disposal of all of products and services we use. This gives a more comprehensive indication of a carbon footprint and is linked to the idea of ecological footprints, as it relates to the way we live our lives and consume resources.

**Carrick’s Ecological and Carbon Footprint**
The Resources and Energy Analysis Programme (REAP) developed by the Stockholm Environmental Institute and the Centre for Urban and Regional Ecology has produced an ecological and carbon footprint for each local authority in the UK. This is currently based on 2001 data, but is due to be updated to 2003 data during 2008. A copy of the full footprint is included in appendix one, and the headline data and charts are reproduced below, more information is available from the REAP website.

<table>
<thead>
<tr>
<th>Activity Category</th>
<th>Main Consumptive Items included in Category</th>
<th>Ecological Footprint (gca/capita)</th>
<th>Carbon Footprint (t/cap)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Food includes the impact of all organics and non organic food consumed by households and at restaurants and takeaways.</td>
<td>1.16</td>
<td>0.92</td>
</tr>
<tr>
<td>Transport</td>
<td>The footprint measures the impact of fuel emissions from public and private vehicles as well as the impact from maintaining vehicles, buying new vehicles and building infrastructure.</td>
<td>0.82</td>
<td>2.57</td>
</tr>
<tr>
<td>Housing</td>
<td>The footprint of housing measures the impact of fuel emissions from direct household energy use for heat, hot water, lighting and electrical appliances as well as the impact from household maintenance and from household construction.</td>
<td>1.47</td>
<td>3.75</td>
</tr>
<tr>
<td>Consumables</td>
<td>The footprint of consumer items measures the impact of producing all products bought by households, from newspapers to appliances.</td>
<td>0.70</td>
<td>1.33</td>
</tr>
<tr>
<td>Private Services</td>
<td>The footprint of private services measures the impact from services ranging from entertainment to financial services.</td>
<td>0.48</td>
<td>1.18</td>
</tr>
<tr>
<td>Public Services</td>
<td>Additionally, spending on public services, capital investment and other, is included in the total footprint. These are set figures and are the same for each Local Authority.</td>
<td>0.37</td>
<td>0.93</td>
</tr>
<tr>
<td>Capital Investment</td>
<td></td>
<td>0.24</td>
<td>0.60</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>-.01</td>
<td>.08</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>5.22</strong></td>
<td><strong>11.36</strong></td>
</tr>
</tbody>
</table>

Table 2: Carrick ecological and carbon footprint
Source: REAP
The estimates of the current footprints for Carrick raise some interesting points for the district as a whole, highlighting where some of the biggest impacts are. It clearly shows that we are living beyond the means of the natural environment to provide us with the goods and services we need to sustain our current lifestyles, which is a powerful message that supports the case for sustainability in the context of the urban extension.

The footprints help to highlight priority areas that should be considered in the urban extension to reduce the environmental impacts associated with housing, food, transport and consumption. Part of the reason the housing footprint is so high is the wasteful nature of the UK centralised energy generation and distribution systems. The opportunity for Carrick is to ensure that the planned urban extension is developed in the most sustainable way possible. This will ensure that these new communities have a much lower footprint than the rest of the district. Good planning and design can tackle many of the major resource use areas by designing-in sustainability in terms of infrastructure, moving towards decentralised local energy systems, incorporating high levels of energy efficiency, and considering wider sustainability issues.

The Benefits and Limitations of Footprints
As a broad concept, ecological and carbon footprints are powerful communication tools that are useful to show, and estimate, the current impact our lifestyles have on the natural capacity of the earth and as such give a measure of sustainability. They can be used to help inspire action and change peoples attitudes to consumption. They essentially provide a big picture that can be used to inform policy and strategies and monitor progress against them; providing an indication of where we are now and where we could be with the right decisions and action. Their use within the urban extension provides a useful way to engage people with the issues and provide a mandate for ensuring the development is as sustainable as possible. They also allow a top line assessment of the possible impact the urban extension could have.

They do have some limitations. Their main focus regarding sustainability is on the earth’s biological capacity, whilst an important component of sustainable development, they do not cover the equally important economic and social agendas. Neither can they provide information on the quality of a local environment, an
important component of sustainable communities. As with any model, there is an inevitable degree of assumption taken to provide a local footprint based on a top-down approach that uses national or regional data. These assumptions, and the modelling used to calculate them, are still developing and improving, and estimates are likely to change as more recent data is used.

These limitations can be overcome to some degree if they are linked to existing environmental, social and economic evidence and strategies, enabling a fuller picture of sustainable development to be obtained. Local data on the range of issues covered by the footprints would also increase its sensitivity to local circumstances and provide better accuracy for its use as an indicator. Cornwall County Council have recently purchased the licence for the REAP software so it would be possible to introduce local data and model specific scenarios for the urban extension.

2.5 Energy Security & Peak Oil

Energy security and supply is an important consideration for Cornwall. The county is at the end of the supply networks for electricity and gas and is a net importer of energy. Much of the county is also off the gas network, meaning there is a real security of supply issue, in terms of being able to access energy as and when it is needed, without interruption. Nationally, the UK is becoming a net importer of oil and gas, and as demand for these resources internationally is growing, this will inevitably lead to higher prices on world markets, which will be felt at a local level.

The need to import oil is a particular issue as demand is increasing worldwide and its use is coupled to most aspects of our current lifestyles in reference to energy supply, transport, food production, and the goods and services we all rely on. Of particular concern in the near future will be the issue of peak oil. This describes the reality that the output of easily extractable, cheap, crude oil will peak and then start to decline. Once oil production peaks it will become increasingly difficult and expensive to extract and supply will drop quickly. This will drive up prices rapidly. Opinion of when this will occur varies, some suggest we have already reached it, the more optimistic suggest it may not be reached until 2030. Regardless of when it occurs, the need to start moving away from the reliance on this dwindling resource is obvious in terms of sustainability, climate change, energy security and economics.

The opportunity within the urban development is to reduce the need for energy and generate it locally through decentralised energy networks that will improve security, reduce the impact of price rises, lessen the impact of peak oil and reduce the footprints of the development. This will have clear environmental benefits in terms of tackling climate change and wider social and economic benefits such as reducing the uncertainty in fuel bill price rises for individuals and business. It is also likely to create and support jobs in the local installation market for sustainable energy technologies.

2.6 Consultation

Carrick have been running a series of consultation events alongside the development of the master plan and new AAP. This has included work with members, key stakeholders and invited people from the wider community. In reference to the community events, some key indications have developed in terms of what is desired
locally that is relevant to energy and sustainability. These have been taken into account in developing the recommendations contained within this report.

The following overview was circulated by Carrick following the first consultation event:

<table>
<thead>
<tr>
<th>Climate Change &amp; Sustainable Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Design of all new build to incorporate energy creation and efficiency systems – code for sustainable homes needs to be exceeded</td>
</tr>
<tr>
<td>• Redesign energy generation systems for whole areas including sea/wave power generation</td>
</tr>
<tr>
<td>• Need to consider development against waterfront versus flooding issues brought by climate change</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wider Sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatial Planning &amp; Transport</td>
</tr>
<tr>
<td>• The need for regular affordable public transport network and improved/safer cycle routes</td>
</tr>
<tr>
<td>• Walkable local services for all residential and employment areas and/or integrate services with developments</td>
</tr>
<tr>
<td>• Good regular affordable public transport network including increase in halts for rail network</td>
</tr>
<tr>
<td>• Creation/enhancement of real community identities by providing integrated pedestrianised centres for areas</td>
</tr>
<tr>
<td>• Interconnection of developed areas with existing areas – social and walkable</td>
</tr>
<tr>
<td>• New roads become “streets” – liveable/walkable with residential and business</td>
</tr>
<tr>
<td>• Reduction of traffic jams at peak times – more fluid movement</td>
</tr>
<tr>
<td>• Improved cycle routes</td>
</tr>
<tr>
<td>• More pedestrianised areas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Protect farmland/supporting growing and using local food</td>
</tr>
<tr>
<td>• Provide for gardens and allotments to meet projected need/supporting growing own food and community food growing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use local materials when building</td>
</tr>
<tr>
<td>• Retro-fitting of green systems in existing buildings/housing</td>
</tr>
</tbody>
</table>

Further consultation will be needed to allow everybody in the surrounding community to consider the new AAP. It is essential that this includes discussion on the opportunities highlighted within this Strategy, in reference to both sustainability and climate change. We believe it is essential for the local community to understand the issues and the possible solutions to them so they can buy into the possible ways ahead and take ownership of the most appropriate way forward.

This will be particularly important in terms of the possible use of large scale renewable energy generation as this could have, in the case of wind, a major visual impact for local communities. However, it could also bring long term benefits in terms of energy security, tackling climate change and providing a potential income for local initiatives. The community needs to be consulted upon these sorts of issues so they can buy-into the idea and feel it has not just been decided for them.
2.7 Conclusions & Recommendations

The proposed urban extension will provide new housing and associated development that will help to resolve the mismatch between homes and jobs that currently exists within Truro and Threemilestone. It will also help to address the significant imbalance between incomes and house prices, by providing affordable housing, linked in part to the needs of key workers. The ongoing master planning process will help to refine the scale and type of development in different areas in order to set out a clear direction of the future development in terms of a new AAP. This will help to ensure that the right sort of development comes forward in the right location and should help to avoid speculative applications coming forward from developers that do not support the strategic need for sustainable, future proofed communities.

Climate change is a key issue that should be central to the decision making process for the future of the area, informing all of the strategies that Carrick has commissioned to support the new AAP. The evidence that climate change is happening, and will worsen, as a result of human activity is indisputable. It will have a direct impact on existing and future communities within Truro and Threemilestone.

The principles of sustainable development should also be central to the development process for both the new communities that will be created and the existing communities within the area. This will help to reduce the current and future ecological and carbon footprints of local residents.

Combined, these key drivers can help limit the impact of the development and enable local communities to respond to the increased pressures on the natural environment they rely upon. They will also lessen the impact of energy security and peak oil which will become key issues for Cornwall in the future.

Those members of the local community that were involved in the consultation process have given a clear indication that these issues need to be considered.

Recommendations for the Council:

- Climate change and sustainable development should be key principles used to inform all the strategies Carrick have commissioned and they should be made central to the new AAP.
- Further consultation should be carried out to inform the new AAP, including information on the issues and opportunities for energy and sustainability before any final decisions are taken.
3. A Sustainable Urban Extension

This chapter provides an overview of the opportunities to address the key drivers set out in the previous chapter. These include incorporating sustainable energy, mitigating and adapting to climate change, and creating sustainable communities. Collectively these approaches will reduce the overall impact of the urban extension and help to create future proofed local communities.

3.1 Sustainable Energy

The main purpose of this report is to advise on the potential options for incorporating sustainable energy within the urban extension. Sustainable energy is about the use and integration of both energy efficiency measures and renewable energy to reduce the reliance on fossil fuels and nuclear power. By using energy sustainably it is possible to move towards a low carbon economy, which will be essential to help tackle climate change, future proof local communities and reduce energy security and peak oil risks.

Setting high standards for development within the urban extension will be vital to meet the aspirations set out in Carrick’s draft AAP and the policies within the Cornwall Structure Plan and the draft RSS. It is also easier and more cost effective to integrate sustainable energy at the design and build stage, than to retrofit at a later date.

The ‘energy hierarchy’ should be the principal tool for decision making within the urban extension. This is widely quoted and used across sustainable energy policy and advocated by the Local Government Association7. This sets out a priority order of carbon reduction measures to be considered for new developments including:

- reducing the need for energy;
- using energy efficiently;
- using renewable energy sources;
- any remaining use of fossil fuels should use the cleanest and most efficient technologies.

The opportunity to apply the hierarchy to a new development should not be underestimated, as it is possible to address both the demand and supply side, with the aim of achieving zero net carbon emissions, an aspiration highlighted by Carrick. It will help to ensure that energy needs are met in the most efficient, cost effective way, resulting in buildings that will have low energy demand and therefore require a smaller amount of renewable energy to supply the site’s needs.

The four strands of the energy hierarchy are explained in more detail below.

Reducing the need for energy

The primary approach for any new development should be, as much as is feasible, to design-out the need for energy in the first place. All those involved at the concept stage have a key role to play in reducing carbon emissions through careful spatial

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7 Energy Services for Sustainable Communities - the Local Government Position, LGA, 1999
planning, master planning and building/infrastructure design. Demand reduction measures that could be considered include:

- locating housing, workspace and facilities close to existing public transport links;
- the provision of shops and community facilities in new developments;
- maximising the use of southern aspects for solar gain and day lighting (whilst avoiding overheating in the summer);
- utilising natural light in building design (e.g. atria, sun-pipes).

**Using Energy Efficiently**

Having designed out the need for energy as much as practicably possible, steps should then be taken to make buildings as energy efficient as possible in terms of their design and build type and the equipment installed as part of the build. This could include measures such as:

- high levels of insulation;
- reduced infiltration;
- responsive, controllable heating systems;
- appropriate use of thermal mass to help retain heat whilst avoiding overheating in summer;
- specifying low energy lighting and appliances;
- passive ventilation and heat recovery;
- specification of minimum U-values for construction materials;
- water saving devices.

Specific recommendations are provided in chapter six of this report in regard to reducing the need for energy and using it efficiently. By building this into the design of homes, it enables residents to live a more sustainable lifestyle from the start. It also brings economic and social benefits as fuel bills will be greatly reduced for residents and businesses. It will help to reduce the demand and use of energy in new buildings, which should also be reinforced through clear and effective communication materials to make new residents aware of the need to use appliances, lighting etc efficiently. This is considered in more detail under section 8.7 – informing end users.

**Using Renewable Energy**

Whilst much can be done to reduce demand for energy and transport through good design and planning practices, it will still be needed within the urban extension. Demand for heat and cooling can be designed-out more readily than demand for electricity, which is growing with the increased use of gadgets. Where feasible, renewable energy should be the first priority for helping to meet the remaining energy demand of the development.

**Using Low Carbon Technologies**

In the event that all of a development’s energy demand cannot be met by renewable energy, for instance if there is no suitable resource, then the cleanest and most efficient fuels and technologies should be used. For example:

- Combined heat and power (CHP);
- heat pumps (which extract heat from the ground, air or water).
An assessment of both the renewable and low carbon energy options is included in chapter seven of this Strategy. This considers the possible applications for large and small scale forms of energy generation in the urban extension, regarding the approach for the whole site, parts of it, and on an individual building basis.

### 3.2 Embodied Energy

As well as the energy hierarchy, which plays a central role in determining the operational energy of buildings, consideration should also be given to the amount of energy that will be needed to create the urban extension. This embodied energy partly relates to the materials used, including their manufacture, transport, use and disposal within the construction process. There is also a considerable amount of energy used during the construction of buildings themselves and the associated infrastructure.

Traditionally the view has been that embodied energy will be low in comparison to the operational energy used over a building’s lifetime. Whilst this will remain the case within the development, improving energy standards for new build will mean that embodied energy will start to play a bigger role in the overall impact of the development in terms of carbon emissions. The amount of embodied energy will also increase through the use of insulation and renewable energy generating technologies.

To reduce the impact of embodied energy within the urban extension, developers should be encouraged to consider the materials that are selected at the design stage. These should ideally be locally sourced to reduce the embodied energy from transport. For example, BedZED\(^6\) had a policy for selecting construction materials with a low embodied energy that were sourced within a 35 mile radius of the site where possible. Consideration should also be given to the durability of materials and the design life of a building. The more durable a building, the lower the impact of embodied energy will be. Most houses are designed for an average 60 year lifespan, but it is possible to spec higher than this. For example, the new town of Sherford in Devon has set a target lifespan for the basic structure of buildings of 300 years; this will dramatically reduce the embodied energy of the development.

More detail on the selection and use of materials within the urban extension is considered in chapter eight of this report.

Embodied carbon was considered as part of the RSS technical study\(^9\) for building zero carbon homes to try and identify if building such homes would result in buildings that produced more carbon emissions in their construction than would be saved from reduced operational energy consumption. The report authors concluded that energy efficiency and renewable energy do increase the embodied carbon of a building, but this increase is quickly recouped by the savings in carbon that result from the reduced operational energy demands.

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\(^6\) Beddington Zero Energy Development design by Bill Dunster near Beddington, England
3.3 Climate Change Mitigation and Adaptation

Incorporating the principles of sustainable construction, and using the energy hierarchy to set rigorous targets for sustainable energy, within the planned urban extension will go a long way to ensuring that new development helps to mitigate the emissions that are driving climate change. The mechanisms for doing this are considered in detail in chapters six to eight of this report. Strategies to continue to reduce emissions within existing developments in Carrick should also continue.

As changes to the climate are now inevitable, it is also vital that the planned urban extension is designed in such a way to adapt to the changes that are likely to occur. Climate change adaptation is a cross-cutting issue that will impact all aspects of the urban extension. It will be vital that all the documents that support the AAP consider this. This will ensure that a comprehensive and cohesive approach to climate adaptation is taken within the master plan and new developments will be future proofed. For example, the green infrastructure plan, the SUDs strategy and the Landscape Strategy will play important roles in helping communities to adapt to the possible changes. Possible links are highlighted in the tables below.

Climate adaptation is a quickly developing area and it may be necessary to revise adaptation strategies as new policy and guidance develops. A recent report on adaptation has been produced by the Town and Country Planning Association (TCPA)\(^\text{10}\) which provides a useful overview of the main issues that need to be considered in reference to planning for climate change. Two useful checklists have also been produced that can be used to help shape design briefs and plans to ensure developments take account of the climate change impacts we are likely to experience. These are considered in more detail below.

The TCPA report highlights a range of implications and solutions across a range of different scales, including:

- At a conurbation scale – where adaptation will serve a whole city and is likely to include a variety of land uses. At this level, opportunities for creating cost-effective and integrated solutions can form part of climate change strategy (possibly embedded within the RSS, Community Strategy, Open Space Strategy or LDF).
- At a neighbourhood scale – covering developments of discrete groups of dwellings. At this level, consideration should be given to adapting the public realm and spaces between buildings and developments. Solutions can be developed through the LDF, Open Space Strategy, AAP, site brief or master plan.
- At a building scale – covering smaller developments including individual dwellings, apartment blocks or commercial buildings. This would be based on the design of the building, its surroundings, and how it is used and managed. Design or building codes provide useful tools at this level.

The report makes a wide range of suggestions for adaptation, but points out that a holistic approach is needed, as a measure used to adapt to climate change could negatively impact on efforts to mitigate emissions. For example the use of

\(^{10}\) Climate Change Adaptation by Design, TCPA, 2007
mechanical ventilation could make buildings more comfortable, but lead to an increase in energy use, which if from fossil fuels will help drive climate change.

The following summaries from the TCPA report provide a useful overview of some of the key considerations to climate adaptation.

### Managing High Temperatures

The following table gives an overview of the sorts of considerations for adapting to higher temperatures.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Measures</th>
<th>Strategy Links</th>
</tr>
</thead>
</table>
| Conurbation         | • Using high quality greenspace, made up of a linked network of well-irrigated open spaces  
                      • Bluespace, such as open bodies of water, including rivers, lakes and urban canals.  
                      • Shading and orientation to reduce excessive solar gain  
                      • Passive ventilation captured through orientation and morphology of buildings and streets. | Landscape and green infrastructure plan            |
| Neighbourhood       | • Integrating evaporative cooling effects from green corridors, small open spaces, trees and green roof  
                      • Increased use of ponds, swales, flood balancing lakes, swimming pools and fountains  
                      • Reducing solar gain from building and street orientation  
                      • Cool pavement materials  
                      • Networks of cool roofs | Landscape, green infrastructure plan and SUDs       |
| Building Scale      | • Planting, shading and advanced glazing to reduce solar heat gain  
                      • Cool building materials, green roofs and walls to prevent heat penetration  
                      • Innovative use of water for cooling  
                      • Mechanical cooling/conventional air conditioning systems  
                      • Increasing ventilation and removing heat using fresh air  
                      • Using thermal storage to absorb heat during hot periods so that it can dissipate in cooler periods |                                                       |

Table 3: Approaches to managing higher temperatures  
Source: Sections 4.1.1 to 4.1.3 of Climate Change Adaption by Design, TCPA, 2007

### Managing Flood Risk

The following table gives an overview of the sorts of considerations for managing future flood risk.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Measures</th>
<th>Strategy Links</th>
</tr>
</thead>
</table>
| Conurbation/catchment | • Strategic flood risk assessment and a sequential approach to development in the floodplain.  
                          • Flood attenuation, or provision of temporary water storage capacity during flood events, to reduce peak flows.  
                          • Upland land management though storage (e.g. reservoirs) and planting to reduce runoff.  
                          • Managed realignment involves breaching existing hard coastal defences, such as sea walls, allowing land behind to be flooded  
                          • Understanding flooding pathways in urban environments, to help manage the probability of flooding and its consequences. | SUDs           |
• Hard, permanent flood defences and barriers.
• Diversion of flood flows away from vulnerable areas or constructing a second flood channel.
• SUDS to manage and slow down surface water run-off and release it to the natural water cycle.

| Neighbourhood | Strategic flood risk assessment and a sequential approach to development in the floodplain.
• Impermeable surfaces can be replaced by SUDS
• Smaller scale hard barriers or managed realignment schemes
• A second layer of setback flood defence constructed behind the original barrier.
• Use of green open space and green roofs to reduce runoff and ameliorate pressure on drainage systems during heavy rainfall
• Widening drains to increase drainage capacity
• Managing flood pathways and removing ‘pinchpoints’ so that heavy rainfall can drain away.

| Building Scale | Green roofs to reduce runoff and ease pressure on drainage systems
• Managing flood pathways and removing ‘pinchpoints’ so that heavy rainfall can drain away
• One way valves permanently fitted in drains and sewage pipes to prevent backflow
• Flood resilient measures, including raising floor levels, electrical fittings and equipment
• Flood resilient materials can withstand direct contact with floodwaters for some time without significant damage.
• Removable household products like flood boards, air brick covers and flood skirts which are fitted temporarily to properties to form a barrier to water.

Table 4: Approaches to managing flood risk
Source: Sections 4.2.1 to 4.2.3 of Climate Change Adaption by Design, TCPA, 2007

Water Resources and Water Quality
The following table gives an overview of the sorts of considerations for managing water resource and water quality.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Measures</th>
<th>Strategy Links</th>
</tr>
</thead>
</table>
| Conurbation/catchment | Upland and lowland reservoirs to ensure sufficient water supplies during summer while reducing the potential for flooding
• Treated waste water may be disinfected chemically or physically and used for irrigation
• Promoting tighter water efficiency standards
• Encouraging use of SUDS for groundwater recharge
• Abstraction controls and licensing to manage the needs of water users while ensuring adequate protection of the environment
• Greater use of separate drainage systems for surface and foul water, so surface water can go straight back into the watercourse
• More use of reclaimed and recycled water
• In order to sustain the evaporative cooling function of vegetation rainwater harvesting, underground storage and accessing new supplies of lower grade ground water may | SUDs |
provide additional water in times of drought.

<table>
<thead>
<tr>
<th>Neighbourhood</th>
<th>Building Scale</th>
<th>SUDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Rainwater harvesting and storage from roofs or other surfaces for future use</td>
<td>• Water efficient fixtures and fittings to reduce demand</td>
<td></td>
</tr>
<tr>
<td>• SUDS to collect and store water.</td>
<td>• Rainwater harvesting and storage</td>
<td>SUDs</td>
</tr>
<tr>
<td>• Grey water recycling to use waste water from plumbing systems for toilet flushing and irrigation</td>
<td>• Building scale SUDS</td>
<td></td>
</tr>
<tr>
<td>• Xeriscaping, or low water use planting, can greatly reduce water demand.</td>
<td>• Effective storm overflow management</td>
<td></td>
</tr>
<tr>
<td>• Managing point source pollution reduces water quality risks.</td>
<td>• Managing ground conditions</td>
<td></td>
</tr>
</tbody>
</table>

Table 5: Approaches to managing water
Source: Sections 4.3.1 to 4.3.3 of Climate Change Adaption by Design, TCPA, 2007

Managing Ground Conditions
TCPA highlight that ground conditions and land stability are affected by temperature, precipitation, wind and wave action. The following table gives an overview of the sorts of considerations for managing ground conditions.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Measures</th>
<th>Strategy Links</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conurbation</td>
<td>• Development of risk assessment methodologies to improve understanding of coastal erosion risk and evolution in the long term</td>
<td>Landscape</td>
</tr>
<tr>
<td></td>
<td>• Development of coastal risk and evolution maps and, where appropriate, more detailed maps on landslide risk</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Strategic monitoring programmes to assess changes in ground conditions or coastal change</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Land use management, including vegetated slopes and agricultural systems management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Managed realignment and avoidance of development in areas at high risk.</td>
<td></td>
</tr>
<tr>
<td>Neighbourhood</td>
<td>• Structural changes or improvements in external surface protection, such as vegetative cover</td>
<td>Landscape, green infrastructure plan and SUDs</td>
</tr>
<tr>
<td></td>
<td>• Vegetation management, including careful choice and placement of trees to avoid building subsidence in shrink-swell soils and planting to deter erosion on dunes and sandy soils</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Re-grading or reinforcing of slopes to reduce risk of erosion and landslips</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Surface erosion control structures, including retaining walls and fences</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Deeper, stronger, better drained retaining structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use and operation of soakaways and SUDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Maintenance of drainage systems, including channel management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Groynes and other cross-shore structures and toe protection structures.</td>
<td></td>
</tr>
<tr>
<td>Building Scale</td>
<td>• Vegetation management</td>
<td>SUDs</td>
</tr>
<tr>
<td></td>
<td>• Ensuring at the design stage that foundations are strong enough and extend downward below the zone that may be affected by seasonal variations in moisture content</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Underpinning with concrete supports that extend under existing foundations into more stable soils.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Infill of foundations</td>
<td></td>
</tr>
</tbody>
</table>
• Control and maintenance of drainage systems, including channel management
• Regrading and reinforcement of slopes to reduce risk of erosion and landslips
• Stronger retaining walls and fences with good drainage for surface erosion control
• Soakaways and SUDS
• Moisture control systems or soil rehydration to prevent further damage and correct existing problems.

Table 6: Approaches to ground conditions
Source: Sections 4.4.1 to 4.4.3 of Climate Change Adaption by Design, TCPA, 2007

3.3.1 Climate Adaptation Checklists
The South East Climate Change Partnership\textsuperscript{11} has produced a checklist that is aimed at developers, design teams, architects, surveyors and engineers. It suggests design issues affected by climate change which developers and their design teams can consider and provides guidance and suggested techniques for dealing with the following key issues:
- location;
- site layout;
- buildings;
- ventilation and cooling;
- drainage;
- water;
- outdoor spaces;
- connectivity.

More recently, Future Foundations and BRE have produced a checklist for the South West which has been devised to guide the design of new developments by making sense of current policy, highlighting best practice, and complementing the new Code for Sustainable Homes. It covers regionally specific sustainability and planning issues, and can be adapted to reflect locally significant concerns.

The Checklist is intended for use at the design and planning stages of a new development to help developers, local authorities and other interested parties to assess how sustainable the designs are for new housing and mixed-use developments. It is discussed in more detail in section 4.4.2 and 8.8 of this Strategy.

3.3.2 Cornwall Climate Change Action Plan
CSEP has recently begun the process of developing a climate change action plan on behalf of the County Council and the Cornwall Strategic Partnership. It will set out how Cornwall can move towards a low-carbon, sustainable and resilient Cornish economy. It is an 18 month project that will culminate in an action plan, which will outline the county’s approach to addressing climate and energy issues. The development of this document will require climate-energy risk assessments to be made as part of developing a robust evidence base, to inform decisions regarding

\textsuperscript{11} Adapting to climate change: a checklist for development - guidance on designing developments in a changing climate, SECCP, 2005.
adaptation options, mitigation targets and pathways including assessments of the potential for the use of carbon trading and offsetting mechanisms.

The plan is likely to be key tool informing decision making within the county, and as such should help to address the implications of climate change for the urban extension in terms of mitigation and adaptation.

3.4 Sustainable Communities

A key mechanism for delivering sustainable development is by encouraging the creation of more sustainable communities. The Government’s ‘Sustainable Communities Plan’ published in 2003 set out twelve key requirements of what makes a sustainable community. Following its production, the Deputy Prime Minister commissioned Sir John Egan to undertake a review of the skills and training that built environment professions would require to deliver sustainable communities. His report, ‘The Egan Review: Skills for Sustainable Communities’ published in 2004 provided the following definition: ‘Sustainable communities meet the diverse needs of existing and future residents, their children and other users, contribute to a high quality of life and provide opportunity and choice. They achieve this in ways that make effective use of natural resources, enhance the environment, promote social cohesion and inclusion and strengthen economic prosperity’.

The review highlighted the fact that sustainable communities do not come about by chance, but are something we must work to create. Egan and his team identified eight key components of a sustainable community and produced a framework for their delivery. Widely used, this framework was illustrated as a wheel, showing that all the components that make it up have equal importance and no hierarchy.

The Egan Wheel

![Figure 7: The Egan Wheel](source: Draft Cornwall Sustainable Community Strategy, 2007, Local Intelligence Network Cornwall)
Energy and Sustainability Strategy for Truro and Threemilestone Urban Extension

In the Securing the Future strategy, the Government built on the work of Egan to provide a simpler definition and an overview of components of sustainable communities. There is recognition that no standard template can be used, as each community is different. Therefore, local circumstances may lead to some short-term trade-offs between the components, although they are all essential to make a place sustainable. The definition used in their strategy is:

‘Sustainable communities embody the principles of sustainable development. They:
• balance and integrate the social, economic and environmental components of their community;
• meet the needs of existing and future generations;
• respect the needs of other communities in the wider region or internationally also to make their communities sustainable’.

Annex A of Securing the Future\(^\text{12}\) provides a detailed overview of the components of a sustainable community: “Sustainable communities are diverse, reflecting their local circumstance. They should be:

\begin{table}[h]
\centering
\begin{tabular}{|l|}
\hline
(1) **ACTIVE, INCLUSIVE AND SAFE** – fair, tolerant and cohesive with a strong local culture and other shared community activities
Sustainable communities offer:
- a sense of community identity and belonging, tolerance, respect and engagement with people from different cultures, background and beliefs
- friendly, co-operative and helpful behaviour in neighbourhoods
- opportunities for cultural, leisure, community, sport and other activities, including for children and young people
- low levels of crime, drugs and anti-social behaviour with visible, effective and community-friendly policing
- social inclusion and good life chances for all

(2) **WELL RUN** – with effective and inclusive participation, representation and leadership
Sustainable communities enjoy:
- representative, accountable governance systems which both facilitate strategic, visionary leadership and enable inclusive, active and effective participation by individuals and organisations
- effective engagement with the community at neighbourhood level, including capacity building to develop the community’s skills, knowledge and confidence
- strong, informed and effective partnerships that lead by example (e.g. government, business, community) a strong, inclusive, community and voluntary sector
- a sense of civic values, responsibility and pride

(3) **ENVIRONMENTALLY SENSITIVE** – providing places for people to live that are considerate of the environment
Sustainable communities:
- actively seek to minimise climate change, including through energy efficiency and the use of renewables
- protect the environment, by minimising pollution on land, in water and in the air
- minimise waste and dispose of it in accordance with current good practice
- make efficient use of natural resources, encouraging sustainable production and consumption
- protect and improve bio-diversity (e.g. wildlife habitats)
- enable a lifestyle that minimises negative environmental impact and enhances positive impacts (e.g. by creating opportunities for walking and cycling, and reducing noise pollution and dependence on cars)

\end{tabular}
\end{table}
create cleaner, safer and greener neighbourhoods (e.g. by reducing litter and graffiti, and maintaining pleasant public spaces)

**4) WELL DESIGNED AND BUILT – featuring a quality built and natural environment**

Sustainable communities offer:
- a sense of place (e.g. a place with a positive ‘feeling’ for people and local distinctiveness)
- user-friendly public and green spaces with facilities for everyone including children and older people
- sufficient range, diversity, affordability and accessibility of housing within a balanced housing market
- appropriate size, scale, density, design and layout, including mixed-use development, that complement the distinctive local character of the community
- high quality, mixed-use, durable, flexible and adaptable buildings, using sustainable construction materials
- buildings and public spaces which promote health and are designed to reduce crime and make people feel safe
- accessibility of jobs, key services and facilities by public transport, walking and cycling

**5) WELL CONNECTED – with good transport services and communication linking people to jobs, schools, health and other services**

Sustainable communities offer:
- transport facilities, including public transport, that help people travel within and between communities and reduce dependence on cars
- facilities to encourage safe local walking and cycling
- an appropriate level of local parking facilities in line with local plans to manage road traffic demand
- widely available and effective telecommunications and Internet access
- good access to regional, national and international communications networks

**6) THRIVING – with a flourishing and diverse local economy**

Sustainable communities feature:
- a wide range of jobs and training opportunities
- sufficient suitable land and buildings to support economic prosperity and change
- dynamic job and business creation, with benefits for the local community
- a strong business community with links into the wider economy
- economically viable and attractive town centres

**7) WELL SERVED – with public, private, community and voluntary services that are appropriate to people’s needs and accessible to all**

Sustainable communities have:
- well-performing local schools, further and higher education institutions, and other opportunities for life-long learning
- high quality local health care and social services, integrated where possible with other services
- high quality services for families and children (including early years child care)
- a good range of affordable public, community, voluntary and private services (e.g. retail, fresh food, commercial, utilities, information and advice) which are accessible to the whole community
- service providers who think and act long term and beyond their own immediate geographical and interest boundaries, and who involve users and local residents in shaping their policy and practice

**8) FAIR FOR EVERYONE – including those in other communities, now and in the future**

Sustainable communities:
- recognise individuals’ rights and responsibilities
- respect the rights and aspirations of others (both neighbouring communities, and across the wider world) also to be sustainable
- have due regard for the needs of future generations in current decisions and actions"
3.5 Creating a Sustainable Urban Extension

The solutions highlighted in this chapter provide a framework for the creation of a sustainable urban extension for Truro and Threemilestone. To facilitate their implementation, Carrick should ensure that other strategies take account of the issues by either directly including references to them, or by coherently making these links in the new AAP.

The Council also has a role to communicate the solutions to other Officers, Members, the local community and developers, so they are understood and implemented. They should become part of the planning framework and be used to help assess the planning applications that will come forward. To help with this, the Council could consider the merits of developing a specific Supplementary Planning Document on Energy and Sustainability as part of the LDF. This could explain the key issues, the solutions to them and the ways developers can address them, linking to the South West Sustainability Checklist. Although, strategically, this may be a more appropriate role for the new unitary authority as such a document would apply to all the new developments that are planned for Cornwall.

Three examples of local authorities that have already taken this approach are Milton Keynes, Daventry District Council and South Northamptonshire Council:

- Milton Keynes SPD was adopted in April 2007 to help applicants to comply with the council’s planning policy and provides details on what information is required from developers at the planning stage, such as how to calculate energy demand, carbon emissions and the amount of renewables required.
- Daventry and South Northamptonshire SPD on energy and development were adopted in March 2007. It sets out information and guidance on how developments can be more energy efficient and incorporate renewable energy.

3.6 Conclusions & Recommendations

Consideration for creating sustainable communities is a cross-cutting theme that is supported by all of the work that Carrick is undertaking for the new AAP. This chapter supports this process by providing an overview of the key issues and solutions to them, for energy and wider sustainability.

Sustainable energy, based on the energy hierarchy is a key tool in the development process for reducing the demand for energy. The starting point is good spatial planning for new buildings which will support the principle needs of the urban extension in terms of locating housing close to employment, transport links and services. Steps can then be taken to reduce energy demand further through good building orientation and measures to improve the thermal efficiency of buildings. The remaining energy needs should then be met in clean and efficient ways. Even though some of the mechanisms used to do this will increase the embodied energy associated with new build, this will quickly be recouped from the carbon emission savings resulting from the reduced operational energy demand of buildings.

These principles will also help to address the key issue of climate change by reducing the emissions associated with buildings and transport. This will help to mitigate against future climate change, a key role of the planning process. Good
planning can also help communities to adapt to the future climate that we are likely to experience. This will require consideration at the master planning scale, together with approaches for neighbourhoods and the buildings that make these up. A joined up approach in reference to the role of the landscape, green space and SUDs will deliver the highest levels of resilience. Resources already exist to help developers consider how to create future proofed communities and the future Cornwall Climate Change Action Plan will provide a more strategic approach in the long term.

The sustainable community framework provides a mechanism to ensure the urban extension is developed with sustainable development at its heart. The planning process not only allows for this, but requires that it is the case. The opportunity for Carrick to make the urban extension sustainable should not be underestimated. The fact that new communities will be created, through the development, in some respects should allow for all the components identified in this chapter to be considered from the start. This should make it easier to create truly sustainable communities as it is possible to put in place the necessary policies and strategies now. This should include consideration for how to link the new and existing communities within the development area. Policies aimed at creating sustainable communities within the urban development should also be used to help support existing neighbourhoods to become more sustainable.

**Recommendations for the Council:**

- The energy hierarchy should be central to the planning and development process to reduce energy demand and the emissions that drive climate change. It has been included within the draft developer guide that accompanies this report and should be a key consideration in assessing planning applications.

- The sustainable community framework from ‘Securing the Future’ should be used to assess ways to make both new and existing communities as sustainable as possible. This can be used to strengthen Carrick’s existing Sustainability Assessment Criteria. It should be used to inform the development of local policies and be used to check the plans coming forward from developers.

- The Council should ensure that the other strategies that support the AAP consider the recommendations within this chapter by either making reference to them or by pulling this together in the revised AAP. This includes:
  - the role of the master plan and spatial planning in reducing energy demand and supporting the components of sustainable communities;
  - the role of the landscape and green infrastructure strategies in helping communities adapt to climate change and in supporting the principles of sustainable communities;
  - the role of SUDs in reducing the impacts of climate change.

- The Council could consider the potential of developing a Supplementary Planning Guidance document as part of the LDF, covering the key issues set out within this and other chapters of the Energy and Sustainability Strategy.
4. Planning Framework

The introduction of the Planning and Compulsory Purchase Act in 2004 has led to a fundamental reform of the planning system, introducing a new plan-led system. It is currently in a transitional state and for this reason this chapter of the Strategy only provides an overview of what is currently known at the time of writing.

The new plan-led system is based upon a hierarchal structure of guidance and plans covering national, regional and local planning. This review takes account of existing planning policy and the current consultations that will affect it. It also makes wider policy links to key regional and local strategies in relation to sustainable energy. It considers these at three levels:

- national (Building Regulations and PPSs);
- regional (RSS);
- local (the documents that make up the LDF).

These will help to shape the recommendations made in this Strategy, providing a framework for setting targets and standards for energy and wider sustainability issues within the planned urban extension.

It is vital that this Strategy fits into the wider policy framework, nationally, regionally and locally. The following sections provide an overview of key policy that can be used in terms of planning for the proposed urban extension, but it is important that this Strategy fits in with other existing policy. Appendix two provides an overview of this policy.

Links should also be made to the other work Carrick has commissioned as part of the LDF, as these are finalised.

4.1 Key National Policy

4.1.1 Building Regulations

Building Regulations have been revised to improve construction of new, and the refurbishment of existing, buildings. The revision also brings the regulations in line with the requirements of the EU Directive on the Energy Performance of Buildings.

**Part L: Conservation of Fuel and Power 2006**

This part of the Building Regulations sets the baseline mandatory national standards for conservation of fuel and power in buildings. It covers both the construction of new buildings and renovation of existing buildings. Parts L1A and L1B are concerned with domestic dwellings and parts L2A and L2B deal with other buildings.

Updated in 2006, Part L1 introduced higher standards for energy efficiency to help tackle climate change. They set an overall energy/carbon target for a dwelling using SAP (Standard Assessment Procedure rating). This will ensure that new buildings reach a minimum overall energy performance standard, in relation to a Target carbon dioxide Emission Rate (TER). Compliance is demonstrated by calculating the actual Dwelling carbon dioxide Emission Rate (DER) for a dwelling to ensure it is not
greater than the TER. The regulations also introduced mandatory pressure testing to ensure that new dwellings do not have unacceptable levels of air leakage that lead to heat loss.

The new regulations allow flexibility in how that TER is met. The target ratings can be met by: improving the fabric of the building, e.g. through better insulation and sealing of the fabric, draught-proofing of windows and doors; improving the efficiency of heating and lighting; and through the use of lower carbon fuels and heating appliances. This approach gives designers the option to consider which approach is most suited to the development.

Part L2A for new non-domestic build also sets out that carbon emissions will need to meet a target emission rate. This is calculated by modelling a notional building of the same size, shape and use as the proposed building (using 2002 Building Regulations energy performance values). Energy efficiency improvement and low/zero carbon energy sources are then applied to the notional building to provide a TER to achieve.

As Part L is mandatory, compliance will ensure that new and refurbished buildings within the urban extension will meet current standards for energy use. However, there is considerable scope to set standards above current regulations to both ensure developments meet as high a standard as possible and also to fit with the anticipated improvements in Part L, see below.

### 4.1.2 Energy Performance Certificates

Energy Performance Certificates (EPCs) grade the performance of a building on a scale from A-G similar to the system used for grading white goods. For existing domestic properties they have already been introduced for some homes via Home Information Packs (HIPs) and they will be required for all new build homes from April 2008. They cover both the energy efficiency rating of the home and indicate its environmental impact in terms of CO₂.

![Figure 8: Example ratings](Source: Home Information Pack website)
For commercial buildings, two types of EPCs will be required. Asset certificates will measure the energy performance of the building based on its design. Operating certificates will measure how the building is managed and actually performs. Asset certificates will have to be renewed every 10 years and operating certificates will be renewed on an annual basis. From 2009 it will also be necessary to inspect large air conditioning systems whether they are in homes or commercial buildings. EPCs will be introduced on a phased basis, as set out in table 7.

<table>
<thead>
<tr>
<th>Date</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 April 2008</td>
<td>• EPCs required on construction for all dwellings.</td>
</tr>
<tr>
<td></td>
<td>• EPCs required for the construction, sale or rent of buildings, other than</td>
</tr>
<tr>
<td></td>
<td>dwellings, with a floor area over 10,000 m²</td>
</tr>
<tr>
<td>1 July 2008</td>
<td>• EPCs required for the construction, sale or rent of buildings, other than</td>
</tr>
<tr>
<td></td>
<td>dwellings, with a floor area over 2,500 m²</td>
</tr>
<tr>
<td>1 October 2008</td>
<td>• EPCs required on the sale or rent of all remaining dwellings</td>
</tr>
<tr>
<td></td>
<td>• EPCs required on the construction, sale or rent of all remaining buildings</td>
</tr>
<tr>
<td></td>
<td>other than dwellings</td>
</tr>
<tr>
<td></td>
<td>• Display certificates required for all public buildings &gt;1,000 m²</td>
</tr>
<tr>
<td>4 January 2009</td>
<td>• First inspection of all existing air-conditioning systems over 250 kW</td>
</tr>
<tr>
<td></td>
<td>must have occurred by this date*</td>
</tr>
<tr>
<td>4 January 2011</td>
<td>• First inspection of all remaining air-conditioning systems over 12 kW</td>
</tr>
<tr>
<td></td>
<td>must have occurred by this date*</td>
</tr>
</tbody>
</table>

**Note** - a system first put into service on or after 1 January 2008 must have a first inspection within 5 years of it first being put into service.

Table 7: Timetable for EPCs
Source: DCLG

### 4.1.3 Code for Sustainable Homes

The Code for Sustainable Homes (CSH) was introduced in England in April 2007. It measures the sustainability of a new home against categories of sustainable design, rating the whole home as a complete package. It is hoped that the Code will drive a step change in sustainable home building practice and it will become the single national standard for them. Importantly the CSH will form the basis for future developments of Building Regulations in relation to carbon emissions. It complements the system for Energy Performance Certificates in regard to measuring energy in buildings.

The Code uses a sustainability rating based on stars and has six levels. One star is the entry level, which is above current Building Regulations and six stars is the highest exemplar level. In all, nine different sustainability factors are taken into account including: energy; water; materials; surface water run-off; waste; pollution; health and wellbeing; management; and ecology.

The Code will be an important tool in helping to reduce the threat of climate change by ensuring new homes reduce carbon emissions, as well as encouraging more sustainable construction. The Government has suggested that the CSH should be voluntary, other than for Government funded social housing built by Registered Social Landlords, who must achieve a 3 star rating. However, the Examination in Public (EiP) on the draft RSS indicates the Code will effectively become mandatory in the South West. The CSH is described in detail in chapter five of this report.
4.1.4 Planning Policy Statements

Planning Policy Statements (PPS) set out the Government’s national policies on different aspects of land use planning in England. They are designed to complement, but not replace or override, other national planning policies. They should be taken into account by regional planning bodies in the preparation of regional spatial strategies, and by local planning authorities in the preparation of local development documents.

Several of the PPSs directly relate to the aims of this Strategy.

**PPS1: Delivering Sustainable Development**

PPS1 sets out the overarching planning policies on the delivery of sustainable development. It is based on three key themes: 1. sustainable development; 2. spatial planning; and 3. public participation.

It states that regionally, and locally, planning should ensure ‘development plans contribute to global sustainability by addressing the causes and potential impacts of climate change through policies which reduce energy use, reduce emissions, promote the development of renewable energy resources, and take climate change impacts into account in the location and design of development.’

Specific references are made within PPS1 to protect and enhance the environment through development that mitigates the effects of, and adapts to, climate change through the reduction of greenhouse gas emissions and the use of renewable energy. For the use of natural resources, development should seek to promote and encourage the use of renewable resources, make buildings energy efficient and consider community heating, the use of combined heat and power, small scale renewable and low carbon energy schemes.

**PPS1: Planning and Climate Change**

The Government published this new supplement to the above PPS in December 2007. It sets out how planning should help to reduce emissions and take account of the changes to the climate that are now unavoidable. It is a key document for setting policies for the urban extension, as it is such a recent document we have included the headline objectives and decision making principles that Carrick should adhere to below. It should also be noted, as set out in the introduction of this PPS that: “Where there is any difference in emphasis on climate change between the policies in this PPS and others in the national series this is intentional and this PPS takes precedence.”

The key planning objectives of the PPS are:

- To deliver sustainable development, and in doing so a full and appropriate response on climate change, regional planning bodies and all planning authorities should prepare, and manage the delivery of, spatial strategies that:
  - make a full contribution to delivering the Government’s Climate Change Programme and energy policies, and in doing so contribute to global sustainability;
  - in providing for the homes, jobs, services and infrastructure needed by communities, and in renewing and shaping the places where they live and work, secure the highest viable resource and energy efficiency and reduction in emissions;
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- deliver patterns of urban growth and sustainable rural developments that help secure the fullest possible use of sustainable transport for moving freight, public transport, cycling and walking; and, which overall, reduce the need to travel, especially by car;
- secure new development and shape places that minimise vulnerability, and provide resilience, to climate change; and in ways that are consistent with social cohesion and inclusion;
- conserve and enhance biodiversity, recognising that the distribution of habitats and species will be affected by climate change;
- reflect the development needs and interests of communities and enable them to contribute effectively to tackling climate change; and
- respond to the concerns of business and encourage competitiveness and technological innovation in mitigating and adapting to climate change.

In reference to decision making, all planning authorities should apply the following principles when making decisions about their spatial strategies:

- the proposed provision for new development, its spatial distribution, location and design should be planned to limit carbon dioxide emissions;
- new development should be planned to make good use of opportunities for decentralised and renewable or low carbon energy;
- new development should be planned to minimise future vulnerability in a changing climate;
- climate change considerations should be integrated into all spatial planning concerns;
- mitigation and adaptation should not be considered independently of each other, and new development should be planned with both in mind;
- sustainability appraisal (incorporating strategic environmental assessment) should be applied to shape planning strategies and policies that support the Key Planning Objectives; and
- appropriate indicators should be selected for monitoring and reporting on in regional planning bodies' and planning authorities' annual monitoring reports. Such monitoring should be the basis on which regional planning bodies and planning authorities periodically review and roll forward their planning strategies.

In terms of planning applications, Carrick will need to adhere to the following principles:

- controls under the planning, building control and other regulatory regimes should complement and not duplicate each other;
- information sought from applicants should be proportionate to the scale of the proposed development, its likely impact on and vulnerability to climate change, and be consistent with that needed to demonstrate conformity with the development plan and this PPS;
- specific and standalone assessments of new development should not be required where the requisite information can be made available to the planning authority through the submitted Design and Access Statement, or forms part of any environmental impact assessment or other regulatory requirement; and in considering planning applications before Regional Spatial Strategies (RSSs) and Development Plan Documents (DPDs) can be updated to reflect this PPS, planning authorities should have regard to this PPS as a material consideration which may supersede the policies in the development plan. Any refusal of planning permission on grounds of prematurity because a DPD is being prepared or is under review but has not yet been adopted should be consistent with Government policy.

Detailed information is provided within this PPS on: renewable and low carbon energy generation; the use of local development orders; the process of selecting land for development; requirements for decentralised energy; requirements for sustainable buildings; and how to test local requirements.
PPS3: Housing
PPS3 underpins the delivery of the Government’s strategic housing policy objectives and their goal to ensure that everyone has the opportunity to live in a decent home, which they can afford, in a community where they want to live.

Several references are made within PPS3 that are relevant to this Strategy. These include recommendations for sustainable new housing that reflect the PPS on climate change and the Code for Sustainable Homes. Developments should ensure that they facilitate the efficient use of resources and both adapt to, and reduce the impact of, climate change; and are located to cut carbon emissions from transport. Location should also consider the potential to use energy from decentralised energy supply systems based on renewable energy and low carbon.

PPS22: Renewable Energy
PPS22 sets out the Government’s policies for renewable energy. Increasing the development of renewable energy sources is seen as essential to the delivery of the Government’s commitments on climate change.

Among other things, PPS22 states that renewable energy development should be accommodated providing the technology is viable and that the environmental, economic and social impacts can be addressed. Also policies should be designed to promote and encourage, rather than restrict, renewable energy developments. At a local level, planning authorities should provide criteria for assessing planning applications for renewable energy developments.

Links to other PPS’s
The Impact Assessment of the PPS1 on Planning and Climate Change provides a good overview of how other PPS’s link to the challenge of tackling climate change:

<table>
<thead>
<tr>
<th>PPS</th>
<th>Policy/Guidance with an Impact on Climate Change</th>
</tr>
</thead>
</table>
| PPS1: Delivering Sustainable Development      | • Address causes and potential impacts of climate change  
• Reduce energy use  
• Reduce emissions  
• Promote renewable energy use  
• Location and design of development            |
| PPS3: Housing                                 | • Delivery of homes that are well designed  
• Making the best use of land  
• Making use of new building technologies to deliver sustainable development                                 |
| PPG 4: Industrial, commercial development and small firms | • Reduce the need to travel  
• Location of development                                                                                     |
| PPS6: Planning for Town Centres               | • Reduce the need to travel  
• Encourage use of public/alternative transport  
• Facilitate multi-purpose journeys                                                             |
| PPS7: Sustainable Development in Rural Areas  | • Planning applications should recognise the need to protect natural resources  
• Provide for sensitive exploitation of renewable energy sources                                              |
| PPS9: Biodiversity and Geological Conservation | • Account for climate change on distribution of habitats and species, and geomorphological processes and features |
| PPS10: Planning for Sustainable Waste Management | • Encouraging more sustainable waste management which respects the waste hierarchy (avoid, reuse, recycle, energy recovery, recycling) |
4.2 Key Regional Policy

4.2.1 Regional Spatial Strategy (draft)
The Regional Spatial Strategy (RSS) reflects the needs and aspirations for
development and land use to 2026. It reflects and builds upon national policies,
providing the overall development context for the Carrick LDF, and contains key
policies for this Strategy. It is currently in draft format and the panel reports and
recommendations from the Examination in Public (EiP) were released in January
2008, which will give an indication of the direction of suggested improvements to the
RSS, these suggestions have been incorporated into discussion for Policy G and
RE5, below. It is anticipated that a final, approved version will be available in
Summer/Autumn 2008. Once approved the RSS will supersede the Cornwall
Structure Plan. It has been developed alongside the Regional Economic Strategy
and been informed by the Strategic Sustainability Assessment.

The RSS has a major role in helping to achieve developments that tackle climate
change both in reference to mitigation and adaptation, and in helping to ensure that
new buildings are built sustainably.

Sustainable Development
Sustainable development is at the heart of the RSS and several policies reflect this,
which need to be interpreted at a local level.

SD1 is based on the ecological footprint of the region and recognises the need to
balance growth and resource consumption. Links can be made to this Strategy by
encouraging best practice in sustainable construction, using energy efficiently,
making more use of renewable energy, and minimising travel impacts.

SD2 specifically addresses climate change. It recognises that policies are needed to
help reduce CO₂ emissions in line with national targets, i.e. a 20% reduction by 2010
working towards a 60% reduction in 2050 (based on a 1990 baseline). Development
will have a key role to play in making this happen.
Development

Sets the context and foundation for design standards and quality to ensure development is sustainable and contributes to the wider aspirations of the RSS. It suggests the South West Sustainability Checklist will be a key tool in bringing about more sustainable developments.

Policy E encourages the raising of design standards, the production of detailed design briefs and the use of current examples of best practice to inform new developments.

Development Policy G provides recommendations for promoting sustainable construction, recognising that this will have a major role in meeting many of the policies set out in the RSS. In terms of this Strategy, it recognises that although energy efficiency measures can add to cost of construction, there is a payback for residents through lower fuel costs, especially so in the case of zero carbon developments. It recommends that all new development should be built to reach at least Level 3 of the Code for Sustainable Homes, using the highest practicable standards of energy efficiency. It also states the ambition of meeting the remaining energy demand using on-site renewable energy generation; and provides the context for using building materials that reduce the embodied energy of development.

In agreement with Carrick, this Strategy has used the recommended changes to Policy G set out in the report produced for GOSW and SWRDA\(^{13}\) and supported by the findings of the South West Examination in Public (EiP)\(^{14}\). These are slightly lower than those originally set out in the draft RSS and introduce a phased approach. Importantly they effectively make the CSH mandatory and advance it a quicker rate than proposed nationally. They also suggest including targets for non-residential developments. The Government Office indicates that this is allowable in reference to national policy and that the detailed evidence base has shown it to be technically feasible, without adding undue burden on developers. The revised Policy G is included in full below:

**Policy G Sustainable Construction**

Developers, local authorities, regional agencies and others must ensure that their strategies, plans and programmes achieve best practice in sustainable construction by:

- Following the principles contained within the Future Foundations, the South West's sustainable construction charter, to raise awareness of sustainable construction; and
- Requiring that all new and refurbished residential buildings achieve as a minimum the requirements of Level 3 of the Code for Sustainable Homes in order to minimise lifetime resource use, energy consumption, water use and waste production; and
- Requiring that all new and refurbished non-residential buildings achieve, as a minimum, the requirements of BREEAM Very Good standard (or, in the case of buildings for which there is no

\(^{13}\) Supporting and Delivering Zero Carbon Development in the South West – Final Policy Report, Faber Maunsell and Peter Capener, 2007

\(^{14}\) South West EiP Panel Report, 2008
such standard, the nearest comparable standard for the industry) in order to minimise lifetime resource use, energy consumption, water use and waste production; and

- Requiring that all larger scale residential developments and, in particular, urban extensions, are designed and constructed to meet or exceed the levels of the Code for Sustainable Homes set out in appendix C (vii) table 1; and

- Requiring that all larger scale non-residential developments are designed and constructed to meet or exceed the carbon reduction minimum requirements set out in appendix C (vii) table 2; and

- Requiring the use of sustainability statements for larger scale residential and/or mixed-use planning applications (as defined in paragraph 3.7.7), the contents of which should meet, or exceed, the South West Sustainability Checklist for Developments; and

- Minimising the environmental impact of new and refurbished buildings, including reducing air, land, water, noise and light pollution throughout the building's lifetime; and

- Requiring the use of sustainable drainage systems to minimise flood risk associated with new developments; and

- Designing homes which are safe and adaptable, for example by following Lifetime Homes standards, Secured by Design principles and including live/work space; and

- Taking action to improve the energy efficiency of existing buildings, and ensuring that all refurbished buildings achieve the best current standards of energy efficiency.

Based on the above, all new housing should be built to at least the CSH level 3 in terms of sustainable construction. In reference to the energy targets, the urban extension is classified as a large-scale development\textsuperscript{15}, homes should be built to at least level 4 of the code based on the schedule below (these tables are those referred to in appendix C in the above text):

<table>
<thead>
<tr>
<th>Date</th>
<th>Scale of Development</th>
<th>Level of the Code for Sustainable Homes</th>
<th>Of Which, Minimum Requirements for On-Site CO\textsubscript{2} Reduction Required Beyond Requirement of Part L BR 2006</th>
<th>Of Which, Minimum On-Site Renewables Required to Meet Policy RE5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2010</td>
<td>Residential, 10 or more dwellings</td>
<td>Level 4</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td>20% regulated emissions (20% of 2006 TER)</td>
</tr>
<tr>
<td>2011-2015</td>
<td>Residential, 10 or more dwellings</td>
<td>Level 5</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td>2016 on</td>
<td>Residential: 10 to 50 dwellings</td>
<td>Level 5</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residential: &gt; 50 dwellings</td>
<td>Level 6</td>
<td>100% total emissions</td>
<td></td>
</tr>
</tbody>
</table>

Table 9: Carbon reduction requirements for residential developments
Source: Appendix C (vii) table 1, South West EiP Panel Report, 2008

\textsuperscript{15} For the purpose of Policies G, RE5 and W4, ‘larger scale development’ proposals include significant urban regeneration projects covering new build, refurbishment, conversion and change of use and are defined in line with the ODPM Form PS2 definition, used for reporting general developments, as: for dwellings, the development of 10 or more dwellings or sites of more than 0.5 ha if the number is not given; for all other uses, where the floor space will be 1,000 square metres or more or the site is 1ha or more. Floor space is defined as the sum of floor area within the building measured externally to the external wall faces at each level. Basement car parks, rooftop plant rooms, caretaker’s flats etc should be included in the floorspace figure.
Energy and Sustainability Strategy for Truro and Threemilestone Urban Extension

### Table 10: Carbon reduction requirements for non-residential developments

<table>
<thead>
<tr>
<th>Date</th>
<th>Scale of Development</th>
<th>Minimum Requirements for On-Site CO2 Reduction Required Beyond Requirement of Part L BR 2006 to Meet Development Policy G</th>
<th>Of Which, Minimum Onsite Renewables Required to Meet Policy RE5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2010</td>
<td>Non residential &gt; 1000m²</td>
<td>25% regulated emissions (25% of 2006 TER)</td>
<td>20% regulated emissions (20% of 2006 TER)</td>
</tr>
<tr>
<td>2011-2015</td>
<td>Non residential &gt; 1000m²</td>
<td>34% regulated emissions (34% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td>2016 on</td>
<td>Non residential &gt; 1000m²</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Appendix C (vii) table 2, South West EiP Panel Report, 2008

It is suggested in the accompanying text for Policy G that the requirement for sustainability statements as part of planning applications should enable developers to demonstrate how sustainable the proposed development is. The RSS promotes the use of the South West Sustainability Checklist to encourage a consistent approach for sustainable design and construction. See section 4.2.2, below for information on this resource.

**Environment Enhancement**

This section of the RSS sets out policies for enhancing the distinctive environments and culture. It provides guidance on protecting the environment and designed areas such as the AONB, which may need to be considered in regard of some renewable energy developments. It also emphasises the need to avoid developments that risks, or contributes to, flooding and sets the case for the wise use of natural resources.

Specific details are provided in terms of energy use and renewable generation. For existing buildings the forthcoming Regional Sustainable Energy Strategy will help identify how to reduce energy use. For new build, the move towards sustainable construction (Policy G) will be the main tool for reducing the demand for energy. Policies for renewable energy are included under RE1 to RE5 and again we have taken on board the recommendations from the 2008 EiP to inform this Strategy.

The Government has set a target of producing 10% of renewable electricity by 2010, 20% by 2020, working towards 40% by 2050. Policy RE1 sets out the renewable energy targets for Cornwall to 2010, set at 93-108 MWe installed capacity from a range of onshore renewable electricity technologies. The target for the region to 2020 is 850 MWe installed capacity from onshore renewables (this includes the installed capacity up to 2010).

Policy RE2 covers offshore renewable energy generation, recognising that this could play an important role in helping the region to meet the 20% renewable electricity target by 2020, providing that the onshore targets set out in RE1 are met.

Policy RE3 covers renewable heat targets, highlighting that although no Government targets current exist for these, they are likely to be introduced within the timescale of the RSS. Based on this assumption, RE3 suggests that Local Development
Documents should include positive policies to enable the achievement of 100 MWt capacity by 2010, rising to 500 MWt by 2020; this is equivalent to 0.2% and 1.4% of the region’s heat demand respectively. The use of Combined Heat and Power is seen as a key mechanism in major new development to help reach these targets.

Policy RE4 covers the importance of ensuring that new renewable energy developments do not have negative local impacts. It states that: “When considering individual applications for development of renewable energy facilities, Local Planning Authorities will take into account the wider environmental, community and economic benefits of proposals, whatever their scale, and should be mindful that schemes should not have a cumulative negative impact and that proposals in protected areas should be of an appropriate scale and not compromise the objectives of designation.”

The original Policy RE5 suggested that for larger scale developments, an initial target of 10% for on-site renewable energy generation is set, whilst acknowledging that this target is expected to increase. The technical paper16 and 2008 EiP have suggested this is revised linking closely to the targets set out in Policy G. The revised text states: “When meeting carbon reduction requirements in new developments set out in Policy G, larger-scale developments will be expected to provide, as a minimum, sufficient on-site renewable energy to reduce CO2 emissions from energy use by users of the buildings constructed on site by the equivalent of 20% of regulated emissions. Developers will be expected to demonstrate that they have explored all renewable energy options, and designed their developments to incorporate any renewable energy requirements.”

For large scale developments the revised text for Policy RE5 indicates that an energy strategy should accompany planning proposals to describe how much energy is expected to be used, and therefore the likely carbon emissions that will result from the development. The strategy should be based on the energy hierarchy (described in chapter 3 of this report). The approach links to requirements of Policy G, and the energy targets are set out in the tables 9 and 10 above.

4.2.2 South West Sustainability Checklist

Developed by Future Foundations and BRE, the checklist has been devised to guide the design of new developments by making sense of current policy, highlighting best practice, and complementing the new CSH. It covers regionally specific sustainability and planning issues, and can be adapted to reflect locally significant concerns.

It is intended for use at the design and planning stages of a new development to help developers, local authorities and other interested parties to assess how sustainable designs are for new housing and mixed-use developments. The full Checklist including background and questions for each category is available from the dedicated website http://www.checklistsouthwest.co.uk/. The categories used by the checklist are reproduced below:

- **Climate Change and Energy** - To ensure that new developments are appropriately adapted to the impacts of present and future climate change and to

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16 Supporting and Delivering Zero Carbon Development in the South West – Final Policy Report, Faber Maunsell and Peter Capener, 2007
minimise their own impact on greenhouse gases, flooding, heat gain, water resources and water quality.

- **Community** - To ensure that the development supports a vibrant, diverse and inclusive community which integrate with surrounding communities.

- **Place Making** - To ensure that the most sustainable sites are used for development and that the design process, layout structure and form, provide a development that is appropriate to the local context and supports a sustainable community.

- **Transport and Movement** - To ensure people can reach facilities they need by appropriate transport modes, encouraging walking and public transport use and reducing the use of private cars for shorter journeys.

- **Ecology** - To ensure that the ecological value of the site is conserved and enhanced, maintaining biodiversity and protecting existing natural habitats.

- **Resources** - To promote the more sustainable use of resources related to both the construction and the operation of new developments.

- **Business** - To ensure that the development contributes to the sustainable economic vitality of the local area and region.

- **Buildings** - To ensure that the design of individual buildings does not undermine the sustainability of the overall development.

### 4.3 Local Policy

#### 4.3.1 Cornwall Structure Plan

Adopted in 2004, the Structure Plan is currently saved and will be superseded by the RSS which is due for adoption in 2008. As is stands, there are several areas of policy set out in the Structure Plan that relate to this Strategy.

Policy 1 sets the context for sustainable development and the need to improve Cornwall's economic, social and environmental circumstances without harming future opportunity.

Policy 3 outlines how development must be compatible with the prudent use of natural and built resources and energy conservation. It states that development should facilitate energy conservation and the utilisation of renewable energy sources to help reduce energy consumption and CO₂ emissions and follow sustainable construction principles for resource use and energy efficiency.

Policy 7 provides guidance on renewable energy resources. It states that provision should be made for renewable energy generation to maximise environmental and economic benefits (whilst minimising any adverse local impacts); and that a range of technologies for renewable energy production (for heat and electricity) should be encouraged. It highlights the target for Cornwall for 2010 of renewable electricity generation of about 93MW of installed capacity.

The policy recognises that the conservation and efficient use of energy should be encouraged in the first instance, in addition to more environmentally friendly ways of producing energy need to be developed.
4.3.2 Carrick – Draft Core Strategy
As the Core Strategy was found to be unsound by the Government Inspector at the end of 2007, we have not included guidance from it within this Strategy.

4.3.3 Carrick - Statement of Community Involvement
Adopted in July 2006, this strategy forms an integral part of Carrick LDF. It sets out how and when the community can get involved in the new planning system, allowing the opportunity to give views on local development documents and planning.

4.3.4 Carrick – draft Truro and Threemilestone Area Action Plan
Published as part of the Carrick LDF in January 2007, this draft TTAAP set out the preferred options for how this area will develop in the next ten years and beyond. It takes account of national PPS and the draft RSS in determining what development should take place and how this should occur. It went through a consultation stage and is now being revised based on this and the other studies that are being completed. This will result in a revised draft which following further consultation will be submitted to the Secretary of State. Despite this revision process, the first draft still contains useful information for setting out the principles and direction of growth and these are considered here.

The vision within the TTAAP sets the context for this energy study, stating under 2.3, that ‘all new developments will incorporate renewable energy and energy saving features to help cut down bills, make better places to live, reduce emissions and respond to the challenges of climate change.’

Section 8 of the TTAAP sets out the overall development principles for this area in reference to sustainable construction, water reuse and drainage, biodiversity, and energy efficiency and renewables. In terms of sustainable construction, it states that ‘wherever possible the needs of development should be met within its own footprint. This means that wherever possible the drainage, water and energy requirements of development should be integrated into and dealt with on-site’.

Under energy efficiency and renewables, 3 key statements are made:

- new developments will be expected to provide over 15% on-site renewable energy or to be carbon neutral. An energy use assessment, setting the baseline for the proportion of on-site generation, will be required to be submitted with all applications. All proposals must incorporate energy efficient features;
- for existing developments, where appropriate, the Council will encourage the provision of renewable energy sources for new and existing development (including housing and industry). The Council will also search for appropriate land within, and adjoining, the urban area to encourage the development of a supply of renewable energy for the city;
- Preferred Option DP1: Combined Heat and Power generation - the Council will investigate the feasibility of providing a combined heat and power plant within the proposed urban extension to provide heat and power to major employers/energy users and residential development.

It should be noted that the 15% renewables target suggested above has in effect been superseded by Policy RE5 in the draft RSS. However, in reality there is not a
significant change as the RSS is suggesting a 20% target based on regulated emissions17, which is close to the Carrick target of 15% for on-site renewable energy generation, as shown in the table below:

<table>
<thead>
<tr>
<th></th>
<th>RE minimum requirement (% regulated emissions, based on 2006 TER)</th>
<th>Equivalent % on-site generation target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>20%</td>
<td>10-14%</td>
</tr>
<tr>
<td>Non-residential</td>
<td>20%</td>
<td>12-17%</td>
</tr>
</tbody>
</table>

Table 11: Comparison between renewable targets
Source: Supporting and Delivering Zero Carbon Development in the South West – Final Policy Report (Table 1), Faber Maunsell and Peter Capener, 2007

4.4 Developments in Planning Policy

4.4.1 Building a Greener Future: Towards Zero Carbon Development

Published in December 2006, this consultation sets out the Government’s ideas for achieving zero carbon new homes within a decade. They propose that this will be achieved in three steps: ‘moving first, in 2010 to a 25% improvement in the energy/carbon performance set in Building Regulations; then second, in 2013, to a 44% improvement; then, finally, in 2016, to zero carbon’.

They aim to do this through setting the right planning framework for low carbon development, and by improving the environmental standards of our homes through the Code for Sustainable Homes and Building Regulations.

In July 2007, the Government published ‘Building a Greener Future: policy statement’ which confirms their intention to achieve the above staggered zero carbon development target.

4.2.2 Code for Sustainable Homes

Linked to Building a Greener Future, the Government has proposed in the consultation ‘The Future of the Code for Sustainable Homes’ that all new homes will be required to have a mandatory rating against the CSH. In February 2008 they announced that this will be a requirement and that ratings need to be provided from May onwards. This does not mean that the home has to be built to the Code, only that it is given a rating. This means that those developers who chose not to work to the code will end up with a zero rating for the property. It provides a simple mechanism to enable a potential home owner to know whether a property has been built to a higher standard than Building Regulations.

The argument from Government is that this will help to raise the profile of the Code and raise awareness amongst homebuyers. It is hoped that this may increase demand for sustainable homes and boost the market for sustainable construction and technology. This also relates to the fact that the Code is seen as a vehicle for encouraging improvements within the home building industry, without imposing unnecessary costs. However, the Government is keen to strengthen policy by setting minimum energy performance levels via Building Regulations and this links to the

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17 Regulated emissions are determined by Building Regulations and include carbon emissions resulting from the energy used for space heating, water heating, fixed internal lighting, cooling and ventilation pumps and fans.
CSH. It should be noted that the targets in the draft RSS suggest that all new homes will have to be built to at least level 3 of the Code.

**4.4.3 Building Regulations**

These provide the mandatory national standards for new buildings and would provide a legal framework for reducing carbon emissions to tackle climate change. The Government proposes to improve the energy performance of Building Regulations over time, so that all new homes meet the energy/carbon standards set out in the CSH. The proposal sets out the following improvements and timescales:

<table>
<thead>
<tr>
<th>Energy/Carbon improvement as compared to Part L (Building Regulations 2006)</th>
<th>2010</th>
<th>2013</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equivalent energy/carbon standard in the Code</td>
<td>Level 3</td>
<td>Level 4</td>
<td>Level 6</td>
</tr>
</tbody>
</table>

Table 12: Proposed energy improvements

Source: DCLG

**4.4.4 Draft RSS**

As highlighted above, the proposed changes to the draft RSS suggests the timescale for improving emissions will be bought forward in the South West. It also suggests that the use of the CSH will become a mandatory requirement for developers to ensure that climate change and sustainability are addressed effectively within the region.

For the rest of this Strategy we have based our recommendations on the result of the 2008 EiP, in terms of setting targets and the possible approaches to reaching them. This approach was agreed with Carrick, but introduces an element of risk until the draft RSS is formally adopted. Whilst it seems likely that the energy and sustainability objectives of the RSS will be approved (as they are backed up with an evidence base and passed the EiP process) they may not get approval. If this occurs it will be necessary to review the targets and recommendations set out within this document to bring them in line with the approved RSS.

**4.5 Targets and Emissions**

The RSS policy set out above and used in the next chapter on target setting uses the following definitions. These are taken from the EiP for the RSS:

- **Regulated emissions** are “the carbon emissions resulting from energy used to meet those services in a building that are regulated under the Building Regulations. Currently, these services are: space heating, water heating, fixed internal lighting, cooling and ventilation pumps and fans”. (The majority of these emissions will be from space and water heating).

- **Unregulated emissions** are “the carbon emissions resulting from energy used to meet those services in a building, or on a site, that are not currently regulated under the Building Regulations. Currently, these include: cooking, appliances, small power, communal lighting for flats, lifts, external lighting, IT equipment, etc.” (The majority of these emissions will be from cooking and appliances).

- **Total emissions** “are therefore all the carbon emissions from energy used in a building or on a site and are the sum of both regulated and unregulated emissions”.
These definitions are important as the required reduction in emissions to meet different levels of the CSH, and the renewable target, is only based on regulated emissions. Although in the case of domestic build, this will change in 2016 when all homes will have to be built to zero carbon standards. This is defined in the RSS as ‘zero net emissions (over the course of a year) of carbon dioxide into the atmosphere resulting from energy use in buildings’.

The RSS also defines what counts as on-site generation: ‘this allows for a site to connect up to an existing or proposed energy network off site, e.g. to a district heating or cooling network. It also allows for on-site electricity generation where electricity is supplied directly into the grid, and does not require there to be a private wire distribution network on site. It does not include the purchase of electricity on a “green tariff” generated at a facility which would not be considered a part of the wider development’.

### 4.6 Conclusions and Recommendations

Recent changes to the national planning framework have made sustainable development and climate change central to the planning process. This includes policies to improve Building Regulations, linked to EPCs and the CSH and ongoing consultations for further improvements to them. The Council will need to consider the outcomes of the current consultation on the CSH in relation to improvements in Building Regulations. These may result in lower national targets than proposed in the draft RSS and these may require changes to the RSS when it goes for approval.

In reference to the aims of this Strategy, the PPS’s highlighted provide a clear framework in terms of sustainable development, climate change, housing and renewable energy. Of these, the most recent PPS 1 on climate change clearly indicates how this needs to become a central element of development. Additionally, the draft RSS provides a strong and clear framework for ensuring new development incorporates the principles of sustainable construction, energy efficiency, renewable energy and the broader principles of sustainable development.

Resources such as the South West Sustainability Checklist will become key tools for encouraging developers to build sustainable homes. It should be promoted and used to assess planning applications and could form part of the previously recommended Supplementary Planning Document.

**Recommendations to the Council:**

- The policy highlighted in this chapter provides an overview of how the planning process can support the aims of this Strategy, Carrick should take these into account when finalising the revised AAP.
- Policy G and Policy RE5 of the draft RSS should be used to set targets within the urban extension for sustainable construction, energy efficiency and renewable energy generation. These targets and requirements should be used to assess planning applications.
- Carrick should ensure that the AAP and other key documents making up the LDF take account of the new PPS1 on Planning and Climate Change.
- The Council may need to revise the recommendations and targets set out within this Strategy based on the final RSS.
5. Target Setting

5.1 Context

As highlighted in chapter two of this report, energy use in homes is responsible for around 27% of all the UK’s carbon emissions. When you take account of the wider construction, use and maintenance of the built environment, it is suggested this figure rises to around 50% of the UK emissions of carbon dioxide\(^\text{18}\). A recent briefing from CABE\(^\text{19}\) highlights the problems of climate change relate in a large part to planning, design and management issues, and that climate change and the wider remit of sustainable development are linked with dynamic feedbacks between the two, affecting one another. They state that this relates to “where things are located and how they’re designed: how resources and energy are consumed; land developed; buildings and infrastructure constructed; services supplied, and places connected.”

In reference to this Strategy the way forward is clear. Carrick need to be ambitious in setting targets for the urban extension, based on the principles of sustainable development and the mitigation of, and adaptation to, climate change. Work must also continue in the rest of district to tackle emissions from existing housing. This is important as it is suggested that the rate at which new build adds to the overall housing stock is low, with at least 75% of the homes that will exist in 2050 having already been built\(^\text{20}\).

The framework to make this a reality is the energy hierarchy set out in chapter three of this report. For energy efficiency, Building Regulations set minimum standards and this is linked to the CSH and the draft RSS which sets out the proposed improvements in the regulations for carbon emissions towards the 2016 target of zero carbon homes. The Code will also be a key mechanism for encouraging wider sustainability opportunities to be incorporated into new housing. Minimum targets for renewable energy generation will also play an integral role in ensuring the development has a limited impact, particularly in the run up to 2016.

An indication of the future direction of improvements in energy and carbon emissions from domestic dwellings is set out in the draft RSS and linked to improving Building Regulations and the CSH. These are measured in the carbon emission rates for new housing, as described in the previous section. Essentially, developers need to ensure the actual emissions (DER) from new homes are lower than the target emissions (TER) in kg CO\(_2\) per metre squared of floor area, per year, as calculated by SAP. This just covers regulated emissions which result from the energy used to meet space heating, water heating, fixed internal lighting, cooling and ventilation pumps and fans. The diagram below provides an overview of how standards have and will improve in homes in relation to Part L Building Regulations (2002), linking to the new CSH. The apparent lack of difference between Level 5 and 6 in the diagram is because Level 5 is zero carbon from regulated emissions only, whereas Level 6 is zero emissions from all energy use.

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\(^{19}\) Sustainable Design, Climate Change and the Built Environment, CABE, 2007

\(^{20}\) Stock Take: Delivering Improvements in Existing Housing, Sustainable Development Commission, 2006
Figure 9: Carbon reduction levels
Source: NGS Greenspec website

Whilst this approach gives a roadmap for reducing emissions from homes, it does not give a clear indication of how energy use will be reduced, although this will happen as a result of improving the thermal efficiency of homes. The following table helps to clarify how energy use will change. It can be seen that the biggest savings occur from a reduction in space heating requirements, as a result in improved thermal efficiency in construction.

<table>
<thead>
<tr>
<th>Residential energy consumption benchmarks in kWh / m² p.a.</th>
<th>Heating</th>
<th>Hot Water</th>
<th>Lights &amp; Pumps/Fans</th>
<th>Appliances &amp; Cooking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline 2006 Part L</td>
<td>35</td>
<td>35</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>CSH Level 4 (44%)</td>
<td>20</td>
<td>35</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>CSH Level 5 (100%)</td>
<td>15</td>
<td>35</td>
<td>8</td>
<td>30</td>
</tr>
<tr>
<td>CSH Level 6 (true zero carbon)</td>
<td>15</td>
<td>35</td>
<td>8</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 13: Residential energy consumption benchmarks
Source: London ESCo

This is provided as a guide only, the actual predicted energy demand of any building will depend on what plans come forward from developers and what materials and quality of build is used.

5.2 Baseline Projections
Following discussions with Carrick it was agreed that it would not be appropriate for this Strategy to include a baseline assessment of the energy demand and carbon emissions that will arise from the urban extension. This is because the current level of information available on what will be built, and when it will be built, is still emerging and being refined. This includes both housing and non-domestic buildings.
To make an assessment at this stage could therefore lead to wrong assumptions being taken about what the likely levels of energy demand will be and the best ways to meet the needs of heat and power. To predict the energy demand in the future will require detailed modelling that takes account of the:

- type of building and floor area;
- density of build;
- standards that they will need to be built to.

The benchmarks for a range of homes could be calculated by Carrick using the data in table 13 above, once the final densities are known and what the mix of housing at each of these densities is likely to be. However, it will also be necessary for any financial and technical feasibility studies into the use of combined heat and power, and the creation of an energy service company to carry out this sort of modelling to assess their viability. This is discussed in more detail in chapter seven of this report. Basic information will also emerge as part of the planning process, as the RSS has made it a requirement on developers to produce an energy strategy within their proposals. This should include details on the amount of energy that the development is likely to require and the associated carbon emissions that will result.

For non-domestic buildings, only limited information was available at the time of writing and we have provided approximate baseline data for this in the table below. This only includes the larger buildings that were known about at the time of writing and even then, assumptions on floor space have been taken where details were not given. Clearly there will be a range of additional buildings within the urban extension such as retail, offices, light industrial and community buildings. Once details of these are known, an assessment of their probable energy and carbon should be assessed. Again this is likely to be needed as part of a more detailed study and could be considered at that stage.

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Electricity</th>
<th>Heat</th>
<th>Cooling</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truro College</td>
<td>1,400 MWh p.a.</td>
<td>1,060 MWh p.a.</td>
<td>960 MWh p.a.</td>
<td>12,000 m²</td>
</tr>
<tr>
<td>Primary School/s</td>
<td>1,350 MWh p.a.</td>
<td>1,720 MWh p.a.</td>
<td>0 MWh p.a.</td>
<td>20,000 m²</td>
</tr>
<tr>
<td>Hospital</td>
<td>1,720 MWh p.a.</td>
<td>6,000 MWh p.a.</td>
<td>720 MWh p.a.</td>
<td>20,000 m²</td>
</tr>
<tr>
<td>Innovation Centre</td>
<td>330 MWh p.a.</td>
<td>250 MWh p.a.</td>
<td>220 MWh p.a.</td>
<td>2,800 m²</td>
</tr>
<tr>
<td>Supermarket</td>
<td>2,000 MWh p.a.</td>
<td>1,600 MWh p.a.</td>
<td>1,000 MWh p.a.</td>
<td>5,600 m²</td>
</tr>
</tbody>
</table>

Table 14: Possible non-domestic energy benchmarks for the urban extension
Source: London ESCo

Even without including the baseline projections within the study, the information and recommendations still provide a clear indication of the potential ways to reduce carbon emissions and generate heat and power in clean and efficient ways.

5.3 Setting Targets

Setting high standards for development within the urban extension will be vital to meet the aspirations of Carrick and to meet the requirements of the draft RSS. The relatively slow rate and high cost of development suggest that high standards must be sought to ensure emissions are reduced as far as reasonably practicable and that new housing is built sustainably. Consideration also needs to be given to the wider social and economic opportunities the targets will bring.
Whilst Building Regulations set out the minimum standards that new buildings have to be built to, the main policy for setting targets for energy within the urban extension will be the RSS, linking to the Code for Sustainable Homes (and BREEAM) to ensure buildings are energy efficient, that they make use of on-site renewable and low carbon energy generation, and they contribute to wider sustainability issues.

As highlighted in the previous chapter, there are two main policies for determining energy targets within the draft RSS, namely Policy G which deals with sustainable construction and the creation of energy efficient buildings and Policy RE5 which sets targets for on-site renewable energy. The use of the phrase ‘renewable energy’ also includes other low carbon technologies such as CHP and heat pumps. In addition, in considering the required energy targets, the urban extension is classified as a large-scale development, as defined within the RSS glossary: “...for dwellings, the development of 10 or more dwellings or sites of more than 0.5 ha if the number is not given; for all other uses, where the floor space will be 1,000 square metres or more or the site is 1ha or more."

The targets for residential and other buildings in urban extensions are set out below. These bring forward the proposed improvements to the 2006 Building Regulations, but are considered to be technically viable within the time-scales, without causing undue burden on developers. The possible cost implications are considered in more detail in chapter nine of this report.

### 5.3.1 Domestic Energy Targets

Table 15 below, sets out the schedule of energy targets that homes should be built to within the urban extension as set out in the draft RSS. This starts from 2008 where homes should meet Level 4 of the CSH, which is equivalent to a 44% reduction in regulated emissions from 2006 Building Regulations. This should include a minimum of 20% on-site renewable energy generation for regulated emissions.

<table>
<thead>
<tr>
<th>Date</th>
<th>Scale of Development</th>
<th>Level of the Code for Sustainable Homes</th>
<th>Of Which, Minimum Requirements for On-Site CO₂ Reduction Required Beyond Requirement of Part L BR 2006</th>
<th>Of Which, Minimum On-Site Renewables Required to Meet Policy RE5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 - 2010</td>
<td>Residential, 10 or more dwellings</td>
<td>Level 4</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td>20% regulated emissions (20% of 2006 TER)</td>
</tr>
<tr>
<td>2011 - 2015</td>
<td>Residential, 10 or more dwellings</td>
<td>Level 5</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td>2016 on</td>
<td>Residential: 10 to 50 dwellings</td>
<td>Level 5</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residential: &gt; 50 dwellings</td>
<td>Level 6</td>
<td>100% total emissions</td>
<td></td>
</tr>
</tbody>
</table>

Notes:
- All requirements in terms of regulated emissions are against the sum of TERs for all dwellings in a development generated by Part L1A calculation for the 2006 Building Regulations.
- All minimum requirement figures relating to regulated emissions should be read as ‘equivalent to’ a percentage of regulated emissions.

Table 15: Domestic energy targets
Source: Appendix C of EiP for RSS, 2008

Chapter 5 – Target Setting
The implication of Policy G is that energy efficiency needs to be applied first to reduce carbon emissions. In simple terms, the requirement to build to level 3 of the Code, suggests that savings of 25% should be achieved with energy efficiency, before the renewable energy target of 20% is applied. Combined, these approaches will reduce emissions in line with the targets for level 4 of the CSH i.e. 44%. To get to level 5 and 6 it will be necessary to consider higher levels of energy efficiency and/or increase the use of renewable energy generation.

The new CSH will therefore be the main tool used in the urban extension for specifying energy standards to work towards. This will ensure that emissions are reduced through the use of both energy efficiency and renewable energy. A range of standards are already available nationally to help developers to meet the energy and carbon targets set out in the Code. It is worth noting that over the coming years there is likely to be a considerable amount of information on how to build to higher levels of the Code as examples of actual developments emerge. This is likely to lead to improved standards and better guidance as the industry and agencies involved learn the lessons from them.

5.3.2 Domestic Sustainability Targets

Policy G in the draft RSS states that all new homes need to be built to at least level 3 of the Code in regard to sustainability. This will help to ensure that a wider range of issues are considered and result in buildings that are environmentally robust and future proofed for new occupiers. The requirement to produce sustainability statements that meet, or exceed, the South West Sustainability Checklist will ensure that sustainability beyond the individual building is considered. This will help meet the wider agenda of creating sustainable communities.

The rest of this section provides more detail on the CSH and the standards that can be used to support construction to level 3 in terms of sustainability and level 4 (and above) for carbon emission reductions. The approach and reasoning for incorporating energy efficiency, renewable energy and wider sustainably is discussed in the chapters six, seven and eight of this report.

Code for Sustainable Homes
This is the new national standard to encourage a step change in design and construction of sustainable homes. It provides a good framework for individual buildings and the accompanying technical guide provides background and guidance for how to meet the requirements of the CSH.

The Code takes a whole house approach, measuring the sustainability of a new home, using a star rating system. Nine design categories are included, as shown below, and developers are awarded points against each of these to gain a Code rating, the more points received, the higher the rating and the more sustainable the home. Some design categories have mandatory standards and others offer developers more flexibility, this is summarised below.
Categories | Flexibility
--- | ---
- Energy/CO₂ | Minimum standards at each level of the Code
- Water | 
- Materials | Minimum standard at Code entry level
- Surface water run-off | 
- Waste | 
- Pollution | No minimum standards
- Health and well-being | 
- Management | 
- Ecology | 

Table 16: Design flexibility summary
Source: Code for Sustainable Homes, DCLG, 2006

A summary of the number of points required to achieve each level of the Code is shown below against the minimum standards for energy and water. The shading shows the requirements for carbon emissions and sustainable construction.

<table>
<thead>
<tr>
<th>Code Level</th>
<th>Energy</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (★)</td>
<td>10</td>
<td>1.2</td>
</tr>
<tr>
<td>2 (★★)</td>
<td>18</td>
<td>3.5</td>
</tr>
<tr>
<td>3 (★★★)</td>
<td>25</td>
<td>5.8</td>
</tr>
<tr>
<td>4 (★★★★)</td>
<td>44</td>
<td>9.4</td>
</tr>
<tr>
<td>5 (★★★★★)</td>
<td>100</td>
<td>16.4</td>
</tr>
<tr>
<td>6 (★★★★★★) zero carbon home³</td>
<td>17.6</td>
<td>80</td>
</tr>
</tbody>
</table>

Notes
2. Zero emissions in relation to regulated emissions – i.e. Part L 2006
3. A completely zero carbon home (i.e. zero net emissions of CO₂ from all energy use in the home).
4. All points are rounded to one decimal place.

Table 17: Summary of code levels
Source: Adapted from Code for Sustainable Homes, DCLG, 2006

Table 18 below, provides an overview of the minimum standards that must be met within the Code. Appendix three includes the detailed scoring used against each design category within the Code (including those that do not have a minimum standard).
<table>
<thead>
<tr>
<th>Code Level</th>
<th>Category</th>
<th>Minimum Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(★)</td>
<td>Energy/CO₂</td>
<td>Percentage improvement over Target Emission Rate (TER) as determined by the 2006 Building Regulation Standards</td>
</tr>
<tr>
<td>2(★★)</td>
<td></td>
<td>10%</td>
</tr>
<tr>
<td>3(★★★)</td>
<td></td>
<td>18%</td>
</tr>
<tr>
<td>4(★★★★)</td>
<td></td>
<td>25%</td>
</tr>
<tr>
<td>5(★★★★★)</td>
<td></td>
<td>44%</td>
</tr>
<tr>
<td>6(★★★★★★)</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A ‘zero carbon home’ (heating, lighting, hot water and all other energy uses in the home)</td>
</tr>
<tr>
<td>1(★)</td>
<td>Water</td>
<td>Internal potable water consumption measured in litres per person per day (l/p/d)</td>
</tr>
<tr>
<td>2(★★)</td>
<td></td>
<td>120 l/p/d</td>
</tr>
<tr>
<td>3(★★★)</td>
<td></td>
<td>120 l/p/d</td>
</tr>
<tr>
<td>4(★★★★)</td>
<td></td>
<td>105 l/p/d</td>
</tr>
<tr>
<td>5(★★★★★)</td>
<td></td>
<td>105 l/p/d</td>
</tr>
<tr>
<td>6(★★★★★★)</td>
<td></td>
<td>80 l/p/d</td>
</tr>
<tr>
<td>1(★)</td>
<td>Materials</td>
<td>Environmental impact of materials</td>
</tr>
<tr>
<td>2(★★)</td>
<td></td>
<td>At least three of the following 5 key elements of construction are specified to achieve a BRE Green Guide 2006 rating of at least D – Roof structure and finishes – External walls – Upper floor – Internal walls – Windows and doors</td>
</tr>
<tr>
<td>3(★★★)</td>
<td></td>
<td>120 l/p/d</td>
</tr>
<tr>
<td>4(★★★★)</td>
<td></td>
<td>105 l/p/d</td>
</tr>
<tr>
<td>5(★★★★★)</td>
<td></td>
<td>105 l/p/d</td>
</tr>
<tr>
<td>6(★★★★★★)</td>
<td></td>
<td>80 l/p/d</td>
</tr>
<tr>
<td>1(★)</td>
<td>Surface Water Run-off SR management</td>
<td>Ensure that peak run-off rates and annual volumes of run-off will be no greater than the previous conditions for the development site</td>
</tr>
<tr>
<td>2(★★)</td>
<td></td>
<td>120 l/p/d</td>
</tr>
<tr>
<td>3(★★★)</td>
<td></td>
<td>120 l/p/d</td>
</tr>
<tr>
<td>4(★★★★)</td>
<td></td>
<td>105 l/p/d</td>
</tr>
<tr>
<td>5(★★★★★)</td>
<td></td>
<td>105 l/p/d</td>
</tr>
<tr>
<td>6(★★★★★★)</td>
<td></td>
<td>80 l/p/d</td>
</tr>
<tr>
<td>1(★)</td>
<td>Waste</td>
<td>Site waste management</td>
</tr>
<tr>
<td>2(★★)</td>
<td></td>
<td>Household waste storage</td>
</tr>
<tr>
<td>3(★★★)</td>
<td></td>
<td>Ensure there is a site waste management plan in operation which requires the monitoring of waste on site and the setting of targets to promote resource efficiency Where there is adequate space for the containment of waste storage for each dwelling. This should allow for the greater (by volume) of the following EITHER accommodation of all external containers provided under the relevant Local Authority refuse collection/recycling scheme. Containers should not be stacked to facilitate ease of use. They should also be accessible to disabled people, particularly wheelchair users and those with a mobility impairment OR at least 0.8m³ per dwelling for waste management as required by BS 5906 (Code of Practice for Storage and On-site Treatment of Solid Waste from Buildings)</td>
</tr>
</tbody>
</table>

Table 18: Minimum code standards
Source: Code for Sustainable Homes, DCLG, 2006
For an example of how the Code works in relation to the RSS, to meet the required standards up to 2010, a developer will need to reach level 3 in the Code for sustainable construction and level 4 for carbon emission reductions. They must also generate 20% on-site renewable energy. To do this they will need to construct a house that:

- reduces water consumption to at least 105 l/p/d;
- meets or exceeds the minimum requirements for waste, surface water run-off and waste;
- reduces emissions by at least 44%, compared to 2006 Part L. This should include energy efficiency improvements of approximately 25% (equivalent to level 3 of the CSH) and by supplying a minimum of 20% on-site renewable energy generation;
- makes up the remaining points needed to reach level 3 from the other CSH design categories to score a total of 57 points.

Assessment against the Code is a two stage process that uses a network of trained and accredited independent assessors. They conduct an initial design stage assessment on each home type within any development to recommend a sustainability rating and issue an interim Code certificate. Once built, the assessor performs a second assessment to verify the rating and issue a final Code certificate of compliance that shows the overall sustainability of the home and a breakdown of how this has been achieved. This post-completion check is carried out on a sample basis within the development.

**Energy Standards**

A range of standards are available to help developers to build homes that reduce carbon emissions, to reach the required levels of the CSH. They can be used to help with the design and construction of homes that are as energy efficient as possible, before renewable and low-carbon generation is considered. This is required by Policy G of the RSS and will generally be more cost effective for a developer. It will result in homes that are very well insulated and airtight, and that are comfortable and cheap to run for the occupiers. Such an approach will also ensure that the principles of the energy hierarchy are followed, whilst helping to reduce the overall energy demand of the urban extension. The implication of Policy G is that the minimum level of energy efficiency required will result in a reduction in regulated emissions of 25%.

In theory it is possible to reach up to level 5 of the Code by just focusing on energy efficiency by improving the thermal efficiency of a home through the choice of construction materials and the quality of construction to reduce heat loss.

**Energy Saving Trust (EST)**

The ESTs Best Practice Standard has been widely used in many of the national and regional modelling exercises that have considered how developers can work towards the energy requirements of the CSH. In February 2008, EST released a revised standard that links directly to Code Level 3. It is essentially the same as the previous Best Practice Standard, in that it enables and models ways to achieve a 25% reduction in carbon emissions. By using renewable or low-carbon generation in

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addition to this new standard, it will be possible to achieve higher ratings within the Code, as required by the draft RSS.

The standard uses a similar structure of Part L (2006), allowing an element of flexibility in the design and construction of new dwellings. It covers issues such as insulation, airtightness, ventilation, space and hot water heating, lights and appliances. It recognises the importance of taking an integrated whole house approach, to ensure that energy efficiency measures work together to maximise cost-effectiveness in construction and to minimise fuel costs. It can also help to ensure that renewables are incorporated within the building design to maximum effect.

Alone, this standard can provide a 25% improvement in energy efficiency compared to the minimum standards in the Building Regulations. It will therefore be necessary to incorporate renewable energy generation to take a home up to level 4 of the Code as this requires a 44% improvement in emissions. Some of the modelling used in the EST guide also shows how some renewables can be used to reach the level 4 target, but this approach reduces some of the fabric improvements and could therefore result in higher running costs for the occupiers.

This standard is a useful tool and EST provides free technical support to housing professionals including a technical help line, technical reports and publications, events and training. EST also intends to produce a range of new standards, setting out how to work towards the requirements of levels 4, 5 and 6 of the CSH. These are likely to be available later in 2008. A copy of the Level 3 version is included within Appendix four.

**Carbon Lite**

The Association of Environment Conscious Builders (AECB) Carbon Lite Programme, funded by the Carbon Trust, has developed what it considers to be a robust and practical guidance programme consisting of three standards that would enable developers to reach the energy and CO₂ targets of the CSH levels 4, 5 and 6.

They provide a step-by-step guide for creating low energy and low CO₂ emission buildings and are aimed at clients, developers, design teams, builders and the end users of buildings. As with the EST standards, it takes a whole building approach to provide guidance and advice on achieving the three standards contained within Carbon Lite:

- the Silver Standard (Level 4 CSH);
- the PassiveHaus Standard (Level 5 CSH);
- the Gold Standard (Level 6 CSH).

These standards are available from [http://www.aecb.net/](http://www.aecb.net/)

**5.3.3 Non-Domestic Energy and Sustainability Targets**

Table 19 below, sets out the schedule of targets that non-residential buildings should be built to within the urban extension. This starts from 2008 where they should reduce regulated emissions by 25% from 2006 Building Regulations. This should include a minimum of 20% on-site renewable energy generation for regulated emissions.
The targets below and the accompanying text in Policy G of the draft RSS, require that all new non-residential buildings achieve the requirements of BREEAM ‘very good’ standard to minimise resource use, energy consumption, waster use and waste production. BREEAM does not cover all non-domestic building types (medical buildings, for example) and in this instance Policy G states that the nearest comparable standard for the industry should be used.

<table>
<thead>
<tr>
<th>Date</th>
<th>Scale of Development</th>
<th>Minimum Requirements for On-Site CO₂ Reduction Required Beyond Requirement of Part L BR 2006 to Meet Development Policy G</th>
<th>Of Which, Minimum Onsite Renewables Required to Meet Policy RE5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2010</td>
<td>Non residential &gt; 1000m²</td>
<td>25% regulated emissions (25% of 2006 TER)</td>
<td>20% regulated emissions (20% of 2006 TER)</td>
</tr>
<tr>
<td>2011-2015</td>
<td>Non residential &gt; 1000m²</td>
<td>34% regulated emissions (34% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td>2016 on</td>
<td>Non residential &gt; 1000m²</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td></td>
</tr>
</tbody>
</table>

- All requirements in terms of regulated emissions are against the sum of TERs for all non-residential buildings in a development generated by Part L2A calculation for the 2006 Building Regulations.
- The requirement for 2016 assumes that Building Regulations by that date will also require a 44% reduction compared to 2006. If this does not happen, the 44% target may need to be reviewed to ensure it is viable.

Table 19: Non-domestic energy targets

**BREEAM**

BREEAM is a well established and widely used environmental assessment method for buildings. It was created, and is managed, by BRE and sets technical standards for a wide range of non-domestic buildings, including: office buildings; light industrial units; warehouses and workshops; retail outlets and shopping malls; schools and sheltered homes; nursing homes and student accommodation. A bespoke scheme can also be used to assess any other building type. All the versions of BREEAM are regularly updated to ensure that it remains representative of current best practice.

BREEAM assesses the performance of buildings in the following areas:
- management: overall management policy, commissioning site management and procedural issues;
- health and well-being: indoor and external issues affecting health and well-being;
- energy use: operational energy and carbon dioxide (CO₂) issues;
- water: consumption and water efficiency;
- materials: environmental implication of building materials, including life-cycle impacts;
- transport: transport-related CO₂ and location-related factors;
- land use: greenfield and brownfield sites;
- ecology: ecological value conservation and enhancement of the site;
- pollution: air and water pollution issues.
It can be seen that BREEAM uses a similar approach to CSH in reference to the design categories and this is because the Code was developed from the Ecohomes scheme which is part of BREEAM. However, there are some differences between the two, including the consideration of a wider range of issues other than just the individual building, which is the approach of the Code. In addition, unlike the Code, BREEAM does not set minimum standards for the different design categories; rather a rating is based on the total number of credits received to assess the overall performance. This provides a rating for the building on a scale of: Pass; Good; Very Good; and Excellent.

BRE publish a range of pre-assessment estimators to show the level of information required to complete a BREEAM assessment and to show how the scoring system works. These are available from www.breeam.org. These checklists allow a quick evaluation of the rating that could be achieved, under a formal assessment. Actual assessments are carried out by an independent assessor that is licensed and trained by BRE. For each assessment, a report is produced to outline the building or development’s performance against each of the criteria to provide an overall score and BREEAM rating. This can be carried out at the design stage and this approach is recommended by BRE as it can help developers and designers to achieve a high BREEAM rating in the most cost effective way. A post-construction review then ensures that the end result achieves the design’s aspirations.

As different versions of BREEAM exist for different non-domestic building types it is not possible to provide a generic list of elements that designers should use. As an example of the sorts of considerations included within BREEAM, a very simplified version of the 2006 Offices Design & Procurement Assessment Estimator is included in Table 20 below. This only provides an approximation of the scoring used in a formal assessment and is therefore for guidance only.

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22 Although this is the approach of BREEAM, this will not be the case for carbon emissions, as the draft RSS suggests that targets of 25% to 44% reduction will have to be achieved and that 20% on-site renewables will be needed. This policy therefore makes these parts of BREEAM mandatory.
<table>
<thead>
<tr>
<th>Category</th>
<th>Elements Included</th>
<th>Approx. Points</th>
</tr>
</thead>
</table>
| **Management**         | • Appointment of team member to monitor commissioning  
• Compliance with Considerate Constructors or similar  
• Site construction monitoring and reporting for range of issues  
• Provision of guide to end users on operation of building                                                                                           | Up to 22       |
| **Health & Wellbeing** | • Adequate daylighting; Desk distance from windows  
• Glare control; Control of fluorescent and compact lamps  
• Recommended lighting levels; Zoned lighting  
• Openable windows  
• Avoidance of external air pollution in air intakes  
• Ventilation rate  
• Thermal comfort levels  
• Area based temperature controls  
• Measures to avoid legionella contamination  
• Internal noise levels                                                                                                                                  | Up to 20       |
| **Energy**             | • Percentage improvements above required CO₂ emissions from Building Regulations (15 point scale from 1% to ≥ 70%)  
• Sub-metering of electricity for substantive energy uses covering lighting and small power  
• Sub-metering of energy in tenancy/areas installed in a building  
• Energy efficient external lighting                                                                                                                  | Up to 14 points|
| **Transport**          | • Access to public transport networks  
• Total net CO₂ from transport to and from building (predicted based on location)  
• Cycle racks and shower provision  
• Travel plan developed                                                                                                                                 | Up to 13 points|
| **Water**              | • Water efficient fittings  
• Use of water meter  
• Leak detection system  
• Proximity detection shut off for urinals/WCs                                                                                                         | Up to 4 points |
| **Materials**          | • Green Guide Specification rating  
• Carpet installation  
• Low environment impact paints/varnishes  
• Re-used façade materials  
• Re-use of space  
• Re-use of aggregates  
• Responsible sourcing  
• Recycling space in building                                                                                                                          | Up to 11 points|
| **Land Use & Ecology** | • Use of brownfield land  
• Use and treatment of contaminated land  
• Use of low ecological value land areas  
• Steps to reduce negative impact of development on ecology  
• Use of professional ecologist or similar to advise on site  
• Compliance with legislation in terms of ecology protection, etc                                                                                      | Up to 17 points|
| **Pollution**          | • Low GWP refrigerants  
• Leak detection for refrigerants  
• Low GWP insulating materials  
• Low NOₓ emissions from space heating  
• Development in low flood risk areas & use of SUDs  
• Pollution risk avoidance on site  
• Use of renewable and low carbon energy  
• Avoidance of light pollution                                                                                                                          | Up to 15 points|

Table 20: Summary of 2006 Offices Design & Procurement Assessment Estimator  
Source: BREEAM website
The minimal score required to reach different BREEAM levels based on a design and post-construction review for offices are:

- **Pass** 25 points
- **Good** 40 points
- **Very Good** 55 points
- **Excellent** 70 points

As an example of meeting the targets within the urban extension, as set out in the draft RSS, any offices built up to 2010 would need to:

- reduce emissions by 25% compared to 2006 Building Regulations;
- generate 20% on-site renewable energy for regulated emissions (as part of the above target);
- obtain an overall score of 55 points from a combination of the above criteria and the other design categories within BREEAM.

As with some of the other standards, BREEAM is due to be updated soon, with an expected launch for new 2008 standards in April. This will include consolidation of the methodology to drive improvements in sustainability and to improve consistency between different versions. It is also proposed to bring some of the environmental weightings used in the calculation process in line with the CSH; and to introduce a new ‘outstanding’ category for the most exemplar buildings.

**Future Standards for Non-Domestic Buildings**

It should be noted that in the future a Code for non-domestic buildings, similar to the CSH may emerge to set standards for energy and wider sustainability in this sector, possibly with a timetable for improving Building Regulations towards a zero carbon target. However, when, and in what form, this may take is not clear at the time of writing. A report was produced at the end of 2007 setting out the considerations for implementing this and it suggests a number of recommendations to overcome the complexity of setting up such a scheme.

**5.4 Additional Requirements**

In addition to setting energy and carbon targets and requiring the use of sustainable construction in relation to the CSH and BREEAM for new build, Policy G of the RSS also makes additional requirements. These include:

- following the principles contained within Future Foundations, the South West’s sustainable construction charter, to raise awareness of sustainable construction;
- submitting sustainability statements for larger scale residential and/or mixed-use planning applications, the contents of which should meet, or exceed, the South West Sustainability Checklist for Developments;
- minimising the environmental impact of new and refurbished buildings, including reducing air, land, water, noise and light pollution throughout the building’s lifetime;
- requiring the use of sustainable drainage systems to minimise flood risk associated with new developments;

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• designing homes which are safe and adaptable, for example by following Lifetime Homes standards, Secured by Design principles and including live/work space.

More information on Future Foundations and its charter are available from their website http://www.futurefoundations.co.uk/. The South West Sustainability Checklist is discussed in more detail in sections 4.4.2 and 8.8. It will be a key tool in considering the wider remit of sustainable development and the creation of sustainable communities. Further information is available from http://www.checklistsouthwest.co.uk/. Developers can meet the requirements of the RSS by following this guidance and reference has been made to them within the developer guide that accompanies this report. The checklist, CSH and BREEAM should enable developers to meet the requirement of minimising the environmental impact of new buildings.

The requirement for the use of SUDs has not been discussed within this Strategy as Carrick has commissioned a separate report for this. This should both refer to, and deal with, the requirements under Policy G for this area of sustainable construction. More information on Lifetime Homes and Secure by Design is included within section 8.6 of this report.

A final requirement included within the accompanying text for Policy RE5 in the RSS, is for developers to submit an energy strategy as part of planning. This should set out how much energy is expected to be used, how this will relate to carbon emissions and how these can be reduced through the use of the energy hierarchy. Guidance on what this energy strategy should contain was not available at the time of writing, but is likely to emerge soon.

5.5 Meeting the Required Targets
The basic requirements to meet the targets up to 2010 for homes and non-domestic buildings are included above, linking to the CSH and BREEAM. The next three chapters of this report go on to consider broad approaches for working towards the energy and sustainability targets. Within these chapters direct links to the CSH have been included, where applicable, together with an indication of the possible costs associated with them and an indication of the number of points that are available for each category. It should be noted that the links to the CSH technical guide are correct at the time of writing, but this resource is due to be updated in April 2008 and therefore the figures used within this Strategy may need to be revised. The estimate of costs is taken from chapters four and five of a study by Cyril Sweet, based on a notional large (100-200 unit) and small (12 unit) development using 2006 prices.

5.6 Conclusions & Recommendations
The targets within the draft RSS provide the Council with a strong mechanism to ensure developers come forward with applications for homes and other buildings that use the principles of sustainable construction and incorporate renewable energy. The requirements are set out under Policy G and Policy RE5 of the draft RSS. This

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includes several additional provisions, including the requirement to submit both a sustainability and energy strategy as part of the planning application.

Domestic targets will require developers within the urban extension to build to at least level 3 of the CSH and in regard to carbon reduction at least level 4 of the CSH. They will also need to incorporate 20% on-site renewables. The energy and carbon targets in relation to the Code rises to level 5 from 2011 and level 6 from 2016. The policy makes the CSH a mandatory requirement for developers for both energy and the wider sustainability design categories of the Code. The South West Sustainability Checklist will be an important tool in helping to develop sustainable communities.

To meet the required energy targets, developers will need to both improve the efficiency of buildings and incorporate renewable energy, so supporting the energy hierarchy. A range of existing energy standards are currently available to help developers work towards the carbon reduction targets of the CSH.

Non-domestic targets will require developers within the urban extension to improve the emissions from buildings initially by 25% and rising to 44% by 2016 (based on a 2006 part L baseline). They will also be required to achieve a BREEAM rating of ‘very good’ which will help to deal with a range of wider sustainable construction issues.

Combined, these policies will significantly reduce the impact of the urban extension, supporting the key drivers of sustainable development and climate change. It will lead to the development of buildings that are future proofed against climate change and rising energy price rises, provide occupiers with a dwelling that is comfortable to use and affordable to run, in communities that are sustainable.

Consideration for pushing for higher targets than required by the RSS, in order to meet Carrick’s aspiration of making the urban extension carbon neutral, have not been considered here. It will be challenging for developers to do this in the short term, but opportunities do exist. These directly relate to the potential choice for large scale energy generation and the financial implications of building to the CSH, these are considered within chapters seven and nine of this Strategy.

A summary of the targets and standards that will apply to large scale developments is provided below:

<table>
<thead>
<tr>
<th>Target or Standard</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Regulations</td>
<td>Mandatory</td>
</tr>
<tr>
<td>RSS – CSH Levels</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>RSS – BREEAM</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>RSS - 20% on-site renewables</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>RSS – Future Foundations principles</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>RSS – Sustainability Statements and Energy Strategy</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>RSS – the use of SUDs</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>RSS - Adaptable Homes (e.g. Lifetime Homes or Secured by Design)</td>
<td>Mandatory (when approved)</td>
</tr>
<tr>
<td>EST standard</td>
<td>Guidance only</td>
</tr>
<tr>
<td>Carbon Lite</td>
<td>Guidance only</td>
</tr>
</tbody>
</table>

Table 21: Summary of targets and standards
Recommendations for the Council:

- Carrick should use the targets set out within this chapter to ensure that developers come forward with plans for buildings that are constructed sustainably, have low carbon emission rates and contribute to the wider principles of sustainable development.
- The developer guide that accompanies this report (appendix five) should be checked by Carrick. Once approved it should be provided to developers wishing to build within the urban extension.
- The targets should apply equally to any refurbishment within the urban extension.
- The target should apply equally to affordable housing.
- Carrick should consider modelling the predicted energy demand and carbon emissions for each site once more details are known about housing densities and other non-domestic build.
6. Energy Efficiency Measures

Reducing the need for energy, and using energy efficiently, should be the first steps in reducing both carbon emissions and the overall energy demand within the urban development. This can be achieved through good design and construction considering a range of issues such as orientation, air tightness and ventilation, reduced u-values for the building envelope, and efficient heating and lighting. If done well, it will result in buildings that are easy to manage, cheap to run and more comfortable for the occupiers. It will also generally be cheaper and easier for a developer to reduce carbon emissions by considering energy efficiency before the use of renewable energy generation. This approach is required by the targets which suggest that at least 25% of the emission savings in housing should come from energy efficiency measures. It will also be cost effective to reduce the energy demand in new buildings at the construction stage, than to try to retrofit measures at a later date.

Where appropriate, direct references to the guidance in this chapter have been linked to the CSH technical guide, for more detailed information and an overview of the criteria used to calculate points, please refer to the technical guide.

6.1 Passive Solar

Sunlight that enters a building can provide useful amounts of heat and light to reduce the overall energy demand of a building. By considering this at the design stage it is possible to maximise this potential at no additional cost. This can reduce CO₂ emissions if the energy displaced comes from fossil fuels and create warm and sunny homes that are more desirable and comfortable for the occupiers. Known as passive solar design, such approaches work with conventional construction techniques. However, care is needed to ensure that overheating does not occur during the summer months, particularly in light of the likely increases in temperature as a result of climate change.

It is suggested by BRE/Energy Efficiency Best Practice Programme²⁶ that by applying simple layout and design principles, savings of up to 10% on fuel cost are possible.

Orientation and Site Layout

Possibly the most important part of passive design is building orientation. Buildings should ideally be within 30° of south, to ensure they receive sunlight for most of the day. Rooms that are oriented east of south will mainly receive morning sun. Those orientated west of south will mainly receive afternoon sun.

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²⁶ GIR17 - Passive Solar Estate Layout, BRE/Energy Efficiency Best Practice Programme, 1997
To increase the number of buildings that can face in a southerly direction, consideration is needed at the design stage to the road layouts. The best design will use access roads that run in a predominantly west-east alignment as houses can then be built around south. For other road directions:

- detached and semi-detached buildings will allow more flexibility for using solar gain for roads running north-south;
- for roads running diagonally across west-east, plots or buildings could be skewed to bring them within $30^\circ$ of south.

However, this does not require a strict linear development. Place making, the use of green or public space and wider considerations in terms of sustainable communities also need to be taken into account.

Shading is an important consideration for passive solar design as the benefits of good orientation can quickly be lost if the sun is blocked by other buildings or trees.

This can be reduced at the site planning stage by making use of southern facing slopes. These help to reduce over shading from other buildings and allows for a higher density build, than northern slopes.
Over shading can also be reduced by:

- locating taller buildings to the north of a site, or to the south of open spaces, car parks or road junctions;
- locating low rise buildings, such as bungalows or well spaced semi-detached and detached housing to the south side of a site;
- locating car parking/garages to the north of buildings;
- taking account of mature heights of any designed planting;
- avoiding the use of high pitched roofs which overshadow neighbouring buildings;
- avoiding over shading of living rooms by projections from the south elevation or staggered house plans.

Privacy needs to be considered as part of the build, as houses on the north side of access roads will have south facing front gardens/living rooms and it is likely that some screening will be needed to ensure privacy. This would need careful planning to ensure it does not reduce solar gain. For this reason, and the fact that the rear garden in such properties would be shaded to some degree by the building itself, such plots may be more appropriate for apartments.

Existing trees and vegetation should be taken into account at the design stage. They will play an important role in wider green space strategy for the urban development, help with climate adaptation by providing cooling and help to reduce surface runoff. Existing vegetation can also help reduce energy demand by providing shelter, particularly for exposed sites. However, without careful planning tall vegetation can cause shading and therefore reduce solar gain within a building. To avoid this, consideration should be given to:

- shelter belts that protect a building from the prevailing winds should be spaced at least three or four times their mature height from south-facing elevations;
- any tall trees in a shelter belt or amenity area should be deciduous, to allow some penetration of low level winter sun;
- small trees and shrubs can help to provide privacy without compromising solar gain for ground floor south facing rooms.

The need to reduce summer overheating can be achieved by the use of deciduous trees that block much of the sunlight during the summer, but allow it into the building during the winter. Summer overheating can also be reduced with sun louvers and will be influenced by building form.

**Designs for Passive Solar**

Direct gain systems are the simplest form of passive solar design in which solar energy that enters the building is absorbed by the thermal mass incorporated in floors and walls.

During the day the thermal mass absorbs heat and this is gradually released into the living space during the night, helping to maintain a comfortable temperature. This is particularly beneficial during the cooler months of the year. During the summer it is important that the thermal mass is prevented from heating up by using shade to avoid overheating the dwelling, otherwise the cooling energy demand will increase. It is important that thermal mass is used appropriately. The traditional view that the
most effective thermal mass comes from dense and heavy materials such as concrete, stone or masonry does not necessarily mean they are the most appropriate. Good design is required to ensure that thermal mass is considered as part of a complete package that includes the consideration of balanced glazing, building size, orientation, etc.

It is also possible to design for indirect solar gain that transfers solar energy through conduction and convection from outside of the building envelope into the heated space. Conduction methods make use of south facing, dark, thermal walls that are situated within the building, behind glass. Designs vary, but they absorb heat through the glazing area and store it within their thermal mass. This heat migrates through the thermal mass gradually over a number of hours and is released into the building later in the day. There are variations on this including Trombe walls that also allow for air movement around the thermal mass and designs that use insulation shutters on the glazing to avoid heat loss back through the window at night or on cold days. Such devices can provide useful heat gains for a house, but care is needed in regard to user education for some of the more complex designs.

Indirect solar gain can also make use of convection to provide useful space heating, such as integrated sunspaces or conservatories. These should be south facing and located outside the main fabric of the building allowing them to naturally gain heat from solar gains and lose heat at night time. They bring additional benefits such as additional living space (when conditions allow), a shelter zone against wind chill and rain, and a thermal buffer for the building envelope. They can also be used as a passive drying space for laundry.

Conservatories or lean-to designs are simple to construct and can provide useful solar gains. However, they need to be designed and used correctly to ensure they provide an overall net benefit for the dwelling. It is important that they are thermally isolated from the rest of the dwelling to prevent excessive heat loss and must be designed to avoid the risk of overheating during the summer either by providing adequate shading or an effective ventilation strategy.
Sunspaces or lightwells can create warm and light spaces within buildings and are particularly suited to flats, apartments and some non-domestic buildings where they can provide daylight further back into deep plans or for communal walkways and staircases. They can also provide an attractive internal space where no private garden space is available. As with conservatories sunspaces can be open to misuse by occupants which can lead to heat loss and an increase in energy use, or overheating if they are not isolated from internal living spaces or incorrectly shaded/ventilated.

![Figure 15: Sunspace](image)

Source: National Green Specification Website

**Heat Gains and Overheating**
Passive solar design is only effective if a balance is struck between providing useful heat whilst minimising heat loss. In addition, care is needed to avoid overheating during the summer months to ensure that a reasonable level of comfort is maintained without the need for air conditioning. This can be achieved through good design that should take account of window size, the use of shading during summer months, thermal capacity and night time ventilation. The latest Building Regulations have included a provision for limiting excessive solar gains. This should include consideration of:

- the appropriate use of thermal mass to provide heat storage and a buffer against heat fluctuations. It should be prevented from heating up during the summer months using shading, allowing it to provide cooler internal temperatures;
- correctly sized glazing mainly focussed on the south elevation of dwellings. EST’s best practice guide suggests that 60-75% of the total window area should face south, but this does not need to be especially large, as this can lead to heat loss or occupants using curtains or blinds to increase privacy, which reduces solar gain. On other elevations the glazed area should be smaller, but at least 15% of a room’s floor area, to allow for adequate day lighting. Windows with a low u-value should be used to reduce heat loss.

**6.2 Building Form & Fabric**
It is important to minimise the exposed surface area of a building. This will favour simpler compact building forms that will help reduce heat losses. It will also help to maximise the use of available land.

![Figure 16: Building form](image)

Source: National Green Specification Website
A higher degree of thermal performance will be achieved in terraced houses and flats, as compared to semi-detached and detached houses. However, in a mixed development it is unlikely to be feasible to just build these sorts of properties. Consideration should therefore be given at the master planning stage to the site suitability for different building forms. For the urban extension, southerly facing slopes that can maximise the potential of passive solar design could be favoured for larger houses, whereas to the north of the A390, it may make more sense to opt for more compact designs such as apartments.

Internal layouts of buildings should ensure that the main living spaces and other frequently used rooms are on the south side and rooms that benefit less from sunlight (bathrooms, utility rooms, etc) are on the north side. Kitchens are better positioned on the north side to avoid excessive heat gain.

Consideration should be given to the building fabric of houses in reference to thermal mass and the energy efficiency of different construction materials. By considering this at the design stage it is possible to develop comfortable, future proof, energy efficient homes.

Thermal mass describes the ability of a material to absorb heat, store it and then release it at a later time. As already highlighted, thermal mass is important for passive solar design, but it has wider general benefits for a building. If used appropriately, thermal mass helps to moderate fluctuations in internal temperatures, reducing the total heating and cooling requirements and therefore increasing energy efficiency. It is also an important consideration for climate change adaptation, in terms of regulating internal temperatures in a warmer climate.

It would be fair to say that there is an ongoing debate about the amount and form of thermal mass that is appropriate for new build. Whilst the traditional view has seen a preference for dense and heavyweight thermal mass, this can result in excessive internal temperatures that increase the need for air conditioning. The important point is that thermal mass is most effective when considered in terms of its surface area, rather than its volume, with only the first 100mm or so of dense material playing an effective role. As such, it is possible to consider a range of construction types from lightweight to heavy weight, providing that good design is used to maximise the benefits of thermal mass, whilst limiting the potential negative impacts.

Insulating the building fabric is generally considered to be one of the lowest cost methods of reducing energy use and carbon emissions. Building Regulations set minimum specifications and a range of standards are available nationally to improve the thermal efficiency of buildings. As an example, the EST Best and Advance Practice standards are included in table 22 below to show how different elements of the building fabric can be improved. The u-value of specific materials provides a measure of the overall heat transfer through a section of construction, the lower the u-value the better the thermal insulation of that element. The EST guidance includes information on indicative construction materials that can be used to obtain these u-values. Such an approach can help developers reduce carbon emissions and work towards the required level of the CSH. It can be seen that progressive improvements

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26 These are assumed values based on the modelling tables in Annex 2 of ‘Supporting and Delivering Zero Carbon Development in the South West’, Faber Maunsell and Peter Capener, 2007
in u-values and in limiting air permeability result in the construction of more energy efficient homes.

<table>
<thead>
<tr>
<th>Element</th>
<th>Building Regs 2006</th>
<th>EST Best Practice</th>
<th>EST Advanced Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>0.16 W/m²K</td>
<td>0.13 W/m²K</td>
<td>0.13 W/m²K</td>
</tr>
<tr>
<td>Walls</td>
<td>0.35 W/m²K</td>
<td>0.25 W/m²K</td>
<td>0.15 W/m²K</td>
</tr>
<tr>
<td>Exposed floors</td>
<td>0.25 W/m²K</td>
<td>0.20 W/m²K</td>
<td>0.15 W/m²K</td>
</tr>
<tr>
<td>Windows</td>
<td>2.00 W/m²K</td>
<td>1.60 W/m²K</td>
<td>0.80 W/m²K</td>
</tr>
<tr>
<td>Glazed doors</td>
<td>2.00 W/m²K</td>
<td>1.60 W/m²K</td>
<td>0.80 W/m²K</td>
</tr>
<tr>
<td>Solid doors</td>
<td>1.80 W/m²K</td>
<td>1.00 W/m²K</td>
<td>0.80 W/m²K</td>
</tr>
<tr>
<td>Air Permeability</td>
<td>&lt;10 m³/m²/hr @ 50Pa</td>
<td>&lt;3 m³/m²/hr @ 50Pa</td>
<td>&lt;1 m³/m²/hr @ 50Pa</td>
</tr>
<tr>
<td>% improvement of AD L</td>
<td></td>
<td>25%</td>
<td>60%</td>
</tr>
</tbody>
</table>

Table 22: Example building fabric improvements

Consideration of the building fabric is included within the CSH, providing developers with a way to gain points towards their Code rating. The aim is to help future proof a dwelling over its lifetime, in regard to energy efficiency, by limiting heat losses across the building envelope. It takes account of the thermal performance of the building envelope in its own right, recognising that it can have a significant long-term effect, as it is generally not altered once built; even adding an extension only makes relatively minor changes to the building envelope. It is measured by the Heat Loss Parameter (HLP), which measures the total fabric and ventilation heat losses from a dwelling based on its floor area, the lower the HLP the better in terms of energy efficiency. The HLP can be reduced by using efficiency design forms that limit external surface area such as flats and terraces, as well as increased levels of insulation, and air tightness. For a HLP of ≤ 1.3 (W/m²K) 1.2 points are available, if this is improved to ≤ 1.1 (W/m²K) 2.4 points can be obtained.

Achieving a HLP of ≤ 1.1 (W/m²K) is a mandatory standard required at CSH level 6:

<table>
<thead>
<tr>
<th>CSH ID – Ene 2</th>
<th>Points</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building Fabric</td>
<td>1.2 to 2.4</td>
<td>no</td>
</tr>
</tbody>
</table>

### 6.3 Space Heating

Emissions from space heating make up a large part of the regulated emissions developers need to reduce to meet the required targets. To reduce these emissions, developers are likely to reduce the need for space heating, through energy efficiency, and then supply the remaining demand with as few emissions as possible. However, specific guidance on space heating is difficult to provide as it will vary with the size of a dwelling and becomes even more variable for non-domestic buildings, depending on the end-user requirements. It could be assumed that as the urban extension is within a gas area, that many developers will take a standard approach for larger dwellings using independent gas fired wet central heating systems. For apartments and flats, the choice may be for communal heating systems or individual flue-less room heaters. These choices are likely to change as homes become more energy efficient as this will reduce the demand for space heating significantly. It will also depend on what forms of renewable and low carbon generation are selected to reach the required targets.
Based on current standards, developers will need to follow the requirements of Building Regulations in regard to the use of thermostats, thermostatic radiator valves and boiler interlock controls. There may also be an increased use of improved controls to help reduce carbon emissions, discussed in more detail under 6.10.

The CSH does not include a design category on heating, but does award developers for the use of systems that reduce emissions of nitrogen oxides (NOx) that arise from the operation of space and water heating systems, linked to the type of dwelling. NOx is emitted when fossil fuels are burnt and varies with the type of system and temperature at which the fuel is burnt. In domestic systems, low levels of NOx tend to be produced, but the use of electric heating that relies on grid electricity will be a significant source of NOx as power stations release large amounts. The Code therefore provides points for developers who include low NOx boilers or take other approaches, such as the use of renewables.

<table>
<thead>
<tr>
<th>CSH ID – Pol 2</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx Emissions</td>
<td>0.5 to 2</td>
<td>no</td>
<td>£0</td>
</tr>
</tbody>
</table>

### 6.4 Hot Water

Hot water also makes up a large part of the regulated emissions within buildings, so is another area that developers should consider. As new homes become more energy efficient the total energy demand for space heating will fall, meaning it is likely that the ratio of space to water heating will approach 50:50. It is therefore important that consideration is given to how hot water is provided and used in new homes.

In a new house, in a gas area, hot water is likely to be either provided instantaneously with a gas combi boiler, or with a conventional gas boiler that stores hot water within a cylinder. Energy efficiency can be improved by ensuring all boilers are condensing and rated A for their efficiency, current Building Regulations state that all boilers must be condensing, but they can be SEDBUK A or B rated. If a cylinder is used, high performance models are preferable that have more insulation and so heat up and store heat efficiently. Efficiency can be increased by reducing pipe runs around the house, for example by putting bathrooms and kitchens close together; and using small bore pipes can reduce the volume of cold water that has to be drawn off each time a hot tap is used.

Hot water use within a house will be for showers, baths, taps and appliances such as washing machines and dishwashers. Once used, hot water generally becomes waste water, so consideration should be given to its efficient use. This can be achieved by both reducing the demand for hot water by using low flow and aerated flow taps and showers and by encouraging householders to buy water and energy efficient appliances, discussed in more detail in section 8.1. Such measures will not only reduce the overall demand for energy and water within a building, but will also increase the contribution any renewable heating source could make to the overall energy demand of a building.

For non domestic buildings hot water needs will be very site specific, however some of the general principles set out above would apply. For buildings that do not require lots of hot water, such as offices, point of source heaters are more efficient that having long pipe runs from a centralised boiler.
Reducing NOx emissions from heating hot water are included within the Code, see space heating above.

6.5 Lighting

Fixed internal lighting forms part of regulated emissions within Building Regulations, so is another area which developers can consider to meet the required targets. Good design and site layout can increase the amount of natural day lighting a building receives and measures such as lightwells or sun pipes may be appropriate in some buildings. The use of daylight helps to reduce the energy demand for electric light and this can be increased by ensuring that all electric lighting is provided using low energy fittings.

EST suggest that 10 to 15% of energy use within current homes is for lighting, and this proportion could rise in new homes as the demand for space heating reduces. Emissions can be reduced by the use of energy efficient lighting, which also last longer. Current Building Regulations require fixed dedicated energy efficient light fittings to be installed in the most frequented locations in the dwelling (not less than one per 25m² floor area or one per four fixed light fittings). This is relatively low and it would make sense to developers to increase this to help reduce emissions, as it is relatively cheap and easy to achieve.

A study by EST\(^{27}\) suggests that areas of the homes lit the most are hall, lounge and landing, as such, these areas would benefit from low energy lighting. The report also suggests that lighting in the lounge and dining areas should be suitably designed as new occupants are most likely to assert their own style in such areas. Techniques such as low energy under-cabinet lighting in kitchens could also be considered as home owners are less likely to replace these.

Recent improvements in compact fluorescent lamps and efficient fluorescent strip lights include a wider range of fittings, better colour rendering and shorter warm up times. This makes their use in new buildings more practical and this can be ensured by specifying fittings that can only take energy efficient lamps. To some degree this is likely to happen anyway with the announcement in 2007 by the Government that high energy bulbs will be phased out in coming years, with major retailers already beginning to do this on a voluntary basis. In the future the use of LED lighting, which is even more energy efficient, is likely to increase.

The CSH encourages a greater use of internal low energy lighting than Building Regulations require, helping reduce CO\(_2\) emissions. Up to 2.4 points are available towards a rating against the Code.

<table>
<thead>
<tr>
<th>CSH ID – Ene 3</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Lighting</td>
<td>1.2 or 2.4</td>
<td>no</td>
<td>£10 to £30</td>
</tr>
</tbody>
</table>

External lighting in homes and communal buildings also needs to be considered. Current Building Regulations only cover external lighting that is fixed to a building which should use low energy light fittings or for security lighting, a maximum 150 W

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\(^{27}\) Low Energy Domestic Lighting, EST, 2006
Bulb is specified with movement and daylight cut out sensors. The regulations do not cover garage lighting, lighting on outbuildings, feature lighting or lighting in communal areas in blocks of flats, so standards would need to be specified to help reduce the energy demand for these. The CSH encourages developers to use the same specifications as set out in Building Regulations for all external lighting.

<table>
<thead>
<tr>
<th>CSH ID – Ene 6</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Lighting</td>
<td>1.2 or 3.6</td>
<td>no</td>
<td>Up to £15</td>
</tr>
</tbody>
</table>

Consideration needs to be given to providing the end users with good information when they move into a building. The use of dedicated fittings will help discourage replacement lighting, but good advice that explains how systems work and why particular choices have been made should be provided to reduce the likelihood of high energy lighting being installed. This is discussed in more detail in section 8.7 of this report.

For other buildings, as well as using low energy lighting, intelligent building control systems can be integrated. This can include fairly standard measures such as presence detectors in zones that are not in regular use, through to sophisticated controls that take into account the time of day or the outside light level. Simple measures such as individual desktop lighting with low background lighting can also be encouraged at the design stage. Communal areas such as corridors and stairs can also have motion sensitive lighting installed.

6.6 Energy Efficient Appliances

As homes become more energy efficient the demand for space heating is falling, but this good work is being undone by our increasing demand for energy intensive appliances. A recent report from EST28 suggests that between 1972 and 2002 the electricity consumed by household appliances doubled and is expected to rise by a further 12% by 2010.

Energy use from appliances is not included within Building Regulations, as it is not easy for developers to influence the appliances that occupiers of a building may use, or influence the actual efficiency of any appliance as these are set by manufacturers. As such, they are excluded from the calculations of target and dwelling emission rates for new build, even though they clearly contribute to the actual CO2 emissions from a dwelling. The CSH technical guide29 suggests that for a typical new semi-detached house built to 2006 standards, the CO2 emissions from lights and appliances will make up about 43% of the total CO2 emissions. However, these unregulated emissions will be taken into account at level 6 of the Code. Before then, the CSH awards points for developers who provide information to inform and influence new occupiers to choose energy efficient appliances. If appliances are provided by a developer, additional points are available for fitting the most energy efficient products.

<table>
<thead>
<tr>
<th>CSH ID – Ene 5</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Labelled White Goods</td>
<td>1.2 or 2.4</td>
<td>no</td>
<td>£540 (if appliances fitted)</td>
</tr>
</tbody>
</table>

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28 The Rise of the Machines, EST, 2006
29 Section 1, category Ene 5 of CSH Technical Guide, DCLG, 2007
In the UK, the EU energy label is obligatory for all white goods and it grades products from A (best) to G (worst) for energy use (the scale now goes up to A++ for fridges and freezers). In addition, EST Recommended Logo is also used on a wide range of products including appliances. Both of these should be promoted to households in the urban extension. The use of A and A++ appliances would reduce peak consumption, householders’ bills and reduce CO₂, if the electricity is from non renewable sources.

**Fridge/ Freezers**
These operate continuously throughout the day and as such the use of A or above rated appliances could significantly reduce the overall energy demand. Whilst developers cannot influence where an occupier might place a fridge/freezer, they can assist by leaving space for them away from the space for the cooker or other heat sources such as a window.

**Washing Machines & Dishwashers**
Again, higher rated appliances should be promoted. The EST Recommended logo grades both in regard to their energy and water use. There is a role in the design process, as space for the appliance can be located near to the dwelling’s hot water supply enabling a shorter pipe run to be used that will help to reduce energy consumption. Preference should be given for appliances that are designed to operate with a hot water supply as this is likely to be more efficiency than appliances that heat their own water.

**Tumble Dryers**
These could be one of the most energy intensive appliances within properties. They are covered by both the EU and EST Recommended schemes which can help to reduce electricity demand for these products. There is also considerable potential to encourage developers to include a drying space for clothes as part of the build. Drying clothes on an outside line is much more energy efficient, but there can be security concerns about leaving clothes out in a garden. A way to avoid these would be the incorporation of a secure external space or an internal space which can be un-heated or heated providing ventilation is provided in accordance with Building Regulations (AD F). This could possibly include a conservatory or sunspace.

Points are awarded under the CSH for the provision of secure drying.

<table>
<thead>
<tr>
<th>CSH ID – Ene 4</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying Space</td>
<td>1.2</td>
<td>no</td>
<td>£20</td>
</tr>
</tbody>
</table>

**Information, Communication and Entertainment**
In addition to the standard household appliances mentioned above a growing area of electricity consumption within the home is through things like computers, digital televisions, digital radio, etc. In 2007, EST³⁰ estimated that 45% of all electricity use in the home by 2020 could come from these products. Part of the problem with many of these products currently is that they are left on standby when not in use, new products are coming to market, such as energy saving plugs that turn off standby when the equipment is not in use, and there is also pressure on industry to tackle this issue in the manufacturing process.

³⁰The Ampere Strike Back, EST, 2007
6.7 Air Tightness & Ventilation

Air tightness and ventilation are related issues within dwellings. It is important to build homes that are air tight, but adequate ventilation must also be considered. EST\textsuperscript{31} defines ventilation as the replacement of stale indoor air with ‘fresh’ outdoor air through purpose-provided openings. This ensures a high level of comfort for occupants and avoids health risks associated with the build up of condensation and mould from moisture laden air. By contrast, air leakage is the uncontrolled flow of air through the fabric of a dwelling which results in a loss of heat, associated CO\textsubscript{2} emissions, increased energy costs, and discomfort from cold draughts. EST describes this balance in terms of ‘building tight - ventilating right’, with the aim of ensuring airtight construction combined with well designed ventilation to both improve energy efficiency and comfort levels. In theory, as long as good ventilation is provided, a building cannot be too air tight.

**Air tightness**

Making new buildings air tight can have a dramatic effect on their energy efficiency and high standards should be encouraged at the design and build stage to ensure this happens. Research by BRE\textsuperscript{32} showed that of 100 new properties tested, around a third failed to meet the standard for air tightness.

The 2006 Building Regulations (part L) have set standards for air tightness to minimise uncontrolled leakage at 10 m\textsuperscript{3}/hr/m\textsuperscript{2}. This is quantified in reference to air permeability, where the rate of leakage in metres cubed, per hour, per metre squared is measured at a reference pressure difference of 50 Pascals between the inside and outside of a dwelling. There is now a mandatory requirement to carry out an air tightness pressure test on a proportion of any new development. If a new home fails to meet the standard when tested, remedial measures will need to be undertaken to ensure the air tightness standard is achieved.

The paths of air leakage in a typical home can be quite complex as shown in the diagram below and consideration of these possible leakage areas is needed to help avoid them.

![Common air leakage paths](image)

**Figure 17: Common air leakage paths**
Source: GPG224 Improving Air tightness in Dwellings, EST, 2005

\textsuperscript{31} GPG268 Energy Efficient Ventilation in Dwellings, EST, 2006
\textsuperscript{32} Compliance with Part L1 of the 2002 Building Regulations: an investigation on the reasons for poor compliance, BRE, 2004
EST\textsuperscript{33} recommend that at an early stage a designer should identify a line through the envelope of the dwelling where the barrier to air leakage will be - a dwelling’s air barrier. Careful thought must then be given to sealing gaps and ensuring the continuity of the air barrier. Having designed this in, it is critical that people on-site during the construction phase are aware of the need to protect the air barrier, which will require training, supervision and ongoing inspections to avoid contractors unwittingly creating holes in the air barrier which will lead to air leakage. Such holes can be difficult to find once fixtures and fittings have gone in and can be costly to repair. The use of an air tightness strategy is recommended and examples are available from the EST GPG224 guide and other sources.

**Ventilation**

As well as making the building air tight it is also necessary to provide adequate controlled ventilation that meets the required Building Regulations (Approved Document F). This ensures that homes are comfortable and healthy by removing or diluting polluted air from within the building such as moisture, volatile organic compounds, nitrogen and carbon oxides, smoke, food smells, etc. This needs to be done in an energy efficient way.

EST\textsuperscript{34} recommends a three-pronged strategy for ventilation:

- **extract ventilation** in rooms where moisture and/or other pollutants are released e.g. kitchens, bathrooms, utility rooms and WC’s. This approach removes air directly to the outside before it has a chance to spread into the rest of the building;
- **whole building ventilation** that provides a continuous supply of fresh air that helps to disperse water/other pollutants that are not removed by extract ventilation or are generated in other rooms in the house;
- **purge ventilation** throughout the building that aids removal of high concentrations of water vapour/pollutants released by occasional activities such as painting and decorating – typically through opening a window.

**Extract ventilation** is possible through a number of different mechanisms. The simplest is with extract fans that are locally placed in wet rooms, providing rapid extraction of the moisture laden air. They can be operated manually, but preferably they should be automatic by linking them to lighting controls and by using run-on timers, this reduces the likelihood of them being left on accidentally. They can also be controlled using humidity sensors. Extract fans can be installed with heat recovery built-in which can improve their energy efficiency. Mechanical extract ventilation can also be used to extract air from wet rooms using ducts and a central extraction unit. For all forms of extract, replacement air is drawn in by background ventilators such as trickle vents in other rooms (and by air leakage). Gaps at the bottom of internal doors can help encourage the movement of air through a dwelling.

Consideration should be given to energy consumed by the fan plus any other electrical system components, known as the specific fan power; this is the power consumption in Watts divided by the air flow through the system in Watts per litre per second. To encourage energy efficiency this should be limited to around 1 – 2 W/l/s

\textsuperscript{33} GPG224 Improving Air tightness in Dwellings, EST, 2005
\textsuperscript{34} GPG268 Energy Efficient Ventilation in Dwellings, EST, 2006
for extract fans and less than 1 W/l/s for mechanical extract systems. Fan power forms part of regulated emissions.

**Whole house ventilation** can be provided passively or mechanically. Passive stack ventilation utilises the natural combination of stack and wind effects to draw warm, moist air out of a dwelling. The system uses vents in wet rooms that are connected to vertical ducts that run up to the roof ridge. Wind induced pressure differences draw the moist air into the ducts and replacement dry air is drawn into a property through trickle vents and air leakage. This provides ventilation to the whole house. As it is a passive system, there are no running costs or CO₂ emissions meaning they are a good choice for energy efficient homes. Performance can be improved by installing humidity-sensitive inlets that provide higher air flows when humidity is higher, therefore giving enhanced energy performance as air extraction is minimised when moisture is not being produced. These can also use passive heat exchangers at crossover points to improve performance.

Whole-house mechanical ventilation with heat recovery combines supply and extraction in one system. Generally, extraction takes place from wet rooms and passes through a heat exchanger before being released outside. Fresh incoming air is pre-warmed by the heat exchanger before entering other habitable rooms in the house. In terms of a ventilation strategy they provide a complete package, but they are expensive to install and will only achieve good levels of energy efficiency in the most airtight properties (less the 5 m³/h/m² at 50Pa).

For non-domestic buildings, natural ventilation should be encouraged to reduce the need for air conditioning, but this will be very site specific. Good design can enable natural ventilation to maintain comfortable internal temperatures and modelling at the design stage allows for the optimisation of such systems. If air conditioning is unavoidable, energy efficiency should be a key principle in choosing the most appropriate system.

### 6.8 Smart Metering

Smart meters are the next generation of energy metering devices. They provide accurate data on gas and/or electric use within the home. This data can be displayed on a unit situated in a visible location or possibly linked to a digital TV, computer or mobile phone, to enable residents to be more in touch with their energy consumption. It is suggested that by providing accurate and easily accessible information, people are more likely to engage with their energy use and change their behaviour to reduce demand.

The meters may be able to display energy use in kWh, money and carbon emissions, they may even provide a breakdown of energy use by appliance. It may also be possible to link in any energy generation from renewable sources, allowing the capability to sell back energy to the supplier through one meter. They will also enable energy suppliers to gather actual energy use data automatically, avoiding the need for estimated bills and meter readings.

The Government began trials of smart meters in 2007 that will involve around 40,000 households, with a suggestion of rolling this out to all households within 10 years.
Consideration is also being given to the use of simpler display units that would provide energy use data more easily to consumers.

Installing smart meters as part of the construction of new homes will reduce costs, compared to retrofitting, and should be encouraged. These could also become a selling point.

For commercial buildings, smart meters and half hourly reading is already used to help energy managers monitor consumption and as part of the more complex energy tariffs suppliers offer.

6.9 Cooling Techniques
With higher predicted temperatures as a result of climate change it will be increasingly important to ensure buildings do not overheat. Good design and ventilation strategies will be the key mechanisms to ensure that homes can maintain a comfortable internal temperature without the need for air conditioning or other means of mechanical cooling. Whilst air conditioning would provide a quick fix to internal temperature regulation they would lead to an increased energy demand and associated carbon emissions and should be discouraged.

The need for cooling should be designed out of the building prior to construction. Some of the mechanisms to achieve this will be through the use of appropriate thermal mass within the building fabric; strategies to avoid excessive solar gain during the summer and secure ventilation to allow night-time cooling that can purge spaces of any heat built up in a controlled way.

For non-domestic buildings it may be more difficult to provide cooling through design alone. For buildings with a large cooling demand it may make sense to consider cooling as part of the target to include on-site renewable energy generation. This could include CHP with cooling or heat pumps that can run in reverse; these are considered in chapter seven.

6.10 Building Controls
It is essential occupants can effectively control energy use within the home to reduce unnecessary energy use and heat loss. This partly relates to information provision, by giving clear operating instructions that occupants can understand such as adjusting timers and heating controls, maintenance requirements and information on any renewable energy generation equipment. This is discussed in more detail in section 8.7. It could also involve the use of zoned and temperature controlled heating.

In non-domestic buildings, controls for heating, ventilation and air-conditioning are more complex and very specific to the building, often linked to different zones for larger buildings. In simple terms controls should be integrated to avoid coincident heating and cooling on the same zone. Internal temperatures can be controlled for different zones to maintain a suitable thermal comfort range and these can take account of external temperatures to avoid large temperature differentials as people move between zones. Building Management Systems can improve the operation of
the building systems to improve comfort and reduce energy use by monitoring and controlling cooling, heating, hot water and lighting across different building zones.

6.11 Links to Sustainable Development
The efficient use of energy brings benefits to local communities in regard to the environmental, social and economic aspects of sustainable development. Clearly, reducing energy use results in a reduction of carbon emissions helping to protect the climate now and for future generations. It will also bring a wider range of social and economic benefits as it results in buildings that are cheaper to run and comfortable to occupy. This will reduce the amount of the occupant’s disposable income that needs to be spent on fuel bills, will reduce the risk of fuel poverty and will help to improve business profitability.

6.12 Conclusions and Recommendations
The starting point for reducing carbon emissions within the urban extension is through the creation of energy efficient buildings. This will require initial consideration of the site layout and building orientation and then a range of measures to improve the energy efficiency of the building envelope. The requirements of Policy G of the draft RSS mean that developers will need to consider these issues first. They are also likely to be more cost effective in terms of working towards the required targets. Some of the basic design considerations will not add any additional build cost as they relate to the use of passive solar design and improved construction techniques.

The council can support this by ensuring that planning applications fully address the use of energy efficiency, based on the energy hierarchy. The developer guide that accompanies this Strategy (appendix five) provides guidance on how to achieve the required targets and recommends the use of the new version of EST’s Best Practice Standard which can provide a 25% reduction in emissions through energy efficiency.

As well as being a principal tool in reducing carbon emissions, the measures set out within this chapter will help developers to gain points under both the CSH and BREAAM, enabling them to work towards the required targets. It will result in buildings that are future proofed and will address the social, economic and environmental aspects of sustainable development.

Recommendations for the Council:
• Check and approve the draft developer guide that accompanies this Strategy and then make it widely available.
• Check that the energy hierarchy has been considered as part of the planning applications that come forward. This should be possible from the energy strategy that developers are required to provide as part of planning.
• Encourage developers to make use of the EST CSH level 3 Standard to ensure high levels of energy efficiency are implemented.
**Recommendations for the Master Plan:**
Many of the principles set out within this chapter will apply to all the sites that make up the urban extension. However, there are some key considerations that will vary and these should be considered within the master plan. Chapter 10 summarises the recommendations and possible wording for inclusion in the master plan. In reference to energy efficiency, the following is included:

**Gloweth/Treliske & North Langarth**
As these sites have a northerly aspect it will be more difficult to follow the principles of passive solar design. It would therefore be more appropriate for these areas to include a large proportion of high density development, such as flats and apartments.

**Threemilestone & Highertown**
These areas can make a better use of passive solar design principles. This can be supported by encouraging a predominance of west-east road layouts and lower density detached, semi-detached and terraced housing in these areas. This will support passive solar and provide more roof space for building-integrated renewables such as solar hot water and PV panels.

**Other Areas (including Kenwyn, Higher Newham and East of the City)**
The principles set out within this section could apply equally to other areas. It should be possible to incorporate passive solar design, to some degree, into buildings in all areas. Any north facing sites should consider the use of high density housing.
7. Renewable and Low Carbon Energy Generation

Implementing the recommendations within the previous chapter of this report will result in buildings that are constructed to high levels of energy efficiency. This will help to reduce the energy demand within the urban development and reduce carbon emissions, based on the energy hierarchy. The next step is to consider ways to generating the remaining energy demand in clean and efficient ways.

The first consideration should be to use renewable energy. This can be defined as the natural and continuous flows of energy in our environment such as the sun, wind, plants, tides and waves. Most sources of renewable energy are driven by the sun and as such can be considered as inexhaustible.

A range of technologies exist to extract this energy into useful forms of heat and power. These include building-integrated approaches that can provide energy for an individual building, larger scale applications that can supply communal buildings or clusters of buildings, and technologies that could provide heat and/or power to large parts, or the whole, of the site. The use of renewables reduces the need for fossil fuels or nuclear power, helps to reduce the carbon emissions that are driving climate change, and increases energy security.

In addition to the use of renewable energy resources, it is also possible to generate heat and power at a local level using fossil fuels in a way that is more efficient and secure than using the national centralised networks. These include small scale technologies such as heat pumps and larger scale plant such as Combined Heat and Power (CHP). These forms of generation can be considered as ‘low carbon’, since the improved efficiency reduces the loss of energy and therefore reduces the amount of carbon emitted in comparison to conventional generation.

The range of renewable and low carbon generation is summarised below, with an indication of heat and power sources, and their possible scale.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Use</th>
<th>Energy Sources</th>
<th>Likely Site Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>• Passive solar design for space heating and daylight</td>
<td>Heat</td>
<td>Individual buildings</td>
</tr>
<tr>
<td></td>
<td>• Solar thermal panels for heating hot water</td>
<td>Electricity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Photovoltaic panels for producing electricity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind</td>
<td>• Turbines to produce electricity</td>
<td>Electricity</td>
<td>Part or whole site</td>
</tr>
<tr>
<td>Biomass</td>
<td>• Wood stoves/boilers to provide space and water heating from woody based materials</td>
<td>Heat</td>
<td>Individual buildings</td>
</tr>
<tr>
<td></td>
<td>• Combustion of gas produced from biomass/biogas to generate heat and/or power</td>
<td>Electricity</td>
<td>and/or part site</td>
</tr>
<tr>
<td>Hydro</td>
<td>• Turbines to produce electricity from rivers, tides or the sea</td>
<td>Electricity</td>
<td>Individual buildings</td>
</tr>
<tr>
<td>Heat Pumps</td>
<td>• Ground or air source heat pumps to provide space heating (This is considered by some to be a renewable form of energy, but it requires electricity to run the heat pump, so if this is not provided from a renewable resource it is considered as a low carbon technology)</td>
<td>Heat</td>
<td>Individual buildings</td>
</tr>
<tr>
<td></td>
<td>• Burning fossil fuels to provide electricity and heat (if burning biomass this can be considered as a renewable resource)</td>
<td>Electricity</td>
<td>Part site</td>
</tr>
</tbody>
</table>

Table 23: Energy generation options
7.1 Energy Context
In determining which energy generation technologies will be most suitable within the urban extension, consideration needs to be given to the likely demand that will arise from what will be built in terms of heat and power, the targets that need to be met to reduce carbon emissions, and the target to generate 20% of a building’s demand through the use of on-site renewables.

Estimating the likely energy baseline, and changes to it as the result of improving regulations, is problematic as the focus of Building Regulations is improvements in carbon emissions. Also, at the time of writing, the final housing densities were still being refined and little information was known about non-domestic build which will be crucial to estimate some of the large energy demands. Neither were accurate details on the time-scale of build available, which will influence the level of standards developers will need to meet. It is assumed the main source of emissions in the urban extension will come from housing, simply because of the number of homes that are due to be built.

Energy demand can be considered in regard to heat and power. Based upon the figures in section 5.1 and 5.2, the thermal demand of the development, as estimated in December 07, is likely to be balanced between residential and non-residential loads at a ratio of approximately 60:40. However, non-domestic energy usage limits the seasonality of the thermal loads, as cooling needs to be provided during the summer months for these buildings (in homes, cooling should be designed-out). The improved thermal efficiencies of dwellings at Code levels 4, 5 and 6 will also decrease the seasonality of the thermal demand. The requirements for electricity are more difficult to estimate as this will depend, in part, on how buildings are occupied and energy is used.

The basic split between heat and power for homes is summarised in the table 24 below, together with the split between regulated and unregulated emissions, as determined by 2006 Building Regulations.

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>Energy Source</th>
<th>Building Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space heating</td>
<td>Heat</td>
<td>Regulated</td>
</tr>
<tr>
<td>Water heating</td>
<td>Heat</td>
<td>Regulated</td>
</tr>
<tr>
<td>Cooking</td>
<td>Heat or electricity</td>
<td>Unregulated</td>
</tr>
<tr>
<td>Lighting</td>
<td>Electricity</td>
<td>Partly regulated</td>
</tr>
<tr>
<td>Appliances</td>
<td>Electricity</td>
<td>Unregulated</td>
</tr>
<tr>
<td>Fans and pumps</td>
<td>Electricity</td>
<td>Regulated</td>
</tr>
</tbody>
</table>

Table 24: Energy and regulations summary

The RSS, in the run up to 2016 when all homes will have to be zero carbon, allows flexibility in how the 20% reduction target is met, as it allows for approaches to generate heat and/or power, based on the actual amount of carbon that is released from regulated emissions. For example, and for the sake of simplicity, if a home built to 2006 Building Regulations has a TER of 1000Kg of CO2, to meet the 20% target, developers will need to achieve a saving of at least 200Kg from on-site renewables. A developer could meet this target by either providing energy in the form of renewable heat or power, as long as at least 200Kg is saved. This provides developers with a bigger range of renewable energy technology choices.
A second consideration in meeting the 20% target is the requirement within the RSS for this to be from on-site sources. In simple terms, any form of generation that is integrated into the building would meet this requirement. However, near-site or off-site generation will also be allowed, providing that a developer can demonstrate that the energy produced is used by the buildings within the site. The simplest way to effectively demonstrate this would be by connecting a building to either a heat main and/or a private wire system (see CHP, below). There is currently more uncertainty about how the use of off-site wind power to provide electricity could be counted, in terms of whether a private wire is needed or not, this is discussed in more detail in section 7.7.6, below.

As well as meeting the 20% target set out in the RSS, the use of renewable energy generation will also help developers reduce emissions towards the required levels of the CSH and as such will help to meet the requirements of Policy G. Points are available under the CSH under Category 1- Energy and Carbon Dioxide Emissions, which aims to ensure that emissions of CO₂ are limited from a dwelling and its services.

<table>
<thead>
<tr>
<th>CSH ID – Ene 1</th>
<th>Points</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwelling Emission Rate</td>
<td>up to 17.6</td>
<td>yes</td>
</tr>
</tbody>
</table>

Points are awarded on a scale that is based upon the percentage improvement in the DER, over the TER as defined in Building Regulations Part L1. As the RSS targets start at level 4, we have not included points below this level in the table below.

<table>
<thead>
<tr>
<th>% Improvement of DER over TER</th>
<th>Points</th>
<th>Mandatory Levels</th>
<th>RSS Timescale</th>
</tr>
</thead>
<tbody>
<tr>
<td>44%</td>
<td>9.4</td>
<td>Level 4</td>
<td>2008 - 2010</td>
</tr>
<tr>
<td>52%</td>
<td>10.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60%</td>
<td>11.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>69%</td>
<td>12.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>79%</td>
<td>14.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>89%</td>
<td>15.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100% (for regulated emissions)</td>
<td>16.4</td>
<td>Level 5</td>
<td>2011 – 2015</td>
</tr>
<tr>
<td>100% (for all emissions)</td>
<td>17.6</td>
<td>Level 6</td>
<td>2016 onwards</td>
</tr>
</tbody>
</table>

In addition, the CSH includes a category for the use of low or zero carbon energy technologies, so additional points will be gained by developers towards their overall Code rating for the use of renewables. The RSS targets in effect make this part of the CSH mandatory and developers will score 2.4 points based on the 20% target for on-site renewables.

<table>
<thead>
<tr>
<th>CSH ID – Ene 7</th>
<th>Points</th>
<th>Mandatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low or Zero Carbon (LZC) Technologies</td>
<td>2.4</td>
<td>no</td>
</tr>
<tr>
<td>• Where at least 15 % of total energy supplied</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For non-domestic buildings over 1000m², BREEAM uses a similar credit rating system. The table below is based upon the 2006 Offices Design & Procurement Assessment Estimator.
7.2 Renewable Resource Assessment

To help determine which renewable generation options will be possible within the urban extension, a basic resource assessment has been carried out. Some of these resources may require further detailed studies to ascertain the actual resource potential.

### 7.2.1 Solar Resource

The UK, and particularly Cornwall, has a good total solar resource. The map opposite, from the Solar Trade Association[^STA], suggests that average solar radiation on a 30° incline facing due south is 1300 kWh per square metre per year.

The actual intensity of this solar radiation varies with each season; as does the efficiency of the different solar collectors to convert this energy into useful heat or electricity.

### 7.2.2 Wind Resource

A basic estimate of the likely wind resource in the development area has been obtained from the DTI Windspeed Database. This provides average wind speeds in metres per second (m/s) at three different heights above ground level, as summarised in the table below. These measurements are based on 1 Km grid squares. Generally, a good resource is considered to be above 6.25 m/s.

<table>
<thead>
<tr>
<th>Height above ground level (agl)</th>
<th>Wind Speed Range (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 metres</td>
<td>6.4 to 7.4</td>
</tr>
<tr>
<td>25 metres</td>
<td>5.5 to 6.8</td>
</tr>
<tr>
<td>10 metres</td>
<td>4.7 to 6.2</td>
</tr>
</tbody>
</table>

Table 25: Wind Speed and Heights

The data confirms that there is a good wind resource for a range of different sized wind turbines, but actual measurements would be required by any developer to check the wind speeds and turbulence at different sites. The wind speeds for each of these heights has been superimposed on the TTAAP map, as shown below (top figure = 45m agl, middle = 24m agl, bottom = 10m agl). In addition, the South West Renewable Energy Atlas suggests that wind speeds in many of the grid squares around Threemilestone are in the range of 7.5 - 15 m/s at 65 and 80 meters above ground level.

[^STA]: [http://www.greenenergy.org.uk/sta/solarenergy/ukresource.htm](http://www.greenenergy.org.uk/sta/solarenergy/ukresource.htm)
7.2.3 Biomass Resource

For this study, CEP has considered the potential of using existing biomass from forestry and woodland, the potential of growing energy crops, the opportunity to generate biogas and the use of waste wood.

Although biomass is generally considered as carbon neutral, as the carbon released when it is grown is equal to that it absorbed when it grew, transport of the fuel has an implication for this assumption. For local sources of biomass it would be possible to estimate the carbon associated with its harvest, processing and transport, but it is more difficult to estimate for more processed biomass such as pellets, unless the supplier is able to provide this information. A basic way to estimate the carbon and financial costs linked to transportation from the point of growth to the point of use is considered below. It is likely any biomass that is used within the urban extension would be transported by road, and the cost and CO₂ implication of this is shown below.

<table>
<thead>
<tr>
<th>Mode of transport</th>
<th>Fuel type</th>
<th>Transport cost (£/odt/km\textsuperscript{36})</th>
<th>CO₂ equivalent emissions (kg/odt/km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>SRC (chip)</td>
<td>0.077-0.086</td>
<td>0.18-0.27</td>
</tr>
<tr>
<td></td>
<td>Miscanthus (baled)</td>
<td>0.058-0.080</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Forestry (chip)</td>
<td>0.077-0.086</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Straw (baled)</td>
<td>0.102-0.139</td>
<td></td>
</tr>
</tbody>
</table>

Table 26: Biomass transport and carbon costs
Source: Biomass as an Energy Source, Royal Commission on Environmental Pollution, 2004

Element Energy\textsuperscript{37} highlighted in their study for Camborne, Pool and Redruth (CPR) that reducing the transport of biomass will have economic and environmental benefits and that this should also take account of the density of the biomass resource. Bauen

\textsuperscript{36} Odt = oven dried tonnes

\textsuperscript{37} CPR Regeneration – Energy Feasibility Study, Element Energy, 2005
et al. calculated mean economic road transport distances for a variety of biofuels, based on a limiting final fuel cost of £60/tonne, which suggests a maximum collection radius should be limited to:

- 50 - 80 km for forestry residues;
- 45 - 90 km for SRC;
- 30 km for Miscanthus.

**Wood & Forestry Resource**

Element Energy in their CPR report suggests that there are a variety of products available from managed woodlands that could be used for fuel:

- **short round wood** – comprises small stems that are only extracted as part of the whole site management. It has a low financial value and will generally be chipped or used for stakes. It is suggested that this is the most promising source of wood fuel from harvesting of forestry;

- **brash or ‘lop and top’** – the stem tops and side branches from harvesting operations, typically left behind on the forest floor. Some of this needs to be left behind to recycle nutrients and encourage biodiversity and there are doubts about the viability of extracting it for sale as a wood fuel;

- **arboricultural arisings** – is the wood derived from clearances of roadsides, stream sides and the removal of invasive exotic species. Currently this is generally left on-site or removed to landfill;

- **pre-commercial thinnings** – if a market for wood fuel were established it may present forest managers an opportunity to thin forests earlier or extract trees that are too small to justify extraction for existing markets.

Data from the Forestry Commission suggests that within an 80 km radius of Truro the total area of woodland over 2 Ha is in the region of 35,000 Ha of which 88% is in private ownership. The potential resource that could be sustainably extracted from this whole area is shown in table 27 below. This is a top line, and fairly crude, estimate as it takes no account of the availability of the actual resource that could be economically or physically extracted. It is also only based on figures for the potential resource for broadleaf woodland; a higher yield would be extractable from conifer woodland. To assess the actual resource would require a more detailed study that considers ownership, woodland species, management costs, accessibility, current woodland uses and the availability of local processors.

<table>
<thead>
<tr>
<th>Source</th>
<th>Size of resource (dte tonnes per year) [1]</th>
<th>Equivalent energy resource (MWh/year) [2]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forestry Commission</td>
<td>2,200</td>
<td>11,400</td>
</tr>
<tr>
<td>Other woodland</td>
<td>15,500</td>
<td>80,600</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>17,700</strong></td>
<td><strong>92,000</strong></td>
</tr>
</tbody>
</table>

Notes:
1 - Assuming 2 dte (dried tonnes equivalent) per ha from sustainably managed woodland of which 25% is recoverable & available for fuel use.
2 - Assuming 5,200 kWh per odt (estimate from Woodfuel South West Advice Service)

Table 27: Potential woodland resource

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39 Section 5.1.1 of Revision 2020, GOSW/SWRDA, 2005
Growing Biomass
For energy crops, the most viable resource appears to be Miscanthus, as there are reported problems of growing Short Rotation Coppice (SRC) within Cornwall.

A recent report by Land and Landscape Management Ltd\(^40\) considered the environmental issues and opportunities for growing Miscanthus in Cornwall. They used a constraints model to assess which areas of the county offered the best potential opportunity for its growth. Based on the map they produced, and a basic methodology used by Element Energy for CPR Regeneration, an approximation of the possible resource within 30km of Truro has been produced. The areas that offer a good resource opportunity within these distances are estimated by counting the number of squares of 4 km\(^2\) that are predominantly good.

![Miscanthus opportunity map](source: Based on Element Energy report)

In reference to the good resource opportunities identified, an assumption has been taken that between 1% and 5% of the available cultivatable land in each good area would be appropriate for growing the resource. This decision is based on information in the Land and Landscape Management Report that suggests that growing Miscanthus at above 5% would have adverse landscape implications, if this was the only crop grown. Using this percentage range and the figures provided in the Element Energy report, based upon a potential yield of 15 oven dried tonnes (odt) per hectare for a mature crop, with a calorific value of 4.5 MWh/odt, the total maximum resource estimated within a 30km radius of Truro is approximately 36,800 MWh/year.

Currently some land is being used to grow Miscanthus in Cornwall. The Duchy College, Rosewarne and two farms in the county are currently using this as a fuel source, and other producers are growing it for bedding material. However, this could

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\(^{40}\) Energy Crops in Cornwall, Land & Landscape Management Ltd, 2004
change if a market for the crop was developed at a price that is favourable to famers. The Element Energy report suggested that typical prices for this resource were around £25/tonne in 2005. The viability at this price would depend on what land use the energy crop replaces and what local policy develops in terms of protecting or using local land for food production.

**Biogas Resource**

The potential for generating power from sewage sludge, arising from the urban extension and Truro, has not been considered within this study. Consultation with South West Water has highlighted a number of issues with generating power from sewage at the Newham Treatment Works. This includes:

- the amount of sewage generated from the surrounding area is not sufficient to economically generate power from CHP;
- for CHP to work the plant would require a sludge digestion process, a by-product of which is ammonia which could be an environmental hazard in relation to its location – the works already has a strict ammonia consent;
- previous digesters at the site have been removed as they have been prone to bad corrosion from saline infiltration at the site – due to its low lying location.

The opportunity to use organic waste streams arising from domestic waste, the local food sector, or livestock farms in and around Truro, could be an option for anaerobic digestion. In many respects this could be a good and secure long term resource. However, this would require a separate study to assess the amount of waste available and the economics of collecting and using it for local energy generation.

**Waste Wood**

It has not been possible to provide a detailed estimate of the potential resource from waste wood streams in the Truro area. This would require further study into the amount generated by local sawmills, timber merchants and other businesses such as joinery, manufacturing, construction and demolition. It may also be possible to extract waste wood from the municipal solid waste stream such as packaging, garden waste, etc.

However, we have spoken to Truro Sawmills, who estimate that they have a current resource of around 2,500 tonnes/yr, excluding sawdust. In addition, they have a new facility opening soon which may lead to a doubling of this resource. The waste wood could be chipped and burnt to provide heat and assuming it has a moisture content of around 40% this could provide approximately 7,000 MWh, rising to 14,000 MWh when the new facility opens. This is a good and significant local resource that could be utilised for biomass heating in the area.

**Local Fuel Production**

Rawnsley Woodland Products, near Wadebridge is currently in the process of establishing a local plant for the production of biomass fuel in Cornwall. This will include pellets, bricks and logs. They have identified the equipment they need and established the feedstock routes including waste wood from sawmills, joineries, etc as well as through thinnings from woodland management or roadside maintenance. They hope to begin production in late 2008 and estimate that they will be able to produce around 1,200 tonnes a year of pellets/bricks depending on the quality of
the biomass resource. This is based on running at a one shift capacity and they suggest that if demand (and biomass supply) is sufficient they would be able to run double shifts to produced twice this quantity.

Assuming they are able to set up good local supply chains, this company should be in a position to provide local biomass fuel that has a low impact in regard to the embodied energy from transport and the associated emissions this causes. This would be more preferable than purchasing pellets from other companies that have imported the fuel from outside Cornwall, in some cases as far away as Europe.

In addition, in late 2007 a new £2m wood pellet distribution company, Forever Fuels\(^1\), was launched at New County Hall. Forever Fuels will be supplying Cornwall County Council with wood pellets as a fuel to heat public buildings in 2008. It is proposed that a local supply and distribution partnership will be forged between Forever Fuels and Rawnsley Woodland Products to supply schemes in Cornwall with locally sourced wood pellets.

### 7.2.4 Small Scale Hydro Resource

It is suspected that the opportunity to use small scale, run of river, hydro power schemes will be limited in the area. Such schemes are very site specific and work best on steep slopes with fast flowing water. Based on the geographical information available, the potential resources include the stream that runs into Calenick Creek to the south of the development area, and the River Kenwyn and the various streams that feed this to the north of the development area. As both are outside the current preferred options areas any energy from these resources would not be counted as on-site generation, unless a private wire connection was used which is likely to make any small scale hydro scheme uneconomic.

There are also likely to be planning and consent issues as any hydro scheme needs to gain an abstraction licence from the Environment Agency, and would need to carry out a site based assessment of possible changes to river ecology and the risk of flooding. As both of the water courses are in high flood risk areas, and already have some flood defences in place, it seems unlikely that permission would be granted for small scale hydro.

### 7.2.5 Tidal Resource

No consideration has been given to the tidal resource as it is very unlikely a scheme would be possible. The main reason is the protected status of the estuary, which is classified as an EU designated Special Area of Conservation. It is also likely that any such scheme would need careful integration with flood defences and as such would need a separate and detailed feasibility study.

### 7.2.6 Further Research

It has only been possible to provide a top line assessment of the potential renewable resources that could be used in the urban extension within the time-scale and budget for this Strategy. As mentioned, any use of large scale wind power would need a detailed feasibility study by a developer to assess the actual resource and possible location of any wind turbines. A detailed study would also be needed to assess the

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\(^1\) (this is the outcome of a biomass study tour for key stakeholders, led by CSEP to Austria in 2007)
viability of using hydro or tidal power. The Council may also want to consider carrying out a full biomass resource assessment to provide detailed information on the potential to use this resource within the urban extension. Such a study should consider:

- identification of, and discussions with, forestry contractors and woodchip suppliers active in the county;
- mapping and discussions with individual private land owners / forest managers;
- assessment of waste wood resource from local industry;
- assessment of the feasibility of separating the organic part of municipal waste and the collection of commercial food waste for anaerobic digestion.

7.3 Renewable and Low Carbon Generation Options

This section provides an overview of different renewable and low carbon technologies which are considered to be commercially available, technically proven and likely to enable developers to meet the required targets. The actual choice and feasibility of different technologies will depend on technical, economic and social issues for each site. It will also depend on whether homes are connected to the gas network, as this directly influences the likely carbon emissions that will arise.

A range of issues for on-site generation will need to be considered when identifying the suitability of different technologies. These include:

<table>
<thead>
<tr>
<th>Development Type</th>
<th>Main Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>House type (flat vs. houses)</td>
<td>Affects the total energy demand of the dwelling and also access to roof area for roof based renewables.</td>
</tr>
<tr>
<td>Development size</td>
<td>Affects the relevance and scale of site-wide solutions.</td>
</tr>
<tr>
<td>Development density</td>
<td>Affects the heat load density and therefore the viability of site-wide solutions, particularly CHP.</td>
</tr>
<tr>
<td>Social vs. private housing</td>
<td>May affect the decision making with respect to long term energy costs (social housing providers have an obligation to reduce fuel bills). This also affects size of dwellings with social dwellings being generally smaller than private.</td>
</tr>
</tbody>
</table>

Table 28: Technology constraints
Source: from table 3-1 in RAB, 2007

7.3.1 Whole and Part Site Opportunities

Based on the resource assessment, a range of options are potentially available to provide heat and power to the whole site, or parts of it, including:

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Technology</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>Medium wind</td>
<td>Up to 100 kW</td>
</tr>
<tr>
<td>Electricity</td>
<td>Large wind</td>
<td>100s to 1000s kW</td>
</tr>
<tr>
<td>Heat</td>
<td>Medium biomass</td>
<td>10s to 100s kW</td>
</tr>
<tr>
<td>Heat</td>
<td>Large biomass</td>
<td>MW scale</td>
</tr>
<tr>
<td>Electricity and heat</td>
<td>Medium CHP</td>
<td>10s to 100s kW</td>
</tr>
<tr>
<td>Electricity and heat</td>
<td>Large CHP</td>
<td>MW scale</td>
</tr>
</tbody>
</table>

Table 29: Renewable opportunities
Source: from table 5-1 in RAB, 2007

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Some of these will need to be considered within the master plan to increase the range of options in terms of their feasibility and economics. This will include considerations of mixed-use versus residential areas, and possible locations for some of the technologies.

The use of large scale generation is likely to play an important role in enabling developers to reduce carbon emissions more cost effectively and as such enabling higher levels of the CSH to be reached.

**A. Wind Power**

Wind turbines convert the energy contained within the wind into electricity, generally via a rotating axle connected to a gearbox and generator. The amount of power produced depends upon the height of the turbine, the sweep area of the blades and rating of the turbine itself.

The power output produced is proportional to the cube of the wind speed, so a doubling in the wind speed increases the potential power output eight fold. For this reason the potential wind speed at a site is crucial to the economic viability of a wind turbine. Generally wind speeds of over 6.25 metres/second are needed for commercial viability. Table 20 below shows a range of turbine sizes and their potential outputs.

<table>
<thead>
<tr>
<th>Manufacturer &amp; Model</th>
<th>Rated Output (kW)</th>
<th>Hub Height (m)</th>
<th>Rotor Diameter (m)</th>
<th>Est. Annual Output (MWh)</th>
<th>Est. CO₂ savings (tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iskra AT5</td>
<td>5</td>
<td>15</td>
<td>5</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Westwind-20</td>
<td>20</td>
<td>18</td>
<td>10</td>
<td>51</td>
<td>27</td>
</tr>
<tr>
<td>AOC 15/50</td>
<td>50</td>
<td>25</td>
<td>15</td>
<td>145</td>
<td>77</td>
</tr>
<tr>
<td>Wes18</td>
<td>80</td>
<td>31 - 41</td>
<td>18</td>
<td>200</td>
<td>106</td>
</tr>
<tr>
<td>Wes30</td>
<td>250</td>
<td>30 - 50</td>
<td>30</td>
<td>650</td>
<td>345</td>
</tr>
<tr>
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<td>40 - 86</td>
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<td>46 - 69</td>
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<td>90</td>
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Notes:
1. Based on average wind speeds of 7 m/s for turbines under 1MW and 9 m/s for those over 1MW
2. Based on the current emission factor of 0.53 per kWh for grid electricity

Table 30: Wind turbines overview

Source: Adapted from ESCo Scoping Study – CPR, Thameswey Energy Ltd, 2007

**Resource Potential**

The wind map (figure 19) and table above shows that there is a good resource in reference to both the economics and potential carbon savings from the use of wind. This is backed up by the fact that two wind farms are already well established in the area at Four Burrows and at Carland Cross.

The wind map also shows a good resource across the development area, but any turbines would need to be a safe distance from existing or planned buildings. An actual location for one or more large wind turbines has not been identified, as this would require a detailed feasibility study to determine the suitability and potential resource. It is likely that any wind developer would want to take actual wind measurements at a potential site to more accurately assess the resource. A possible
constraint to the west of the development, depending on Carrick’s internal policy, is the World Heritage Site and this may influence possible locations for the use of wind.

However, it is important that the master plan includes reference to the wind power in order to indicate that, subject to necessary planning and consultation, this technology may be an option for the urban extension. This will help to provide evidence for the use of large scale off-site wind in relation to demonstrating additionality (see 7.7.6).

**Cost and Savings**

Installed costs are difficult to estimate, as they will depend on a number of local factors such as land ownership, site accessibility, connection to the supply network, choice of manufacturer and size of turbine, and the construction and operating costs.

As an example for a large turbine an approximate cost for a 1MW turbine has been provided. Based on the average local wind speeds, and assuming that the turbine would have a load factor of around 30%, i.e. the wind turbine would run 30% of the time at its full generation capacity; approximately 2,600 MWh of electricity per year could be generated. The cost of constructing such a turbine would be in the region of £600,000, with an additional cost of 10% to 20% for connection to the electricity network. The annual operation and maintenance costs are likely to be in the region of £9,000 to £18,000 per annum.

The turbine would save up to 530 Kg of CO₂ per MWh of electricity generated. Therefore a 1MW wind turbine could save up to 1,380 tonnes of CO₂ per annum. With a technical lifespan of 25 years, it would generate up to 65GWh of zero carbon electricity and save around 34,500 tonnes of CO₂ at a total cost of £1.2 million.

**Planning**

Planning risk will be decisive for the installation of any wind turbines in the area and work should begin quickly to establish the feasibility, economics and acceptability of any such scheme in terms of the required infrastructure and potential impacts on the landscape and local communities. A typical development process of a wind turbine is an iterative process and essentially consists of, but may not be limited to, the following elements:

- site prospecting and selection;
- wind resource assessment;
- Environmental Impact Assessment (this may not be necessary for smaller schemes i.e. three or four 1MW turbines);
- planning and community consultation;
- power sales contract procurement;
- detailed engineering;
- economic assessment;
- investment appraisal & financing;
- final development.

Early consideration should be given to potential locations and land ownership. It is likely that because of planning constraints, as well as best practice, that any use of large scale wind would need to be a reasonable distance from any buildings to
ensure health and safety requirements are met, as well as issues such as noise, flicker and interference. Appendix six contains more information on some of these issues.

In addition, some key issues will need to be addressed in the development of a wind scheme, such as:

- consultations and scoping studies with local stakeholders will allow the wind scheme to be integrated into the local community and economy;
- minimum safety distance between the wind turbine and public roads, overhead electric lines and buildings (known as ‘topple’ distance being tip height plus 10%);
- proximity of turbine(s) location to any future development within the urban extension;
- the visual impact of any wind energy proposal on the existing positive landscape features;
- satisfactory assessment of any impact from noise and shadow flicker effect;
- assessment of electro-magnetic interferences on telecommunications;
- ornithological implications of a wind turbine at the identified location. An early consultation with English Nature and the Royal Society for the Protection of Birds (RSPB) is recommended.

Integration

Based on the potential wind resource, the economics of wind power look favourable and its use could provide a large resource for meeting the electricity needs of part, or the whole, of the urban extension. It could also be used, at a medium scale, to provide the needs of individual buildings with a large electrical demand or clusters of buildings.

However, before any decision on the use of wind power is taken it is recommended that the Council have internal discussions on the suitability and possible location of this approach. It will be essential that the local community is fully engaged about this option before a final decision is taken. This is discussed in more detail in appendix six. It will also be necessary to hold further discussions with regional and national government to clarify the on-site, off-site legislation.

It may be preferable to take a smaller scale approach with medium sized turbines with lower hub heights. This would reduce their visual impact in terms of height, but could result in a larger number being installed to meet the energy demand which would have a spatial visual impact. An additional consideration for the use of wind power would be the potential for community ownership. Several schemes already exist in the UK and provide a mechanism for local people to either invest their own money in return for an income from the sale of electricity, or a requirement can be made from the developer to provide community shares which generate and income stream for community projects. Such approaches could help to get community buy in for a local wind project. These opportunities are discussed in more detail in appendix six.
Without the use of wind power it will be difficult for other forms of renewable technologies to economically generate large amounts of electricity, with the only real alternatives currently being PV or biomass CHP.

Wind power could easily enable the 20% on-site renewable energy generation target for regulated emissions, set out in the draft RSS, to be met. It could also be the only technology currently that could make the whole development zero carbon.

Further Information
A more detailed fact sheet on wind energy from Regen South West is provided in appendix seven. Appendix six includes more information on wind and planning.

B. Biomass Heating
Biomass boilers range in size from around 10 kW to 10 MW and can be used to provide space and water heating, either to individual buildings, blocks of flats, or a number of buildings via a heat network. They are a well established and proven technology that, depending on the fuel source, can be fully automated in terms of ignition, control, and fuel feed, but require de-ashing and cleaning. They require annual safety and maintenance checks and have a life time of around 20 years.

A wide range of biomass fuels can be used, depending on the boiler, such as logs, wood chips, pellets or bulkier agricultural crops such as straw or miscanthus. The most common and convenient are wood chip or pellets. When biomass is burnt it releases CO₂, but it can be considered as a low or zero carbon fuel as the CO₂ released is approximately equal to the amount the plant absorbs over its lifetime. However, the proximity principle needs to be taken into account to reduce the carbon and cost associated with the transport and processing of wood fuel (see 7.2.3 above). It is also important to know the source of the fuel, as it could be grown a long way from the point of use and would therefore have embodied carbon from the transport. The combustion process also produces other emissions such as oxides of nitrogen and sulphur, and particulates.

Biomass fuels have a lower energy density in comparison to conventional fossil fuels, which means that a storage facility will be needed for larger biomass boilers. It is likely that this will need regular deliveries of fuel which will need to be taken into account in planning any scheme. The graph shows the comparative volumes of fuel required to supply the space heating and hot water needs of a typical dwelling.

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44 Biomass has the potential to increase rather than reduce CO₂ emissions if care is also not taken to assess the carbon content that will be emitted with the associated carbon sequestration and timescale needed to offset the CO₂, from the re-growing of each specific fuel.

45 Planning guidance for biomass schemes is available in the ‘Cornwall Energy Study’ available on Cornwall County Council’s website.
Another important consideration is the moisture content of the fuel. The lower the moisture content the more efficiently it burns, which is important for the performance of biomass boilers. Woodchip is wood that is chipped into a fairly uniform size; it can come from a variety of sources and is generally a comparatively cheap source of biomass. Ideally a moisture content of 30% or less is desirable. Large biomass boilers will be more economic if using woodchip. Wood pellets are manufactured from compressed wood from waste streams, woodland or biomass crops and have a higher energy density and uniformity compared to wood chip. This means less space is required for storage, but they cost more to buy.

Biomass boilers work most efficiently when running at full capacity with a continuous burn, rather than having regular start-ups and shutdowns. This generally requires them to be sized to meet the baseline heating load of the building/s they supply. To help regulate heat a thermal store is incorporated as this allows the boiler to continue operating even when heat demand is low. To meet peak heating demands it is normally necessary to incorporate a back up gas boiler. Correct sizing is a key component of their use to ensure efficiency and to reduce the costs of the boiler, associated equipment and the amount of storage space.

Resource Potential
The basic resource assessments suggest that there could be a good biomass resource in the locality, particularly from the sawmill. Further work would be need to properly assess the accessible resource from woodland, as would an ongoing monitoring of the number of installations of boilers requiring this fuel, as this could impact the resource availability. In the case of pellet fired systems a new manufacturing plant is soon to begin production in Cornwall, and it is likely that this plant could meet much of local demand for pellets over the coming years.

The report authors have some concerns over the wide scale use of biomass within the urban extension and these are discussed in section 7.7.2, below.

Cost and Savings
Cost and savings for biomass boilers is very site specific and depends on the size and type of boiler used, and the cost of creating sufficient storage space. Regensuggest a range of £150 to £300 per kW of heat output for larger systems. Unlike some other forms of renewable energy generation, there will also be an ongoing fuel cost for a biomass boiler.

As an example of possible costs and savings, a 1 MW system could provide sufficient heat for 1,200 flats at an installed cost of around £300k. Operation and fuel costs are likely to be in the region of £150k per annum, depending on the fuel supply chain. However a biomass boiler would always be supported by natural gas boilers for security of supply, which adds to the overall cost.

In this example the biomass boiler would generate up to 75,000 MWh and its estimated 15 years lifespan would save up to 17 tonnes of CO₂

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46 Wood Heat - infosheet 12, Regen, 2007
Planning
Good design and construction should help meet any planning requirements. Issues that are likely to need consideration for larger scale projects would be the location and design of any external buildings such as boiler house, fuel store and flue. If a large number of fuel deliveries will be anticipated, an assessment of the additional traffic and possible noise from lorry movements would be needed. Controls on potential emissions of particulates and NOx and SOx will also need consideration.

Integration
Subject to a study to establish the long term secure supply of locally available biomass, the use of this form of heating could play an important role in the urban extension. However, it would make sense to consider this alongside any development of a district CHP scheme, as its use could play both a positive or negative role if not planned carefully. If used independently, in areas where CHP is viable, it could directly compete with CHP by reducing the overall heat load and therefore make CHP less economically viable. If integrated as part of a CHP system it could act in a back-up role to help meet peak load demands.

In areas where a CHP heat main does not exist, biomass boilers are likely to be a good mechanism to reduce emissions from buildings. The operation, maintenance and management of independent biomass boilers and the delivery of fuels would need to be considered for any large scale applications. This could include a local energy services company or be part of a landlord’s responsibility.

It would be relatively straightforward to meet the 20% on-site renewables target for regulated emissions through the use of biomass heating systems.

Further Information
A basic factsheet on wood fuel heating is included in Appendix seven. A list of local installers is available from the CSEP website

C. Combined Heat and Power (CHP)
CHP is a form of decentralised energy generation that simultaneously provides usable heat and power (electricity) in a single process. Schemes can be developed at a range of sizes, using different fuels and technologies. They can provide energy for one or several buildings and are installed on-site to provide energy at the point of use, helping to avoid the significant losses and carbon associated with the current centralised energy network operating in the UK. Within this section when talking about CHP this is in terms of district heating, not building-integrated approaches.

A basic overview of a CHP system is provided below, this is partly based on a recent report from Thameswey Energy Ltd47. A typical CHP system could comprise of:

- an energy centre to house the CHP engine/s;
- a back up boiler to meet peak demand;
- thermal stores;
- a heat main network;
- a private wire network.

47 ESCo Scoping Study – CPR, Thameswey Energy Ltd, 2007 (Appendix 2)
Energy Centre
An energy centre would need to be built within the development area to house the CHP engines. This should ideally be located in close proximity to the buildings it serves as this will reduce inefficiencies in transporting heat over large distances, as well as limiting electrical transmission losses. Discussions on possible locations should be considered early on in the planning process for the urban extension.

There are a wide variety of CHP engines available which can burn different fuel types. This combustion process converts approximately 35% of the fuel energy into electricity, with the rest being converted to heat. The advantage of CHP, over a centralised generation system, is that the heat can be distributed to local buildings for space and water heating.

Currently most large scale CHP is gas fired using spark-ignition reciprocating engines to generate electricity and heat, as shown in figure 22. Although this would not be considered as a renewable energy source, it is much more efficient than conventional generation. The efficiencies of the UK’s centralised power stations are very low48 (36–38%), since most of the energy generated is heat which is expelled into the atmosphere through power station cooling towers or water cooling systems. A further 9% of energy is lost in the national grid and public distribution networks, so that only 33% of the energy burnt at power stations actually reaches our buildings. Added to this, 50% of the UK’s water resources are used to evaporate the waste heat from power stations into the atmosphere.

By comparison, decentralised energy technologies such as CHP can achieve efficiencies of 85% to 90% by recovering the heat that is generated as a by-product of electricity generation to heat and cool buildings. Not only does this result in the better use of limited fossil fuel resources, but also significantly reduces carbon emissions.

Biomass fired CHP is widely used in Europe and examples in the UK to meet the requirements of the CSH are likely to emerge soon, including within the region. The use of biomass, instead of gas, could provide large amounts of low carbon heat and power. Any use in the urban extension area would need a more detailed study into its feasibility and this would need to include more detailed modelling of the thermal baseload and the identification of a secure and reliable local fuel resource.

Back-up Boilers & Thermal Storage
The CHP engines are sized to meet the base-load requirements of the buildings it serves in reference to heat, as this maximises efficiency. To meet heat demands that are above the base-load, back-up boilers are used to provide additional energy as

48 Annual thermal efficiencies of UK centralised power stations are: Coal = 36%, Gas = 46% and nuclear = 38%, DTI Digest of UK Energy Statistics
and when needed. These also provide security of supply by providing heating if the
CHP engine is off-line for any reason. The back-up boilers could also be biomass
fired to reduce emissions.

Thermal stores are an integral part of a CHP plant and consist of large insulated
water tanks. These allow the CHP engine to run at full capacity to allow electricity
production from the plant to be maximised, as this enables CO₂ savings and revenue
from the sale of electricity to be maximised. The heat generated from this process, if
not required on site, can then be dumped into the thermal stores to be used when
demand rises.

The temperature in the thermal store will vary from around 60°C at the bottom of the
tanks to 90-95°C at the top. When fully charged all the water in the thermal store is at
90-95°C. The thermal stores are likely to be charged and discharged simultaneously,
to better meet demand peaks and minimise disturbance of stratification during
periods of low flow rates across the site.

Heat Network
To distribute the heat around the site to the buildings connected to a CHP scheme an
underground network of pipes is used. This delivers heat directly to the building for
space and water heating, operating at a temperature of around 95 °C (flow) and 55
°C (return). This heat network, depending on its size, would comprise of pre-insulated
pipes generally made of steel pipe with integrated insulation contained within a
plastic outer casing. This would incorporate a leak detection system within the insulation
layer to quickly detect the location of any leaks in the system. Such pipes have a high
reliability, a low rate of heat loss and a life
time of over 20 years.
Private Wire
To distribute the electricity from the CHP plant it is possible to use the existing electricity infrastructure or to incorporate a private wire network on the site. This would be separate from the National Grid network and therefore would not have to pay distribution charges. Private wire can therefore improve the economics of CHP in certain situations.

Private wire also helps to reduce the losses associated with the National Grid as the electricity is used in close proximity to the point of generation and enables greater flexibility for future expansion of the network.

The energy centre would still be connected to the National Grid in order to meet peak electricity demands above the base-load that the CHP engine can supply. Again this ensures security of supply, as the electrical demands of the buildings connected to a private wire network could be met from the National Grid if the CHP engine is not running. In theory, a CHP plant could also be designed to meet the peak load requirements of the site, with excess electricity sold into the grid, although this could result in waste heat being dumped.

The use of a private wire can also provide additional security of supply as it is possible to run a CHP plant in ‘island mode’ – where, in the event of a failure on the National Grid, the CHP can still provide electricity to those connected in island mode via a private wire.

Cooling
Major CO₂ savings, efficiencies and economic benefits can be achieved through the use of heat fired absorption cooling (air conditioning/ refrigeration) in conjunction with CHP. Such systems known as Tri-generation or Combined Cooling Heat and Power (CCHP), can use low temperature water to drive single stage absorption chillers to meet base commercial cooling loads. Alternatively, where the cooling loads are sufficiently big or localised in one part of the development, it is possible to generate chilled water in the energy centre and to serve the development through a chilled water distribution network. This could be an important consideration in the future as more thermally efficient buildings coupled with temperature rises, as a result of climate change, could lead to an increasing demand for cooling, particularly in non-domestic buildings. This would also provide a load for the CHP plant when heat demand is low, during the summer for example.

The location of a supermarket within any areas earmarked with potential for CHP would provide a year round cooling (refrigeration) load helping to increase financial viability of a district energy network. Because heat fired absorption cooling uses ODP and GWP refrigerants, there is the added environmental benefit of displacing the powerful greenhouse gas refrigerants used by conventional electric air conditioning and refrigeration⁴⁹.

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⁴⁹ ODP = Ozone Depletion Potential. GWP = zero Global Warming Potential. 1 tonne of HFC 134a is equivalent to 3400 tonnes of CO₂ emissions. (LCCA).
Linking to Customers
A CHP plant would need to be managed through an organisation that can maintain, operate and bill customers connected to it. This is discussed in more detail in section 7.5, below. For fuel pricing, a CHP plant would generally offer more attractive tariffs for customers connected to the system, as the energy is generated more efficiently (and therefore less is used) in comparison to the national networks for heat and power. Often prices are fixed at below the main supplier in the area, so they always remain competitive.

Customers connected to the heat main or private wire network would not notice any difference in regard to meeting their energy requirements in comparison to connection to the national networks. Heat or power should not fail as back-ups are built into the design of the energy centre and this is likely to be more secure in many respects.

To ensure viability of a CHP scheme the customer base will be important. If a CHP system was developed, it should be a requirement of planning permission that any development in the area where a heat main or private wire network is in place, or planned, should be required to connect to it. This ‘guarantee of connections’ could be done through land sale agreements or Section 106 agreements.

Example Scheme
The diagram below shows a high-level view of a combination of a Tri-generation scheme with private electricity distribution.

Figure 26: Example CCHP scheme
Source: London ESCo
CHP systems can be configured to meet different heat to power ratios. A typical performance is around a ratio of 3:1 for heat to power, but this can rise depending on the type of engine and fuel that is used. This means CHP design and sizing tends to be heat led and will therefore work best in areas where there is a constant heat (and/or cooling) demand, throughout the year, day of week and time of day. A viable CHP scheme would typically include a mix of buildings such as hotels, leisure centres, supermarkets, dense housing/flats, colleges/schools and hospitals. The application of CHP to meet the needs of housing alone could be more difficult as current, and improving, insulation standards result in a low and decreasing heat demand, which could result in heat generated by the CHP engines being wasted. Generally it is suggested that to become viable, a CHP plant needs to run for at least 5,000 hours per year.

Resource Potential
The use of gas fired CHP would be straightforward as the urban extension is within a mains gas area. For biomass CHP, proven technologies are available for district based schemes over 1MW in capacity. There also appears to be locally available resources that could be used to power the energy centre, particularly the waste wood from Truro Sawmills, but it will be vital to ensure that a sufficient and secure resource is available once the size of any CHP scheme is determined.

Feasibility in the Urban Extension
It is generally accepted that it is preferable to serve a large energy demand rather than several smaller ones. A stand-alone CHP system, for individual buildings, is not as efficient as a larger CHP system, serving a mixed development using large scale thermal storage and heat fired absorption cooling. Therefore, whenever it is possible to connect a development to one unique energy centre, this is the preferred option. However, the geography of the development and its build-out profile may not suit this approach and this would need further study in order to minimise the capital costs associated with the heat and power distribution networks.

Initial costings for a site-wide district CHP approach were completed in December 2007, but since then the master plan and densities of housing have changed and at the time of writing are going through further refinement. Based on the revised data that was available in February 2008, it seems likely that district CHP may only be suitable for the mixed-use development areas, particularly where the housing density is high i.e. above 40 and preferably 50 dwellings per hectare. This suggests the most suitable location will be linked to education and employment in the Gloweth/Treliske area. It would therefore make sense to establish the feasibility, likely costs, and potential energy and carbon savings for this area only.

The Council could consider CHP in other areas if it becomes clear there will be additional non-domestic build within other development areas, or consider a retrofitting strategy into existing large heat loads such as the leisure centre, schools or college and any other high energy users. This would also require additional research.

Cost and Savings
Once final housing density and more information on the scale of non-domestic building is available, it will be possible to estimate the cost of using CHP for part of
the site. Typical costs from industry are nominally based on £1 million per MW of electricity generating capacity. Additional costs will be associated with the installation of the heat main and, if used, a private wire network. This would need to be calculated once the size of these networks is known, which will depend on the final location of buildings within Gloweth/Treslike.

It is generally agreed that a gas fired CHP scheme for mixed-use development can offer CO₂ savings of 20% to 40% in comparison to using natural gas boilers and grid electricity. Switching to biomass would result in zero carbon emissions.

In regard to meeting the required targets, the actual CO₂ savings that would result would need to be modelled through SAP in order to estimate the carbon emission savings that could be claimed by developers for different buildings. Gas fired CHP on its own will not be sufficient to enable developers to reach higher levels of the Code as the carbon savings are too low. In fact, with the current way gas CHP is considered in SAP, savings of 20% to 40% will only help developers reach level 4 of the Code. To reach level 5 and work towards level 6 of the CSH it will therefore be necessary to switch to biomass CHP. At level 6, additional building-integrated renewables may still be required to provide enough electricity to meet the targets. This would need to be modelled in more detail.

D. Anaerobic Digestion

Anaerobic digestion (AD) involves the breakdown of biodegradable material into biogas (methane and carbon dioxide) and water in the absence of oxygen, by microbes. This process to some degree occurs naturally when organic waste decomposes, in a landfill site for example. However, with AD the biogas is captured and can be burnt to produce heat and/power, or potentially used as a transport fuel. When burnt, methane releases CO₂, but methane has a global warming potential over 20 times higher than CO₂ so is much more damaging to the climate. Therefore, capturing and burning methane can be considered as a beneficial process in regard to climate change and the energy produced can help off-set fossil fuel use.

A range of technology options are available for different waste streams and ultimately the moisture content of the waste will determine which is most appropriate. For food waste, and liquid farm waste, a ‘wet’ based system will be favoured which takes two to three weeks to complete the digestion process. A by-product of AD will be a digestate which, subject to meeting appropriate standards, can be used on land as a fertiliser or soil improver (if the use of this replaces chemical fertilisers, additional fossil fuels and carbon savings will be achieved). It is worth pointing out that this process is already widely used for treating sewage waste, including two plants in Cornwall.

Although a proven technology, and widely used outside the UK, there are currently few examples of large AD schemes operating in the country (other than for sewage and some animal waste digesters) ⁵⁰. However, it is considered likely to play an increasingly important role in the future, partly as a waste management mechanism and it could therefore play a role in the urban extension in the future.

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⁵⁰ For examples of AD plants in the UK and Local Authorities that have opted for AD see: http://www.anaerobic-digestion.com/html/ad_plants_in_the_uk.html
Resource Potential
A resource assessment would need to be carried out to check the full availability of local biodegradable waste. In terms of domestic waste, approximately 2.5kg per person per week is an average figure that could be used to assess the level of resource available in the Truro area. However, the use of this resource would require an additional waste collection strategy, the feasibility and cost of which would need to be investigated.

Consideration would also be needed regarding how it would fit into current waste policies which encourage composting. The possible resource for collection of animal wastes from local farms would also need investigation, to both assess the potential resource and to check with local farmers about their willingness to be involved with a scheme, as many will already use this waste as fertiliser on their own land. The final assessment should be a basic assessment of the scale of local food waste from the food sector in the area.

The technologies are modular, not too scale sensitive and can be located at waste collection sites (rather than waste disposal sites), helping to reduce transport CO₂ emissions. The systems involve dewatering, giving the additional potential to provide a significant non potable water resource which could form part of an integrated MUSCo energy and water services package.

Cost and Savings
It has not been possible to identify typical costs and savings for AD.

Feasibility in the Urban Extension
Any AD would be considered in terms of the planning process as a major development and there will be a number of planning implications for any scheme. Many of these would be common with other waste management facilities and include issues such as siting, traffic, emissions, air quality, noise, odour, etc. Not that these should be seen as a barrier to the development of any such scheme as good design and planning can, and should deal, with all the key issues.

It is likely any scheme would not be located directly within the urban extension, so any power would need to be brought into site via a private wire. This may have implications for using the heat generated from the process, although some of this would be used by the plant itself, unless there are other buildings nearby that could utilise this heat it could be wasted. An alternative approach would be for the biogas to be used as a transport fuel, or to be brought onto site and burnt to produce heat and power close to where it is needed.

Integration
AD could play a useful role in serving the urban extension, both for dealing with waste locally, and providing heat and power. It could be complementarily linked to a CHP or wind scheme or it could be used as a stand-alone energy source.

Further Information
A basic factsheet on AD is available from Regen South West and is included in appendix seven. A detailed overview of this technology is available from the Defra in their report ‘Advanced Biological Treatment of Municipal Solid Waste’, 2007.
7.3.2 Building-Integrated Opportunities

Having considered the potential options for meeting the energy need for parts, or the whole, of the site, consideration should be given to the options for integrating energy production into buildings.

Based on the potential resource assessment carried out in section 7.2, this study has not considered the use of small scale hydro. At the time of writing, the use of micro, building mounted, wind power has also been discounted. Whist small scale wind may play a role in the future, there have been some major issues with the amount of energy generated from micro wind turbines, and field trials are currently taking place to assess the viability of this technology.

E. Solar Thermal

The energy in the sun can be converted by solar thermal panels to provide useful hot water for a property. Designs vary, but the most common commercially available collectors are either flat plate or evacuated tubes.

To maximise the performance, solar collectors should be mounted between 25° to 65° (this matches most roof pitches) and face due south. Shading from trees, other buildings, chimneys, etc should be avoided as this will reduce the amount of energy collected. Most reports suggest a solar thermal can provide around 50% to 70% of hot water demand for domestic properties. The contribution will vary over the year, during the summer a high percentage of hot water needs will be met, but this will reduce over the winter months. For this reason an additional heating source will be required to ensure there is always hot water available.

Collectors have a low maintenance requirement with a recommendation of a yearly check/clean by a householder and check by an installer every 5 years. They have an estimated life time of up to 25 years.

Good design and construction can reduce the overall demand for hot water, which will help to increase the useful solar fraction of hot water supply. This can include practical measures such as the installation of water saving devices and use of low water washing machines or dishwashers. Demand will also be influenced by occupancy.

Resource Potential

The useful contribution of hot water provided by a solar thermal will depend upon the size of the system, the type of collector used, the number of people living in a household, and the amount of water used. Estimates vary nationally, but a typical four metre square system could generate around 1,800 to 2,300 kWh/year. It is likely to be nearer the higher figure in Cornwall.

Cost and Savings

Installed costs will depend on the size of the panels, the need to do extra work (such as install a new twin coil tank) and the type of collector used. Estimates for domestic properties vary, but are likely to be in the region of £2,500 to £4,000 for a four square metres system. For non-domestic buildings it is more difficult to estimate cost as it
tends to be very site specific. London Renewables\textsuperscript{51} suggest costs would probably start at around £700 per square metre. However, installing solar hot water as part of the construction of a new building will help to reduce the cost. This is partly due to economies of scale, but also costs can be reduced by installing a twin coil tank within the property at the design stage, plus savings on scaffolding, travel to and from site and by bulk purchase of the panels. It is suggested that savings over 10\% of these costs would be realistically achievable. It is also likely that price reductions in the manufacturing process in future will help to bring down the unit cost for solar collectors. Some reports are suggesting an installed cost in large scale new build, of around £2,000 in the near future.

A typical 4m\(^2\) would over its lifetime produce around 51,000 kWh of energy and save around 9.7 tonnes of CO\(_2\) (if replacing gas).

Planning
Solar thermal collectors are generally fixed to a south facing roof and as such are visible. However, planning permission tends to only become an issue for installation in a conservation area or on a listed building. It is therefore unlikely that the use of solar thermal will cause any planning issues within the urban extension. In the Government’s response to the 2007 consultation on Permitted Development Rights for Householder Micro-generation, it is proposed that solar panels are treated as permitted development providing that panels do not project more than 150mm from the roof or wall and do not face onto and be visible from the highway in conservation areas or World Heritage Sites (legislation forthcoming in Spring 2008).

Integration
The use and economics of solar thermal will depend on the final choice of technologies that are used in the urban development. They may not be worthwhile in high density build where hot water could be provided more efficiently by a centralised system using another renewable or low carbon technology. It may also not be possible to access sufficient roof space to make their use viable on flats. In lower density build they could play an important role and their use in non-residential buildings would be beneficial where there is sufficient demand for hot water.

However, the use of solar thermal would depend on any decision to use CHP, as they would directly compete with this resource by reducing the overall demand for heat in the urban extension. Their use should therefore be discouraged in any areas where a local heat main is installed. For locations outside the operating area of a CHP plant they could play an important role in helping to meet the hot water demand of individual buildings, helping to reduce CO\(_2\) emissions from the development.

To meet the 20\% on-site renewable energy target, they could be a relatively cost effective mechanism for developers, depending upon the size of the property.

Further Information
A basic factsheet on solar hot water systems from Regen South West is included in appendix seven. A list of local installers is available from the CSEP website

\textsuperscript{51} Section 3.6.4 of London Renewables
F. Solar Photovoltaic (PV)

Solar energy can also be converted by PV panels into electricity which can be used within an individual building or exported to the national grid. Individual PV cells are made of semi-conductors which generate direct current (DC) electricity when exposed to light, this needs to be converted to alternating current (AC) for use in a building or for selling into the grid, an inverter is therefore required as part of a PV installation in most cases.

The individual PV cells only generate a small amount of electricity, so they are generally connected together to form a module that is capable of generating a higher and more useful voltage. Individual modules are then connected together to form a PV array. Different silicon based materials are used in their manufacture, including:
- mono-crystalline which is the most expensive, but most efficient;
- polycrystalline which are cheaper, but with lower efficiency;
- amorphous which are the cheapest and least efficient.

As well as a difference in material construction, the way they are used on buildings also varies. PV arrays are often fixed to the roof on a metal framework, particularly for retro-fitting. However, PV can also be incorporated into slates and tiles or be integrated into glass or cladding. These materials are interchangeable with ordinary roofing materials and allow for a fully integrated approach.

To maximise the performance of PV arrays, they should be mounted at an angle of 30° to 40° and be orientated between southeast and southwest. It is important that shading is avoided as it can have a dramatic effect on the efficiency of a system as part shading can stop a whole panel from working.

PV arrays require very little maintenance; they operate silently and have a suggested lifetime of 25 years, although some report that they could last for up to 40 years (this is yet to be tested).

PV systems tend to include a grid connection so that electricity supply and demand can be balanced. For smaller domestic sized systems up to 5 kW, connection to the grid requires permission from the local Distribution Network Operator. The equipment used also needs to be approved for use within the UK.

It is essential that good design and construction help to reduce the electricity demand as much as possible. This could include measures to install low energy lighting throughout the building and by ensuring that any appliances that are fitted as part of the build have a high energy efficiency rating. This will increase the percentage of electricity that can be supplied sustainably through PV.

Resource Potential

The useful contribution a PV array will make to a building depends upon the demand for electricity, the type of PV cells used, the size of an array/design and their orientation on a building. PV systems are rated in kilowatt peaks (kWp) which describe the amount of electricity that can be produced in optimum conditions. Regen suggest that a 1kWp system will provide up to 750kWh of electricity per year, although local installers in Cornwall have suggested they are generating nearer
1,000 kWh a year within the county. As different cell materials have different efficiencies the area of PV cells required to generate 1kWp varies. The following table from the Regen factsheet in appendix seven provides a useful overview:

<table>
<thead>
<tr>
<th>Silicon PV</th>
<th>Efficiency</th>
<th>m² required for 1kWp</th>
</tr>
</thead>
<tbody>
<tr>
<td>mono-crystalline</td>
<td>13-17%</td>
<td>8 m²</td>
</tr>
<tr>
<td>poly-crystalline</td>
<td>8 – 12 %</td>
<td>10 m²</td>
</tr>
<tr>
<td>amorphous/thin film</td>
<td>4 – 8%</td>
<td>20 m²</td>
</tr>
</tbody>
</table>

Table 31: PV efficiency and area summary  
Source: Regen

Cost and Savings
PV is currently one of the most expensive renewable energy resources. Installed costs depend on the type of PV used and its size. The Energy Saving Trust suggests that domestic systems are usually between 1.5 to 2 kWp and that average prices range around £7,000 per kWp installed\(^5\)\(^2\).

However, it is likely that installing PV as part of the construction of a new building will help to reduce this cost. This is partly due to economies of scale, such as bulk purchase of PV systems, for example London Renewables suggest a discount of 20% may be available from some suppliers for large systems (50kWp)\(^5\)\(^3\). Additional savings are likely through savings on scaffold, travel to and from site, etc. The savings that can be obtained by using PV will depend on the choice of PV material, the size of system, the use of the building, and the cost of the electricity purchased. With so many variables it is only possible to provide approximate estimates for the levels of savings possible. Based on a 25 year lifespan, each installed kWp of PV will generation around 19,000 kWh, saving 8 tonnes of CO\(_2\).

Planning
Planning issues for PV tend to be similar to those for solar thermal collectors, in that permission is likely to be required in conservation areas and for listed buildings. It therefore seems unlikely that the use of PV should not cause any planning issues within the urban extension. The Permitted Development Rights for Householder Micro-generation for PV are the same as for solar thermal, see above.

Integration
The use and economics of PV will depend on the final choice of technologies that are used in the urban development. In the short-term, at current costs, PV will be a costly way to reach the required targets, but without the use of wind power, it could be the only option available to developers. PV would integrate well with any CHP scheme.

Its use will also be problematic on flats where roof area becomes a major constraint to their use, although wall or independently mounted options may be possible.

Further Information
A basic factsheet on PV from Regen South West is included in appendix seven. A list of local installers is available from the CSEP website.

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\(^5\)\(^2\) Renewable Energy Factsheet 4, EST, 2005  
\(^5\)\(^3\) Section 3.5.3 of London Renewables, GLA, 2004
G. Biomass Heating

For smaller domestic properties it would be possible to use a pellet fired room stove to provide space heating. These can also have a back boiler to provide heat for radiators or a hot water system. Large houses and non-domestic buildings can use a smaller biomass boiler linked to a central heating system. For both, a backup water heating system would be needed to meet summer demand such as an immersion heater. Both would require a storage area for the fuel and the size of this would increase with the size of the boiler. Correct sizing is an important issue to keep the costs of the equipment and storage area down.

Individual room stoves tend to have an internal hopper incorporated into the design and these would provide around 20 hours of continual operation. These would therefore require the occupier of the house to regularly manually add fuel. Some sort of storage facility would need to be incorporated into the house to allow for a reasonable amount of fuel storage. Pellets for smaller properties can be purchased by the bag.

For larger systems it is possible to incorporate a fully automated system that feeds fuel via an auger directly into the boiler. This requires a reasonable sized fuel store, but makes their use easier than individual stoves. Fuel can be purchased in bags or more likely delivered by a lorry and blown into the fuel storage area, which brings down the cost of the fuel.

These types of system require that the occupants (or landlord) are willing and capable of managing fuel use and supply, as well as regularly removing and disposing of the ash from the combustion process.

Resource Potential

Pellets can be purchased from a number of shops within the county already in small bags, but they become more economical when they are bought in bulk. The imminent start up of a pellet production facility in Cornwall should insure that demand could be met locally (reducing transport carbon emissions) from late 2008.

Cost and Savings

Cost and savings for small biomass stoves will depend on the size of the system installed and any requirements for storage space. Typical costs per installed kW for smaller systems are likely to be in the region of £200 to £400. In addition to the installation cost there is an ongoing fuel cost with biomass (unlike other renewable options), currently pellets are cheaper than oil, but not yet as low as gas.

The scale of savings will depend upon the size of the system installed, the biomass fuel used and the type of fossil fuel displaced; an estimate is therefore not possible.

Planning

Planning permission may be required for external flue pipes to carry the combustion gas from the biomass system. However, good design should enable these to be unobtrusive.

In the Government's response to the 2007 consultation on Permitted Development Rights for Householder Micro-generation, it is proposed that biomass systems are
treated as permitted development, subject to the flue being no more than 1m above the ridge line of the highest part of the roof and not facing onto and visible from a highway in a conservation area or World Heritage Site. (Legislation forthcoming in spring 2008).

**Integration**
The use of small biomass boilers will again depend on whether the building is in an area where a CHP heat main is available. In these instances the use of biomass should be discouraged as it will compete with CHP making it less economically viable. For buildings outside a CHP heat main, the use of biomass is likely to be a relatively cost effective way to meet the 20% target for regulated emissions.

However, it will be increasingly important to correctly size the use of biomass heating systems in homes, as they will have a relatively low heat demand with improving insulation standards. Security of fuel supply must also be considered if this option is widely adopted.

**Further Information**
A basic factsheet on wood heat from Regen South West is included in appendix seven. A list of local installers for biomass is available from the CSEP website.

**H. Heat Pumps**
Heat pumps can extract heat from the ground, air or water, to provide useful space and water heating for a building. The most common application for domestic micro-generation is currently Ground Source Heat Pumps (GSHPs). However, Air Source Heat Pumps (ASHPs) are starting to be used in Cornwall and are likely to become an increasingly attractive option in new build in the future.

Both upgrade low temperature heat into a higher temperature that can be used to provide space heating and possibly water heating. As with other technologies, good design and construction can increase the efficiency of a heat pump. They are best suited to highly insulated buildings allowing them to provide all or most of the heating requirements, if properly sized.

**GSHPs**
GSHPs upgrade low temperature heat from the ground to a higher temperature that can be used for space and water heating. System designs vary, but work by circulating a fluid through an underground pipe network. As the fluid in the pipes is at a lower temperature than the surrounding ground, it warms up as it passes through the pipes. This low-grade heat passes through a heat exchanger in the heat pump that extracts the heat and, through compression, raises it to higher temperature for use within a building. Generally GSHPs are designed to only provide pre-heating for hot water so an auxiliary form of hot water heating is usually required, such as an immersion heater.

The heat pump works on the same principle as a refrigerator’s cooling circuit – but in reverse. By compressing a refrigerant the heat pump is able to ‘upgrade’ the low temperature heat from the ground circuit into a higher temperature, typically 40°C to 60°C. Heat pumps are generally driven using electricity and as such, GSHPs are not
strictly renewable, unless this electricity comes from a renewable source. However, typical performance figures suggest that for every unit of electricity used to drive the heat pump, between 3 and 4 units of heat are produced, e.g. 1 kW of electricity will yield 4 kW of heat which can give good energy and running cost savings. This ratio of heat delivered to compressor power input is known as the Coefficient of Performance (CoP).

The heating system within the building should be designed for low temperature heat distribution to increase efficiency. This is generally best achieved using under floor heating that can be incorporated at the construction stage. It is also possible to install non-conventional radiator systems or air-duct systems, but these can be less efficient.

Although some systems are configured for heating only, reverse cycle heat pumps are available that use a reversing valve to change the direction of refrigerant flow within the system. This allows the heat pump to provide both heating and cooling for a building. However, this will require energy to operate and it is likely to be more appropriate to design out the need for cooling within housing.

GSHPs have an expected lifetime of around 20 years. They emit some noise, but this is comparable to a standard refrigerator so should not cause problems if they are sensitively place within a building. Maintenance requirements are relatively low, the ground pipes will not require any maintenance and the heat pump needs standard servicing to maintain a high CoP.

**Resource Potential**
The ground resource is somewhere between 8ºC and 13ºC and this remains constant throughout the year.

**Cost and Savings**
The installed cost of a GSHP system is site dependent and will depend on which ground system and heat distribution system is used. It is therefore difficult to provide accurate cost and savings figures. Regen\(^54\) suggest installed costs of £1,000 to £1,700 per kW of peak heat output (includes cost of heat pump and ground loop). A typical installation for a house is likely to be in the region of 6 to 8 kW and this would save between 2 to 8 tonnes of CO\(_2\) per year, depending on the type of fuel being displaced.

For new build, costs are likely to be lower than retro fitting, as the ground loop and under floor heating can be installed during construction. Also new homes can be made much more energy efficient, reducing the size of heat pump that is installed.

**Planning**
GSHPs are not visible from the outside of a building so should not be an issue for planning consent. Even if the heat pump is placed outside the building it is not large and can be discretely housed from a visual perspective. In the Government’s response to the 2007 consultation on Permitted Development Rights for Householder

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\(^54\) Ground Source Heat Pumps, Regen, 2007
Micro-generation, it is proposed that ground source and water source heat pumps are treated as permitted development (legislation forthcoming in Spring 2008).

**Integration**

GSHPs are more economic in off gas areas so they will struggle to compete with conventional gas fired heating at current gas prices. However, the way SAP considers gas heating could result in developers choosing not to connect to gas and using a heat pump to meet the require TER. The ideal solution if GSHPs are used would be to meet the electricity demand they need through the use of another renewable resource.

If large scale CHP is used, the use of GSHPs should be discouraged in areas where a heat main exists or is planned as it would compete with this resource. However, without CHP, it would link well with large scale wind.

**Further Information**

A basic factsheet on heat pumps from Regen South West is included in appendix seven. A list of local installers for GSHPs is available from the CSEP website.

**ASHPs**

ASHPs work in the same way as GSHPs except that the source of heat is the external ambient air, rather than the ground. This makes them less efficient than GSHPs because the ambient air temperature is much more variable and the external air temperature tends to be lowest when the demand for heating is highest. They can have a CoP of 1:4, but this will fall as air temperature drops. However, Cornwall is fortunate in that ambient air temperatures tend to remain fairly high even in the winter months, so their application locally is more feasible than other areas of the UK.

The advantage of using ASHPs over GSHPs is that they are cheaper and easier to install as they do not require extensive ground work. They are also relatively compact and therefore do not require much space. As with GSHPs they work most efficiently in well insulated buildings, so are likely to be most appropriate in new build. They can also provide air conditioning by running in reverse, although the need for this should be designed out in homes.

They can be used for individual properties as well as in blocks of flats where each flat has its own ASHP. Systems are often installed on an external wall, and this may give rise to noise issues in high-density housing developments. Carrick Housing has trialled a number of ASHPs on existing homes across the district.

Most of the considerations above for GSHPs, including planning and integration would apply to ASHPs. However, the government has indicated that standards will need to be set on noise and vibration for air source heat pumps to ensure neighbours are not disturbed by the development. As such, permitted development rights for ASHPs are not expected until such standards and safeguards have been drawn up and put in place.\(^\text{55}\)

I. CHP
We have not reconsidered CHP here as it is described in detail above, but it will be viable technology to use smaller scale CHP to meet the needs of individual large buildings or groups of buildings. However, this should not occur in an area where large scale district CHP is planned. For building-integrated CHP, a general rule of thumb for its potential is where there are proposed point loads in excess of 200 kW thermal or electric base load\(^{56}\).

7.4 Life Cycle Cost Comparisons
Part of the brief for this work asked for a comparison of the life cycle costs of different technologies. This is not straightforward as the technology cost estimates vary nationally and it also depends on a range of other local factors such as: the energy demand of the building; the fuel displaced; the size of system installed; the standards the building are built to; and the lifetime estimate of the technology.

With so many variables it is not surprising that few reports have attempted to provide a like for like comparison. One of the few that has was produced by the TCPA\(^{57}\) in 2006. Their data has been used below to provide the Council with a potential overview of life cycle costs and savings. As their report makes clear, these should be used as a guide only. They are based on a typical dwelling energy demand of 70 kWh/m\(^2\) for space heating, 40 kWh/m\(^2\) for water heating, and 50 kWh/m\(^2\).

The approximate CO\(_2\) savings per pound of capital cost are shown below. It provides an overview of the relative cost effectiveness of different technologies in relation to the carbon savings per pound spent.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Kg CO(_2) saved per £ of capital cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Wind</td>
<td>26.8</td>
</tr>
<tr>
<td>Biomass</td>
<td>9.8</td>
</tr>
<tr>
<td>CHP</td>
<td>3.9</td>
</tr>
<tr>
<td>Solar thermal</td>
<td>3.0</td>
</tr>
<tr>
<td>PV</td>
<td>2.4</td>
</tr>
<tr>
<td>GSHPs</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Table 32: Cost of carbon saving
Source: Page 48 of Sustainable Energy by Design - a TCPA ‘by design’ guide for sustainable communities, TCPA, 2006

The comparison of typical capital costs on a per dwelling basis and the total CO\(_2\) savings that could be possible are shown below in figure 27.

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\(^{56}\) Estimate by Element Energy (15/3/06). “For a typical office building, the electrical load can be approximated at 30 W/m\(^2\) and the thermal load at 70 W/m\(^2\). So a 200 kW thermal load might be expected at an office block of around 2500-3000 m\(^2\). A 200 kW electrical load might be expected at a > 5,000 m\(^2\) office space”.

\(^{57}\) Sustainable Energy by Design - a TCPA ‘by design’ guide for sustainable communities, TCPA, 2006
Based on this large scale wind will most likely be the most capital and carbon effective technology within the urban extension, followed closely by the use of biomass. The least effective using these metrics are PV and GSHPs.

However, life cost comparisons do not necessarily provide the best measure of effectiveness in regard to the wider sustainable development agenda, as they take no account of the potential social and economic benefits of a technology. This could, for example, make PV a more attractive option as it would provide occupiers with free electricity. This is discussed in more detailed in section 7.7.1.

An additional resource that shows cost in terms of the CO₂ savings was provided in the RAB report. This shows the potential cost effectiveness of the technologies modelled within this study for 2016, using UK figures. It reflects the capital cost, based on first year costs (which most developers will consider). It does not consider the ongoing operation and maintenance costs for different technologies.
7.5 Delivery Options

The use of building-integrated generation technologies is relatively straightforward. At a domestic or small scale the equipment can be installed by the developer as part of the construction, with information provided to the new occupiers on its operation and maintenance. For large individual buildings the energy production equipment could be installed and managed by a local utility or energy company. Other options are also possible and these are considered in section 9.3.8 of this Strategy.

A larger scheme linked to meeting the needs of part, or the whole, of the site could require a more complex model to be developed, as an organisation will be needed to deliver, operate, maintain and bill customers, particularly if this involves a private wire and heat network. A variety of models are available and the most appropriate for the urban extension would depend on the final choices that come forward for large scale energy generation. Some of the possible approaches include:

- an Energy Service Company (ESCo) that would generate and distribute power and heat (and possibly cooling) in the local area and bill customers in the same way that their current energy provider does;
- a Multi Utility Service Company (MUSCo) that provides the services of an ESCo with additional services such as water management, ICT networks, CCTV, etc;
- the direct engagement of a utility or specialist energy contractor to own and operate the energy scheme and provide their own billing services.

The most appropriate model should be investigated with a feasibility study, possibly linked to CHP; although it seems likely that an ESCo type approach would bring a wider range of benefits for the urban extension for any large scale generation options. Such an organisation could take responsibility for:

- design;
- finance;
- installation;
- operation and maintenance;
- monitoring and emissions reporting;
- customer services and billing.

One of the primary benefits of an ESCo would be the transfer, or sharing, of financial risk. This could potentially be a full transfer, where the ESCo has full ownership of the project, but it would also be possible to develop a model that allows for investment from interested parties such as developers, the Council, or even the local community. Such an approach would be based on a 20-30 year timescale that would allow the capital costs of the energy infrastructure to be recouped and a profit made from the sale of heat and power. As such it would provide a return on the investment for those involved in the company. To achieve this, all parties will need to see a model that demonstrates a satisfactory return over the project lifetime, together with acceptable payback periods, to attract any necessary private investment.

There are also a range of additional benefits an ESCo could offer, such as:

- no maintenance costs associated with individual boilers, assuming heat is supplied via a CHP heat main;
Energy and Sustainability Strategy for Truro and Threemilestone Urban Extension

- prices of heat and/or power could be guaranteed to be lower than the cost of supply from other local suppliers for the term of the project;
- increased security of supply;
- support for local jobs and knowledge;
- retaining income from the sale of energy within the county;
- the possibility of expanding services into existing homes within Truro and Threemilestone to incorporate renewable energy and energy efficiency;
- subsidising renewable energy measures and other ESCo/MUSCo services in more rural communities;
- supporting the provision of local energy advice and facilitation services;
- an effective mechanism to reassure developers about the possible concerns they may have about the ongoing operation and management of energy generation technologies;
- no need for back up generators;
- releasing additional floor space and reducing capital cost of industrial-office space for CHP schemes.

7.6 Technology Choice
The primary decision making process for most developers will be to select technologies that enable them to meet the required targets for the least capital cost. The cost of different approaches is considered in chapter nine of this report, based on national modelling. Other considerations may include:
- any land take issues;
- any resource constraints such as roof space on flats;
- the technology risk and any ongoing operation and maintenance requirements.

Many of these could be overcome by considering larger scale options first and the potential of creating an ESCo to provide ongoing operation and maintenance contracts.

7.6.1 Whole and Part Site Options
There are currently three possible options for generating heat and power for the whole or large parts, of the site, including:
- large scale wind power for electricity requirements;
- district CHP scheme/s for heat and electricity requirements;
- biomass for heat requirements.

In the longer term, anaerobic digestion may become a fourth option. However, further research into the potential resource for organic waste in the development area would determine what the opportunity of using anaerobic digestion will be. It is also likely that more projects that use this technology will come forward in the near future which will help to confirm its economic and technical viability.

Whilst a developer could pursue these large scale options independently, as part of their requirements to meet the CSH and the 20% on-site renewables target, this is likely to lead to a piecemeal approach that misses the wider opportunities for taking a
combined approach that integrates the options and avoids any heat load competition issues. As such, a better approach for large scale energy generation would be for a strategy to be developed by the Council. This is also important for ensuring the whole sustainable development agenda is considered, i.e. the wider social and economic benefits for the local community, often not a key driver in regard to developer choice of technologies, this is discussed in more detail in section 7.7.1.

Any large scale approach is likely to require an energy service company to be established. Procurement or development of a local ESCo/ MUSCo model would be a potential (and major) mechanism for financing, building and operating larger scale renewable energy and possibly other sustainability measures in the urban extension. Such an organisation could therefore lead on the whole/part site options. It could also include an element of local ownership, support the local economy and has the potential to protect the community against fuel poverty by supplying energy at a lower price than grid supplied energy.

We have assumed within this report that as the urban extension is in a gas area, this would be the main fuel use for space and water heating. However, if large wind got approval, and high levels of energy efficiency were specified, an alternative option could be to install electric heating or heat pumps. This would offer a low carbon solution and may enable higher targets to be reached within the development. It may also help protect the potential biomass resource for areas of the county without a gas or wind resource (discussed below in 7.7.2). However, this decision would need to be considered alongside any decision on district CHP or biomass heating as it would eliminate the heat load for them.

A traditional concern with electrical heating is the high cost and inefficient nature of grid electricity. In reference to fuel cost this would be less of an issue at higher levels of the Code if high standards of energy efficiency were specified, as this would reduce the heating demand and therefore the cost of using this fuel source. The issue with carbon emissions from grid electricity would be avoided if this was generated locally with wind power. We would not encourage the use of electric heating in a gas area if large scale wind does not go ahead.

7.6.2 Building-Integrated Options

Subject to the availability of large scale generation options, developers will be able to use a range of building-integrated technologies to work towards the required targets. This should not be problematic at level 4 of the Code up to 2011, but will be much more challenging for meeting levels 5 and 6.

It is likely that building-integrated technologies will need to be used in the short-term before any final decisions on large scale options are taken. In these instances it will be up to developers to select which technologies to opt for to meet the required targets within the financial and site constraints. It is likely that most developers will model their proposed plans through SAP to calculate the TER they will need to achieve and then consider which technologies will give them the required saving. This will be based on a wide number of design criteria for the size of house, type of house, the heating choice, the fuel used and all the building design issues such as u-values, thermal bridges, etc. This makes any assumption about both the typical
dwellings energy use and carbon emissions, and the potential choice of technologies, difficult to predict.

There are additional resources that could assist with the decision making process, such as the London Renewables Toolkit, which is freely available. A simplified overview of the sort of considerations to select the most appropriate technology is shown below for levels 4 and 5 of the Code. For level 6, the process would be the same, but the figures would be based on total emissions, i.e. regulated and unregulated. Ultimately the choice of building-integrated renewables should depend on what site-wide options are available, so this is also considered in figure 29, below.

![Technology selection overview](image)

Figure 29: Technology selection overview
Source: Based on London Renewables Toolkit

Section 4 of the London Renewables Toolkit provides a flowchart for each of the technologies mentioned within this Strategy. Developers could be referred to the toolkit if they require assistance on selecting the most appropriate renewable resource. It can be downloaded from [http://www.london.gov.uk/](http://www.london.gov.uk/)

### 7.6.3 Meeting the Targets

Based on the technologies highlighted within this report, a range of options can be considered for meeting the 20% target and the required CSH level. Using the data in the table below, three scenarios have been considered. These figures are derived on the baseline estimates for homes built to 2006 Part L Building Regulations provided in section 5.1 of this Strategy and are not modelled through SAP, they therefore do not provide a TER and are for guidance only. Also it is assumed that gas is used for
heating and hot water with a conversion factor of 0.19 KgCO$_2$/kWh, all other energy use is electricity, based on 0.43 KgCO$_2$/kWh.

<table>
<thead>
<tr>
<th>House Type</th>
<th>Energy Demand (kWh/yr)</th>
<th>CO$_2$ Emissions (Kg CO$_2$/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Regulated</td>
<td>Unregulated</td>
</tr>
<tr>
<td>Flat 60m$^2$</td>
<td>4,800</td>
<td>1,800</td>
</tr>
<tr>
<td>Terrace house 70m$^2$</td>
<td>5,600</td>
<td>2,100</td>
</tr>
<tr>
<td>Semi-detached house 88m$^2$</td>
<td>7,040</td>
<td>2,640</td>
</tr>
</tbody>
</table>

Table 33: Domestic energy and carbon emissions

As Policy G of the RSS requires that energy efficiency is applied first, and it appears to suggest this should be at least 25% of regulated emissions, this has been taken into account within the scenarios below.

### Scenario 1- Flat

Based on the estimated carbon emissions above, the required targets for this property will be approximately:

- 25% savings from energy efficiency = 264 Kg CO$_2$
- 20% on-site renewables = 211 Kg CO$_2$
- CSH Level 4 (44%) total reduction required = 460 Kg CO$_2$
- CSH Level 5 (100%) total reduction required = 1,047 Kg CO$_2$
- CHS Level 6 (zero carbon) total reduction required = 1,821 Kg CO$_2$

<table>
<thead>
<tr>
<th>Technology</th>
<th>CO$_2$ saving (kgCO$_2$/yr)</th>
<th>Renewable energy contribution (kWh/yr)</th>
<th>Potential contribution to Policy RE5</th>
<th>Potential contribution to CSH after energy efficiency applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHW (4m$^2$)</td>
<td>230</td>
<td>1,200</td>
<td>&gt; 100%</td>
<td>&gt; 100% 29% 15%</td>
</tr>
<tr>
<td>PV per kWp</td>
<td>325</td>
<td>750</td>
<td>&gt; 100%</td>
<td>&gt; 100% 41% 21%</td>
</tr>
<tr>
<td>Biomass boiler</td>
<td>875</td>
<td>4,600</td>
<td>&gt; 100%</td>
<td>&gt; 100% 75% 56%</td>
</tr>
<tr>
<td>GSHP</td>
<td>580</td>
<td>4,500</td>
<td>&gt; 100%</td>
<td>&gt; 100% 73% 37%</td>
</tr>
</tbody>
</table>

Notes:

The carbon and renewable contribution figures are based on EST’s CE190 report. This includes the following assumptions:

- figures are based on mains gas;
- the biomass boiler provides 100% of space and hot water requirements, but the CO$_2$ emission and energy expenditure produced as a result of specifying an over sized system, have been ignored.

In addition, the figures for the biomass boiler at level 5 of the Code only take account of the contribution this makes to space and water heating emissions (not total emissions).

**NB:** these notes apply to the next 2 scenarios also

Table 34: Building-integrated summary for flats

Source: Technology figures are based upon table 2 of CE190, EST, 2006

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58 CE190 Meeting the 10% target for renewable energy in housing – a guide for developers and planners, EST, 2006
**Scenario 2 – Terrace house**

Based on the estimated carbon emissions above, the required targets for this property will be approximately:

- 25% savings from energy efficiency = 308 Kg CO₂
- 20% on-site renewables = 246 Kg CO₂
- CSH Level 4 (44%) total reduction required = 542 Kg CO₂
- CSH Level 5 (100%) total reduction required = 1,232 Kg CO₂
- CHS Level 6 (zero carbon) total reduction required = 2,135 Kg CO₂

<table>
<thead>
<tr>
<th>Technology</th>
<th>CO₂ saving (kgCO₂/yr)</th>
<th>Renewable energy contribution (kWh/yr)</th>
<th>Potential contribution to Policy RE5</th>
<th>Potential contribution to CSH after energy efficiency applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHW (4m²)</td>
<td>230</td>
<td>1,200</td>
<td>93%</td>
<td>98%, 25%, 13%</td>
</tr>
<tr>
<td>PV per kWp</td>
<td>325</td>
<td>750</td>
<td>&gt; 100%</td>
<td>&gt; 100%, 35%, 18%</td>
</tr>
<tr>
<td>Biomass boiler</td>
<td>1,000</td>
<td>5,250</td>
<td>&gt; 100%</td>
<td>&gt; 100%, 75%, 55%</td>
</tr>
<tr>
<td>GSHP</td>
<td>580</td>
<td>4,500</td>
<td>&gt; 100%</td>
<td>&gt; 100%, 63%, 32%</td>
</tr>
</tbody>
</table>

Table 35: Building-integrated summary for terraced housing

**Scenario 3 – Semi-detached house**

Based on the estimated carbon emissions above, the required targets for this property will be approximately:

- 25% savings from energy efficiency = 387 Kg CO₂
- 20% on-site renewables = 310 Kg CO₂
- CSH Level 4 (44%) total reduction required = 682 Kg CO₂
- CSH Level 5 (100%) total reduction required = 1,549 Kg CO₂
- CHS Level 6 (zero carbon) total reduction required = 2,684 Kg CO₂

<table>
<thead>
<tr>
<th>Technology</th>
<th>CO₂ saving (kgCO₂/yr)</th>
<th>Renewable energy contribution (kWh/yr)</th>
<th>Potential contribution to Policy RE5</th>
<th>Potential contribution to CSH after energy efficiency applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHW (4m²)</td>
<td>230</td>
<td>1,200</td>
<td>74%</td>
<td>78%, 20%, 10%</td>
</tr>
<tr>
<td>PV per kWp</td>
<td>325</td>
<td>750</td>
<td>&gt; 100%</td>
<td>&gt; 100%, 28%, 14%</td>
</tr>
<tr>
<td>Biomass boiler</td>
<td>1,180</td>
<td>6,200</td>
<td>&gt; 100%</td>
<td>&gt; 100%, 75%, 51%</td>
</tr>
<tr>
<td>GSHP</td>
<td>580</td>
<td>4,500</td>
<td>&gt; 100%</td>
<td>&gt; 100%, 50%, 25%</td>
</tr>
</tbody>
</table>

Table 36: Building-integrated summary for semi-detached houses

**Scenario Summary**

The above tables provide a simplified overview of the potential technologies that can be used to work towards the targets. Whilst it is possible to meet the 20% renewable target relatively easily for most homes and, with most technologies (except SHW), it shows the difficulty of reaching levels 5 and 6 of the Code with building-integrated renewables. The modelling also does not provide a complete picture as it is not based on SAP. It takes no account of the potential to scale the technologies, which would be applicable to PV, biomass and GSHP. Finally, it does not consider any site, or technology, constraints.
Achieving Level 4
To reach the required targets at level 4 of the CSH a developer will need to reduce regulated emissions by 44%, based on the 2006 Part L TER. They will also have to generate 20% on-site renewable energy and use energy efficiency measures.

It can be seen in the scenarios that this target can be achieved in nearly all instances.

Achieving Level 5
To reach the required targets at level 5 of the CSH a developer will need to reduce regulated emissions by 100%, based on the 2006 Part L TER. They will also have to generate 20% on-site renewable energy and use energy efficiency measures.

It can be seen that this target is more difficult to achieve and will require a combination of technologies to be used, as emissions from both heating and electricity use will need to be offset. Whilst feasible this would make the target more challenging and expensive to achieve. However, larger site-wide options could play an important and cost effective way to reach Level 5, by reducing the amount of building-integrated renewables needed.

Achieving Level 6
To reach the required targets at level 6 of the CSH a developer will need to reduce total emissions by 100% (net over a year) based on the 2006 Part L TER. They will also have to generate 20% on-site renewable energy and use energy efficiency measures.

It would be fair to say that the implications of meeting level 6 of CSH are not currently clear nationally. It may be possible to use much higher standards of energy efficiency to reduce emissions and therefore make the use of renewables easier, such as the EST Advance Practice or the Carbon Lite Standards.

Most studies nationally, currently suggest that the only mechanism to achieve level 6 will be through the use of biomass CHP. However, in Truro the use of large scale wind could make a significant contribution. If combined with other technologies, the scale of wind needed could be reduced, for example with the use of heat pumps, but this would need much more accurate modelling than we have been able to include within this Strategy.

Currently there are few examples of buildings built to level 6 of the Code, but much more information, on the implications and methods of achieving this longer term target, is likely to emerge over the coming years.

Large Scale Options
For large scale applications, it has not been possible to model CHP, as the carbon savings will vary with the engine and fuel used. Also, it will depend on the final densities, site layouts and the level of non-domestic build. Only when this is known will it be possible to model the thermal heat load and size of CHP required. However, it is clear that, with the way gas CHP is currently considered by SAP, the maximum savings achievable would range from 20% to 40%, so it could only enable developers to reach level 4 of the Code. Biomass CHP could potentially meet level 5, but
additional renewable electricity generation may be needed, and it will certainly be required to reach level 6 of the CSH with biomass CHP.

Using biomass for just space and water heating would enable a large proportion of emissions to be off-set and developers could reach level 4 of the Code with this technology. To reach levels 5 and 6 of the CSH they will still need to generate renewable forms of electricity to offset the emissions associated with this energy use.

The use of large scale wind can be modelled on these scenarios. To give an example of the potential of large wind, the 1 MW turbine figures can be used. This could save up to 1,400 tonnes of CO₂ per year. In this scenario it is assumed that the housing would use electrical heating, which changes the level of emissions that need to be worked to. As required by Policy G, it is assumed that an initial reduction in emissions of 25% from energy efficiency will be required. The remaining total emissions are then considered in terms of level 6 of the Code – i.e. zero net emissions over the year. This is summarised below:

<table>
<thead>
<tr>
<th>Estimate of carbon emissions (2006 baseline) less 25% from energy efficiency</th>
<th>Total zero carbon homes with 1MW turbine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat – 2,129 Kg CO₂</td>
<td>657</td>
</tr>
<tr>
<td>Terrace – 2,483 Kg CO₂</td>
<td>564</td>
</tr>
<tr>
<td>Semi-detached – 3,121 Kg CO₂</td>
<td>449</td>
</tr>
<tr>
<td>Average across housing types</td>
<td>557</td>
</tr>
</tbody>
</table>

Table 37: Possible large scale wind contributions

7.6.4 Next Stages
The Council could leave developers to develop their own strategies to meet the required targets. This would not require a contributions approach, but it could lead to a less strategic approach being taken across the development area and may miss the wider social and economic opportunities associated with large scale energy generation. It is also likely to cost developers more to meet the targets if they work in isolation. It is therefore suggested that the Council consider taking a role in the planning and implementation of large scale energy generation within the urban extension and consider seeking contributions towards the cost of the final options that come forward.

In order to fully assess the potential for the various options highlighted within this section it will be necessary for a more detailed financial and technical feasibility study to be completed. This should take a site by site approach, once final densities and mix of housing and non-housing build is known. This should be started as soon as practicable in order to plan an effective approach before too much development occurs. This should include:

- a full assessment of the feasible technologies;
- a more detailed assessment of the potential local biomass resource;
- detailed modelling of the energy and carbon baseline for each site;
- scenarios for linking large scale and building-integrated technologies;
- the options for establishing a local ESCo.

Other local authorities have used Growth Area Funding to enable this sort of work to take place.
7.7 Further Considerations

This chapter only provides a broad overview of the potential resource and technology choices that would be appropriate within the urban extension. As discussed, much more detailed modelling will be needed to provide more accurate data on the most appropriate options and their likely costs.

In addition, the following points should be considered.

7.7.1 Links to Sustainable Development

Much of the focus of this chapter has been on the environmental benefits that renewable energy brings by reducing emissions. It is therefore important to consider the wider issues of the social and economic benefits in reference to sustainable development, to ensure renewable energy also contributes to the aim of creating sustainable communities.

The ideal scenario for all new buildings within the urban extension would be low carbon emissions, through the use of high levels of energy efficiency and renewable energy, and low running costs for new residents. Currently, we feel that legislation primarily focuses on emission reductions, but does not consider running costs. Although more thermally efficient homes will emerge as a result of the legislation, depending on the choice of some technologies, running costs could go up in comparison to gas central heating.

This issue could arise as a developer’s main concern is likely to be based on reaching the required targets in the most cost effective way. Some building-integrated technologies such as SHW and PV will reduce fuel bills, but others such as biomass, and possibly GSHPs, could increase running costs compared to gas. This could clearly change with rising gas prices and cannot really be legislated against under current planning laws. One possible solution would be through the creation of an ESCo that includes a technology selection process that considers running costs. The Council should also encourage developers to consider running costs as part of their decision making process. This would support the social elements of sustainable communities by reducing fuel bills.

The use of renewable energy will help local communities by increasing energy security and helping to reduce the impact of peak oil. It could also have a significant impact on the local economy, as Cornwall has a large and growing range of businesses involved in the installation of renewable energy. If local ownership in some of the larger scale generation options is considered there could be additional economic benefits for the local community.

A final consideration, highlighted in the discussion under wind power, but equally applicable to other technologies is the link to local governance, a key part of sustainable communities. As highlighted under section 2.6 we feel it essential that the local community is consulted regarding the options, particularly in the case of large scale renewable energy generation. This will be vital for getting local buy-in towards any schemes and would add value to the Council’s wider role as community leader. This could include discussions on the potential opportunities to generate income at a local level, either for individuals within the existing communities or
through an ESCo that offers a wider range of additional benefits to both new and existing communities.

7.7.2 Biomass
The report authors have some concerns over the long term, and wide scale, use of biomass within the urban extension. It is clear that this fuel source can bring many benefits in reference to its potential to displace fossil fuels and therefore reduce carbon emissions. It also has the benefit of removing the intermittency of energy supply, which is an issue for most other renewable generation sources. The basic resource assessment suggests that there is:

- a large supply of waste wood from Truro Sawmills;
- potential to grow miscanthus;
- a potential sustainable resource from woodland in the county.

The most promising resource is from the waste wood streams from the sawmills and it would make sense to consider how this could most appropriately be used within the urban extension, either for use with CHP or larger scale biomass heating systems. However, in terms of other resources there could be both long-term supply, and equity, issues for its wide-scale use. In terms of supply, although initially the resource looks good, this could change as biomass appears to be seen as the universal answer to meeting the CSH in many of the studies that have been carried out so far, particularly for meeting higher levels of the Code in areas where wind power is not available. This could result in shortages in the future, if biomass is widely used locally or regionally as there could come a point where the demand for biomass outstrips the potential supply. This could become a constraint, leading to higher prices, fuel shortages or biomass having to be transported large distances, effectively reducing the carbon free argument. As such, we are cautious about the potential role biomass could play in the urban extension if it is used on a large scale, unless sustainable local resources can be indentified and long-term contracts are secured.

Even then, the resource assessment for woodland was based on an 80 km radius of Truro and a 30 km radius for growing miscanthus. This takes no account of other areas of the county that may need to make use of this resource to supply renewable heat and/or power. As Truro has access to mains gas and it has a good wind resource, there are a range of alternatives available. Other areas of the county are not so fortunate, in terms of not having access to gas, or not being able to use wind power because of land designations. There is therefore an equity issue which the Council should consider in terms of using large amounts of the potential local biomass resource.

7.7.3 SAP and Changes to Building Regulations
SAP 2005 is the current software required under Building Regulations for calculating the required TER to work towards in housing. There are currently some anomalies within this that can lead to unexpected results. Part of the problem is that with so many options which can be factored into the calculations, the modelling can become an end in itself, in terms of selecting the way to reach the required TER. One example that is widely known about is the use of GSHPs in a mains gas area. In this instance, a developer can choose not to install gas heating and instead switch to electricity. This increases the carbon content of the fuel and makes reaching the TER
with a GSHP possible. However, this can result in both higher emissions and running costs in comparison to the use of gas heating.

The software is likely to improve and remove some of the anomalies that currently exist. It also seems possible that the proposed improvements to Building Regulations suggested by the Government may also result in an updated calculation method. This may change the baseline that carbon emissions are taken from, effectively taking into account improving thermal efficiencies and therefore increasing the potential of renewable energy technologies to meet the required level of reductions, or the 20% on-site requirement.

There will also be changes to the carbon content used to calculate emission rates, which could also impact on the choice of technologies. In theory, as the UK moves towards its targets for renewable energy generation and carbon emissions nationally; the carbon content of grid electricity will reduce. This will need to be taken into account in the future in terms of the contribution on-site or building-integrated renewables can make. Although any official changes to such factors are unlikely to be made outside the normal Building Regulation review periods, designers should be aware of how sensitive their proposals are to the projected carbon savings for schemes. Based upon the possible revision dates currently being consulted upon by the Government, revisions to Building Regulations may occur in 2010, 2013 and 2016. The Council should be aware of this as it may change the target assumptions within this Strategy.

7.7.4 Site Phasing
The phasing of the construction will need to be considered for large scale district CHP. As discussed, CHP is likely to be most viable in the mixed-use development areas in Gloweth/Treslike, where heat loads will be more appropriate. It would therefore make sense to consider it use quickly if these areas are likely to come forward for development first.

7.7.5 Technology
There is likely to be a revolution in low carbon and renewable energy technologies over the timescale of the AAP. This will be driven by the increasing need to mitigate against the effects of climate change and the legislation that will follow this. In the short term, the implementation of the CSH will also lead to a major increase in the markets for micro-generation and large decentralised systems as developers work towards these targets and the projected scale of new housing. It will also change the economic barriers that have stopped some forms of renewables being used in the UK under current market conditions.

There are likely to be technology improvements to existing generation options, reductions in cost as markets expand and the development of new technologies that will come to market in the near future. It is also likely that regulatory and legislative changes will lead to an increasing use of these technologies. Finally, increasing prices for conventional fossil fuels seem likely as demand globally continues to rise; this will help to make renewable and low carbon technologies more economically viable and more cost effective. The technology opportunities are discussed in more detail in section 9.3.3 of the Strategy.
One of the main concerns currently is an availability risk for a range of technologies as a result of the introduction of the CSH and the scale of house building required by Government. A recent report from the Renewable Energy Advisory Board\(^{59}\) suggests that future demand for on-site generation will outstrip the current UK supply for every technology and that the demand for biomass CHP, small wind and micro-wind could exceed global supply. However, it is less clear how quickly the market will respond to meet the required demand, or what new technologies may come to market within the timescale of the Code.

7.7.6 On-site definition
Further clarification of the definition of on-site renewables is needed. We have used the definition set out in the RSS for this Strategy (see 4.5 or glossary), but the definition and criteria used by government in terms of zero carbon vary (even between departments). It was announced in the 2008 budget that the government will set out the definition, in relation to the zero carbon target, by the end of 2008.

The main area where more clarity needs to be sought relates specifically to the use of off-site wind power in the urban extension. If CHP went ahead, and a wind scheme was connected to an energy centre using private wire, then it could be counted. Without an energy centre, there may be ways around this using a standard connection to the grid if the developer can demonstrate additionality, i.e. where the wind project has been put to specifically support the needs of the development. The exact approach without private wire is yet to be tested and would require further clarification from Government. This is currently a key risk for the use of wind power.

Based upon our conversations with Regen South West our assumption is that the on-site definitions will be revised to allow for off-site wind generation that connects to the grid within the development area.

7.7.7 Renewable Obligation Certificates (ROCs)
Also linked to the use of renewables is the issue of ROCs. This can provide an additional income stream for electricity generation technologies, which makes their use much more economical. However, there seems to be some uncertainty about whether they can be claimed if the energy generated is used to meet the requirements of the CSH. This would be a particular issue for larger scale renewables. Informal discussions with some in the industry suggest that ROCs can be claimed, whilst national and regional guidance suggests they can’t. This would need to be clarified as part of the detailed feasibility study for large scale renewables as it may have a big impact on the economics of different technologies.

7.7.8 Electricity Licence Exemptions
The UK’s regulated electricity market is administered by the Office of Gas and Electricity Markets (Ofgem). Various Licence Exemptions apply to Generation, Distribution and Supply Licence conditions aimed at allowing new and smaller operators to enter the market whilst still affording protection to individual consumers. The key licence exemption with a potential to impact on this study relates to ESCo operations. It is possible that they will be imposed with a maximum 1MW aggregated limit for residential customers who can be supplied electricity over a private network. This exemption reduces the opportunity for an ESCo to serve a large number of households.

\(^{59}\) The Role of Onsite Energy Generation in Delivering Zero Carbon Homes – RAB, 2007
residential customers. Consultations have reviewed the current exemption limits, and have also investigated whether a specific derogation should be introduced to allow an increase in the limit to increase the scope for ESCos. This issue will need to be considered as part of a more detailed study as it could impact on the financial viability.

7.8 Conclusions and Recommendations

This chapter provides a detailed overview of the options for generating heat and power, within the urban extension, in clean and efficient ways. It raises a number of questions that will need to be considered, but does show that there are a good range of options that developers could take to work towards the required targets.

It would be beneficial to take a strategic approach to meeting the energy needs of parts, or the whole, of the site. This is likely to enable better integration of technologies, larger amounts of clean energy generation, lower carbon emissions and more cost effective solutions. The options for consideration include wind, biomass heating and district CHP. Whilst a range of approaches have been identified, specific recommendations have not been made, because these options will require much more detailed work to assess their technical and financial appropriateness and should be completed when final densities are known. In addition, there are a range of building-integrated technologies available, but the actual choice will depend on the type, size and construction of buildings that developers intend to build.

To fully assess the options for the large scale generation of heat and/or power an assessment of the viability of different approaches should be completed. Such a study should be quickly pursued as it will take time to act on its findings and could result in some poor development choices taking place on the ground in terms of energy generation. Guidance should be sought from Regen South West on the final scope for the study, appropriate consultants that could complete it and the possible cost. The most likely source of finance for this work would be Growth Area Funding.

Depending on the final choice for large scale generation options, it may be beneficial to set up a local ESCo to oversee their development and delivery. Such an organisation could bring a wide range of additional benefits for the local community. An ESCo could also have a role in the use of building-integrated renewables. However, the potential benefits need to be assessed against the time and effort needed to create such an organisation. Alternative approaches are available and the best approach should be considered as part of the further study.

Based upon the evidence, it should be possible to meet the 20% on-site target relatively easily; the ability to meet the higher emission reductions is less straightforward. Basic analysis suggests that by using the EST Best Practice Standard, that it would be possible to reach level 4 with a variety of technologies. At level 5 it is more difficult and will require a combination of technologies which will increase cost. At level 6 of the Code it becomes harder still. However, the use of large scale generation could make the targets easier and more cost effective to achieve at all levels of the Code.
A range of additional issues were highlighted within this chapter. The Council needs to be aware of these in regard to the decisions that are taken now and in the future. In particular, it is important that the community is fully consulted on possible options and the wider social and economic benefits of different renewable technologies could bring, before considering the final way forward.

As this Strategy has focussed on the Highertown corridor, the Council will need to consider how to apply the possible technology choices in any other areas that come forward. It seems likely that any development in Kenwyn, Higher Newham and to the east of the city, will be more problematic in terms of large scale generation, because of their location. This may require development in this area to take a building-integrated approach to meeting the required targets, which will be more costly. The heat load in each of these areas is unlikely to make CHP an obvious choice and the use of large scale wind would have a significant visual impact upon the city.

Recommendations for the Council:
• Quickly commission a detailed technical and financial feasibility study into the potential generation and delivery options. This should include:
  o a full assessment of the large scale generation options;
  o an more detailed assessment of the potential local biomass resource;
  o detailed modelling of the energy and carbon baseline for each site;
  o how large scale and building-integrated options could work together;
  o the options for, and role of, establishing a local ESCo.
• Seek support for this study from Regen South West and make an application for money to cover this work from Growth Area Funding.
• If development is likely to come forward in Gloweth/Treslike early in the development phasing, quickly pursue a feasibility study into CHP for these areas, as they offer the best potential for this technology.
• Ensure that the local community is widely consulted on the possible choices for renewable energy generation within the urban extension.
• Promote sustainable communities by considering the use of renewable energy in terms of their environmental, social and economic benefits
• Keep up to date on the development of the CSH, particularly in relation to guidance and examples of homes being built to levels 5 and 6 of the Code. When practical examples and good practice emerges this should be made available to developers.
• Keep up to date on the legislation and issues highlighted in section 7.7

Recommendations for Master Plan:
• Some of the options for reducing the impact of climate change should be made clearer under section 3, point 6 of the draft master plan. This could include:
  o all developments should incorporate high levels of energy efficiency and maximise the potential for solar gain to reduce the energy demand of buildings, before renewable energy is considered;
  o the use of large scale wind should be considered as a mechanism to reduce carbon emissions, subject to appropriate planning and impact assessments;
combined heat and power should be considered in mixed-use development areas and guarantee of connections secured where it is in use or planned
biomass heating systems should be considered to provide renewable heat in areas where CHP is not viable;
building-integrated renewables could also play an important role in reducing carbon emissions within the urban extension.

**Gloweth/Treliske**
Change the implication for ‘renewable energy’ to ‘sustainable energy’ and state “Housing should reduce the demand for energy by incorporating high levels of energy efficiency. The opportunity for district CHP can be increased by building to a high density per hectare and considering mixed-used developments”.

**North Langarth**
Change the implication for ‘renewable energy’ to ‘sustainable energy’ and state “Housing should reduce the demand for energy by incorporating high levels of energy efficiency.”

**Threemilestone**
Change the implication for renewable energy to sustainable energy and state “The majority of the site areas are either flat or on south facing slopes. The use of high levels of energy efficiency and passive solar design should be maximised in these areas. Buildings should be, as far as possible, sited within 30° of south in order to maximise this potential and to enable roof mounted solar technologies to be considered.”

**Highertown**
Change the implication for renewable energy to sustainable energy and state: “The use of high levels of energy efficiency and passive solar design should be maximised in these areas. Buildings should be, as far as possible, sited within 30° of south in order to maximise this potential and to enable roof mounted solar technologies to be considered.”

**Other Areas (including Kenwyn, Higher Newham and East of the City)**
Any other areas that come forward in the final master plan should be based on the principles set out for other areas in terms of passive solar design and energy efficiency. It is likely that sites outside of the main Highertown corridor will require a building-integrated approach to reach the required targets, as it will be more difficult to link to any CHP or large wind scheme.

**Implications for master plan:**
- Subject to a detailed study into the use of CHP, there will be a need to allocate potential land for an energy centre within the master plan. The location of this is most likely to be within the Gloweth/Treliske development area. The amount of land needed will depend upon the outcome of the detailed study.
- To increase the viability of CHP any large heat loads should be focussed within the Gloweth/Treliske area, including a primary school, supermarket, light industrial/retail, the college buildings, the innovation centre, and possibly linking to the hospital redevelopment. Higher density accommodation will also be more appropriate in this area.
8. Wider Sustainability Opportunities

This chapter provides an overview of some of the wider sustainability opportunities that could be considered within the urban extension. Many of these go beyond the scope of individual buildings, which is the focus of the CSH and as such can have a wider role on reducing the impact of the development and its ecological and carbon footprint. Many of the themes that are discussed can be designed-in to make it easier for people to live more sustainably and this can be supported further by providing information and support to encourage greener choices and behaviour. Collectively this can make sustainability an everyday part of people’s lives.

The CSH includes several categories that relate to sustainability for individual buildings. This provides a mechanism to encourage developers to build to a high quality in regard to sustainability and the accompanying technical guide for the Code provides useful guidance for achieving high standards. The Building for Life Standard, highlighted by Carrick in the draft TTAAP, also considers a range of sustainability opportunities that considers issues beyond the individual building. These two programmes should be promoted to developers as a way to help develop sustainable communities in the urban extension.

Where appropriate direct references to the guidance in this chapter have been linked to the CSH technical guide, for more detailed information and an overview of the criteria used to calculate points, please refer to the technical guide.

8.1 Water

Water is becoming an increasingly important issue in terms of sustainability. The Environment Agency suggest that each person in the UK currently uses about 155 litres of water every day and this has been rising steadily, in the last 25 years water use has increased by 50%. The rise in demand needs to be addressed, particularly as new development will lead to an overall increase in water use in the area. The RSS and Structure Plan recognise the importance of the use and disposal of water. The effects of climate change are also likely to add pressure on the use of water. Longer, warmer summers coincide with predictions for a reduction in rainfall by as much as 30% by 2050 in the summer months. Such changes are likely to increase the time people spend outdoors and could add pressure on water supplies for recreation activities, watering gardens, parks, etc, at a time when the overall population within Cornwall rises with the influx of tourists. It is suggested that climate change could result in an additional 1-2% increase in household demand for water. The process of capturing, treating and distributing water also requires energy that, if from non renewable resources, results in greenhouse gas emissions that contribute to climate change.

The solution is to design and build homes that can help to minimise water consumption, particularly potable water. This is drinking quality water that is taken from the mains water supply in the dwelling and used for toilets, washing, drinking, etc.

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60 Water Conservation & Recycling, Woking Borough Council
cooking, and outside of the house. Simple measures can be designed into new build to reduce demand, such as:

- spray taps;
- small bore pipes;
- dual flush and low flush toilets;
- water saving showers;
- smaller shaped baths;
- encouraging the use of low water washing machines and dishwashers.

Water can also be recycled to reduce the demand for potable water. This can include rainwater harvesting and re-using greywater. Rainwater recycling is relatively simple to incorporate into new build and in its simplest form can just be collected in a water butt for use within the garden. This can help to reduce the use of potable water, but more advanced systems are also available that can collect and store rainwater in a storage tank in the roof or underground which can be used in WCs, washing machines and the garden, this will be a more effective strategy for reducing water demand.

Greywater systems collect and cleanse water from baths, showers and sinks on a single dwelling, communal buildings or on a larger part site basis. This requires a collection and basic treatment system that can return the water for use in WCs and washing machines. Any such system would need to be reliable and easy to maintain.

The use of water efficient devices, rainwater harvesting, and grey water reuse, can dramatically reduce the impact of new development. It is possible to incorporate these at the design stage to reduce their cost and maximise their benefit and fully integrated systems can be used for integrating mains, rain, and grey water. Any measures to reduce water use will help to save money for occupiers by reducing water bills and will support the SUDs strategy by reducing the amount of water discharged into drains and watercourses, helping to reduce the risk of flooding.

The issues of drainage and flood risk are important components of wider water sustainability issues. They have not been considered in detail within this report as a separate SUDs strategy has been commissioned. A requirement to reduce water consumption and deal with run-off will help with Carrick’s aspiration of meeting the needs of the site, within the site. It will also help to future proof the urban extension in reference to climate change. The driving force for ensuring this should be the CSH.

The Code has four targets that relate to water sustainability including:

- WAT 1 – Internal Potable Water Use;
- WAT 2 – External Water Use;
- SUR 1 – Surface Water Run-off;
- SUR 2 – Flood Risk.

**Internal Potable Water**

The Code recognises the need to reduce water use within new housing. Mandatory targets are set for different levels of the Code, with up to 7 points available. To reduce the use of potable water the Code encourages water efficiency through low
water WCs, showers, taps and appliances as well as the waste water recycling and rainwater harvesting.

<table>
<thead>
<tr>
<th>CSH ID – Wat 1</th>
<th>Internal Potable Water Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water consumption (l/person/day)</strong></td>
<td><strong>Points</strong></td>
</tr>
<tr>
<td>≤ 120 l/p/day</td>
<td>1.5</td>
</tr>
<tr>
<td>≤ 110 l/p/day</td>
<td>3</td>
</tr>
<tr>
<td>≤ 105 l/p/day</td>
<td>4.5</td>
</tr>
<tr>
<td>≤ 90 l/p/day</td>
<td>6</td>
</tr>
</tbody>
</table>
| ≤ 80 l/p/day | 7 | Levels 5 and 6 | House: £2,520  
Flat: £805 |

**External Water Use**
This encourages ways to collect and reuse rainwater for use in a garden. Points are available towards a CSH rating that can include the provision of rainwater butts and central rainwater collection systems.

<table>
<thead>
<tr>
<th>CSH ID – Wat 2</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
</table>
| External Water Use | 1.5 | no | House: £200  
Flat: £30 |

**Surface Water Run-off**
This is a mandatory rating within the code, so to reach CSH Level 1 and above measures must be put into place to reduce and delay water run-off from hard surfaces to sewers and water courses. Such measures will reduce flooding, pollution and other environmental damage. This can be achieved by specifying permeable paving for hard surfaces and/or by the adoption of soakaways and other systems such as green roofs to reduce run-off loads.

<table>
<thead>
<tr>
<th>CSH ID – Sur 1</th>
<th>Reduction of Surface Water Run-off from the site</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 to 1</td>
<td>yes</td>
<td>£225 per dwelling</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The requirement to include SUDs as part of development permission within Truro and Threemilestone will enable developers to meet this requirement of the Code.

**Flood Risk**
The Code encourages development in areas with a low risk of flooding or, if developments are to be situated in areas with a medium or high risk of flooding that appropriate measures are taken to reduce the impact in an eventual case of flooding. In the case of the urban extension, it sits above a high risk area, but not within it, so it is likely the points would be available to developers in the urban extension.

<table>
<thead>
<tr>
<th>CSH ID – Sur 2</th>
<th>Flood Risk</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 to 1</td>
<td>no</td>
<td>£0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**8.2 Food**
Food is a cross-cutting issue in regard to sustainability, linking to environment, economy and social issues. It is a vital consideration for sustainable communities, but tends to sit around the edges of planning policy, rather than playing an integral role. The draft RSS makes the link between food production and the wise use of resources and recognises the impact it has on the region’s ecological footprint.
highlights the importance of spatial planning in regard to providing access to shops where healthy food can be bought, and the environmental benefits of local food. It also highlights the need to avoid compromising the potential for food production in the land around urban areas. However, no reference is made to food in either the Cornwall Structure Plan or draft TTAAP, and this is an oversight that should be addressed in terms of wider sustainability.

Nationally, policy is driven by Defra\textsuperscript{61} and includes strategies to create a more sustainable farming and food sector, including promoting the market for locally sourced produce. National agriculture and food strategies are delivered within the South West by the regional agencies that aim to ensure the policies can be effectively delivered at a regional and local level.

It is recommended that the Council consider producing a detailed food strategy to properly explore these cross-cutting themes of environment, society and economy to develop an integrated approach to sustainable food. A basic overview of some of the key issues for food sustainability are considered below, there is considerable cross-over between them.

A central theme is food security. The UK already imports much of its food, currently it is suggested we are approximately 58% self sufficient that this level is decreasing (since 1995 self-sufficiency in all food decreased by around 21%)\textsuperscript{62}. This makes the UK vulnerable to changes in the global market for food, because of simple supply and demand issues. Examples of the sort problems that may become more common in the future are already being seen.

The food sector is energy intensive and reliant on fossil fuels right through the food chain from production to purchase. This has major implications for food security as fossil fuel resources are dwindling, their use contributes to climate change, and prices are set globally so are outside of Government control. Recent oil price rises have lead to increased costs for the food sector and this is resulting in higher prices for food. Linked to the use of fossil fuels, are the emissions these lead to, that are driving climate change. Increased climatic events such as droughts and storms that destroy crops or reduce yields also result in an increased demand for food in the global market.

Other impacts on food prices are also being seen. These include changing demands for food products in developing countries that, as they become more prosperous, are seeking western foods which have not traditionally formed part of their diets, this increases demand in the market place. The recent development in policies within the EU and USA to promote the use of biofuels is also seeing productive land being taken out of food production, which puts further pressure on global food resources as well as causing significant inequality issues within developing countries.

The increasing demand ultimately leads to inflated food prices, which are felt in UK as well as other countries, for example the price of a loaf of bread rose by 15% in


\textsuperscript{62} Food Statistics Pocketbook 2007, Defra
Energy and Sustainability Strategy for Truro and Threemilestone Urban Extension

2007 and milk prices rose by 11%. It seems likely governments will take action on food security through national policies in the future. This will include simple economic steps, such as removing the tariffs on cheap food imports that are designed to protect domestic farmers. The EU has already indicated, for example, that it may no longer use import duties on wheat from next year. Increasing evidence on the environmental impacts of growing biofuels will hopefully also lead to a change in this policy. It is also likely that strategies will develop to enable UK farmers and producers to improve food sustainability. In the long term, such policies will be essential to avoid the current situation of demand exceeding supply for basic foodstuffs on the worldwide market, a problem that could become more acute as world population continues to rise.

Food and Environmental Impacts
The ecological and carbon footprints for Carrick show that food accounts for 22% and 8% of each person’s footprint, respectively. One of the main drivers is climate change and the need to mitigate and adapt to the changes we are likely to see. Central to this is the energy intensive nature of food production right through the supply chain from producer to consumer. As shown below, it is estimated that in 2004 total greenhouse gas emissions from the UK food chain resulted in 116 million tonnes (CO₂ equivalents). Food and energy will need to be decoupled as we move towards a low carbon economy.

![Figure 30: Greenhouse gas emissions from the food chain 2004](Source: The Environment in your Pocket 2007, Defra)

Climate change could also impact UK food production through events such as more frequent storms, heat stress, and increased pests and diseases. Farmers will need to understand the impact a changing climate could have to their current practices, whilst helping to mitigate their emissions. It is worth noting, that some changes may present new opportunities to grow crops, but there is still uncertainty about the balance between the negative and positive impacts that climate change may result in.

An issue that is linked to emissions and sustainability is food miles (the distance food travels from the producer to the consumer). Food miles arise in lots of different ways and can be complex to determine. It includes food produced in the UK which,
because of the centralised processing and distribution networks, can mean even food produced in Cornwall can travel hundreds of miles to be processed and packaged before returning to a local store. This relies on road transport that results in climate change emissions and has wider environmental impacts such as congestion, pollution and traffic accidents. A report for Defra\textsuperscript{64} found that food transport accounts for 25\% of all heavy goods vehicle miles in the UK and lead to the production of 10 million tonnes of CO$_2$ in 2002.

Food miles also result from the desire to have food that is out of season or exotic. These foods, particularly in the case of perishable foods like soft fruit and vegetables, are often flown into the UK. Transport of food by air is increasing, despite this being one of the most damaging forms of transport for the climate. Out of season food is also grown in the UK, but requires heated greenhouses and these often burn fossil fuels to provide this heat.

Shopping habits also have environmental impacts. This includes a major shift in the way people buy their food in recent decades, away from regular (on foot) small shops, towards centralised sales in supermarkets. Whilst this perhaps has helped to drive down costs to the consumer, it has had economic impacts on local producers and shops and results in increased transport emissions from car use. The breakdown of distance travelled in transporting food in the UK shows that in 2004, approximately 50\% of all the kilometres travelled were from personal car use\textsuperscript{65}.

Changes in shopping habits also impact on waste. According to WRAP\textsuperscript{66} the UK throws away around 6.7 million tonnes of food each year, which in monetary terms, could be up to £400 per household. This waste could be avoided by better planning in regard to shopping choices and managing food within the home. Increasing waste from the domestic sector also arises from food packaging, which tends to be linked to supermarket shopping as their food is generally more packaged compared to a local producer or farm shop.

**Food and Social Impacts**

A central part of food sustainability is the link to health and wellbeing. National and local studies show the link between poor diets and problems such as heart disease and cancer, as well as increasing concerns over obesity. It is often the poorest in our community on lower incomes that have highest incidents of poor diet, so there is real health inequalities linked to food. The 2020 Health and Well Being Strategy for Cornwall and the Isles of Scilly is due to be launched in early 2008 and sets out the long term vision of how the NHS, local government and community organisations will work together to improve health. One of the 13 key action areas covers food and includes suggestions for action to encourage people to buy more local and seasonal food as well as encouraging people to grow their own food in gardens and allotments.

As already highlighted, food security will also have a social impact. As the price of food rises, especially for staples such as bread and milk, the less well off in our society who are on a fixed income will suffer as they will have to spend more on food.

\textsuperscript{64} The Validity of Food Miles as an Indicator of Sustainable Development: Final report, AEA Technology, 2005
\textsuperscript{65} Food Statistics Pocketbook 2007, Defra
\textsuperscript{66} Understanding Food Waste, WRAP, 2007
Food and Economy
Less of an issue and more of an opportunity are the benefits of promoting and developing local sustainable food chains. A study by the New Economics Foundation\(^{67}\) showed that spending £10 with a Cornish local box scheme results in a £25.90 reinvestment in the local economy. This is because a high percentage of the £10 is re-spent in Cornwall, and of this, a high proportion is spent locally again. A comparative study showed that spending £10 at a supermarket resulted in just a £14 reinvestment locally. Cornwall has a considerable number of local producers and retailers and there are real economic opportunities to be gained by promoting and supporting them.

A Sustainable Way Forward
The most straightforward solution to too many of the issues highlighted above are policies to support and develop local food. Definitions for what local food is vary, but generally anything within a 30 mile radius can be considered as local. This can include local producers, market gardening, farm shops, farmers markets, etc. Local food tends to be fresher, less processed, and less packaged than supermarket alternatives. It tends to have less climate impacts as it travels less distance, and is often more seasonal. It also results in more money and a fairer share of the money going to the producers, much of which stays within the local economy.

Cornwall has a vibrant and diverse food sector that includes primary producers, food processors, manufacturers, and many smaller businesses. Evidence from the Centre for Rural Research at Exeter University suggests that in 2005/06 the Cornish food economy could be worth in excess of £1.5 billion\(^{68}\). In addition there are a wide number of initiatives operating within the County linked to the food sector, such as:

- the NHS Cornwall Food Programme that supports local suppliers, growers and the producers, by purchasing their goods and offering longer contracts to allow local businesses to develop and grow. This has seen the introduction of local fish, milk, cheese, eggs and yoghurt onto hospital menus and they are due to open a Cornish Food Production Unit in early 2008 to prepare, produce and cook hospital and canteen meals for all of the NHS in Cornwall;

- Cornwall Agricultural Council’s strategy\(^{69}\) aims to ‘transform Cornwall into the UK’s exemplar agri-food centre of excellence, characterised by innovation, added-value, competitive advantage & environmental sustainability’. This mainly focuses on producers offering business and marketing support, new product development, processing facilities, and efficiency in the supply chain;

- Taste of the West provides regional support to the food and drink businesses to improve business competitiveness through events, training and by providing support and practical advice on marketing, etc. It has a Cornwall office that has been able to provide capital and promotional funding through Objective One. This includes support for resources such as local food directories, and the Food from Cornwall website that details producers, farm shops, events and farmers markets;

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\(^{67}\) The Money Trail, NEF, 2002  
\(^{68}\) Food production, processing and distribution in Cornwall and the Isles of Scilly, Centre for Rural Research, 2006  
\(^{69}\) Strategy for Agriculture, Horticulture, Food and Land Based Industries in Cornwall and the Isles of Scilly 2003-2010, DTZ Pieda Consulting, 2005
• the new Agri-Food Innovation Centre at the Duchy College that offers training, innovation, new product development and many other support services to the food sector in the South West.

Whilst all this good work is going on and the local food sector is growing, there appears to be a missed opportunity within local government to develop local policies to strategically work with this sector for the benefit of local communities.

Opportunities in the Urban Extension
Taking account of the issues raised above, the potential economic benefits and the wide range of activity within the local food sector, there is a real opportunity within the urban extension to consider sustainable food policies. This would have positive economic, environmental and social benefits and help to future proof the development. This should be considered in terms of spatial planning and informing new and existing residents in the area about the benefits of local food.

The most sustainable approach for food production is to enable people to grow their own and this can be supported by ensuring space is provided within the development area to allow this to happen. By its nature, high density developments are likely to lead to reduction in the number of properties that have gardens of sufficient size to grow food, so it is important that land is allocated for allotment space. Information from Transition Truro suggests that there are currently 71 allotments in Truro, with a waiting list of over 80, and that demand is growing. This shows the desire by local people to grow their own food and the new urban development is likely to lead to an increased pressure on existing allotment space. The need to protect local farmland to support the growing and use of local food was highlighted during the consultation process, as was the need for gardens and allotments to support community food. A requirement should be made on developers to provide new allotments within individual plots, or as part of the wider contributions strategy. Consideration should also be given for land for new local initiatives such as market gardens, community farms, or community supported agriculture, which should be close to the development area. Enabling people to grow their own food will support healthier food choices, SUDs, Biodiversity, and Green Space strategies.

Creating sustainable communities within the urban development should be fundamental to the master planning process. This should include spatial planning that supports existing community centres, as well as the creation of new centres that include requirements on developers to provide local shops. This should be based on the principle of walkable neighbourhoods to encourage people to use local shops without the need to drive.

The opportunity to provide people with information on local food should also be considered. This could include information on local allotments, local producers, farmers markets, as well as healthy eating, linking in to existing initiatives.

As already stated, the Council should also consider developing a local food strategy. This could be for the urban extension or be more strategically for the whole district. The Duchy of Cornwall has commissioned just such a report for the Newquay Growth
Area\textsuperscript{70} and this could be used as a starting point. A key recommendation within their study was to develop a new local food partnership between the public, voluntary and private sector agencies and other organisations. There is an opportunity to consider the recommendations within the Duchy report and learn from the experience they gain from developing such a partnership. The Council could also work with local community groups such as Transition Truro, resident associations, etc and begin to make links with key organisations and producers locally to take this forward.

Local sustainable food is and will become an increasingly important issue for local communities. We would suggest that any decisions on potential changes in land use within the area should consider food production first. This would include food taking priority over growing of energy crops in close proximately to the urban extension.

\section*{8.3 Transport}

The way people travel can influence the quality of life for everyone within the community. The need for, and implementation of, sustainable transport policies are well set out within the RSS, Cornwall Structure Plan, second Local Transport Plan and draft TTAAP. This is echoed by national and regional planning and transport policy and guidance. The general approach adopted within policy is firstly to reduce the need to travel by locating development close to existing facilities and services. Secondly, policies should promote connected transport networks to make it easier for people to travel more sustainably by walking, cycling and using public transport. By considering sustainable travel at the master planning stage it will be possible to reduce the impact of travel on the environment, the community, and the economy.

The evidence base review for Strategy and Action\textsuperscript{71} suggests that there are now 66\% more vehicles in Cornwall than 20 years ago, partly due to increasing population, but also linked to changing lifestyles and the weaknesses in the public transport networks. It also recognises that there are growing transport inequalities with lower levels of car ownership in lower income households. At a local level, the ecological footprint associated with all forms of transport, associated maintenance and infrastructure is 16\% of the total footprint of Carrick, and in terms of the carbon, transport is responsible for 23\% of the footprint or 2.57 tonnes per person per year.

Transport has direct impacts on the environment. The recent Energy Review\textsuperscript{72} states that transport accounts for around 30\% of total UK energy use, and is responsible for approximately a quarter of UK carbon emissions, plus other greenhouse gases such as nitrous oxides, methane and hydrofluoro-carbons. In the last 20 years, CO\textsubscript{2} emissions from transport have almost doubled, and over 60\% of the emissions relate to personal car use\textsuperscript{73}. Emissions from this sector continue to rise and these are contributing to the problem of climate change. Vehicle emissions also have a local impact on the health of communities by reducing local air quality. Monitoring of air pollution through the Cornwall Air Quality Forum has shown that there have been incidents when the national air quality standards have been exceeded on the Hightertown corridor in Truro. This is not surprising given the level of congestion that occurs at peak travel times.

\begin{footnotesize}
\begin{itemize}
    \item \textsuperscript{70} Newquay Growth Area Food Strategy, Sustain, 2007
    \item \textsuperscript{71} Draft 1 Evidence Review for Strategy and Action, Cornwall and Isles of Scilly Economic Forum, 2006
    \item \textsuperscript{72} The Energy Challenge, DTI, 2006
    \item \textsuperscript{73} http://www.energysavingtrust.org.uk/
\end{itemize}
\end{footnotesize}
The Energy Review also states that around 99% of the energy used in transport relies on oil in the form of petrol or diesel, so in regard to sustainability, consideration also needs to be given to the continued and expanding use of this dwindling resource. Oil price rises and the issue of peak oil will impact local communities as the cost of private and public transport is likely to rise.

There are other social and economic issues related to unsustainable transport. These often impact on the poorer members of society, who may have to pay more of their income to travel as a result of fuel price rises. This includes those who do not own a car, who have additional inequalities as they have to live with the negative impacts associated with car ownership such as safety and pollution, without receiving any of the benefits cars offer. Road safety is linked to traffic levels and accidents come with a high social and economic burden.

**Opportunities in the Urban Extension**

The creation of a new urban extension will lead to increased pressure on existing transport infrastructure if robust and proactive steps are not taken through the master planning process. The proposed location of the urban extension is linked to the need to create a better balance between homes and jobs. It should therefore help to reduce the impact of transport by providing close access to work, amenities and services. This needs to be backed up by an integrated transport policy that encourages sustainable transport solutions. Carrick must continue to work closely with the County Council, local transport providers and developers to ensure this happens, linking to the current framework within the draft TTAAP and second Local Transport Policy through the master planning process.

The aspiration for Carrick that development should broadly follow the Building for Life Standard will help to encourage sustainable transport and good neighbourhood design as it includes detailed criteria on roads, parking and pedestrianisation.

The need and desire for sustainable transport is also recognised by the local community. The Carrick Community Plan indicates that people think the availability, reliability and affordability of transport is an important issue. This was echoed in the consultation events linked to the new Area Action Plan, which also suggested there is a desire locally for improved safer cycle routes and walkable local services.

Such policies will ensure that transport within and around the urban extension area can contribute to the wider agendas of sustainable development and sustainable communities. The opportunities identified as part of this study include:

- place making;
- walking and cycling networks;
- public transport;
- accommodating the car;
- information provision.
Good Place Making
Well connected developments that link well to the existing areas in the urban extension, and that have good access to local services, will be vital to reduce travel impacts. This was raised in the consultation process, with a desire for liveable streets rather than roads, with walkable residential and business premises. This is a role for the master planning process and the principles of good place making. This should be based at a human scale that considers movement through the development; many detrimental developments have been based on the requirements of vehicular traffic which dictate the final character of the place.

In Movement and Place-making\textsuperscript{74} it is suggested that a movement framework should consider:

- the integration of new development into existing routes;
- provision for a wide choice in how people make their journeys;
- the control of vehicle movement and speed;
- the design of routes which reinforce the character of the place;
- the location of shops and services near to new housing.

The same paper also highlights the importance of making good connections, based on routes that lead to where people want to go. Consideration to the need for well-connected layout brings many advantages:

- frequent points of access into and through the development;
- more convenient, direct routes for pedestrians and cyclists;
- better opportunities for the provision of bus services through the site;
- clear views and easy orientation;
- traffic dispersal;
- allowing for long-term adaptation and change.

Walking and Cycling
Steps to encourage walking and cycling will reduce noise and air pollution, will provide more space on the streets, and help to encourage health and well-being. It links to the idea of place making and is supported by the master plan which provides a strategic approach of creating walkable neighbourhoods that are close to amenities, such as shops, schools and work. This should include effective links to existing neighbourhoods to allow free movement through the urban extension. However, the Manual for Streets\textsuperscript{75} points out that walking is not only determined by distance, but also the quality of the walking hierarchy.

\textsuperscript{74} Available on DCLG website, no author or date provided, see http://www.communities.gov.uk/documents/planningandbuilding/pdf/153337

\textsuperscript{75} Manual for Streets, HMSO, 2007
experience. This includes the look and feel of the development in relation to wider issues such as safety. It suggests that inclusive designs that consider the needs of everyone are most suitable, and that accommodating the needs of children and disabled people are likely to suit most users.

Walkable neighbourhoods should also encourage cycling. Again, consideration of place making and connectivity should ensure routes are direct and lead to places that people want to go to. Such approaches should allow for cyclists to be accommodated within the carriageway and this can be encouraged by designs that reduce traffic speed and volume, which will also support walking. The provision of new and improved cycle routes with the urban extension, if well designed, should also support the increased used of cycling as a mode of transport.

To encourage cycling, developers could include secure cycle storage within the design of buildings. This provision could encourage cycling as a practical alternative to the car. The CSH encourages developers to include adequate and safe storage for bicycles.

<table>
<thead>
<tr>
<th>CSH ID – Ene 8</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cycle Storage</td>
<td>1.2 to 2.4</td>
<td>no</td>
<td>House: £500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Flat: £150</td>
</tr>
</tbody>
</table>

**Public Transport**

There is already a good public transport network on the Highertown Corridor, but it will be necessary to work with the local operators to ensure that the new development areas are well served by buses. Such routes should be identified during the design process to ensure that they are integral to the development. This could include the diversion or extension of existing routes, or the creation of new ones, and should be based on the principle of routes to where people want to go, including work, shops and leisure. The important point is to ensure that bus stops are well located in terms of facilities and are close to homes. Guidance varies, but stops every 200 to 400 meters in built up areas are suggested. These routes should be frequent, affordable and safe. Such a strategy will encourage people to make use of this service, rather than taking the car. Consideration could also be given for improving bus priority over cars wherever this is appropriate within the master plan.

The new park and ride scheme at Threemilestone, once fully operational, is forecast to remove approximately 10-15% of the traffic on the A39 and A390 routes into Truro. It is likely that many of these users will be destined for the main employment sites on the A390 and the city centre. It is anticipated that buses will run at 10 minute intervals during peak periods and at 15 minutes at all other times.

The park and ride should help to reduce congestion and the associated vehicle emissions, including the improvement of local air quality.
Private Cars
Consideration will still need to be given for accommodating the car within the urban extension. This needs to be done in such a way as to minimise their impact, through considerations such as reduced speed limits and careful planning of parking. There is a role in terms of master planning based around good place making and the guidance that is provided to developers. The Manual for Streets highlights issues around car parking and the need to balance parking demand with provision in such a way as not to encourage cars to be the main choice of travel modes. There are also links with safety for other users and crime issues for car owners in poorly designed parking layouts.

Consideration could be given to schemes that consider inclusive approaches for streets in which road space is shared between vehicles and other users, with an emphasis on the needs of local residents and quality of life. The Manual for Streets provides detailed guidance on these sorts of issues.

The use and number of private cars within the urban extension could also be reduced through the promotion of schemes that encourage car sharing or by creating a car club. Lift sharing is a simple approach where people share lifts, which allows people to benefit from the convenience of a car, whilst alleviating the associated problems of congestion, pollution and climate change. Cornwall County Council already works with Liftshare to promote car sharing within the County through Car Share Cornwall. There are already over 1,700 members using this resource in Cornwall and so far they have saved:

- nearly 622,062 miles;
- which is equivalent to 190 tonnes of carbon dioxide;
- and £62,206 in fuel bills.

Another possible way to reduce car ownership and their impact within the development is by establishing a car club. These provide shared cars which members of the car club can book, use, and pay for their use, as and when they need them. Their use can help to reduce the need for parking provision, with car clubs typically replacing six private cars76. As a result they can help to reduce congestion and emissions, whilst encouraging members to make better use of public transport or walking and cycling.

Car clubs are often set up in existing communities where a need for such a service is identified. However, they can be considered as part of new developments, possibly linking to the Contributions Strategy. Organisations such as Carplus have produced guidance77 on setting up car clubs in new developments and they can advise Carrick and developers on the potential ways forward. Their recent guide suggests that car clubs will work best in mixed-used developments of over 250 units and that the success of a new club can be increased by establishing it before people move in.

Information Provision
Providing travel information to new residents will be fundamental to encourage more sustainable travel. This could include background information on the impacts of travel

76 Carplus
77 Car Clubs in Property Developments, Carplus, 2007
and solutions to them, including bus routes, lift sharing, car clubs, etc. Information should also be provided to new business premises, linking to the work of the County Council in developing travel plans.

8.4 Domestic Waste Minimisation

Dealing with Municipal Solid Waste (MSW) is a challenging, but central component of sustainability. Waste management is mainly driven by European and national legislation to reduce the amount of waste going to landfill and includes targets for reducing waste through recycling and composting. The new Waste Development Framework within the County will see a new integrated waste management approach that will include measures aimed at minimisation, recycling and composting with a possible new energy from waste plant to reduce the amount of waste going to landfill. Although centralised systems such as these can more effectively deal with different components of MSW, by their nature they are energy intensive and rely on the use of fossil fuels that add to climate change. To help reduce this impact, steps to minimise and recycle MSW at source must continue to expand.

According to the County Council, the average household throws away over half a tonne of waste per person, per year, and this figure is rising. Increasing population numbers and changing demographics, such as more people choosing to live alone, are partly responsible for increased levels of waste. In addition, lifestyle choices such as buying pre-prepared meals or the latest gadgets affect the amount of waste thrown away. This is unsustainable in reference to resource use and the energy required to collect, sort and dispose of the waste.

Current consumer led lifestyles also put increasing pressure on the natural resources used in the production, distribution and use of products, as well as their disposal, adding to an individual’s ecological and carbon footprint. A basic approach for reducing this impact, that is widely advocated, follows a simple hierarchy:

- reduce the amount of waste generated;
- reuse materials when possible;
- recycle what cannot be reused.

In terms of minimising waste and re-using materials, awareness-raising is the main route to encourage this. This includes advice on simple decision making in regard to choices when shopping, such as avoiding packaging, reusing bags, etc, and encouraging people to reuse materials by passing unwanted things on to charity shops or using services like Freecycle78.

Products that cannot be re-used should then be recycled. The breakdown of the typical components of a domestic dustbin is shown in figure 33, with suggestions that between 40% and 80% of this could be recycled. Within the County, kerbside collection schemes and local facilities have led to around 23% of household waste being recycled or composted. Carrick already runs a kerbside recycling scheme which collects paper, card, glass, cans, plastic bottles and textiles. The provision of

78 http://www.freecycle.org/
bumper boxes and bags within the new development should help to encourage new residents to recycle, particularly if this is backed up with information on why this is important. To facilitate this, new housing should have adequate space for collection containers (inside and outside).

Figure 33: Typical breakdown of home waste
Source: Cornwall County Council

A recent report from WRAP\(^79\) suggests that recycling offers more environmental benefits and lower environmental impacts than other waste management options. It found that the UK’s current recycling of paper/cardboard, glass, plastics, aluminium and steel saves between 10-15 million tonnes of CO\(_2\) equivalents per year, compared to the current mix of landfill and incineration with energy recovery of the same materials.

Kitchen and garden waste can also be composted at home or communally, removing the need for collection and separation. This is one of the easiest, most effective and environmentally friendly ways to deal with the organic waste component of MSW. Compost can be used locally within the garden or allotments. To facilitate composting, homes with gardens and communal gardens can be provided with a compost bin. Consideration could also be given to a separate collection for food waste when composting is not an option, especially if this was linked to possible use in anaerobic digestion to create biogas for energy generation.

**Opportunities in the Urban Extension**

The opportunity within the urban extension is to encourage new and existing occupants to follow the waste hierarchy through awareness raising and the provision of suitable facilities to enable recycling to become second nature.

The CSH requires developers to incorporate waste management into new homes. Points are provided for the inclusion of adequate internal and external storage space.

<table>
<thead>
<tr>
<th>CSH ID – Was 1</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Waste Storage and Recycling Facilities</td>
<td>1.8 to 3.6</td>
<td>yes</td>
<td>£160</td>
</tr>
</tbody>
</table>

The Code also encourages developers to provide facilities to compost household waste. Points are awarded when composting facilities are provided for either houses with gardens, local authority kitchen waste collections, or communal/community composting services. It also requires any facilities to be accompanied by information explaining how they work.

<table>
<thead>
<tr>
<th>CSH ID – Was 3</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composting</td>
<td>0.9</td>
<td>no</td>
<td>£70</td>
</tr>
</tbody>
</table>

\(^79\) Environmental Benefits of Recycling, WRAP, 2006
8.5 Sustainable Construction

The design, choice of materials, and process of construction of should be considered in relation to sustainability and the impact it has on local communities. The CSH includes a range of categories that relate to construction including:

- waste;
- site management;
- materials;
- pollution.

Waste

It is important to try and reduce the waste created through the construction process. This starts with good design and runs through site management and the work of each trade during the construction process. It should include the efficient use of resources during construction, avoiding damage to materials before they are used, and consideration for recycling, re-using and minimising waste streams.

The CSH recognises the importance of construction waste management and the impacts it can have at a local level. It highlights the fact that Defra are suggesting that Site Waste Management Plans are likely to become a legal requirement on construction projects over £200,000 during 2008.

This part of the CSH is mandatory so will need to be met in order to gain a Code rating. It requires that waste generated on site is monitored and that relevant guidance is used to increase the efficiency of resource use. Procedures and commitments for minimising waste generation are required including sorting, re-using and recycling construction waste on-site or through a licensed external contractor.

<table>
<thead>
<tr>
<th>ID – Was 2</th>
<th>Credits</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Site Waste Management</td>
<td>0.9 to 1.8</td>
<td>yes</td>
<td>£0</td>
</tr>
</tbody>
</table>

A wide range of organisations provide guidance to help the construction industry manage and monitor waste, such as BRE, CIRIA, WRAP, Envirowise and the Environment Agency. The tools they provide can help manage and monitor the generation of waste on site and developers should be encouraged to make use of the systems that are on offer to reduce site waste.

Site Management

As well as good site management in regard to waste, there are wider considerations for reducing the impact of construction in terms of the local community. This could be a significant issue within the urban extension as many of the development areas are close to existing communities. Carrick should discuss with developers how they intend to limit the impact of their work on local communities and could consider a requirement for them to join a programme such as the Considerate Constructors Scheme (CCS) operated by the Construction Confederation. This requires them to sign a code of practice on a range of issues under eight sections:

- Considerate
- Respectful
- Environmentally aware
- Safe
- Site cleanliness
- Responsible
- Good neighbour
- Accountable
CCS is also included within the Code, but is not a mandatory requirement.

<table>
<thead>
<tr>
<th>CSH ID – Man 2</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate Constructors Scheme</td>
<td>1.1 to 2.2</td>
<td>no</td>
<td>£0</td>
</tr>
</tbody>
</table>

There is also a case for considering the wider issues construction sites have in reference to their environmental impact and sustainability. Construction by its very nature is a disruptive process that is energy and water intensive, and can cause considerable local disturbance such as noise, dust, dirt, traffic, etc. These wider impacts should be managed and reduced as far as reasonably practicable.

This is another area picked up by the CSH. In the background discussion for this area of the Code, reference is made to pollution and energy. It suggests that air and water pollution can be the main concerns and that guidance is available from BRE and the Environment Agency respectively to reduce these impacts. In terms of energy use, there is a suggestion that sites should monitor and report on energy use as part of a process to improve its use on site. Guidance on site energy management is available from the Construction Confederation.

<table>
<thead>
<tr>
<th>ID – Man 3</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Site impacts</td>
<td>1.1 to 2.2</td>
<td>no</td>
<td>£100 for monitoring</td>
</tr>
</tbody>
</table>

**Materials**

As well as considering the responsible use and disposal of materials, in reference to wider sustainability, their environmental impact should be considered. This includes considerations of the energy used in their extraction, manufacture and processing and the wider approaching of sourcing.

BRE’s Green Guide is the widely used and quoted publication that provides simple environmental profiles for different building materials using an A+ to E rating system in terms of environmental impact, including embodied energy. It is currently being updated and once complete will provide a simple tool to consider the environmental implications of their materials. Ratings are based on a life cycle assessment for a range of impacts. It compares materials on a like for like basis over a 60 year study period that takes account of repair and maintenance, and impacts relating to dismantling or demolition at the end of its life.

Closely linked to the choice of materials is their embodied energy. It is recommended that developers are encouraged to consider a holistic approach to sourcing materials to balance the energy used by buildings over their lifetime with the embodied energy of the materials used to construct them. If it does not compromise the operational energy of the building, a preference should be given for materials that have a lower embodied energy. BRE’s Green Guide and more comprehensive databases such as the Inventory of Carbon & Energy (ICE) from Bath University can be used to help choose materials.

The CSH includes a rating for the environmental impact of materials and it is a mandatory requirement for developers to gain a rating at Level 1 and above.

<table>
<thead>
<tr>
<th>CSH ID – Mat 1</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Impact of Materials</td>
<td>0.9 to 4.5</td>
<td>yes</td>
<td>Up to £420</td>
</tr>
</tbody>
</table>
The CSH also provides points towards the responsible sourcing of materials for basic and finishing elements. This is demonstrated through auditable third party certification schemes and considers Environmental Management Systems for a range of products. Points are available across the different building elements listed within the Code.

<table>
<thead>
<tr>
<th>CSH ID – Mat 2</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible Sourcing of Materials – Basic Building Elements</td>
<td>0.3 to 1.8</td>
<td>no</td>
<td>£0</td>
</tr>
<tr>
<td>CSH ID – Mat 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsible Sourcing of Materials – Finishing Elements</td>
<td>0.3 to 0.9</td>
<td>no</td>
<td>£0</td>
</tr>
</tbody>
</table>

A final consideration with the CSH for materials, relates to the Global Warming Potential (GWP) of Insulants arising from the manufacture, installation, use and disposal of foamed thermal and acoustic materials used in construction. This encourages developers to use materials that have a low GWP, based on a relative measure of how different greenhouse gases absorb infra-red radiation compared to CO₂.

<table>
<thead>
<tr>
<th>CSH ID – Pol 1</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Warming Potential (GWP) of Insulants</td>
<td>0.5</td>
<td>no</td>
<td>£0</td>
</tr>
</tbody>
</table>

A wider consideration for materials is the use of local resources and local suppliers. By choosing local materials it is possible to reduce the impact of road haulage, support the local economy and enhance local distinctiveness. The use of local materials is encouraged wherever possible within the vision of the draft TTAAP, and was raised during the consultation process. Local materials will also help to reduce the embodied energy of the urban extension. This sort of policy is being used by the Duchy,²⁰ for their proposed Newquay development, where they are promoting sourcing for the development on a hierarchy of: Cornwall; the South West; the UK; and finally Europe. The Duchy²¹ has also produced a detailed list of sources for building materials and craftspeople, based on the above hierarchy. Additional guides to local resources are also from Cornwall Sustainable Building Trust www.csbt.org.uk

**Opportunities in the Urban Extension**

The opportunities in terms of materials are set out above and Carrick should encourage developers to take steps to reduce the impact of construction in regard to waste, pollution and the choice of materials. The CSH is the main driver for this and provides guidance and recognition for developers. The use of programmes like the Considerate Constructors Scheme should also be encouraged alongside the use of local, durable materials.

**8.6 Quality of Life**

The broader sustainably issues of health, well-being and quality of life are central to the creation of sustainable communities. It is a complex challenge to get right and covers the wider topics set out in the ‘Securing the Future’ strategy, highlighted in chapter three of this report. It includes issues such as safety, affordability, connections to services and facilities, governance, etc. It also includes developments

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²⁰ NGA Sustainability Strategy, Duchy of Cornwall, 2007
²¹ Appendix 3, NGA Building Code, Duchy of Cornwall, 2007
and lifestyles that are within environmental limits, use resources wisely, and reduce the threat of, and adapt to, climate change. Much of these are influenced by the spatial policies that are considered through the master planning process, linking to good place making. They also relate to the quality of housing and the decisions that are taken during their design and construction. Some of these building related issues are considered here, drawing on the CSH.

**Daylight**
As discussed in chapter six, the use of daylight can reduce the need for artificial lighting and help reduce fuel bills as part of passive solar design. However, daylight is also important in terms of quality of life because people tend to prefer rooms with natural lighting.

Up to four points are available for providing day light.

<table>
<thead>
<tr>
<th>CSH ID – Hea 1</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daylighting</td>
<td>Up to 4</td>
<td>no</td>
<td>Up to £290</td>
</tr>
</tbody>
</table>

**Sound Insulation**
Building Regulations Approved Document E provides standards for reducing the passage of sound in buildings. The CSH offers points for improving on Building Regulations, to reduce the likelihood of noise complaints. As the CSH background chapter points out “One of the most common causes for disputes between neighbours is noise. Environmental Health Officers in England and Wales received nearly 6,000 noise complaints per million people in 2003/2004 from domestic premises. This accounts for 75% of all noise complaints received.” Clearly, people’s quality of life can be improved if they do not suffer unnecessary noise pollution.

Up to four points are available for improving sound insulation levels.

<table>
<thead>
<tr>
<th>CSH ID – Hea 2</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound Insulation</td>
<td>Up to 4</td>
<td>no</td>
<td>Up to £120</td>
</tr>
</tbody>
</table>

**Private Space**
It is recognised that access to external space close to the home directly influences people’s quality of life. This is unlikely to be a major issue within the urban extension, due to its landscape setting. However, there is still likely to be a desire from people to have an outside space they can use. The ideal solution is a garden; in the case of apartments it would be possible to provide a shared garden, balcony or roof terrace.

One point is available for providing private space.

<table>
<thead>
<tr>
<th>CSH ID – Hea 3</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Space</td>
<td>1</td>
<td>no</td>
<td>£0</td>
</tr>
</tbody>
</table>

**Lifetime Homes**
Linking to the both the CSH and the Building for Life Standard are the concept of life time homes. These are based on the principle of constructing homes that are both accessible to everyone and that can be easily adapted to meet the future needs of occupants. It is a voluntary standard that uses 16 design features to make homes
more accessible and adaptable. Some of the features are covered under Building Regulations Approved Document M.

The CSH offers 4 points for meeting all the principles of Lifetime Homes.

<table>
<thead>
<tr>
<th>CSH ID – Hea 4</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifetime Homes</td>
<td>4</td>
<td>no</td>
<td>House £550, Flat £75</td>
</tr>
</tbody>
</table>

The use of this standard will support Carrick’s desire to see homes constructed to the Building for Life Standard and would meet the requirement of Policy G of the RSS.

**Secured By Design**
This initiative encourages the building industry to adopt crime prevention measures in reference to the design, layout and construction of homes and commercial premises. Such an approach can help reduce the opportunity for crime, and the fear of crime, by creating safer and more secure communities. It therefore helps with the creation of secure, quality places where people wish to live and work, one of the Government’s key planning objectives.

The scheme both awards developers who build developments to the design standards, and runs a licensing scheme for products which meet police preferred specifications (doors & locks, windows, general security and vehicle security). More information is available form the Secure by design website [www.securedbydesign.com](http://www.securedbydesign.com).

The CSH provides points for developments in which people feel safe and secure.

<table>
<thead>
<tr>
<th>CSH ID – Man 4</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
<td>2.2</td>
<td>no</td>
<td>£0</td>
</tr>
</tbody>
</table>

**Home Offices**
The provision of a home office supports broader quality of life issues by offering people the potential to work from home more easily. This can help to reduce the need to commute and offer people more choice. The CSH offers points for providing sufficient space and services (e.g. sockets, telephone points, etc) to allow occupants to set up a home office in a suitable quiet room.

<table>
<thead>
<tr>
<th>CSH ID – Ene 9</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home Office</td>
<td>1.2</td>
<td>no</td>
<td>£210</td>
</tr>
</tbody>
</table>

**8.7 Informing End Users**
Good spatial planning and place making will make it easier for people to lead a more sustainable lifestyle by providing high quality energy efficient homes, near to local facilities and services. This built-in sustainability will help to reduce the impact of the development and this should be supported by providing good information and support to encourage and enable new residents and surrounding communities to live more sustainably.
The consultation process, carried out by Carrick has demonstrated a real interest from people currently living in the area around a broad range of sustainability topics; it also highlighted that there is confusion around some of the issues. There is an opportunity to deal with both points by providing relevant and timely information on how and why people should reduce their impact on the environment and lead more sustainable lifestyles.

Research from EST\textsuperscript{82} on consumer attitude and behaviour suggests that people tend to consider environmental issues such as energy, transport, waste, etc under the same umbrella; from which they summarised that people expect, and want, advice on these issues to be delivered collectively. Based on the information highlighted within this chapter, it is recommended that a detailed information pack is provided to new residents and consideration is given to providing a similar resource to existing local residents. This goes beyond the requirements of Building Regulations and Home Information Packs, but would ensure homes are used appropriately and that wider sustainability opportunities are maximised. This should help to inform people about the benefits and options for living more sustainably.

The CSH contains a detailed category on the provision of information for new homes. It covers all of the issues raised above, recognising and encouraging the provision of guidance to enable residents to both understand and operate their home efficiently, and to make use of local facilities.

<table>
<thead>
<tr>
<th>CSH ID – Man 1</th>
<th>Points</th>
<th>Mandatory</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home User Guide</td>
<td>2.2 to 3.3</td>
<td>no</td>
<td>£0 to £100</td>
</tr>
</tbody>
</table>

Points are given for providing a simple, relevant and non technical user guide on the operation and environmental performance of their home:

<table>
<thead>
<tr>
<th>Criteria:</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Home User Guide compiled using Checklist Man 1 Part 1 together with information that the guide is available in alternative accessible formats.</td>
<td>2.2 (£0)</td>
</tr>
<tr>
<td>Where the guide also covers information relating to the site and its surroundings compiled using Checklist Man 1 Part 2.</td>
<td>1.1 (£100)</td>
</tr>
</tbody>
</table>

The following is taken directly from Category 8 of the CSH Technical Guide, based on the above criteria:

**Part 1 - Operational Issues**
*The list below indicates the type of information that should be included.*

a. **Environmental strategy/design and features**
   - Details of any specific environmental/energy design strategy/features including an overview of the reasons for their use (e.g. environmental and economic savings) and how they should best be operated (where they are not passive features such as insulation). Strategies/features could include passive solar design, super insulation, energy efficient timber windows, heat recovery systems, solar hot water systems, photovoltaics, passive vents or the use of certified timber. *(Each dwelling will in any case be issued with a copy of the Code Certificate)*

b. **Energy**
   - Information as described in the Building Regulations ADL1a (requirement note c) i.e. Sufficient information about the building, the fixed building services and their maintenance requirements so

\textsuperscript{82}Green Barometer III, EST, 2007
that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

- A way of complying would be to provide suitable set of operating and maintenance instructions aimed at achieving economy in the use of fuel and power in a way that householders can understand. The instructions should be directly related to the particular system/s installed in the dwelling.
- The Instructions should explain to the occupier how to operate the system(s) efficiently. These should include: the making of seasonal adjustments to control settings and what routine maintenance is needed to enable operating efficiency to be maintained at a reasonable level through the service live/s of the system/s.
- Details of any renewable system/s and how it/they operate/s.
- Details of low-energy light fittings, their use and their benefits, e.g. how much energy they save compared to traditional light fittings and what this can mean in terms of reduced energy bills.
- General information on energy efficiency

c. Water Use

- Details of water-saving measures and tips
- External water use and efficiency, e.g. the use of water butts or other type of rainwater recycling systems.

d. Recycling and Waste

- Information on the location and use of any recycling bins.
- Information on the location and use of any compost bins.
- Information about the Local Authority collection scheme (if applicable).
- If the home is not covered by a Local Authority collection scheme, details and location of communal recycling bins/skips/facilities.

e. Sustainable DIY

- Environmental recommendations for consideration in any home improvement works, such as the use of low VOC products or the purchase of certified timber.

f. Emergency Information

- Information on smoke detector/s

g. Links, References and Further Information

- Include references/links to other information including websites, publications and organisations providing information on how to run the home efficiently and in the best environmentally sound way. As a minimum, this should include links to:
  - The Energy Saving Trust good practice guidance
  - The Local Authority
  - The company responsible for the construction of the property
  - The company responsible for the management of the home (where applicable)
- In all instances both an address/telephone contact number and a web link will need to be provided.

h. Provision of Information in Alternative Formats

- Include details of the procedure for obtaining a copy of the guide in alternative formats. This should include the contact details of the person/organisation responsible for producing the guide.

**Part 2 - Site and Surroundings**
The list below indicates the type of information that should be included.

a. Recycling and Waste

- Information on what to do with waste not covered by the standard weekly Local Authority collection scheme for example fridges/freezers, computer equipment, batteries and other potentially hazardous equipment. In some areas the Local Authority will collect these items. If this is the case details and information of such a collection should be provided.
• Information and location of local recycling facilities and waste tips.

b. Public Transport
• Details of local public transport facilities including maps and timetables and the location of nearby bus stops and/or train/tube stations.
• Details of cycle storage and cycle paths in the area including, if available, cycle path network maps for the whole town/local area.
• Details of car parking and information on available park and ride, car sharing schemes and/or car pools/car hire in the area.
• Details on how to get to local amenities in the area by public transport or cycling

c. Local amenities
• The location of food shops, post boxes, postal facilities, bank/cash points, pharmacies, schools, medical centres, leisure centres, community centres, places of worship, public houses, children’s play areas, outdoor open access public areas.

AND
• other local amenities such as places of interest/cultural value, areas of beauty/wildlife/conservation, allotments etc.

d. Responsible Purchasing
• Include information about the purchasing of
  - Low energy/low water White goods
  - Electrical equipment, including light fittings and bulbs
  - Timber products from sustainable sources
  - Organic food procurement/food growing/local produce/local food provision, e.g. farmers markets, organic box schemes etc

e. Emergency Information
• Contact details for emergency services including:
  - location of local minor injuries clinics and A&E departments
  - location of nearest police/fire station

f. Links, References and Further Information.
• This should include references/links to other information including websites, publications and organisations providing information on how to reduce the environmental impact in terms of transport, the use of local amenities, responsible purchasing etc. Such links/references may include links to:
  - Sustrans (for cycle networks, www.sustrans.org.uk)
  - the local authority (including information about recycling and waste tips)
  - local transport providers (e.g. bus or train companies)
  - local amenities
• In all instances both an address/telephone contact number and a web link will need to be provided.”

A more proactive approach could also be considered by the Council as this is likely to lead to even better results. For example the Duchy83 is planning to provide annual personal sustainability checklists to residents within the proposed Newquay development. This will be tailored to reflect the sustainability issues relevant to the development itself which is likely to lead to greater interest from those who live within it. It will also be a way for residents to feedback information to the Duchy, which will provide good governance.

83 NGA Sustainability Strategy, Duchy of Cornwall, 2007
The Council should also keep a watching brief on emerging national initiatives such as the recently announced Green Homes Service. In 2008 the EST will start offering:

- a “one-stop-shop” of free and impartial advice on environmental matters, such as energy efficiency, renewable technologies, greener transport, household waste reduction and water conservation. This is due to start in April 2008 and will be delivered through their current advice network (CEP is currently the delivery agent in Cornwall);
- a ‘paid for’ premium service that will offer consumers a more detailed one on one service. Due to be piloted during 2008, it will include:
  - home visits by an assessor, who will audit and identify – through a personalised action plan – where energy can be saved, household waste reduced and water conserved;
  - project manage the installation of household energy saving measures and renewable technologies so that it’s simple and easy to take action;
  - work with the financial sector to ensure green finance packages are available for householders to fund home energy efficiency improvements and renewable technologies.

8.8 Sustainable Communities

A key aim for the urban extension is to create sustainable communities. Several references have been made to this throughout this Strategy for linking environmental, social and economic benefits, but this topic can tend to sit around many of the issues and policies that have been discussed. Fortunately, the requirement from developers to produce sustainability statements, that meet or exceed the contents of the South West Sustainability Checklist, provides a clear way to ensure that this is holistically considered.

As discussed, community involvement and governance are key parts of creating sustainable communities. As the Checklist describes:

“Well-designed developments see community interaction as a high priority in the master planning stages. Creating social spaces and recreational facilities, such as swimming pools and cafes, breaks down barriers so that people come together and form communities. Having a respect and pride for one’s living or working space improves the desire to look after it, which is where sustainable behaviour begins.

But community respect for a development also comes from being involved in decision making, which is why the local people should be involved in every stage of the creation of a development. Developers and local planning authorities will benefit greatly in involving the community who can help them understand the needs, wants and constraints of the work. A development that pleases most will prevent objections arising in the future.”

The use of the Checklist should therefore ensure that the urban extension is vibrant, diverse and inclusive, and integrated to the surrounding communities. It aims to do this through questions and guidance in five areas:

- community involvement;
- sense of belonging and ownership;
- sustainable behaviour;
- public services;
- facilities.
Section 4.2.2 provides a basic overview of the Checklist and further information is also available from [http://www.checklistsouthwest.co.uk/](http://www.checklistsouthwest.co.uk/). The Checklist will also help to ensure a much broader range of sustainability issues are considered that go beyond the individual building focus of the CSH. Guidance for developers on the requirements of this Checklist is included within the developer guide (appendix five).

### 8.9 Links to Other Studies

This assessment of sustainability opportunities has not considered the wider sustainability issues that are covered in the other strategies Carrick has commissioned or is preparing. However, there are some clear synergies that will increase the opportunities for the Council for creating a new AAP that addresses the need for sustainable communities and climate change.

#### Green Infrastructure Plan

We support the intention of developing a Green Infrastructure Plan (GIP). This is seen as a key component of sustainable communities in terms of providing easy and good access to green space within and around the development. It also potentially has a wider role, such as:

- helping communities adapt to climate change, as green space will play an important role in future proofing the development by giving people access to the outdoors in times of increased temperatures. It will help to reduce the heat island effect making the surrounding area cooler. It will also assist in the reduction of surface run off, reducing the risk of flooding below the development areas, and as such will link to the SUDs strategy;
- linking to wider land management issues such as providing space for people to grow their own food, create market gardens or community farms;
- supporting Quality of Life issues as green space in and around the development areas will make it a better place to live, particularly if care is taken to ensure good access.

We would recommend that Carrick finalise the GIP as soon as possible to ensure that it becomes an integral part of the master plan, rather than a ‘bolt on’.

#### Landscape Strategy

We support the recommendations and vision set out in the draft Landscape Strategy linking the key pillars of sustainable development in regard to its economic, social and environmental role for local communities.

We consider the landscape around the urban extension to have an important role in terms of:

- helping communities adapt to climate change;
- supporting the need for, and access to, the landscape and the provision of green space;
- accommodating and protecting biodiversity;
- protecting cultural assets and reinforcing peoples sense of place;
- increasing connectivity by allowing good and easy access for local communities, including opportunities to walk and cycle.
The one area of the Energy & Sustainability Strategy that may conflict with the Landscape Strategy is the use of large scale wind power, as this could have a significant visual impact on the landscape. However, this would need to be assessed as part of the planning process for wind and any conflicts should be considered then.

**SUDs & Biodiversity Strategy**
In climate change terms alone it is vital that the SUDs Strategy is implemented within the development area as it will reduce flood risk in the areas below the urban extension. Depending on the SUDs strategies used, it could also help to provide green space that will help with cooling within the urban extension.

In terms of wider sustainability issues, biodiversity has not really been discussed in this report, but it is a key element of sustainable development and we would support any recommendations that protect and enhance the existing biodiversity within the urban extension area.

The CSH includes several categories that will support the aims of the SUDs and Biodiversity Strategy. We would recommend that these are cross-referenced in the final strategy that CCC produce, as the need for developers to work to the Code will help support this work.

**Contributions Strategy**
A copy of the contributions strategy was not seen before this report was produced. The targets required in the urban extension, as set out in the draft RSS, are likely to have an impact on the contributions strategy as the build cost of homes will increase, as a result of the CSH. Chapter nine of this report considers the potential range of these additional costs and opportunities to reduce them. We have not suggested that contributions should be sought for most of the issues discussed within this Strategy, although this chapter has raised some possible contributions questions, which are summarised in the recommendations below.

**Master Plan**
Part of the purpose of the Energy and Sustainability Strategy is to help inform the new master plan for Truro and Threemilestone. Where appropriate, we have therefore included direct recommendations throughout this report for key issues that we believe the master plan should include.

We support the approach taken by the NEW Masterplanning for using sustainability assessment criteria and the creation of sustainable communities. However, Carrick may want to consider making a stronger case within the master plan to ensure sustainable communities and climate change are key upfront issues that the development needs to address and that these themes run right through the document. This could be within the vision and concept statements for the master plan. Also it may be worth linking discussion on sustainable communities back to the key components of what defines these in regard to the RSS and the Government’s Securing the Future, rather than just Carrick’s previous assessment criteria.
8.10 Conclusions and Recommendations

This chapter considers in more detail a wide range of sustainability issues. It is by no means definitive, but was additional to our brief and we believe it does cover many of the key considerations for making the urban extension as sustainable as possible. There are some clear links to issues highlighted in reference to the requirements of the CSH and it also therefore makes a logical inclusion in terms of the targets described within this Strategy.

Some of the findings will require the Council to work with other regional and local agencies and organisations to take forward some issues, such as food, waste and transport, particularly where these go beyond the individual building approach of the CSH. Many of these wider opportunities for creating sustainable communities are, however, covered by the South West Sustainability Checklist. Some of the issues raised also link to other strategies that will support the LDF.

This makes the recommendations below slightly bewildering, particularly in terms of how they relate to other strategies. We have therefore summarised the strategy links in the table below.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Water</th>
<th>Food</th>
<th>Transport</th>
<th>Waste</th>
<th>Sustainable Construction</th>
<th>Quality of Life</th>
<th>Informing End Users</th>
<th>Sustainable Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Council</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Master Plan</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landscape</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUDs</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GIP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contributions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 38: Sustainability and strategy links

Recommendations for the Council:

General
- Carrick should consider how the points highlighted in section 8.9 are linked to the other strategies and in terms of presenting a coherent overview in the revised AAP.
- The Council should promote a sourcing hierarchy to developers based on Cornwall, the South West, the UK and finally Europe.

Water
- Carrick should ensure the SUDs strategy links to the CSH requirements that relate to surface water run off, flood risk and the targets set out in the RSS in terms of Policy G.

Food
- Space should be allocated to enable local residents to grow their own food. In lower density areas this could be through the inclusion of gardens, although land pressure may make it more practical to provide new allotment space.
- Carrick may need to carry out a further study in the amount of land needed for allotments as no assessment has been possible within this study.
• The Council should consider the provision of allotment space as part of the Contributions Strategy, possibly linking to the Green Infrastructure requirements.
• The master plan should make reference to the need for local food shops within the new urban centres. If the scale of this requirement is not known, Carrick may need to undertake further research to ascertain an appropriate number and size and link this requirement to the Contributions Strategy.
• The Council should consider developing a food strategy.
• Food production should take priority over growing energy crops in close vicinity to the urban extension.

Transport
• The Council should continue to work closely with CCC and local service providers to ensure an integrated transport policy for the urban extension develops.
• Place making should be a fundamental requirement for developers.
• The Council should work to ensure that new bus routes serve the urban extension and that these are in close proximity to dwellings.
• The Council should work up the feasibility of creating one or more car clubs within the urban extension, possibly through a contribution from developers.

Informing End Users
• The Council should work with developers to ensure that a comprehensive Home User Guide is provided to all new residents that not only includes information on the operation of buildings, but also covers the wider issues relating to the site and its surroundings. This should be based on the CSH and the additional information provided within this chapter in relation to local food issues, transport, waste and recycling. The wider information could also be provided to existing communities.
• The Council could seek a contribution towards the production of the wider information resources as these will be a direct cost to developers if they undertake this work themselves. Strategically it may be more appropriate for Carrick to develop this resource.
• The Council could consider the feasibility of taking a more proactive approach in regard to an ongoing engagement with local communities on sustainability issues.
• The Council should assess what role the Green Homes Service could play, once this is established.

Summary of Master Plan Recommendations
Many of the recommendations relate to the master plan on a site-wide basis, rather than individual areas. The following is recommended:
• the master plan should consider the allocation of potential land for allotment space – close to existing or new communities;
• the master plan should make reference to the need for local food shops within the new urban centres;
• place making should be a fundamental requirement for developers and this should be made clearer in the master plan;
• the key issues of sustainable communities and climate change should be included within the vision and context of the master plan and should run throughout the whole document.
Links to Contributions Strategy:
The Council could increase the sustainability of the urban extension by considering contributions towards:

- allotment space;
- more detailed Home Information Packs;
- creating a car club.
9. Financial Considerations

The targets in the draft RSS, as set out in chapter 5 of this report, in reference to both sustainable construction and renewable energy, will result in higher build costs for developers and this will need to be absorbed somewhere within the development process. Ultimately some of this cost could be passed on to the buyers of new homes which is not the most desirable solution, particularly in an area where house prices are already beyond the means of even dual income households. This will also not be an option for affordable housing. In the long term, reduction in land values may help to offset some of these costs but, in the shorter term, developers are likely to argue that the targets will cause undue burden and they will seek a lower level of contributions which the Council will need to consider in relation to the wider aspirations for infrastructure within the development.

Developers are likely to be concerned about both the installed capital costs for different technologies and any potential land take requirements for some technologies (including SUDs). To help inform this debate a summary of the potential additional build costs has been considered within this chapter, together with some of the mechanisms that could help to reduce them. It should be noted that this chapter of the Strategy only contains an overview of costs in relation to domestic buildings, although most of the cost savings will apply equally to all new build.

9.1 Potential Additional Cost

The most comprehensive study into the potential additional build costs associated with building to different levels of the CSH (so far) was produced by Cyril Sweett on behalf of English Partnerships and the Housing Corporation. This report is hereafter referred to as the Sweett Study. A number of further studies are beginning to emerge in reference to the energy and carbon targets that the Code requires, but they tend to be very site specific, so figures from the Sweett Study and the modelling done for the RSS have been used to indicate a range of estimated costs. In addition, the costs provided are not definitive and should be used cautiously. The actual costs will depend on a range of site conditions and the decisions developers take to meet the required targets. We understand the Sweett Study may currently be under review, so revised costs may be available in the future.

9.1.1 Carbon Reduction Targets

The likely cost to developers of achieving the required reduction in carbon emissions will depend on the approach they take to improve thermal efficiency and the choice of renewable technologies to use. The reports referenced below make different assumptions for how this could be achieved at levels 4, 5 and 6 of the CSH in order to estimate the possible cost. They both assume that energy efficiency is initially used, before renewables technologies are applied.

---

The Sweett Study
A selection of choices was made in the terms of the possible technologies used to reach different levels of the CSH. These will not necessarily be the most suitable or cost effective for the urban extension, but are provided to show possible costs (based on 2006 prices). These were modelled against a different range of housing types, three of which are likely to be of local relevance. The Introduction of the Sweett Study describes the caveats and approach taken within their report.

To reach TER target for level 4 of the CSH, the following options were considered:
- option 1 - energy efficiency measures, solar hot water heating and PV;
- option 2 - energy efficiency plus micro wind;
- option 3 – CHP.

<table>
<thead>
<tr>
<th>House Type</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached house</td>
<td>£13,525</td>
<td>£4,484</td>
<td>£2,622</td>
</tr>
<tr>
<td>End terrace house</td>
<td>£12,947</td>
<td>£4,260</td>
<td>£2,296</td>
</tr>
<tr>
<td>Low rise apartment</td>
<td>£7,590</td>
<td>£4,511</td>
<td>£1,349</td>
</tr>
</tbody>
</table>

To reach the TER target for level 5 of the CSH, the following combinations were considered:
- option 1 - energy efficiency measures, PV and biomass heating;
- option 2 - energy efficiency measures, micro wind and biomass heating;
- option 3 - discounted as gas CHP alone would not enable level 5 to be reached.

<table>
<thead>
<tr>
<th>House Type</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detached house</td>
<td>£20,270</td>
<td>£14,943</td>
</tr>
<tr>
<td>End terrace house</td>
<td>£19,962</td>
<td>£14,365</td>
</tr>
<tr>
<td>Low rise apartment</td>
<td>£29,951</td>
<td>£21,742</td>
</tr>
</tbody>
</table>

RSS Technical Report
The study used to model the technical and financial viability of the targets within the draft RSS also provides an overview of possible costs for a range of technology options for meeting the carbon reduction targets at levels 5 and 6 of the CSH. It takes a whole site approach to working out costs, rather than a housing type estimate.

A number of caveats were placed on the methodology used in this study. These can be found on page five of the final technical report. They therefore only provide a rough estimate of costs based on the assumptions used within the model.

Scenario 1: 300 dwellings market town model with GIFA of 26,581 m² and based on an average build cost of £903 per m². In order to give a comparison with the Sweett Study, we have provided an average cost per dwelling. This is based on the assumption that the total cost for the development would be in the region of £24 million, with an average cost per dwelling therefore of around £80,000; this clearly only provides a rough comparison.

## Table 39: Possible cost to reach CSH Level 4 & 5 for market town scale

<table>
<thead>
<tr>
<th>Technology Options</th>
<th>% increase in build costs</th>
<th>Level of constraints and/or technology risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSH Level 5 (100% regulated emissions)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass CHP (194 kWe)</td>
<td>4.7% (£2,400)</td>
<td>high</td>
</tr>
<tr>
<td>• Biomass communal heating (559 kWth); and</td>
<td>5% (£4,000)</td>
<td>high</td>
</tr>
<tr>
<td>• Small wind (261 kWe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass communal heating (559 kWth); and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• PV (451 kWe)</td>
<td>12% (£9,600)</td>
<td>moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology Options</th>
<th>% increase in build costs</th>
<th>Level of constraints and/or technology risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSH Level 6 (100% total emissions)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass CHP (280 kWe); and</td>
<td>8% (£6,400)</td>
<td>high</td>
</tr>
<tr>
<td>• Small wind (253 kWe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass CHP (280 kWe); and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• PV (436 kWe)</td>
<td>15% (£12,000)</td>
<td>high</td>
</tr>
</tbody>
</table>

Table 39: Possible cost to reach CSH Level 4 & 5 for market town scale

**Scenario 2:** Mixed use urban extension model including 2,000 dwellings with GIFA of 177,204 m² and based on an average build cost of £903 per m². As above, a rough comparison for the cost per dwelling is around £80,000.

## Table 40: Possible cost to reach CSH Level 4 & 5 for mixed urban extension

<table>
<thead>
<tr>
<th>Technology Options</th>
<th>% increase in build costs</th>
<th>Level of constraints and/or technology risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSH Level 5 (100% regulated emissions)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass communal heating (3730 kWth); and</td>
<td>3% (£2,400)</td>
<td>high</td>
</tr>
<tr>
<td>• Large wind (1307 kWe)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass CHP (1236 kWe) – residential heat load only</td>
<td>4% (£3,200)</td>
<td>moderate</td>
</tr>
<tr>
<td>• Biomass communal heating (3730 kWth); and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• PV</td>
<td>12% (£9,600)</td>
<td>moderate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Technology Options</th>
<th>% increase in build costs</th>
<th>Level of constraints and/or technology risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSH Level 6 (100% total emissions)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Biomass CHP (2474 kWe) – residential heat load only</td>
<td>7% (£5,600)</td>
<td>moderate</td>
</tr>
<tr>
<td>• Biomass communal heating (3730 kWth); and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Large wind (2000 kWe); and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• PV (4315 kWe)</td>
<td>17% (£13,600)</td>
<td>high</td>
</tr>
</tbody>
</table>

Notes on both tables (39 & 40):
- the costs include building to EST Best Practice Standard that will deliver energy efficiency savings in the region of 9% compared to SAP 2006 Part L;
- savings are relative to SAP ratings for regulated emissions not TER or DER;
- cost and capacity figures are not NET of 10% on-site generation;
- the constraints include for wind power the relatively high level of risk associated with this technology (in terms of planning);
- the constraints include for Biomass CHP at a medium scale a high risk as this scale is not currently available.

Table 40: Possible cost to reach CSH Level 4 & 5 for mixed urban extension

Based on the modelling used in these studies it can be seen that costs differ quite dramatically for the type, or scale, of building and the technology options that are selected. They also vary because of the assumptions that are taken within the models. As such, although these figures provide some indication on the additional cost associated with reaching the required emission targets, it is clear that they cannot be relied on in regard to estimating costs within the urban extension.

It can be seen that the higher costs are within the Sweett Study and this is because they are predominantly based on the use of a combination of building-integrated renewables. Whereas, the RSS work considers some large scale options that will
meet the needs of lots of buildings. This is a clear indication of the potential benefits of taking a larger scale approach first, as it will be more cost effective for developers.

The basic modelling carried out in chapter seven suggests that the most cost effective mechanism for reaching level 6 of the Code, would be to ensure all homes are built to the EST Best Practice Standard and then apply large scale wind. Based on the average emissions from the three housing types in table 37, a 1MW turbine could offset the emissions of approximately 557 homes. With an estimated cost of £1.2 million this would equate to £2,150 per dwelling. The cost of building to EST’s Best Practice Standard is estimated at £2,885. This would result in an additional build cost of around £5,000 per dwelling to achieve a zero carbon standard.

There would be a wide range of scenarios between this and lower levels of the Code, including using wind alongside other building-integrated technologies, such as GHSPs.

The only way to more accurately estimate costs locally would be to carry out a detailed modelling exercise based on what is actually planned to be built. These will need to be modelled through SAP to provide the TER for each build type, from which the most appropriate energy efficiency and generation options can be selected. However, a feasibility study into CHP and an ESCo would require this sort of detail anyway, so this should be carried out as part of these studies.

### 9.1.2 Other CSH Categories

In addition to meeting the required targets for carbon emissions and the use of renewable energy, the RSS also makes building to the CSH level 3 mandatory. This will require developers to gain additional ‘points’ against a range of other sustainable design categories to reach the required number of points at this level of the Code. As highlighted in section 5.3.2, some categories are mandatory to gain a Code rating. Others are flexible, allowing developers to decide on the most appropriate and cost effective way to gain the required total number of points. These are summarised again in the following table from chapter five.

<table>
<thead>
<tr>
<th>Code Level</th>
<th>Energy Points</th>
<th>Water Points</th>
<th>Standard (l/p/d)</th>
<th>Other Points Required</th>
<th>Total Points Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(★)</td>
<td>10</td>
<td>1.2</td>
<td>120</td>
<td>1.5</td>
<td>33.3</td>
</tr>
<tr>
<td>2(★★)</td>
<td>18</td>
<td>3.5</td>
<td>120</td>
<td>1.5</td>
<td>43.0</td>
</tr>
<tr>
<td>3(★★★)</td>
<td>25</td>
<td>5.8</td>
<td>105</td>
<td>4.5</td>
<td>46.7</td>
</tr>
<tr>
<td>4(★★★★)</td>
<td>44</td>
<td>9.4</td>
<td>105</td>
<td>4.5</td>
<td>54.1</td>
</tr>
<tr>
<td>5(★★★★★)</td>
<td>100</td>
<td>16.4</td>
<td>80</td>
<td>7.5</td>
<td>60.1</td>
</tr>
<tr>
<td>6(★★★★★★)</td>
<td>zero carbon home</td>
<td>17.6</td>
<td>80</td>
<td>7.5</td>
<td>64.9</td>
</tr>
</tbody>
</table>

Table 41: Summary of code levels
Source: Adapted from Code for Sustainable Homes, DCLG, 2006

---

A summary of costs and points for those areas of the Code that do not relate to carbon reduction are included table 42 below. The cost and points for the ecology category of the CSH are excluded as these vary with location.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ene 3 - Internal Lighting</td>
<td>£10 to £40</td>
<td>£10 to £30</td>
<td>no</td>
</tr>
<tr>
<td>Ene 4 - Drying Space</td>
<td>£20</td>
<td>£20</td>
<td>no</td>
</tr>
<tr>
<td>Ene 5 - Energy Labelled White Goods</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td></td>
<td>£540 (if appliances fitted)</td>
<td>no</td>
<td>1.2</td>
</tr>
<tr>
<td>Ene 6 - External Lighting</td>
<td>£0 to £15</td>
<td>£0 to £15</td>
<td>no</td>
</tr>
<tr>
<td>Ene 8 - Cycle Storage</td>
<td>£500 to £1,000</td>
<td>£150 to £500</td>
<td>no</td>
</tr>
<tr>
<td>Ene 9 - Home Office</td>
<td>£210</td>
<td>£210</td>
<td>no</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wat 1 - Internal Potable Water Use</td>
<td>£125</td>
<td>£125</td>
<td>yes (3 &amp; 4)</td>
</tr>
<tr>
<td></td>
<td>£2,520</td>
<td>£805</td>
<td>yes (5 &amp; 6)</td>
</tr>
<tr>
<td>Wat 2 - External Water Use</td>
<td>£200</td>
<td>£30</td>
<td>no</td>
</tr>
<tr>
<td><strong>Surface Water Runoff</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sur 1 - Reduction of Surface Water Run-off from the site</td>
<td>£0 to £225</td>
<td>£0 to £225</td>
<td>yes (1 and above)</td>
</tr>
<tr>
<td>Sur 2 - Flood Risk</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td><strong>Waste</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was 1 - Household Waste Storage and Recycling Facilities</td>
<td>£160</td>
<td>£160</td>
<td>yes (1 and above)</td>
</tr>
<tr>
<td>Was 2 - Construction Site Waste Management</td>
<td>£0</td>
<td>£0</td>
<td>yes (1 and above)</td>
</tr>
<tr>
<td>Was 3 - Composting</td>
<td>£70</td>
<td>£70</td>
<td>no</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Man 1 - Home User Guide</td>
<td>£0 to £100</td>
<td>£0 to £100</td>
<td>no</td>
</tr>
<tr>
<td>Man 2 - CC Scheme</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td>Man 3 - Construction Site impacts</td>
<td>Up to £100</td>
<td>Up to £100</td>
<td>no</td>
</tr>
<tr>
<td>Man 4 - Security</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mat 1 - Environmental Impact of Materials</td>
<td>Up to £420</td>
<td>Up to £140</td>
<td>yes (1 and above)</td>
</tr>
<tr>
<td>Mat 2 - Responsible Sourcing of Materials – Basic Building Elements</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td>Mat 3 - Responsible Sourcing of Materials – Finishing Elements</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td><strong>Pollution</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pol 1 - (GWP) of Insulants</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td>Pol 2 - NOx Emissions</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td><strong>Health &amp; Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hea 1 - Daylighting</td>
<td>Up to £290</td>
<td>Up to £290</td>
<td>no</td>
</tr>
<tr>
<td>Hea 2 - Sound Insulation</td>
<td>Up to £120</td>
<td>Up to £120</td>
<td>no</td>
</tr>
<tr>
<td>Hea 3 - Private Space</td>
<td>£0</td>
<td>£0</td>
<td>no</td>
</tr>
<tr>
<td>Hea 4 - Lifetime Homes</td>
<td>£550</td>
<td>£75</td>
<td>no</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td>£1,845 to £6580</td>
<td>£850 to £3,230</td>
<td>33.9 to 63.1</td>
</tr>
</tbody>
</table>

Notes:
1 – these are the estimated costs from the Sweett Study based on 2006 prices. House costs are based on their definition for a traditional house, flat costs are based upon a high rise apartment
2 - indicates flexibly of different categories of the CSH

Table 42: Code categories and cost summary
Source: Adapted from Sweett Study table 5.1
Developers will then need to meet the minimum design requirements for those areas of the Code that are mandatory in order to reach a level 3 rating. These categories and the estimated costs are shown below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Estimated Cost</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>£125</td>
<td>£125</td>
</tr>
<tr>
<td>Flat</td>
<td>£125</td>
<td>£125</td>
</tr>
<tr>
<td>Sur 1 - Surface water run-off</td>
<td>£0 to £225</td>
<td>£0 to £225</td>
</tr>
<tr>
<td>Wat 1 - Internal potable water</td>
<td>£160</td>
<td>£160</td>
</tr>
<tr>
<td>Was 1 - Household waste storage and recycling</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>Was 2 - Construction waste management</td>
<td>£0</td>
<td>£0</td>
</tr>
<tr>
<td>Mat 1 - Environmental impact of materials</td>
<td>£0 to £420</td>
<td>£0 to £140</td>
</tr>
<tr>
<td>TOTALS</td>
<td>£285 to £930</td>
<td>£285 to £650</td>
</tr>
</tbody>
</table>

Table 43: Mandatory code points and estimated costs

It can be seen from the above table, that to meet the minimum design requirements of the Code there will be a cost of at least £285 to gain 10.4 points. To gain the maximum number of points (15.4) the cost range increases to £650 - £930, depending on the housing type.

9.1.3 Cost Summary

In order to reach level three of the Code a total of 57 points need to be gained across the design categories. The improving energy targets of the RSS will make a significant contribution towards these, reducing the number of points that need to be achieved from the other design categories of the Code. The contribution and timescale from the energy targets can be summarised as:

<table>
<thead>
<tr>
<th>Time scale</th>
<th>CSH Level</th>
<th>Points Contribution</th>
<th>Remaining Points Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 – 2010</td>
<td>4</td>
<td>11.8</td>
<td>45.2</td>
</tr>
<tr>
<td>2011 – 2015</td>
<td>5</td>
<td>18.8</td>
<td>38.2</td>
</tr>
<tr>
<td>2016 onwards</td>
<td>6</td>
<td>22.4</td>
<td>34.6</td>
</tr>
</tbody>
</table>

Notes:
1 – This contribution includes the points for reducing emission levels and the additional points from the use of renewable energy
2 – as note one, but also including the points for reducing the HLP, a requirement at level 6.

Table 44: Summary of points from energy targets

To assess the possible cost of reaching the required 57 points for a level 3 rating, we have assumed that the maximum number of points will be sought for each of the mandatory design categories (table 43 above). This can now be linked back to the energy targets, to estimate the possible costs of securing the remaining points needed to reach level 3.

<table>
<thead>
<tr>
<th>Energy Requirements</th>
<th>Other Mandatory Requirements for level 3</th>
<th>Other Cost and Point Estimates</th>
<th>Total Points Achieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSH</td>
<td>Cost Range</td>
<td>Points</td>
<td>Cost</td>
</tr>
<tr>
<td>Level 4</td>
<td>£1,350 -£13,525</td>
<td>11.8</td>
<td>£930</td>
</tr>
<tr>
<td>Level 5</td>
<td>£2,400 - £29,950</td>
<td>18.8</td>
<td>£930</td>
</tr>
<tr>
<td>Level 6</td>
<td>£5,600 - £13,600</td>
<td>22.4</td>
<td>£930</td>
</tr>
</tbody>
</table>

Table 45: Estimated cost for meeting energy and sustainability targets
In the above analysis we have selected the most cost effective options that developers could take to gain the points, based on table 42 (many cost nothing). The actual cost of making up the remaining points will depend on the choices developers make across the design categories. We have included the costs of meeting Lifetime Homes in all the figures, as both Carrick and Policy G of the RSS make reference to this. The costs are based on the price of incorporating measures within a house, so they could be lower for flats. It is meant as an approximate guide only and does not necessarily reflect the choices developers will make (or should make in terms of the most sustainable options).

It is also possible that other planning requirements from the Council for SUDs and biodiversity will enable developers to gain other points under the Code. Depending on what becomes a mandatory part of the planning process, this could change the cost assumptions above.

Using all of the above data it is possible to provide a top-line estimate of the potential extra build cost that will result for implementing the targets of the RSS. Based on table 45 the range of costs, linked to each energy standard level, are in the range of:

- level 4 - £3,400 to £15,550;
- level 5 - £4,000 to £31,500;
- level 6 - £7,200 to £15,200.

It can be seen that the range estimates vary significantly and this is because of the different assumptions taken in terms of meeting the carbon emission reductions. It is also clear that the cost the meeting of the other design categories are insignificant in comparison to energy.

In terms of the Council’s zero carbon aspiration, it could be possible to reach level 6 now with large scale wind. Based on the simple modelling carried out in chapter seven of this report a 1MW turbine could offset all the emissions from electrically heated, energy efficient homes for around £5,000 per dwelling. Adding in the cost of the wider sustainability requirements of CSH level 3 (£1,600), this would suggest a total cost of around £6,600 to make the urban extension carbon zero. This estimate does not take account of the money that would be saved from not using gas which would reduce the cost further as the house would not need a conventional boiler or connection to the gas main (this is likely to be in excess of £1,500). However, this could require up to ten 1MW turbines and the appropriateness of this would need to be assessed by the Council in consultation with the local community. Using larger rated turbines could reduce the total number needed, but they would have a higher hub height and bigger visual impact.

There would also be a range of options that could be used alongside wind power. For example space and water heating could be provided with other technologies such as GSHPs, or biomass heating. This would change the cost assumptions, but could reduce the total number of turbines.

**9.2 Undue Burden**

The technical and policy papers used to support the energy targets within the RSS clearly state that for large scale developments the requirements of building to levels
4, 5 and 6 of CSH will not cause undue burden. The costs of meeting the other categories of the Code, as shown in the table 43, have not, as far as we are aware, been modelled in terms of burden, but appear to be insignificant in comparison to the energy costs.

Even if the requirements of the RSS do not cause undue burden, it is clear that the targets will result in additional build costs and this could have an impact on wider contributions and house prices. The next section therefore considers a number of possible mechanisms to reduce the cost.

9.3 Cost Reduction Opportunities

9.3.1 Bulk Discount
As indicated in chapter seven of this Strategy, it is likely that developers will be able to secure a reduction in price for a range of building-integrated renewable options. These are likely to be at least 10% but could be significantly higher than this for larger purchases. The Sweett Study suggests that for purchases of over 5,000 units savings of between 20% and 30% could be possible. In the case of larger development companies working in the urban extension, they may have the logistical capacity to order at this quantity, for smaller developers 10% is likely to be the level of discount available.

Bulk discount opportunities will also be possible for a range of other building materials that will be required to meet the Code, e.g. grey water harvesting systems.

9.3.2 Learning Curves
The capital cost of many technologies is expected to fall over time as production rates increase. The RSS technical study suggests that ‘learning rates’ are an established phenomena that show how costs fall with each doubling of production volumes for a particular technology. It is based on the recognition that young technologies have a steep learning rate, meaning they go through several doublings of production as they come to market and as such costs fall. The recent RAB study provides an example for PV that has shown a historical learning rate of 18%, i.e. every doubling of capacity/production is accompanied by an 18% reduction in capital cost. It can therefore be assumed that, based on the rate of new build in the UK and the increased level of demand for renewable technologies to meet the requirements of the CSH, there will be significant reductions in capital cost in the near future.

9.3.3 New Technologies
The Sweett Study provides a good overview of the potential range of new technologies, as well as improvements to existing technologies. These advances may result in new and cost effective ways to meet the CSH targets. The following summary is taken directly from chapter nine of the Sweett Study:

- vertical axis wind turbines for use in urban areas where wind speed is lower, more turbulent and the direction is less predictable. These may also help to reduce noise and vibration issues;

87 The Role of Onsite Energy Generation in Delivering Zero Carbon Homes, RAB, 2007
• phase changing materials that can simulate thermal mass in lightweight buildings by storing energy as latent heat;
• using solar energy to power cooling systems;
• dual purpose solar systems such as louvers that provide shading and generate energy;
• fuel cell boilers and other micro-CHP units that provide heat and power for an individual home;
• groundwater thermal storage that use aquifers to provide both space heating and cooling;
• LED lighting that is very energy efficient;
• vacuum waste collection systems in housing complexes that provides a quick and easy way to collect waste (these are already in use in Sweden);
• thin film PV development that is cheaper to produce with higher levels of efficiency (The Nanosolar company has already started production of thin film in the USA and is due to open a second factory in Europe soon. It is suggested that costs will reduce by half for this form of PV and efficiencies of around 20% may be achievable);
• intelligent control systems for appliances to reduce their energy use.

9.3.4 New Building Techniques
The Sweett Study discusses how new methods of construction such as closed timber frame, Structural Insulated Panel (SIP) or light steel frame may become more common as the CSH is implemented. Such approaches can achieve:
• a better thermal performance than traditional build;
• higher standards of air tightness;
• reduced construction time on-site;
• reduced number of skilled workers on-site;
• reduced levels, and better management, of waste in the construction process.

It seems likely that although some of these approaches cost more than traditional build, the increased speed of building and the ease of which higher levels of energy efficiency can be achieved will lead to an overall cost reduction. This may take time to be realised as the industry gains experience from their increased use.

It is also possible that some of these materials will have a lower embodied energy than traditional build, which would bring additional benefits in regard to carbon savings.

9.3.5 Site-wide Approaches
It is clear within the Sweett Study that some of the costs involved in building to the CSH can be reduced by taking a site-wide approach. This would require developers to work together more closely on some of the categories within the Code, which the Council could help to encourage. Whilst this has traditionally been a problematic issue, the economic benefits of developers working together are likely to help them to reduce costs and they should be made aware of this. A good example of this is provided in the Sweett Study for grey water and rainwater collection systems, the cost of which can be reduced by 50% if a shared infrastructure is used. It is also
likely to be much more cost effective in reference to the economic and technical viability of large scale energy generation linked to wind or CHP.

9.3.6 Good Building Practice
It can be seen from table 42 that many of the design categories of the CSH do not incur an additional build cost. This relates in part to better building practice and choice of materials and the design of buildings. Some areas will require research into the supply chain for materials, but a developer is likely to want to do this to secure the most number of points at the least cost.

The use of some of the elements of the energy standards highlighted in section 5.3.2 of this Strategy are also based on improved design and construction techniques that deliver energy savings with minimal additional build cost.

9.3.7 Land Values
It is anticipated that the increased cost associated with building to high levels of the Code will ultimately result in a reduction in land values. This would reduce the cost for developers (that do not have land banks) and would not require additional costs to be passed on to buyers of buildings. However, this may not happen in the short term and it is possible that a significant reduction in land value could affect the supply of land, making it difficult to meet the required build targets. It could therefore take some time to understand how the market may change.

An overview of the potential for reducing land value was provided in the RSS technical study. It suggests that land values could absorb around 10-15% of the extra build cost in the region, but in Cornwall this figure is more likely to be around 5% as land value is relatively low in the County. Even with a reduction, the actual opportunity to absorb costs in this way will still depend on a range of site specific issues such as other contribution requirements, the level of affordable housing and costs to clean up contaminated sites, etc.

9.3.8 Alternative Procurement Models
As well as using a bulk discount approach to reduce the cost of technologies, developers could consider a range of alternative approaches to reduce cost.

One new approach could be procurement via an energy utility company. Developers could hold early discussions with large licensed energy utility companies or ESCOs to see if they would be willing to finance building-integrated renewables. This may be viable, if a long term contract with the new occupiers of buildings is established, which the developer could facilitate. This approach has become possible as the ‘28 day rule’ in the deregulated UK supply market was removed in 2007, meaning suppliers could form long term contracts with customers. This could be an attractive proposition for covering costs in domestic buildings.

A similar approach that could be used for larger buildings or communal blocks is a contract with a local utility or energy company. They could cover the capital costs of installing, managing and maintaining the energy generation equipment. The cost of

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88 Section 5 - Supporting and Delivering Zero Carbon Development – Final Technical Report, Faber Maunsell and Peter Capener, 2007
doing this would be recouped by the organisation through the sale of heat and/or power to the occupiers of the building. A developer would need to identify organisations locally to check the feasibility of this approach. In communal or social housing blocks, this could be a Registered Social Landlord.

For large scale wind projects, a developer could directly contract a wind development company to supply sufficient energy to meet their requirements under the CSH. In this example the housing developer would pay the wind developer to build and maintain the wind turbines, with the energy generated being used within the development area to meet the required carbon reduction targets. It is not yet clear what sort of model will be required to make this approach viable, but it would probably operate like a mini ESCo. The wind developer would have all of their costs, for building and maintaining the turbine, covered by housing developers and in return they would meet the required emission targets. However, there could be considerable risk for securing planning and the developer would need to be sure that the wind turbines would go ahead before the housing is built, otherwise they may find themselves unable to meet the required carbon reduction targets. Carrick could assist in this process by considering potential suitable locations for any use of wind power.

Energy Service Companies
If whole or part site energy options prove viable, an energy service company could be established. A basic overview of how these operate is provided within section 7.5 of this Strategy and includes both ESCo and MUSCo approaches.

In reference to finance, an ESCo could provide a more cost effective way to reduce carbon emissions and a more complete approach in terms of delivering and managing larger scale energy generation for the development. Depending on the model adopted, it could also bring wider benefits to existing and new communities. However, they are complex to set up and a more detailed study should consider the advantages and disadvantages of an ESCo approach.

It is likely that an ESCo will be needed if CHP with a district energy network proves to be viable, as an organisation will be needed to operate, maintain and bill customers for the heat and power provided. In the event of CHP going ahead the ESCo could also take on a wider role for other larger scale renewables in the area such as wind power and possibly biomass heating in larger buildings. An ESCo could also support some of the options highlighted above in relation to the alternative procurement models for building-integrated energy generation.

In terms of finance, the advantage of creating an ESCo is that the financial risk and the capital costs for energy generation would not be on the housing developer. Although, in reality a contribution would be sought to help finance some of the set up or infrastructure costs of an ESCo, this would be in return for them receiving the required carbon reductions necessary to meet their targets. This money would make the viability of an energy service company more attractive and in reality will be cheaper than a developer taking a building-integrated approach for renewable energy generation. As such it would be a more cost effective route for them to reach the required targets. It would also allow a more coordinated approach to be taken across the urban extension, resulting in better design and higher carbon savings.
If established, an ESCo would pay for the capital costs of setting up a CHP or other large scale energy generation schemes and would also cover the ongoing running and maintenance costs associated with them. Income would then be generated by the ESCo from the direct sale of heat and power, allowing the company to recoup its investment and derive a long term income.

As the upfront capital costs of implementing large scale energy infrastructure projects can be substantial, an ESCo approach could be attractive for developers and the Council. The majority of this funding is usually obtained through project finance in the form of a bank loan, which is typically paid off over 7-10 years. The remainder of the finance can come from equity contribution from shareholders, who expect to make a return on capital invested. In order to secure a bank loan the ESCo must be able to demonstrate that the proposed projects will be financially secure over the life of the loan. There must be a stable business plan and demonstration that the ESCo can ensure an ongoing positive cash flow. Up front developer contributions would help to reduce the financial set up costs.

The Council will have a vital role to play in creating a local ESCo for the area in terms of planning and facilitating a more detailed study into its viability. For master planning it will be important to ensure that the development profile, and layout, favours the core technologies. For CHP and decentralised energy networks this means clustering mixed developments with apartment/flat type dwellings in close proximity to get an even energy demand profile – most likely north of the A390. For large scale wind, possible locations and an indication that this may be acceptable should be included within the master plan. This would of course be subject to detailed feasibility, planning and consultation requirements being met before any wind project comes forward.

Creating an ESCo
A variety of different approaches exist for creating an ESCo and the most appropriate model would need to be investigated, based on the potential large scale generation options that come forward. This could include for example:

- Creating a new local ESCo to meet the needs of the development. This would be the most complex, highest risk and time-consuming path, but would give most control over how the ESCo reinvests its profits. It would require an innovative company structure (memorandum of association, shareholders agreement) as well as key legal and regulatory agreements.
- It could also be possible to enter into a joint venture ESCo between a private partner with relevant experience (e.g. an existing ESCo or utility company) and local partners. This model would bring established ESCo expertise into the venture (thus mitigating risks) whilst enabling some local control and influence on its priorities. ESCos of this type have been formed in London and Woking and this is the model that the Government wants to be replicated or rolled out until it becomes the norm. The Woking ESCo (Thameswey) is already developing its services for projects in Teeside and Milton Keynes.

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89 David Miliband, 26 Oct 2006 speech to the Lunar Society.
One advantage of having public and third sector partners in a joint venture is that they can access grants the private sector cannot. Some ESCos have been established with the support of public sector or EU funding programmes. There are some unique funding opportunities in Cornwall which may be of use if gap-funding is required. For instance, CSEP’s delivery of a Local Area Agreement micro-generation stretch target is set to release £1 million of reward funding from 2009, which the Partnership has agreed to invest in a major catalytic project yet to be identified. Truro as a principal town is also a target area for investment from the Convergence programme, although it is likely that only the ‘innovative’ elements of a project might be eligible for funding from this route.

Examples of ESCo partnerships that have worked well include:

- **Thameswey**, the UK’s first public-private joint venture Energy & Environmental Service Company, which is a partnership between Woking Borough Council and a private sector Danish partner, set up in 1999. Thameswey chose not to include politicians on the board because it was felt that elected officials change too frequently to give continuity to the company. Thameswey, as a local authority company, is still subject to central government capital controls but the public/private joint venture allows Thameswey Energy to escape capital controls that would be imposed on a purely local government company. The power of well-being included as part of the Local Government Act 2000 and the Scotland Local Government Act 2003 has made it easier for local authorities to supply gas and electricity directly to consumers since the Thameswey ESCo was formed, but as far as we know, no local authorities have made use of it yet.

- **Southampton City Council** participates at Member and Director level in an ESCo called the **Southampton Geothermal Heating Company Limited**. This is a company limited by shares, which was created in 1986 by the Council and Utilicom Ltd (a company specialising in outsourced services in building maintenance and energy management), under a Joint Co-operation Agreement between the two parties. Utilicom is the sole owner of the company and operates the scheme, thereby lessening exposure on the part of the Council.

- Nine major energy utilities, US and international energy companies, bid to become the private sector partner in the **London ESCo**, as a result of which the **London Climate Change Agency** (LCCA) formed a joint venture ESCo with EDF Energy. The LCCA, which is a municipal company wholly owned by the London Development Agency, takes the view that distributed energy initiatives are better led by Regional Development Agencies rather than local authorities.

Potential local investment and/or delivery partners for an ESCo/ MUSCo for Truro and Threemilestone could be the proposed Cornwall Development Agency (CDA), developers, Truro College, Treliske Hospital (if the NHS leaning toward short term financial planning can be overcome), SWRDA, Carrick Housing (if retrofits to existing housing are included), CUC, local biomass suppliers like Truro Sawmills and possibly third sector organisations like Community Energy Plus that can bring knowledge, advice services and access to a potential pool of ESCo customers and charitable programmes.

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91 London Climate Change Agency response to a call for evidence for the DTI/Ofgem review of barriers and incentives to distributed electricity generation, including CHP, Dec 2006.
grants. There is also the potential to offer shares to the wider community, which would provide local economic benefits as well as an incentive for the community to provide the ESCo with loyal customers.

A typical development phase for creating an ESCo would include:

- **Identification and buy-in of stakeholders.** There are many stakeholders in the development of an ESCo and it would be important to identify and prioritise these at the early stages of a project, to ensure that the venture is complementary to the wider local community and business interests, as well as the statutory authorities and investors.

- **Agreement of objectives and environmental targets.** An ESCo has the potential to deliver substantial CO₂ savings over a business-as-usual approach to energy supply. However, the various stakeholders will often have different mandates for CO₂ saving targets and choice of renewable technologies to be employed. It is important at the outset for there to be consensual agreement between key stakeholders in order that the ESCo is developed correctly.

- **Selection of appropriate procurement model.** The selection of options will be dependent upon the experience and resources of the authority, the scale and scope of the venture, and whether the authority (or community) wishes to have a minority commercial interest in the ESCo.

The design, build and operation of ESCOs are subject to high capital set up costs and the decentralised energy delivery infrastructure (heat mains and/or private wire) is not a recoverable asset. It is vital therefore, that a viable business case can be made in order to secure the substantial private and/or public-sector investment needed to set up an ESCo. An initial scoping exercise should be carried out at this stage to assess if it is worth proceeding with this approach for the urban extension, including gathering much more definitive data on the new development in order to carry out the detailed financial modelling that would be required to secure public or private sector investment. Given the staggered phasing of the developments, it is likely this kind of detailed modelling will need to be carried out on a site by site basis. If there is a very long period between development phases it may be more cost-effective to develop two or more CHP energy centres with a view to connecting them in the future. In this way a district energy network could grow organically from one or two key ‘bankable’ schemes, gradually expanding out into the wider community.

A simple summary of the potential advantages and disadvantages of different energy service companies is shown below in table 46.
Table 46: Energy service companies summary

<table>
<thead>
<tr>
<th>ESCo/ MUSCo option</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA or site owner procures large scale ESCo projects and services directly from an existing ESCo.</td>
<td>• Simpler process and quicker implementation</td>
<td>• No local ownership, therefore no local economic benefit or influence.</td>
</tr>
<tr>
<td>Use the planning process to place obligations upon others (e.g. require developers to procure ESCo/ decentralised energy contracts)</td>
<td>• Simpler process and quicker implementation</td>
<td>Local ownership not certain</td>
</tr>
<tr>
<td></td>
<td>• Would empower developers to choose ESCo delivery mechanism</td>
<td>Could delay planning negotiations/ approval</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Could complicate joining up of district energy networks if developers appoint different ESCos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of developer experience</td>
</tr>
<tr>
<td>Develop a partially locally-owned ESCo in partnership with a third party such as an existing ESCo or utility.</td>
<td>• Local ownership would bring local economic benefits and grow the knowledge economy.</td>
<td>More complicated negotiations and legal work – multiple partners and contracts</td>
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<td></td>
<td>• Consistent service to customers across all developments (same ESCo).</td>
<td>Performance warranties, etc., will be required by the institutional lenders</td>
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<tr>
<td></td>
<td>• Potential to match private sector finance with public sector funding to increase scale of generation possible. Increased financial viability.</td>
<td>Would take longer to develop (typically 2 years)</td>
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<td></td>
<td>Customers may be tied in to a fixed term contract (but the local stakeholders can require that this is lower, or the same, as grid-distributed energy prices)</td>
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</table>

A fourth option could be for local stakeholders to establish their own independent ESCo. However, we have discounted this because the stakeholders would need to possess the full range of technical, financial, legal, regulatory, managerial and administrative skills, experience and expertise to deliver an ESCo. Realistically there is expertise that Cornwall needs to buy-in from existing energy service companies or utilities to begin the process of growing a local knowledge economy in this specialist area. Further information on the establishment of an ESCo is available from the Energy Saving Trust\textsuperscript{92} including the local authority legal powers to enter into them.

If the Council wishes to progress the ESCo/ MUSCo approach in Truro and Threemilestone, then the initial scoping and development process should begin as soon as possible in order to maximise the energy generating opportunities presented by the urban extension. A multi-partner ESCo of the finance, build and operate type may take some 2 years to develop and set up. Carrick District Council and Cornwall County Council could both play a key role now in establishing a framework that would give a future ESCo a level of financial certainty about energy loads and numbers of customers. It should also be possible to gain some experience from the work currently taking place in CPR, which is further down the road to considering an ESCo approach for this regeneration area.

\textsuperscript{92} Energy Services Information Pack, Energy Saving Trust
9.4 Pushing for Higher Targets

The Council’s aspiration for creating zero carbon homes in the urban extension is likely to be challenging in the short term. This directly relates to the higher costs associated with building to the Code. It will take time for developers to skill up and will also take time for the required supply chains to get in place. There will also be a short term gap before any adjustment in land values takes account of the additional build costs.

The main opportunity for pushing for zero carbon standards initially would be linked to any land the Council owns within the development area, as the value could be reduced in return for requiring developers to build to zero carbon (assuming the right technology options are available). The power to do this is given under the Local Government Act 1972, with the only constraint being that a land disposal must be for the best consideration reasonably obtainable. A recent report from BERR\(^3\) states that:

> “Under the General Disposal Consent 2003, local authorities and certain other public bodies are exempted from seeking specific consent where the undervalue is less than £2m, and the disposal will promote the social, economic or environmental well-being of the area.

In England, it is Government policy that local authorities and other public bodies should dispose of surplus land wherever possible, within the context of a strategic approach to the management of local public assets. It is recognised that there may be circumstances where an authority considers it appropriate to dispose of land at an undervalue, for instance in order to transfer leasehold or freehold ownership to a community organisation.

An example of a local authority working within the requirements of best consideration and linking it to tackling climate change was in the acquisition of land for the Beddington Zero (BedZed) development.

Sutton Council had written into their Unitary Development Plan that they wanted to develop a low carbon eco-village. With help from Sutton Council, Bio Regional, Peabody Trust and Bill Dunster Architects (the project team), a site owned by Sutton Council was identified.

The project team produced designs that highlighted the development’s low carbon design and carbon savings from travel plans which focused on reduced car dependency (the site relies on car sharing). Sutton Council commissioned independent consultants to carry out a financial audit of the savings the low carbon design would achieve. The savings were valued at 10% of the land cost which could then be taken off the sale price of the land. The project team could show that their development was more beneficial to the council as it saved them £200,000 (through things such as lower transport costs); therefore the land for BedZed was sold for £1.8million i.e. 10% below the market value of £2million.”

The other big opportunity would appear to be the use of large scale wind power either on its own, or possibly linked with other site-wide, or building-integrated renewables. On paper, at least, it looks as if developers could reach level 6 of the Code, for the energy requirements, at a relatively low cost with wind. Carrick should explore this option in more detail as it could provide a real mechanism to reach the zero carbon aspiration.

9.4.1 The ‘Able to Pay’ Market

Whilst not a solution for the affordable homes market, there is some evidence that the ‘able to pay’ market is willing to cover the costs of additional technologies by

\(^3\) Energy Measures Report, BERR, 2007
paying a premium price for ‘green’ homes. Developers could therefore offer optional extras for renewable energy installations at the point of sale, which would further improve the carbon emission rate of the dwelling. Such an approach would need to be additional to the targets a developer will need to achieve i.e. they should not rely on purchasers covering the cost of incorporating renewable energy to reach the required targets. This approach would clearly be subject to the actual cost of new homes that come to market in the urban extension.

The evidence for the desire for greener homes includes a Mori survey commissioned by EST in 2006 that found nearly 7 out of 10 Britons believe that homes boasting energy saving features are worth paying more money for, with almost half (44%) willing to pay an additional £5,000 - £10,000 for a green home built to high environmental standards. In addition, a report by Mori for the Sponge Sustainability Network found an overwhelming consumer demand for high performance environmentally friendly homes. It indicated that 92% of respondents wanted to see sustainability features offered as options on new homes, while 64% felt they should be compulsory.

Some examples of actual developments that have offered additional options at the point of sale have already emerged. Gleeson Homes incorporated building-integrated solar PV tiles into new homes at The Beeches, Norfolk park, Sheffield. The homes sold at a premium of 8.6% compared to an otherwise identical, conventional townhouse as part of this pilot project. Gleeson marketed the solar PV tiles by offering home buyers the prospect of ‘reduced electricity bills for life.’ The £12,000 premium these homes sold for easily covered the £3,000 unit cost.

Green homes can also sell faster, helping to improve a developer’s cash-flow. For instance, a development of terraced houses opposite a factory at Poundbury, Dorset, built by Cornhill Estates to the EcoHomes Excellent standard in 2003, all sold within three weeks of release. Cornhill state that the overall developer return was greater on the houses built to a higher energy standard than the conventional houses due to the shorter selling period.

The ‘able to pay’ market will be more likely to self-fund additional measures if they are highly visible and easy to order and install. The Council and developer could help facilitate this by reducing the effort a householder would normally have to make to select the most suitable technologies, find a competent installer and obtain planning permission. Through planning negotiations and policy, the Council could encourage developers to include sustainable living technologies in their ‘optional extras’ list, with example installations included on the show home. This means the cost would be voluntarily covered by the home-buyer and if developers work with local installers on this, they will help to contribute to the local economy as well. The Council could clarify at the outline planning stage which renewable energy technologies should be treated as ‘permitted development’ under the revised GPDO, so that the developer

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94 http://www.energysavingtrust.org.uk/
95 Eco Chic or Eco Geek? The Desirability of Sustainable Homes, Ipsos MORI/J28288 & Sponge Sustainability Network, 2006
96 images & case study at: http://www.solarcentury.com/projects/domestic/gleeson_homes

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can design them in at an early stage without causing a delay to the building and selling of homes.

Cornwall Sustainable Energy Partnership could help facilitate an ‘optional extras’ arrangement between developers and Cornwall’s renewable energy installers which could lead to bulk-purchasing discounts for new developments. CSEP can currently give developers and planners free impartial advice on suitable renewable energy technologies and costs for a particular development. The Council and/or developers could work with CSEP, installers and the Community Energy Plus domestic advice team to produce renewable energy technology information sheets and simple user guidelines for home-buyers choosing particular options.

**9.4.2 Stamp Duty Relief**

In the short term (up to 30 September 2012) some more innovative developers that wish to build carbon zero homes could take advantage of the Stamp Duty Land Tax (Zero-Carbon Homes Relief) Regulations 2007 (SDLT).

These came into force in December 2007 and provide stamp duty exemption as follows:

- on the first acquisition of a new house costing less than £500,000 that meets the zero carbon standard, set by HM Treasury, no SDLT will be payable;
- a zero carbon house costing in excess of £500,000 will receive a reduction of £15,000 in the Stamp Duty Land Tax bill.

It is only a short-term measure intended to help kick start the market for zero-carbon homes, encourage micro-generation technologies and raise public awareness of the benefits of living in a zero carbon home.

The relief only applies to residential transactions (individuals) and not to commercial transactions (business). It is only available for newly built zero carbon homes at the first point of sale and is currently restricted to the sale of new homes defined in primary legislation as a “building which has been constructed for use as a single dwelling, and has not been previously occupied”. This definition is designed to capture most new homes including terraced homes, semi-detached homes and bungalows, but it currently excludes new flats.

The SDLT relief will benefit home-buyers with savings ranging from £1,250 to £15,000 - depending on the value of the property.

SDLT relief can help developers to reduce the costs of building zero carbon homes and provide them with a powerful 'no tax/ green home' marketing tool to boost sales. The financial benefit to the home-buyer is likely to be partially offset where developers of zero-carbon homes sell them at a higher price to cover any additional building costs. Even allowing for this, HM Treasury still expect zero-carbon homebuyers to remain overall financially better off compared to the do nothing option. In addition, they will benefit from lower energy bills compared to living in a conventional house.

9.4.3 Grants
Grants to support the private sector, including developers, are rare, but there may be opportunities for partnering with public or third sector organisations that can open up funding streams that the private sector would not normally be able to directly access. CSEP has considerable experience in forming such project partnerships and accessing grants for sustainable energy measures from diverse sources.

There are several grant schemes that could be used to help subsidise sustainability measures for households, community and public sector buildings. They could be a tool to help secure higher targets, above the levels that developers have to achieve.

Low Carbon Buildings Programme
This programme was launched by the Government Department of Business Enterprise and Regulatory Reform (formerly the DTI) in 2006 to help stimulate take up of micro-generation technologies. It is split into two parts according to applicant type:

LCBP Phase 1 is open to householders, who can apply for up to £2,500 (excl. VAT) per property towards the costs of having certified micro-generation products installed by certified installers. To be eligible the home must meet certain energy efficiency standards (which new homes would meet). Grants are offered on a first come first serve basis until the funding runs out. If developers promoted this scheme as part of the optional extras approach above, it could help to encourage the uptake of higher levels of renewables in new homes. The Council could facilitate the process by confirming which renewables are considered acceptable within the urban development and they could provide a standard confirmation letter for developers to show where planning permission is not required (a requirement of the application process).

This information is correct at March 2008, but the scheme has undergone several changes since it was launched. It is advisable to check the website for the latest situation and information on the range of technologies supported.

http://www.lowcarbonbuildings.org.uk/home/

LCBP Phase 2 provides micro-generation grants for public sector buildings (including schools, hospitals, housing associations, libraries, colleges and local authorities) and to charitable bodies (community groups/ non-profit sector). State aid rules apply. Organisations can apply for between 30% and 50% of the cost of installing approved micro-generation technologies, supplied and installed by ‘Framework Suppliers’.

The maximum grant of up to £1m per site is available at different intervention rates according to the technology. Grants are available for up to a maximum of 50kW electricity and 45kW heat and only cover certain eligible costs which are described in detail in the guidelines. It does not cover VAT. It is possible to apply for multiple sites and up to three technologies per property can be assisted from this fund. If the installation is not below the BRE’s ‘value threshold’ (carbon savings/cost ratio - expressed in £/tonneCO₂) the application may be rejected. Hence, it’s advisable to get several quotes to ensure best value.
Further details are available on the LCBP Phase 2 website

9.4.4 Other Support

- Currently, two utilities, E.On and EDF Energy, run micro-generation grant schemes for community projects. Utilities are also subsidising micro-generation products at the manufacturing stage to bring costs down.
- The Big Lottery Community Buildings fund was launched in January 2008 and may also offer a funding route for new community buildings within the urban extension.
- CSEP emails regular free funding alerts to organisations developing projects in Cornwall to help with the identification of potential grants. To receive this mailing organisations need to email CSEP’s Funding and Development Manager (enquiries@cep.co.uk) with a brief synopsis of the project for which funding is being sought.
- Community Energy Plus (01209 614971) can provide free technical, funding and planning advice and hand-holding support for community groups interested in improving new (or existing) community buildings.
- CSEP can provide advice for developers and housing associations on the use of renewable technologies.
- The Carbon Trust offers 10 days or more free/subsidised design consultancy for major building and renovation projects in excess of 10,000m² (0800 085 2005) http://www.carbontrust.co.uk/energy/assessyourorganisation/design_advice.htm

9.5 Links to Sustainable Development

As with other chapters of this Strategy, in terms of financial considerations the Council should consider the environmental, social and economic benefits for the local community. This chapter has mainly focussed on the cost implication of meeting the targets, to help inform the Contributions Strategy. Although important, this is a little short-sighted in regard to the desire to create sustainable communities.

The main area of concern is that developers will predominantly be driven to meet the targets at the least cost. This may not result in the best range of benefits to the local communities. This includes both the possible choice of procurement routes and technologies. The ideal solution for reducing costs, and ensuring the wider sustainability agenda is considered, is for the Council to be actively involved in the development of large scale generation and their delivery mechanisms, such as an ESCo. This would allow for a better, more integrated and more sustainable approach to be taken within the urban extension. In addition, it is important that the local community is consulted with reference to the choice of technologies that come forward and the potential to gain social and economic benefits from them. This will be particularly important in terms of large scale wind as it will have a significant visual impact for the local community.
9.6 Conclusions and Recommendations

It is clear that the requirements of the RSS in relation to building to the CSH will result in an additional build cost for developers. Whilst this is not considered to cause undue burden, it could have an impact on housing prices and the contributions strategy.

Accurate estimates of the scale of additional build cost per dwelling cannot be provided as they are site specific and will directly relate to the choices developers make in regard to design and construction. Based on the two reports referred to within this chapter the range of costs could be in the region of:

- £3,400 to £15,500 at Level 4 of the CSH;
- £4,000 to £31,500 at Level 5 of the CSH;
- £7,200 to £15,200 at Level 6 of the CSH.

The use of large scale wind is estimated at around £6,600 per dwelling. This figure was based on building to level 6 of the CSH in terms of energy and level 3 in terms of sustainability. This estimate also does not take account of the money that would be saved from not connecting to the gas network, or the savings from not installing gas central heating, so this cost would be lower still (probably nearer £5,000).

Of the costs modelled nationally, the bigger proportion relates to meeting the energy requirements of the RSS and CSH. This should therefore be the area that developers are provided with the most guidance on. More detailed modelling of predicted energy demand and the potential for site and part site-wide generation options should be investigated. Such an approach is likely to reduce cost and enable a more strategic approach to be taken, particularly in the case of wind power. It would also greatly increase the opportunity of making the whole development zero carbon.

There are a number of mechanisms that can help to reduce the cost of meeting the required targets. Some of these relate directly to the approach taken by developers in terms of bulk discounts, working together, procuring energy services, improving management and design, etc. Other opportunities will emerge as a result of learning curves, improving and new technology options including building techniques. The most likely way costs will be reduced is through reductions in land values. The creation of an ESCo could be a key mechanism to help reduce cost and bring wider benefits for both new and existing communities within the urban extension.

It is also likely that these cost estimates will change as they are based on current prices. This may reduce the actual cost of meeting level 5 and 6 of the Code in the future, as prices for many technologies is expected to fall. It would therefore be necessary for the Council to review the estimates over the coming years as more examples of actual developments emerge.

In the short term the aspiration for zero carbon developments to come forward will be challenging without large scale wind, but there are a number of ways the Council can encourage this. It is also likely that more and better guidance on building to higher levels of the Code will emerge over the coming years.
Large scale wind is likely to be the most contentious option in relation to planning and the local community, but it appears to offer the most cost effective way to reach high levels of the Code. If it went ahead it may be possible not to consider CHP or a local ESCo, which would reduce the time and costs associated with researching and setting these sorts of schemes up. However, it may not bring the wider benefits an ESCo could offer, so it may be worthwhile to consider creating one, even if CHP does not go ahead.

The Council needs to make a decision on its involvement in any large scale generation options quickly, as it would require contributions from developers. The Council could leave developers to meet the required targets themselves, but this is likely to cost them more if they take a building-integrated route. The alternative would be to seek a contribution to fund either district CHP and/or large scale wind. Based on the costs highlighted in this section this will be a much more cost effective mechanism, not only reducing costs for developers, but potentially reaching higher emission reduction targets.

Recommendations for the Council:

- Quickly consider further work into the potential for large scale energy and a local delivery mechanism. Ideally this should consider all of the options highlighted in chapter seven to ensure a full picture is developed. However, the Council could:
  - hold internal discussions about the potential for using large scale wind and, if felt acceptable, research this area first;
  - alternatively, or additionally, carry out further research into district CHP;
  - alternatively, or additionally, carry out further research into large scale use of biomass.
- Whichever of the above approaches are taken, the Council should consult with the local community on the possible options. It would also make sense to consider the role of a local ESCo for all of these options regarding the additional benefits this could bring.
- The Council should seek a contribution from developers if the above studies indicate that large scale energy generation will be established.
- Consider reducing land value on any land that the Council owns within the urban extension to help secure higher targets.
- Encourage developers to include optional extras for the ‘able to pay’ market and provide an indication of permitted development for building-integrated technologies, including the provision of information on grants.
- Promote the current stamp duty relief to developers.
- Examine ways to secure higher targets in public and community buildings through the use of innovative partnerships and existing grant programmes.
- Promote and use the additional support that is available from CSEP and CEP.
10. Summary of Recommendations

The Energy and Sustainability Strategy provides a range of recommendations against each chapter of this report. All of these should be considered, but they fall under five headline recommendations:

1. Place climate change and sustainability at the heart of local policy
2. Set strong and meaningful targets for developers
3. Create a sustainable urban extension
4. Do this in the most efficient way
5. Consider the risks and opportunities

There are also specific recommendations for the master plan.

1. Place climate change and sustainability at the heart of local policy

- The Council should ensure that climate change and sustainability are central to the planning and implementation of the new AAP.

- The sustainable community framework from ‘Securing the Future’ should be used to assess ways to make both new and existing communities as sustainable as possible. It should be used to inform the development of local policies and be used to check the plans coming forward from developers. This can be used to strengthen Carrick’s existing Sustainability Assessment Criteria.

- The Council should ensure that all the other strategies that support the LDF consider the key drivers within this Strategy by requesting that they make reference to them within their reports, or by coherently pulling this together in the revised AAP. This could also include:
  - the role of the master plan, and spatial planning, in terms of tackling climate change and supporting the components of sustainable communities;
  - the role of the landscape and green infrastructure strategies in helping communities adapt to climate change and in supporting the principles of sustainable communities;
  - the role of SUDs in reducing the impact of climate change and helping local communities adapt to the changes that are now inevitable.

- The Council could consider developing a Supplementary Planning Guidance document as part of the LDF, covering the key issues set out within the Energy and Sustainability Strategy and the methods to address them.
2. Set strong and meaningful targets for developers

- The Council should use the targets within this Strategy (based upon the draft RSS) to set local policy for the urban extension. Compliance should be checked as part of the planning process. This should include:
  
  o **Homes:**
    - reducing emissions in line with the timescales and CSH levels 4, 5 & 6;
    - building to at least level 3 of the CSH in terms of sustainable construction;
    - ensuring the energy hierarchy is used and that at least 25% of emissions are saved through the use of energy efficiency;
    - generating 20% of energy from on-site renewables;
    - meeting the other requirements of Policy G of the draft RSS.
  
  o **Other Buildings:**
    - reducing emissions in line with the RSS timescale and levels;
    - building non-domestic buildings to at least the BREEAM ‘very good’ standard;
    - ensuring the energy hierarchy is used to check energy efficiency has been considered first;
    - generating 20% of energy from on-site renewables;
    - meeting the other requirements of Policy G of the draft RSS.

- Apply these targets equally to affordable housing.

- Apply these targets equally to any refurbishment within the urban extension.

- The Council should check, approve and make available, the developer guide that accompanies this Strategy.

3. Create a sustainable urban extension

**Sustainable Communities and Local Governance:**

- Ensure sustainable development is part of the decision making process so that environmental, social and economic issues are considered equally.

- Carry out a further consultation on the revised AAP.

- Consult local communities on the possible options for energy and sustainability before final decisions are made.

- Consider mechanisms to enable local communities to have a stake in local energy generation projects.
Energy Efficiency:
- Check that the energy hierarchy has been applied and that energy efficiency has been considered first by developers.
- Encourage developers to make use of the EST CSH level 3 Standard to ensure high levels of energy efficiency are implemented.
- Check the quality and contents of the energy strategies developers are required to provide as part of planning.

Renewable Energy:
- Commission a detailed technical and financial feasibility study into the potential large scale generation options for each site (once final densities and the mix of build are known), including an assessment of:
  - wind, district CHP and the potential local biomass resource;
  - the potential benefits and role of creating a local ESCo;
  - how large scale and building-integrated approaches could work together;
  - the likely energy and carbon baseline of the development.
- Seek support from Regen SW and make an application for Growth Area Funding for the above studies.
- If large scale generation options do not come forward, or in the interim period:
  - encourage development firstly in areas where CHP appears to be less viable, if this is not possible, quickly complete a CHP study so this opportunity is not missed;
  - keep up to date on the development of the CSH, particularly in relation to guidance and examples of homes being built to levels 5 and 6 of the Code;
  - provide an indication of what is considered as permitted development for building-integrated technologies.

Wider Sustainability:
- Ensure that the minimum requirements of the South West Sustainability Checklist are met by developers.
- Address water issues, by ensuring the SUDs strategy links to the CSH requirements for surface water run off, flood risk and the targets set out in the RSS and within the above Checklist.
- Ensure space is allocated to enable local residents to grow their own food.
- Ensure local food shops are included within new district centres.
- Consider developing a sustainable food strategy.
- Work with CCC and local service providers to ensure an integrated transport policy develops for the urban extension. This should include new bus stops throughout the development area.
- Ensure place making is central to the development process.
- Consider creating one or more car clubs within the urban extension.
- Work with developers to ensure the Home User Guides include wider issues relating to the site and its surroundings.
- Promote a sourcing hierarchy to developers based on Cornwall, the South West, the UK and finally Europe.
4. Do this in the most efficient way

- Facilitate and support site-wide approaches to energy generation.
- Consider reducing land value on any land the Council owns to secure higher targets.
- Encourage developers to include optional extras for the ‘able to pay’ market, including the provision of information on grants.
- Promote the current stamp duty relief to developers.
- Make use of, and promote, the local and regional support that is available.
- The Council should consider whether or not to seek contributions towards energy and sustainability measures, this could include:
  - Large scale energy generation (CHP and/or wind) that can deliver carbon reductions more cost effectively;
  - Sustainability, which can be improved in terms of:
    - green space;
    - allotment space;
    - detailed Home User Guides;
    - creating one or more car clubs.

5. Consider the risks and opportunities

- The Council may need to revise the targets within this Strategy based on the final adopted version of the RSS.
- The Council should keep up to date on the legislation and policy in terms of the CSH and the wider points highlighted in section 7.7.
- Make use of the best practice and case studies that will emerge in terms of working towards higher levels of the CSH.

6. Recommendations for the master plan

- We believe that the issues of sustainable communities and climate change are key to the development of the urban extension. As such, they should be up front issues within the vision and context of the master plan and should run throughout the whole document.

Section 3: Sustainability Assessment Criteria

- Some of the options for reducing the impact of climate change should be made clearer under section 3, point 6. This could include:
all developments should incorporate high levels of energy efficiency and maximise the potential for solar gain to reduce the energy demand of buildings, before renewable energy is considered;

- the use of large scale wind should be considered as a mechanism to reduce carbon emissions, subject to appropriate planning and impact assessments;

- combined heat and power should be considered in mixed-use development areas;

- biomass heating systems should be considered to provide renewable heat in areas where CHP is not viable;

- building-integrated renewables should also be considered.

**Core Master Planning Criteria**

- It would be beneficial to separate out the sustainable communities section to include separate headings for sustainable construction and sustainable energy. This will help to add weight to the importance of these issues. It is recommended that:

  - Promote Sustainable Communities - this section should have a statement on the need for space to allow people to grow their own food. The last sentence should be removed and picked up under two new headings as set out below.

  - Promote Sustainable Construction - New residential development should be built to at least level 3 of the Code for Sustainable Homes. This will ensure high quality construction that addresses the key issues of climate change and sustainable development. Non-residential buildings should be built to at least the ‘very good’ standard of BREEAM. Development should be promoted in areas that maximise the opportunities for sustainable urban drainage. Combined, these approaches will ensure that buildings are cheap to run, easy to control and comfortable to occupy, leading to sustainable, future proofed communities.

  - Promote a Low Carbon Future - Buildings and communities should be designed to limit their impact on the climate and be fully adapted to the changes that are now inevitable. Development should be promoted in areas which maximise the opportunities for energy efficiency, solar gain and renewable energy generation. This should be based upon decentralised energy networks that increase energy security. At least 20% of energy demands will need to be met with on-site renewables, with the ultimate aim of creating zero carbon homes.

**Site Specific Comments and Recommendations**

**Gloweth/Treliske**

- Subject to a detailed study into the use of CHP, there will be a need to allocate potential land for an energy centre within the master plan. The location of this is most likely to be within the development areas north of the A390.

- To increase the viability of CHP, any large heat loads should be focussed within these areas, including a primary school, supermarket, light industrial/retail, the
college buildings, the innovation centre, and possibly linking to the hospital redevelopment.

- As these sites have a northerly aspect it will be more difficult to follow the principles of passive solar design. It would therefore be more appropriate for these areas to include a large proportion of high density development, such as flats and apartments.
- Change the implication for ‘renewable energy’ to ‘sustainable energy’ and state “Housing should reduce the demand for energy by incorporating high levels of energy efficiency. The opportunity for CHP can be increased by building to a high density per hectare and considering mixed-used developments.”

**North Langarth**
- As this site has a northerly aspect it will be more difficult to follow the principles of passive solar design. It would therefore be more appropriate to include a large proportion of high density development, such as flats and apartments.
- Change the implication for ‘renewable energy’ to ‘sustainable energy’ and state “Housing should reduce the demand for energy by incorporating high levels of energy efficiency.”

**Threemilestone and Highertown**
- These areas can make better use of passive solar design principles. This can be supported by encouraging a predominance of west-east road layouts and lower density detached, semi-detached and terraced housing in these areas. This will support passive solar and provide more roof space for building-integrated renewables such as solar hot water and PV panels.
- Change the implication for ‘renewable energy’ to ‘sustainable energy’ and state “The use of high levels of energy efficiency and passive solar design should be maximised in these areas. Buildings should be, as far as possible, sited within 30° of south in order to maximise this potential and to enable roof mounted solar technologies to be considered.”

**Other Areas (including Kenwyn, Higher Newham and East of the City)**
- Other areas that come forward should, as far as possible, make use of passive solar design principles and use high levels of energy efficiency.
- The use of building-integrated renewables are likely to play a central role in reducing carbon emissions within areas outside the Highertown corridor.
APPENDICES

Appendix 1: Carrick Carbon & Ecological Footprints

Appendix 2: Policy Links Table

Appendix 3: CSH Scoring Summary

Appendix 4: EST Energy Standard

Appendix 5: Draft Developer Guide

Appendix 6: Planning and Large Scale Wind

Appendix 7: Regen South West Renewable Factsheets

Appendix 8: Glossary
Appendix 1: Carrick Ecological and Carbon Footprints
Carrick Ecological and Carbon Footprints

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<td>Catering services</td>
<td>0.31</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Capital investment</td>
<td>0.07</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.16</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td><strong>Transport</strong></td>
<td></td>
<td></td>
<td>The footprint of transport measures the impact of fuel emissions from public and private vehicles as well as the impact from maintaining vehicles, buying new vehicles and building the transport infrastructure.</td>
</tr>
<tr>
<td><strong>Private Households</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase of vehicles</td>
<td>0.11</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>Operation of personal transport equipment</td>
<td>0.10</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Transport services</td>
<td>0.14</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>UK resident holidays abroad</td>
<td>0.08</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>Private transport (car fuel)</td>
<td>0.30</td>
<td>1.05</td>
<td></td>
</tr>
<tr>
<td>Capital investment</td>
<td>0.08</td>
<td>0.21</td>
<td>Capital investment includes that on road construction and transport infrastructure</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0.82</td>
<td>2.57</td>
<td></td>
</tr>
</tbody>
</table>
### Housing

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Private households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual rentals for housing</td>
<td>0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Imputed rentals for housing</td>
<td>0.07</td>
<td>0.12</td>
</tr>
<tr>
<td>Maintenance and repair of the dwelling</td>
<td>0.07</td>
<td>0.13</td>
</tr>
<tr>
<td>Electricity and gas distribution</td>
<td>0.53</td>
<td>1.43</td>
</tr>
<tr>
<td>Goods and services for routine household maintenance</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Domestic fuel and land consumption</td>
<td>0.49</td>
<td>1.37</td>
</tr>
<tr>
<td><strong>Capital investment</strong></td>
<td>0.26</td>
<td>0.61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.47</td>
<td>3.75</td>
</tr>
</tbody>
</table>

The footprint of **housing** measures the impact of fuel emissions from direct household energy use for heat, hot water, lighting and electrical appliances as well as the impact from household maintenance and from household construction.

The footprint of **consumer items** measures the impact of producing all products bought by households, from newspapers to appliances.

### Consumables

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Private households</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobacco</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Clothing</td>
<td>0.02</td>
<td>0.09</td>
</tr>
<tr>
<td>Footwear</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Furniture, furnishings, carpets and other floor coverings</td>
<td>0.05</td>
<td>0.14</td>
</tr>
<tr>
<td>Household textiles</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Household appliances</td>
<td>0.11</td>
<td>0.23</td>
</tr>
<tr>
<td>Glassware, tableware and household utensils</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Tools and equipment for house and garden</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Medical products, appliances and equipment</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Telephone and telefax equipment</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Audio-visual, photo and inf. processing equipment</td>
<td>0.05</td>
<td>0.12</td>
</tr>
</tbody>
</table>
Other major durables for recreation and culture | 0.01 | 0.02
---|---|---
Other recreational items & equipment | 0.21 | 0.22
Newspapers, books and stationery | 0.03 | 0.08
Personal care | 0.03 | 0.09
Personal effects n.e.c. | 0.08 | 0.16

**Capital investment** | 0.01 | 0.03

**Total** | **0.70** | **1.33**

### Private services

**Private households**

<table>
<thead>
<tr>
<th>Service</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water supply and miscellaneous dwelling services</td>
<td>0.03</td>
<td>0.09</td>
</tr>
<tr>
<td>Out-patient services</td>
<td>0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Hospital services</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Postal Services</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Telephone and telefax services</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Recreational and cultural services</td>
<td>0.04</td>
<td>0.09</td>
</tr>
<tr>
<td>Package holidays</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Education</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Accommodation services</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>Social protection</td>
<td>0.02</td>
<td>0.06</td>
</tr>
<tr>
<td>Insurance</td>
<td>0.05</td>
<td>0.13</td>
</tr>
<tr>
<td>Other services n.e.c.</td>
<td>0.02</td>
<td>0.05</td>
</tr>
<tr>
<td>Financial services n.e.c.</td>
<td>0.03</td>
<td>0.08</td>
</tr>
</tbody>
</table>

**Capital investment** | 0.05 | 0.15

**Government spending**

<table>
<thead>
<tr>
<th>Service</th>
<th>2010</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central government</td>
<td>0.11</td>
<td>0.29</td>
</tr>
<tr>
<td>Local government</td>
<td>0.01</td>
<td>0.01</td>
</tr>
</tbody>
</table>

The footprint of **private services** measures the impact from services ranging from entertainment to financial services.
Additionally, spending on **public services**, (e.g. education, sewage and healthcare), capital investment, (e.g. mineral extraction) and other, (e.g. impact of overseas tourists), is included in the total footprint. These are set figures and are the same for each Local Authority.

<table>
<thead>
<tr>
<th></th>
<th>0.48</th>
<th>1.18</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Public Services</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Capital investment</strong></td>
<td>0.07</td>
<td>0.15</td>
</tr>
<tr>
<td><strong>Government Spending</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central government</td>
<td>0.14</td>
<td>0.37</td>
</tr>
<tr>
<td>Local government</td>
<td>0.17</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0.37</td>
<td>0.93</td>
</tr>
<tr>
<td><strong>Capital investment</strong></td>
<td>0.24</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>-0.01</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>5.22</td>
<td>11.36</td>
</tr>
</tbody>
</table>

Source: Reap website
Appendix 2: Policy Links Table
### National Policy

**PPS 1: Delivering Sustainable Development (2005)**

Planning Policy Statement 1 sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system.

Ways in which planning should facilitate sustainable development include ensuring high quality development through good and inclusive design, and the efficient use of resources.

Regional planning bodies and local planning authorities should ensure that development plans contribute to global sustainability by addressing the causes and potential impacts of climate change – through policies which reduce energy use, reduce emissions (for example, by encouraging patterns of development which reduce the need to travel by private car, or reduce the impact of moving freight), promote the development of renewable energy resources, and take climate change impacts into account in the location and design of development. (p13)

A spatial planning approach should be at the heart of planning for sustainable Development.

Development plan policies should take account of the potential impact of the environment on proposed developments by avoiding new development in areas at risk of flooding and sea-level rise, and as far as possible, by accommodating natural hazards and the impacts of climate change. (p15)

The prudent use of natural resources section suggests building housing at higher densities on previously developed land, rather than at lower densities on greenfield sites. (p16)

Regional planning authorities and local authorities should promote resource and energy efficient buildings; community heating schemes, the use of combined heat and power, small scale renewable and low carbon energy schemes in developments; the sustainable use of water resources; and the use of sustainable drainage systems in the management of run-off. (p16)

“securing high quality and inclusive design goes far beyond aesthetic considerations.” (p21)

Plans should be drawn up with community involvement and present a shared vision and strategy of how the area should develop to achieve more sustainable patterns of development.

**PPS1: Planning and Climate Change**

This new PPS sets out how regional and local planning can best support achievement of the Government’s zero carbon targets alongside meeting community needs for economic and housing development. Where there is any difference in emphasis on climate change between the policies in this PPS and others in the national series this PPS takes precedence. Policies include:

LPA’s should prepare and manage the delivery of spatial strategies that address climate change mitigation and adaptation. New development should be planned to make use of opportunities for decentralised, renewable/low carbon energy.

The LPA’s core strategy and local development documents should provide a framework that promotes, encourages and does not restrict renewable or low carbon energy generation. (p.14)

LPA’s should not require applicants to demonstrate the need for or energy justification of their location for renewable energy.

Local approaches to protecting the landscape or townscape should not preclude renewable energy, except in the most exceptional circumstances. P.14

Planners should help create an attractive environment for innovation and in which the private sector can bring forward investment in renewable and low carbon technologies.

Making use of LDO’s to secure renewable/low carbon energy systems and provide additional permitted development rights across the whole of a LPA’s area and/or for specific sites.

In selecting land for development LPA’s should consider opportunities for decentralised/renewable/low carbon energy supply; whether there is a realistic choice of access other than the private car; capacity of existing service infrastructure in ways consistent with climate change mitigation and adaptation; building socially cohesive communities and green infrastructure.

Planning authorities should set a target percentage of the energy to be used in new development to come from decentralised and renewable/low carbon sources, including site specific targets where greater opportunities exist. P.16.

LPA’s should consider opportunities for using existing sustainable energy supply systems (e.g. co-locating potential heat customers and suppliers), and can expect proposed development to connect to an identified system. P.16.

Any requirements for decentralised energy supply or sustainable buildings should be set out in a DPD, not SPD.

LPA’s should make use of Design & Access Statements which show how the proposed development will contribute to the Key Planning Objectives set out in this PPS.

New development should give priority to sustainable drainage systems. P.20

Importantly, “new development should not prejudice renewable or low carbon energy supplies or lead to increased vulnerability of existing or proposed development”.

PPS3: Housing

Underpins the delivery of the Government’s strategic housing policy objectives and their goal to ensure that everyone has the opportunity to live in a ‘decent’ home.

Includes recommendations for sustainable new housing that reflect the PPS on climate change and Code for Sustainable Homes. Developments should ensure that they facilitate the efficient use of resources and both adapt to, and reduce the impact of, climate change; and are located to cut carbon emissions from transport. Location should also consider the potential to use energy from decentralised energy
supply systems based on renewable energy and low carbon.

<table>
<thead>
<tr>
<th><strong>PPS 4: Planning for Sustainable Economic Development</strong>&lt;br&gt;Consultation 12/07 to 3/08</th>
<th>The new PPS on Planning for Sustainable Economic Development sets out how planning bodies should, in the wider context of delivering sustainable development, positively plan for sustainable economic growth and respond to the challenges of the global economy, in their plan policies and planning decisions.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PPS 22: Renewable Energy</strong>&lt;br&gt;Planning for Renewable Energy: A Companion Guide to PPS22</td>
<td>This states that Planning authorities should have regard to the Government’s planning policies for renewable energy when preparing local development documents and when taking planning decisions. PPS22 says local development documents should contain policies designed to promote and encourage, rather than restrict, the development of renewable energy resources. Local planning authorities may include policies in local development documents that require a percentage of the energy to be used in new residential, commercial or industrial developments to come from on-site renewable energy developments. This applies where the renewable energy equipment is viable given the type of development proposed, its location, and design and should not be framed in such a way as to place an undue burden on developers, for example, by specifying that all energy to be used in a development should come from on-site renewable generation. (p.12) The Companion Guide gives further guidance on this. PPS22 includes policies on renewable energy and designated areas. Local planning authorities and developers should consider the opportunity for incorporating renewable energy projects in all new developments. (p12) The Companion Guide states that solar PV and solar hot water systems should be regarded as permitted development and thus not require a planning application “In some cases, provided the installation is not of an unusual design, or involves a listed building, and is not in a designated area,” (P147 &amp; p153)</td>
</tr>
<tr>
<td><strong>PPS 25: Development and Flood Risk</strong></td>
<td>Sets out Government policy on development and flood risk. This PPS aims to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall. All developments in planning stage should be passed by the LPA and developers to the Environment Agency for examination. A Practice Guide on how to implement PPS25 is available.</td>
</tr>
<tr>
<td><strong>Onshore wind</strong></td>
<td>Provides advice on the appropriate types of planning conditions relevant to wind energy</td>
</tr>
<tr>
<td><strong>energy planning conditions guidance note – DBERR (2007)</strong></td>
<td>development. This advice incorporates information already present within existing planning guidance, provides additional advice regarding the use of planning conditions and outlines generic conditions for use in wind energy developments.</td>
</tr>
<tr>
<td><strong>Code for Sustainable Homes (2006)</strong></td>
<td>This new national standard for sustainable design and construction of new homes was launched on 13 December 2006. Since April 2007 the developer of any new home in England has been able to choose to be assessed against the Code. The Code measures the sustainability of a new home against categories of sustainable design, rating the 'whole home' as a complete package. It uses a 1 to 6 star rating system to communicate the overall sustainability performance of a new home. The Code replaces the EcoHomes scheme, developed by the Building Research Establishment (BRE). It considers not just energy/carbon but a range of sustainability issues such as water, waste and materials.</td>
</tr>
<tr>
<td><strong>The Code for Sustainable Homes: Setting the standard in sustainability for new homes (2008)</strong></td>
<td>The Government has announced that a rating against the Code for Sustainable Homes will be mandatory from May 2008. This would mean that all new homes would be required to have a mandatory Code rating indicating whether they have been assessed and, if they have, the performance of the home against the Code. <a href="http://www.communities.gov.uk/publications/planningandbuilding/codesustainabilitystandards">http://www.communities.g ov.uk/publications/planningandbuilding/codesustainabilitystandards</a></td>
</tr>
<tr>
<td><strong>Part L building regulations (2006)</strong></td>
<td>Sets baseline mandatory national standards. Part L1 covers conservation of fuel and power used by new buildings.</td>
</tr>
<tr>
<td><strong>Tightening of Building Regulations</strong>&lt;br&gt;Ref. ‘Building a Greener Future: Towards Zero Carbon Development’ under development</td>
<td>This consultation closed in March 2007 and the Government issued a policy statement in July, confirming its intention for all new homes to be zero carbon by 2016 with a major progressive tightening of the energy efficiency building regulations as follows:&lt;br&gt;• by 2010 – a 25% improvement on Part L 2006&lt;br&gt;• by 2013 - a 44% improvement on Part L 2006&lt;br&gt;• by 2016 – all new homes to be zero carbon&lt;br&gt;The Government also introduced a time-limited stamp duty land tax relief with effect from 1 October 2007 for new homes built to a zero carbon standard. <a href="http://www.communities.gov.uk/publications/planning">Building Regulations Forward Look 2010 and 2013 - http://www.communities.gov.uk/publications/planning</a></td>
</tr>
</tbody>
</table>
### Building for Life Standard

In section 4 of the TTAAP (New Communities), reference is made to the Building for Life initiative, which promotes design excellence and celebrates best practice in the house building industry. It sets the national benchmark for well designed housing and neighbourhoods. Carrick are keen that all development schemes in the TTAAP should be in broad accordance with the Building for Life Standard.

To attain a Building for Life standard, applicants must demonstrate a fulfilment of the Building for Life criteria. It covers four main themes: character; roads parking and predestination; design and construction; and environment and community. Within these are two criteria that relate to the SES:

- Do buildings or spaces outperform statutory minima, such as Building Regulations?
- Does the development have any features that reduce its environmental impact?

These 2 award levels: **Silver standard** (must fulfil 70% of the Building for Life criteria) and **Gold standard** (must demonstrate the highest standards of design by fulfilling 80% or more of the Building for Life criteria).


The new national indicators will be the only means of measuring national priorities that have been agreed by Government. The number of national indicators has been radically reduced, from the around 1200 that local authorities and their partners report on at present, to 198. DCLG will shortly consult on the technical definitions of the indicators.

Relevant indicators include:

- **Local Economy outcome**
  - NI 175 Access to services and facilities by public transport, walking and cycling (DfT DSO).

- **Environmental Sustainability outcome**
  - NI 185 CO2 reduction from Local Authority operations (PSA 27)
  - NI 186 Per capita CO2 emissions in the LA area (PSA 27)
  - NI 187 Tackling fuel poverty – people receiving income based benefits living in homes with a low energy efficiency rating (Defra DSO)
  - NI 188 Adapting to climate change (PSA 27)
  - NI 189 Flood and coastal erosion risk management (Defra DSO)
  - NI 191 Residual household waste per head (Defra DSO)
  - NI 192 Household waste recycled and composted (Defra DSO)
<table>
<thead>
<tr>
<th>REGIONAL POLICY</th>
<th>Relevance/ Targets</th>
<th>Weblink</th>
</tr>
</thead>
</table>
| SW Regional Spatial Strategy | **SD1 The Ecological Footprint** recognises that we can stabilise and reduce the current footprint by:  
- Requiring the wise use of natural resources and reducing consumption of key resources such as energy  
- Building a sustainable, low carbon and low resource consuming economy  
- Requiring sustainable construction and design to improve new build, whilst improving existing building stock to best practice  
- Meeting national and regional targets relating to renewable energy and resource consumption | [http://www.southwest-ra.gov.uk/nqcontent.cfm?a_id=538](http://www.southwest-ra.gov.uk/nqcontent.cfm?a_id=538) |
| Draft – Examination in Public panel reported in Jan 2008. Due to be finalised summer/autumn 2008. | **SD2 Climate Change**  
- All Local Authorities in the LDDs will need to demonstrate how they intend to contribute towards the required 60% cut in CO2 emissions by 2050 and how they intend to identify and respond to the potential impacts of climate change in their area.  
- Reducing greenhouse gas emissions at least in line with current national targets i.e. by 20% by 2026  
- Requiring ‘future proofing’ of development activity for its susceptibility to climate change | |
| **Development Policy E – High Quality Design**  
- Developers, local authorities and public agencies should ensure that all development in rural and urban settings delivers the highest possible standards of design, both in terms of urban form and sustainability criteria. All new, replacement and refurbished public buildings should be designed to have multiple uses as far as possible. | **Policy G Sustainable Construction**  
Developers, local authorities, regional agencies and others must ensure that their strategies, plans and programmes achieve best practice in sustainable construction by:  
- Following the principles contained within the Future Foundations, the South West’s sustainable construction charter, to raise awareness of sustainable construction; and  
- Requiring that all new and refurbished residential buildings achieve as a minimum the requirements of Level 3 of the Code for Sustainable Homes in order to minimise lifetime resource use, energy consumption, water use and waste production; and  
- Requiring that all new and refurbished non-residential buildings achieve, as a minimum, the requirements of BREEAM Very Good standard (or, in the case of buildings for which there is no such standard, the nearest comparable standard for the industry) in order to minimise lifetime resource use, energy consumption, water use and waste production; and  
- Requiring that all larger scale residential developments and, in particular, urban extensions, are designed and constructed to meet or exceed the levels of the Code for Sustainable Homes set out in appendix C (vii) table 1; and | |
• Requiring that all larger scale non-residential developments are designed and constructed to meet or exceed the carbon reduction minimum requirements set out in appendix C (vii) table 2; and
• Requiring the use of sustainability statements for larger scale residential and/or mixed-use planning applications (as defined in paragraph 3.7.7), the contents of which should meet, or exceed, the South West Sustainability Checklist for Developments; and
• Minimising the environmental impact of new and refurbished buildings, including reducing air, land, water, noise and light pollution throughout the building’s lifetime; and
• Requiring the use of sustainable drainage systems to minimise flood risk associated with new developments; and
• Designing homes which are safe and adaptable, for example by following Lifetime Homes standards, Secured by Design principles and including live/work space; and
• Taking action to improve the energy efficiency of existing buildings, and ensuring that all refurbished buildings achieve the best current standards of energy efficiency.

Policy RE1 Renewable Electricity Targets: 2010 & 2020
Local Development Documents will include positive policies to enable the achievement of the following targets:
• By 2010 a minimum target of 509 to 611 MWe installed generating capacity, from a range of onshore renewable electricity technologies (the target for Cornwall is 93-108 MWe)
• By 2020 a minimum target of 850 MWe installed generating capacity from a range of onshore renewable electricity technologies. This onshore target, together with offshore renewable electricity capacity, will help to provide at least 20% of the region’s electricity demand by 2020.

Policy RE3 Renewable Heat Targets
• LDDs will include positive policies to enable the achievement of the following targets by the use of appropriate resources and technologies:

<table>
<thead>
<tr>
<th>Timescale</th>
<th>Installed Thermal Capacity (MWth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>100</td>
</tr>
<tr>
<td>2020</td>
<td>500</td>
</tr>
</tbody>
</table>

RE4 Meeting the Targets Through Development of New Resources
When considering individual applications for development of renewable energy facilities, Local Planning Authorities will take into account the wider environmental, community and economic benefits of proposals, whatever their scale, and should be mindful that schemes should not have a cumulative negative impact and that proposals in protected areas should be of an appropriate scale and not compromise the objectives of designation.
### RE5 Renewable Energy and New Development

Larger-scale developments will be expected to provide, as a minimum, sufficient on-site renewable energy to reduce regulated CO2 emissions from energy use by users of the buildings constructed on site by 20%. Developers will be expected to demonstrate that they have explored all renewable energy options, and designed their developments to incorporate any renewable energy requirements. Individual Local Planning Authorities may use lower thresholds for what constitutes a larger-scale development and set higher percentages for on-site generation, taking into account the impact on initial and lifetime affordability of homes.

### SD2 Climate Change

The region’s contribution to climate change will be reduced by:

- Reducing greenhouse gas emissions at least in line with current national targets, ie by 30% by 2026 (compared to 1990 levels)
- Following the principles outlined in SD1 The region will adapt to the anticipated changes in climate by managing the impact of future climate change on the environment, economy and society
- Identifying the most vulnerable communities and ecosystems given current understanding of future climate change and provide measures to mitigate against these effects
- Avoiding the need for development in flood risk areas and incorporating measures in design and construction to reduce the effects of flooding
- Recognising and putting in place policies and measures to develop and exploit those opportunities that climate change will bring
- Requiring ‘future proofing’ of development activity for its susceptibility to climate change
- Improving the resilience and reliability of existing infrastructure to cope with changes in climate and in the light of future demand. It will be a priority for the places identified in Section 3 to determine potential future climate change impacts and plan ways in which key services and infrastructure needs to adapt

All Local Authorities in their LDDs will need to demonstrate how they intend to contribute towards the required 60% cut in CO2 emissions by 2050 and how they intend to identify and respond to the potential impacts of climate change in their area.

### SW Regional Low Carbon Housing Strategy (draft)

#### Setting Regional Carbon Targets

**Headline Target – 2010**

The region should aim to achieve cuts in overall carbon emissions within the domestic sector of **17% from a 1990 baseline**. This is equivalent to the government’s revised expectations outlined within the latest Climate Change Programme published in May 2006.

**Headline Target – 2020**
The region should aim to achieve cuts in overall carbon emissions within the domestic sector of 30% from a 1990 baseline. This is equivalent to the government’s aspirations as outlined within the Energy White Paper published in 2003.

**Beyond 2020 to 2050**
The region should be aiming to achieve cuts in overall carbon emissions within the domestic sector of at least 60% from a 1990 baseline. However given the developments in understanding of climate science it is highly likely that cuts of greater than 60% will be required.

Higher targets in 2010 and 2020 may also need to be set, but will require enhancements within the national policy and funding climate in order to support such increases.

**Setting Regional Fuel Poverty Targets**

**Headline Target – 2010 & 2016**
The region should seek to deliver the national government target to eradicate fuel poverty in vulnerable households by 2010 and in all households by 2016.

**Regional Measures of Success**
In order to deliver these headline targets the region will need to establish, deliver and monitor against a range of key indicators within the following areas:
- New build - for example numbers of new housing constructed to level 3 and level 5 within the Code for Sustainable Homes or EST’s Best Practice Standard (set appropriate percentage levels following discussions with Regional Assembly)
- Existing housing refurbishment - for example, 95% of properties raised to a minimum SAP of 65 (SAP 2005) during refurbishment and 30% of properties raised to a minimum SAP of 80 (SAP 2005) during refurbishment (set measures following discussions with local authorities, levels should be reviewed periodically and revised upwards as appropriate). By 2015-2020, SAP 80 should be the norm following refurbishment rather than SAP 65.
- Measure installation - for example: 600k lofts and 600k cavities insulated by 2010 and 1 million lofts and 900k cavities insulated by 2020, from a 2003 base
- Funding take up - for example secure regionally 50% above national average funding for energy efficiency capital measures by 2010
- Hard to treat - for example number of properties addressed per year (level to be set locally?)
- Benefit take up - for example, percentage of take up for key benefits, e.g. pension credit (needs more work, little data collected at regional level)

**Revision 2010**
**Renewable electricity targets for Cornwall**
Cornwall has a target to achieve between 93 and 108MW of capacity generating electricity from renewable energy sources by 2010.
<table>
<thead>
<tr>
<th><strong>Revision 2020</strong>: Renewable energy targets for the South-West region up to 2020 (2005)</th>
<th>Proposed regional renewable electricity target to 2020: 847MWe (onshore), 400MWe (offshore). Together, this capacity will generate approximately 20% of the region’s electricity demand by 2020, assuming energy efficiency levels as per the government’s Energy White Paper. Proposed regional renewable heat target to 2020: 503 MWth. County level targets to be set once the RSS has been finalised in 2008.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>South West Sustainability Checklist</strong></td>
<td>This is a regional best practice checklist for the built environment. The Climate Change and Energy questions aim to ensure that new developments are appropriately adapted to the impacts of present and future climate change and to minimise their own impact on greenhouse gases, flooding, heat gain, water resources and water quality. The Transport and Movement questions aim to ensure people can reach facilities they need by appropriate transport modes, encouraging walking and public transport use and reducing the use of private cars for shorter journeys.</td>
</tr>
<tr>
<td><strong>Renewable Energy Strategy for the South West of England 2003-2010,</strong></td>
<td>• Setting individual targets to encourage the take up of renewable energy technologies. • Facilitate access to capital for small renewable energy projects. • Stimulate renewable fuel markets (biomass). • RE in planning guidance. • Renewable energy training. • LA officer and councillor support. • Agriculture industry support. • Construction industry support. • Community action. • Develop and promote the RE sector. Make the SW the global centre of expertise for RE.</td>
</tr>
<tr>
<td><strong>Draft Regional Economic Strategy for the South West of England 2006-2015</strong></td>
<td>Reduce the region’s environmental footprint by adopting a low carbon approach to economic development; by improving resource productivity; by promoting renewable energy and by encouraging better environmental efficiency in private and public sectors (p.11)</td>
</tr>
<tr>
<td>CORNWALL POLICY</td>
<td>Relevance/ Targets</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------</td>
</tr>
</tbody>
</table>
| Cornwall Structure Plan | **Policy 1 Principles for Sustainable Development**  
Development should bring about a long term and sustainable improvement to Cornwall's economic, social and environmental circumstances without harming future opportunity.  
Development should be compatible with:  
- the prudent use of resources and the conservation of natural and historic assets;  
- fostering the links between the environment and the economy;  

**Policy 3 Use of Resources**  
Development must be compatible with the prudent use of natural and built resources and energy conservation. Development should:  
- facilitate energy conservation and the utilisation of renewable energy sources reducing energy consumption and CO2 emissions;  
- follow sustainable construction principles including consideration of the use of resources, energy efficiency and local materials.  

**Policy 7 Renewable Energy Resources**  
Provision should be made for renewable energy generation to maximise environmental and economic benefits whilst minimising any adverse local impacts.  
A range of technologies for renewable energy production (for heat and electricity) will be encouraged. Schemes for electricity generation will contribute to a Cornwall target of about 93MW of installed capacity from renewable resources by 2010. This should be through development that increases local benefits, particularly diversification of the rural economy, and minimises any adverse effects on the natural or built environment.  
In respect of land-based wind energy, the scale and location of development should respect landscape character and distinctiveness and reflect, in particular, county-wide priorities to avoid adverse effects on the Area of Outstanding Natural Beauty, significant intrusion into coastal landscapes, and the unreasonable proliferation of turbines in the landscape.  
Local plans should consider potential sites and locations for all forms of renewable energy development against these considerations and should establish clear criteria or appropriate locations for development to contribute to the Cornwall target. |

| Cornwall Community Strategy | Includes the following actions: | |
| (2003) | • Develop Cornwall as a Centre of Excellence for the Natural Environment – this includes an indicator to “increase the use of renewable energy”. (p.33)  
• Develop and demonstrate innovative and prudent use of natural resources - Develop renewable energy resources whilst minimising any local impacts and maximising economic benefits. District council planning departments are delivery partners for this action. |
| Cornwall Sustainable Community Strategy, Cornwall Strategic Partnership (under development) | This will set out what is important for quality of life in Cornwall and what can be done to protect or improve it in a way that is sustainable. It articulates community needs and aspirations and provides a framework to co-ordinate the actions of public, private, voluntary and community organisations to respond.  
Local Development Frameworks provide the spatial interpretation of Sustainable Community Strategies and provide a means of embedding the latter into mainstream services. |
| Action Today for a Sustainable Tomorrow: The Energy Strategy for Cornwall (2004) | Carrick District Council has formally signed up to work together to deliver the 32 actions of this strategy through their role within the Cornwall Sustainable Energy Partnership. The most relevant actions for the urban extension include:  
**Action 2.** Establish and Energy Service Company.  
**Action 5.** Work with LSP's and integrate sustainable energy in district level community strategies, local development frameworks and parish plans.  
**Action 13.** Promote the role of renewable energy technologies in new housing schemes.  
**Action 14.** Work with local and regional partners to assist in meeting the 2010 target for renewable electricity.  
**Action 15.** Work with building developers to ensure that local renewable resources are considered in all developments.  
**Action 19.** Promote development of small-scale biomass plant and markets for biomass energy.  
**Action 20.** Promote the role of biomass CHP in major developments. |
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cornwall Fuel Poverty &amp; Energy Efficiency Action Plan, CSEP (due for publication in 2008)</strong></td>
</tr>
<tr>
<td>Includes fuel poverty distribution and numbers by output areas. Aimed more at reducing fuel poverty in existing housing, but consideration needs to be given to protecting future generations from fuel poverty by ensuring new homes are energy efficient and have access to affordable energy. An ESCo could be a delivery mechanism to ensure energy prices are competitive as well as green. Affordable homes should be affordable to run as well as to buy.</td>
</tr>
<tr>
<td><strong>Cornwall 2006-2009 LAA – ECON 2 outcome (led by CSEP)</strong></td>
</tr>
</tbody>
</table>
| Cornwall’s Local Area Agreement energy outcome includes the following objectives:  
  - Stimulate growth of Cornwall’s sustainable energy economy.  
  - Reduce greenhouse gas emissions & mitigate impacts of climate change.  
  - Reduce fuel poverty and improve quality of life.  
  - Cleaner more efficient production/products & services and shifts in consumer/citizen consumption patterns though choosing lower impact goods and services.  
  - Stretch target to increase the take-up of microgeneration in domestic and community buildings. |
| **2008 Local Area Agreement** |
| A new Local Area Agreement for Cornwall is under development/consultation and is due to start from April 2008. Local priorities to be based on those in Sustainable Community Strategies and local consultation. There will be 35 improvement targets to be managed and delivered through the LAA. These will be chosen from 200 national indicators. The Government is trying to deliver national priority outcomes resulting from the Comprehensive Spending Review through Local Area Agreements. CSEP is proposing an Energy LAA Outcome based on the new National Indicator set (C02, fuel poverty & climate change adaptation) |
| **Strategy and Action - Economic development strategy for Cornwall & the IoS, 2007-2021** |
| This key strategy makes references to energy and climate change priorities throughout, but of particular relevance is the Objective under Theme 1: Improve Competitiveness (p.44), to ‘Ensure Energy Sustainability.’ Actions include:  
  - Establish a ‘low carbon’, competitive economy for Cornwall and the Isles of Scilly.  
  - Prioritise sustainable energy in planning and development.  
  - Increase competitiveness and sustainability of local energy generation and use.  
  - Eliminate fuel poverty.  
  - Create sustainable energy jobs and industry.  
  - Improve the means of energy distribution. |
The vision for the TTAAP clearly states all new developments will incorporate renewable energy and energy saving features to help cut down bills, make better places to live, reduce emissions and respond to the challenges of climate change.

A key principle running through the preferred options set out in the TTAAP is ‘Incorporating sustainable forms of construction, energy conservation measures and renewable energy’ (H3a, H3b, H3c, H4, H5, E2, E5, E6, E7, AC1, AC3)

In terms of overall development principles section of the draft TTAAP contains the following:

**Sustainable Construction**
- 8.1 - wherever possible the needs of development should be met within its own footprint, wherever possible the energy requirements of development should be integrated into and dealt with onsite (8.1)

**Energy Efficiency and Renewables**
- 8.6 sustainability must be at the heart of any new development, the council is committed to ensuring that the urban extension is sustainable and makes a genuine contribution to meeting its own energy needs. The design of new housing, commercial development and community facilities should incorporate significant features of energy efficient design and renewable energy.
- 8.7 The Hightown corridor is a linear area with the majority of development planned for south facing slopes which would favour renewables. The Council will expect maximum use to be made of solar gain, particularly on south facing slopes. A completely new planned development also provides an opportunity to include ground heat energy exchange.
- 8.8 The Hightown corridor also contains major employers, and energy users such as the hospital and the leisure centre, which combined with significant areas of new housing, provide an opportunity to consider the scope for combined heat and power.
- 8.9 Developments will be expected to aspire to the objective of being carbon neutral through a combination of good design, energy efficiency and use of renewables.
- 8.10 A significant contribution can be made to the carbon footprint of the city through the encouragement of renewable energy for existing developments.
- 8.11 Proposals for community renewable energy projects will be encouraged where their impact is acceptable. The Council will explore the potential for sites for renewable energy generation facilities to serve both new and existing development.

The following key points are highlighted at the end of this section:
### Energy Efficiency and renewables
New developments will be expected to provide over 15% on-site renewable energy or to be carbon neutral. An energy use assessment, setting the baseline for the proportion of on-site generation, will be required to be submitted with all applications. All proposals must incorporate energy efficient features.

### Energy efficiency and renewables in existing developments
Where appropriate the Council will encourage the provision of renewable energy sources for new and existing development (including housing and industry). The Council will also search for appropriate land within and adjoining the urban area to encourage the development of a supply of renewable energy for the city.

### Preferred Option DP1: Combined Heat and Power generation
The Council will investigate the feasibility of providing a combined heat and power plant within the proposed urban extension to provide heat and power to major employers/energy users and residential development.

| Carrick Community Strategy | No specific targets, rather a framework for ensuring the community can comment on aspects of the LDF. The production of the SES will include an element of community consultation and this will follow the guidelines and principles set out within this strategy. |
Appendix 3: CSH Scoring Summary
# CSH Scoring Summary

The following information is reproduced from the “Code for Sustainable Homes - A step-change in sustainable home building practice, DCLG, December 2006” pages 12 to 27.

## Category 1: Energy and CO₂

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Emission Rate (TER) as defined by 2006 Building Regulations Approved Document L (2006) – Conservation of Fuel &amp; Power; calculated using SAP:2005</td>
<td>One of the following Point scores</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>14%</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>18%</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>22%</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>25%</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>31%</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>37%</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td>44%</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>52%</td>
<td>10.5</td>
</tr>
<tr>
<td></td>
<td>60%</td>
<td>11.7</td>
</tr>
<tr>
<td></td>
<td>69%</td>
<td>12.9</td>
</tr>
<tr>
<td></td>
<td>79%</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>89%</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>16.4</td>
</tr>
<tr>
<td>a ‘zero carbon home’</td>
<td>17.6</td>
<td></td>
</tr>
</tbody>
</table>

**Target Emission Rate (TER) as defined by 2006 Building Regulation Standards**
- 17.6

**Building fabric Heat Loss Parameter (HLP)**
- EITHER ≤ 1.3: 1.2
- OR ≤ 1.1: 2.4

**Internal lighting**
- Where the following percentage of fixed fittings are dedicated energy efficient fittings
  - EITHER ≥ 40% of fittings: 1.2
  - OR ≥ 75% of fittings: 2.4

**Other Energy**

**Drying space**
- For providing space and posts, footings and fixings for drying clothes in a secure environment for each unit on the site: 1.2

**Ecolabelled white goods**
- EITHER Where fridges, freezers and fridge/freezers have an A+ rating under EU Energy Efficiency Labelling Scheme: 1.2
- AND OPTIONALLY Where washing machines and dishwashers have an A rating and/or washer driers and tumble driers have a B rating under EU Energy Efficiency Labelling Scheme: +1.2
- OR Information is provided on purchasing and benefits of efficient white goods, where such goods are not supplied with the new home: 1.2
### Category 1 – Energy/CO₂

#### Energy and CO₂ (continued)

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>External lighting</td>
<td>Where all space lighting is provided by dedicated energy efficient fittings, taking into account the needs of people who have visual impairments</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>AND OPTIONALLY</strong></td>
<td>Where all burglar security lighting is:</td>
<td>+2.4</td>
</tr>
<tr>
<td></td>
<td>• A maximum of 150W</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fitted with movement detecting and daylight shut-off devices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Where all other security lighting is provided with energy efficient fittings and daylight shut-off devices</td>
<td></td>
</tr>
<tr>
<td>Low or Zero Carbon Energy Technologies</td>
<td><strong>EITHER</strong> Where at least 10% of total energy demand is supplied from local renewable or low carbon energy sources</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong> Where at least 15% of total energy demand is supplied from local renewable or low carbon energy sources</td>
<td>2.4</td>
</tr>
<tr>
<td>Cycle storage</td>
<td>Where provision is made for the safe, weather-proof and secure storage of cycles as follows:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 1 and 2 bedroom dwellings – storage for 1 cycle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 3 bed dwellings – storage for 2 cycles</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 4 bed dwellings and larger – storage for 4 cycles</td>
<td></td>
</tr>
<tr>
<td><strong>EITHER</strong></td>
<td>In 50% or more of dwellings in a development</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td>In 95% or more of dwellings in a development</td>
<td>2.4</td>
</tr>
<tr>
<td>Home office</td>
<td>For the provision of a space and services which allows the occupants to set up a home office in a quiet room</td>
<td>1.2</td>
</tr>
</tbody>
</table>

### Category 2 – Water

#### Water

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal potable water consumption</td>
<td>Where predicted water consumption (calculated using the Code water calculator) accords with the following levels:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤ 120 l/p/d</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>≤ 110 l/p/d</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>≤ 105 l/p/d</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>≤ 90 l/p/d</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>≤ 80 l/p/d</td>
<td>7.5</td>
</tr>
<tr>
<td>External potable water consumption</td>
<td>For providing a system to collect rain water for use in external irrigation/watering e.g. water butts</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### Category 3 – Materials

#### Materials

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental impact of materials</td>
<td>Where the total building points achieved under the CSH materials calculator is as follows:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Score of at least 3 points</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>• Score of at least 6 points</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>• Score of at least 9 points</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>• Score of at least 12 points</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>• Score of 15 points</td>
<td>4.5</td>
</tr>
</tbody>
</table>
Scores are achieved as follows for each of the specifications:
- A+ rating = 3
- A rating = 2
- B rating = 1
- C, D or E = 0

Scores achieved for each of the following elements are added to give the total building score:
- Roof
- External Walls
- Internal Walls (incl. party walls and partitions)
- Floors – upper and ground floors
- Windows

<table>
<thead>
<tr>
<th>Responsible sourcing of materials – basic elements</th>
<th>Where materials used in key building elements are responsibly sourced (e.g. timber certification, EMS etc.)</th>
<th>Between 0.3 points and 1.8 points (for details see Technical Guidance Manual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible sourcing of materials – finishing elements</td>
<td>Where materials used in secondary building and finishing elements are responsibly sourced (e.g. timber certification, EMS etc.)</td>
<td>Between 0.3 Points and 0.9 Points (for details see Technical Guidance Manual)</td>
</tr>
</tbody>
</table>

**Category 4 Surface Water Run-off**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of surface water run-off</td>
<td>Where rainwater holding facilities/sustainable drainage (SUD) is used from site to provide attenuation of water run-off to either natural water courses or municipal systems. Points for attenuation covering: Hard surfaces</td>
<td>0.5 &amp; OPTIONALLY + 0.5</td>
</tr>
<tr>
<td></td>
<td>AND OPTIONALLY: Roofs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The percentage peak time attenuation should be provided as follows</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 50% in low flooding risk areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 75% in medium flooding risk areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 100% in high flooding risk areas</td>
<td></td>
</tr>
<tr>
<td>Flood risk</td>
<td>Where evidence is provided to demonstrate that the assessed development is located in an area of EITHER: low annual probability of flooding</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>OR: medium/high annual probability of flooding (subject to plans being approved by the relevant statutory bodies) and where the ground level of buildings, car parks and access routes are above the flood level; an appropriate assessment of how the building will react to flooding (including the use of resilient construction where necessary) to mitigate residual risk</td>
<td>OR 0.5</td>
</tr>
<tr>
<td>Category 5</td>
<td>Waste</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td><strong>Issue</strong></td>
<td><strong>Measurement Criteria</strong></td>
<td><strong>Points Awarded</strong></td>
</tr>
<tr>
<td>Household recycling facilities</td>
<td>EITHER Where the following recycling facilities are provided:</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>• 3 internal storage bins for recyclable waste with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– min total capacity of 60ltr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– no individual bin smaller than 15ltr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– all bins in a dedicated position that is accessible to disabled people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR Where full recycling facilities are provided:</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>• 3 internal storage bins with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– min total capacity of 30ltr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– no individual bin smaller than 7ltr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– all bins in a dedicated position that is accessible to disabled people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AND EITHER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A Local Authority collection scheme for recyclable materials covering at least three streams of waste with sufficient space for the storage of the bins provided without stacking (within 10m of an external door) and which is accessible to disabled people</td>
<td></td>
</tr>
<tr>
<td></td>
<td>OR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Where there is not a Local Authority collection scheme for recyclable materials, 3 external bins with:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– min total capacity of 180ltr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– no individual bin smaller than 40ltr</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• All bins to be in a dedicated position (within 10m of an external door), which is accessible to disabled people</td>
<td></td>
</tr>
<tr>
<td>Construction waste</td>
<td>EITHER Where the site waste management plan includes procedures and commitments that minimise waste generated on site in accordance with WRAP/Envirowise guidance</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>OR Where the above is achieved and the plan includes procedures and commitments to sort, reuse and recycle construction waste either on site or through a licensed external contractor</td>
<td>1.8</td>
</tr>
<tr>
<td>Composting facilities</td>
<td>Where home composting facilities are provided in houses with gardens or a communal/community composting service provided in other dwelling types suitable for normal domestic non-woody garden, food and other compostable household wastes. Account should be taken concerning the accessibility of these facilities to disabled people</td>
<td>0.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category 6</th>
<th>Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
<td><strong>Measurement Criteria</strong></td>
</tr>
<tr>
<td>Global warming potential (GWP) of insulant</td>
<td>Where all insulating materials avoid the use of substances that have a global warming potential (GWP) of 5 or more (and an Ozone Depleting Potential of zero) in either their manufacture or composition for the following elements</td>
</tr>
<tr>
<td>• Roof (including loft access)</td>
<td></td>
</tr>
<tr>
<td>• Walls internal and external (including doors, lintels and all acoustics insulation)</td>
<td></td>
</tr>
<tr>
<td>• Floor (including foundations)</td>
<td></td>
</tr>
<tr>
<td>• Hot water cylinder, pipe insulation and other thermal stores</td>
<td></td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>Where NOx emissions from any space heating and hot</td>
</tr>
</tbody>
</table>
### Category 7: Health and well-being

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
</table>
| Daylight            | Homes must meet the following standards before points can be awarded:  

  - Kitchen to achieve minimum average daylight factor of at least 2%  
  - Living rooms, dining rooms and studies to achieve a minimum average daylight factor of at least 1.5%  
  - Kitchens, living rooms, dining rooms and studies to be designed to have a view of the sky  

| Sound insulation    | Points are awarded for achieving higher standards of sound insulation than required by Part E of the Building Regulations, and demonstrating it by either using post-completion testing (PCT) or Robust Details (RD)  

| Private space       | For the provision of outside space that is at least partially private, and that is accessible to disabled people  

| Lifetime Homes      | Where all the standards of Lifetime Homes have been complied with, that is:  

  - access to the dwelling (Standards 1-5);  
  - general standards of accessibility within the dwelling (Standards 6-7, 11, 14, 15 and 16);  
  - potential future adaptability of the dwelling (Standards 8, 9, 10, 12 and 13)  

### Category 8: Management

<table>
<thead>
<tr>
<th>Issue</th>
<th>Measurement Criteria</th>
<th>Points Awarded</th>
</tr>
</thead>
</table>
| Home user guide     | Where there is provision in each home of a simple user guide that covers information relevant to the ‘non-technical’ tenant/occupant on the operation and environmental performance of their home, together with information that the user guide is available in alternative accessible formats  

AND optionally  
Where the guide also covers information relating to the site and its surroundings  

| Considerate Constructors Scheme | EITHER  

Where there is a commitment to comply with best practice site management principles and a regular audit under a nationally or locally recognised independent certification scheme such as or comparable to the Considerate Contractors Scheme  

| Construction site impacts | EITHER  

Where there is a commitment and strategy to operate site management procedures on site that cover 2 or more of the following items:  

  - CO₂ or energy arising from site activities  
  - CO₂ arising from transport to and from site  

|                     | OR  

Where the commitment is to go significantly beyond best practice including a regular audit under a nationally or locally recognised independent certification scheme such as, or comparable to, the Considerate Contractors Scheme  

|                     | EITHER  

Where there is a commitment and strategy to operate site management procedures on site that cover 2 or more of the following items:  

  - CO₂ or energy arising from site activities  
  - CO₂ arising from transport to and from site  

### (NOₓ) emissions

Water systems accord with the following

EITHER  

- Dry NOₓ level <=100mg/KWh  
- Boiler class 4 under BS EN 297:1994  

and 2 points (for details see Technical Guidance Manual)
• Water consumption arising from site activities
• Best practice air pollution controls
• Best practice water pollution controls
• 80% of site timber is reclaimed, reused or responsibly sourced

OR
Where there is a commitment as above that covers 4 or more of the items listed

2.2

Security
Points are achieved by complying with ‘Secured by Design – New Homes’ (Section 2: Physical Security). This will include working closely with an Architectural Liaison Officer or Crime Prevention Design Advisor from the local Police Force

2.2

<table>
<thead>
<tr>
<th>Category 9</th>
<th>Ecology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Issue</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Measurement Criteria</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Points Awarded</strong></td>
</tr>
<tr>
<td>Ecological value of the site</td>
<td>Where development land is of low ecological value as defined by either</td>
</tr>
<tr>
<td></td>
<td>• The BRE Ecological Value Checklist</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>• A report prepared by a suitably qualified ecologist</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Where a suitably qualified ecologist confirms that the site will remain undisturbed by the works</td>
</tr>
<tr>
<td>Ecological enhancement</td>
<td>Where ecological features have been designed for positive enhancement in accordance with the recommendations of a suitably qualified ecologist</td>
</tr>
<tr>
<td>Protection of ecological features</td>
<td>Where all existing features of ecological value are maintained and adequately protected from damage during site preparation and construction works</td>
</tr>
<tr>
<td>Change in ecological value of the site</td>
<td>Where the resulting change in ecological value is as follows calculated using the Code Change (see Technical Guidance Manual for details) in Ecological Value Calculator</td>
</tr>
<tr>
<td></td>
<td>• Minor negative change (-9 to -3)</td>
</tr>
<tr>
<td></td>
<td>• Neutral (&lt;-3 to +3)</td>
</tr>
<tr>
<td></td>
<td>• Minor enhancement (&lt;+3 to +9)</td>
</tr>
<tr>
<td></td>
<td>• Major enhancement (&gt;+9)</td>
</tr>
<tr>
<td>Building footprint</td>
<td>EITHER Where the total combined floor area: footprint ratio for all houses on the site is greater than 2.5:1; and</td>
</tr>
<tr>
<td></td>
<td>Where the total combined floor area: footprint ratio for all flats on the site is greater than 3.5:1</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Where the total combined floor area: footprint ratio for all dwellings on the site is greater than 3.5:1</td>
</tr>
</tbody>
</table>

One of the following point scores

1.2

2.4

3.6

4.8

OR

EITHER

1.2

OR

2.4
Appendix 4: EST CSH level 3 Energy Standard
Energy efficiency and the Code for Sustainable Homes

Level 3
## Contents

**Introduction**  
- Expert and industry development  
- Energy Saving Trust guidance  
- Key features  

**The savings**  

**How the Energy Saving Trust 25 per cent guidance works**  

**Criteria for achieving the Energy Saving Trust 25 per cent guidance**  
- Criterion 1: Predicted CO₂ emissions from the dwelling  
- Criterion 2: Design backstops  
- Criterion 3: Provisions to limit the effects of solar gains  
- Criterion 4: Quality of construction and commissioning  
- Criterion 5: Provision of information and future proofing  

**Scenarios for achieving the Energy Saving Trust 25 per cent solutions**  
- Detached house (104m²) scenarios  
- Semi-detached house (89m²) scenarios  
- Mid-terrace house (79m²) scenarios  
- Four-storey flats (61m²) scenarios  

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**Acknowledgement**  
Cover photo: Peter White, BRE  
The Osborne Demonstration House, built at BRE in 2006. The Osborne Demonstration House exceeds the Energy Saving Trust best practice standard for energy efficiency. It is this best practice standard that forms the basis of the mandatory energy requirement for the Code for Sustainable Homes Level 3.
Introduction

Home energy use is responsible for over a quarter of the UK’s carbon dioxide (CO₂) emissions which contribute to climate change.

To help mitigate the effects of climate change, the Energy Saving Trust has developed a range of technical solutions to help UK housing professionals build to higher levels of energy efficiency.

This guide outlines recommendations for housing professionals to meet the energy efficiency requirements of level 3 of the Code for Sustainable Homes.

Expert and industry development
In 2005 the Energy Saving Trust commissioned BRE to work in collaboration with an industry consultation group. The aim was to carry out research that would underpin solutions to achieve a 25 per cent reduction in carbon emissions. This standard became known as the Energy Saving Trust best practice standard. The specifications were arrived at using a combination of energy modelling and analysis of existing low carbon dwellings, as well as practical experience provided by the developer design teams. The solutions were assessed against the seven most common built forms, and refined in line with comments from industry consultees before being finalised for launch in 2006.

In December 2006 Communities and Local Government (CLG) adopted the best practice standard to form the basis of the mandatory energy requirement for the Code for Sustainable Homes level 3.

Energy Saving Trust guidance
This publication is the first in a suite of Energy Saving Trust guides, designed to achieve step-change energy efficiency improvements over national building regulations¹. It provides technical guidance on designing and building new homes that have 25 per cent lower CO₂ emissions than the minimum levels in the regulations, and meet the energy requirements of the Code for Sustainable Homes level 3.

Other guides in this series cover 44 per cent, 100 per cent and true zero carbon and will help housing professionals to meet levels 4, 5 and 6 of the Code for Sustainable Homes respectively.

For more information on the other Energy Saving Trust guides go to www.energysavingtrust.org.uk/housing or contact the free helpline on 0845 120 77 99.

Who the guides are for
Energy Saving Trust guides will help:

- Anyone wanting to build a low carbon dwelling (whether developer, designer or builder, etc).
- Developers and specifiers needing to formulate robust energy specifications to demonstrate performance beyond the requirements of current building regulations.
- Policy makers in local government wanting to refer to recognised standards in local development frameworks.
- Builders required to meet an energy efficiency standard – building to best practice reduces technical risks whilst maintaining a good level of flexibility.
- Housing professionals required to meet a percentage target for the use of renewable energy – this is made easier by building to best practice because dwelling energy demand is reduced.

Outline of the guidance
This guide presents the required criteria and a set of scenarios for applying the Energy Saving Trust 25 per cent guidance.

The guidance is based on energy efficient products and technologies that combine to give very well insulated, airtight dwellings with appropriate and efficient building services. It emphasises the importance of maximising long-lasting energy efficiency improvements to the fabric of a dwelling, before adding the optimum renewables solution.

if required. Due to the multitude of potential configurations it has not been possible to present every combination of fabric and renewables strategy. The scenarios have been modelled using four standard housing types:

1. Detached house – 104m² (page 12)
2. Semi-detached house – 89m² (page 13)
3. Mid-terrace house – 79m² (page 14)
4. Four storey flats – 61m² (page 15)

Key features
Key features of the Energy Saving Trust guidance include:

An integrated design-led approach
The guidance provides an integrated design-led approach so that insulation, heating and ventilation systems work together to maximise cost-effectiveness in construction, and minimise occupant fuel costs. Carbon reduction targets are combined with minimum ‘backstop’ design performance requirements based on practical insulation levels and appropriate dwelling airtightness.

Flexibility
Beyond these backstop requirements, the method of achieving the desired CO₂ reduction is flexible – insulation can be increased, renewables can be added, and thermal bridging or airtightness can be improved. Builders are free to innovate and use newly available products, or to minimise technical risks by using only tried and tested solutions.

Proven solutions
All of the aspects, strategies, and components required by the guidance have been successfully built on developments in the UK. These solutions bring these together to form a rounded approach that is achievable using proven and available products and technologies. If product availability or skills are limited, industry should consider taking the lead in developing stronger manufacturing capability via their supply chains, and increasing on-site skills through training.

Compatibility across the UK
This guidance has been structured to ensure alignment with the building regulations in England and Wales, and has been reviewed to ensure continuing compatibility with subsequent changes in Scotland and Northern Ireland, as well as the Code for Sustainable Homes.

A familiar format
This guidance has been specifically designed to adopt the existing building regulations compliance methodology, ensuring a familiar format for builders and designers that will help to speed up the design process.

More help available
The Energy Saving Trust provides a specifiers’ helpline and a range of publications for support and assistance (see back page for details).

Achieving Level 3 of the Code for Sustainable Homes
As well as showing housing professionals how to achieve CO₂ emissions that are 25 per cent lower than the requirements of current building regulations, the guidance describes how to meet the energy efficiency requirement of level 3 of the Code for Sustainable Homes. This level of efficiency is mandatory for all publicly funded housing in England and is likely to be incorporated into the new national Building Regulations in England and Wales by 2010. It is possible that Scotland, Wales and Northern Ireland may adopt a similar rating scheme in the future.

In addition to the energy efficiency benefits, this guidance also describes how to achieve additional credits for internal lighting, external lighting and drying space under the Code for Sustainable Homes (and EcoHomes, where applicable). Further credits for the heat loss parameter and the use of renewables are available, and depend on the specifics of the design.
The savings

Table 1 compares typical fuel costs and CO₂ emissions for dwellings constructed in accordance with Energy Saving Trust 25 per cent guidance, with the requirements of current building regulations.

<table>
<thead>
<tr>
<th>Dwelling type</th>
<th>Building regulations</th>
<th>Energy Saving Trust 25% solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fuel cost (£/yr)</td>
<td>CO₂ (t/yr)</td>
</tr>
<tr>
<td>Detached house (104m²)</td>
<td>265</td>
<td>2.3</td>
</tr>
<tr>
<td>Semi-detached house (89m²)</td>
<td>227</td>
<td>1.9</td>
</tr>
<tr>
<td>Mid-terrace house (79m²)</td>
<td>197</td>
<td>1.6</td>
</tr>
<tr>
<td>Flats (61m²)</td>
<td>205</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Notes on table 1

- The dwelling-type modelling applies to England and Wales. Different regulations in Northern Ireland and Scotland mean that results may differ from those in table 1.
- All of the fuel costs and carbon intensities are taken from SAP 2005. Costs and CO₂ emissions have been obtained for each house type by averaging results across the scenarios presented on pages 12 to 15.
- Due to SAP compliance methodology, the emissions shown in table 1 do not reflect low energy lighting savings beyond the requirements of current building regulations levels (30%).
- Figures for the flats are the aggregate of ground, middle and top-floor dwellings in a four-storey building.
How the Energy Saving Trust 25 per cent guidance works

There are two key stages – summarised in figure 1 – in achieving 25 per cent less CO₂ emissions than the legal maximum CO₂ emissions required by the building regulations:

1 Establishing minimum backstop design performance requirements on practical insulation levels (see page 8) and appropriate dwelling airtightness (see page 10). It is up to the design teams to determine how best to meet the specified U-values, airtightness and other parameters, and the exact specifications may vary depending on individual dwelling design.

2 Once the backstop values have been adopted, fabric, service or renewable options (pages 12–15) are then used to gain the 25 per cent reduction. This gives the guidance user flexibility in choosing whether to increase insulation, improve thermal bridging or airtightness, or add renewables.

Figure 1: Summary of how the Energy Saving Trust 25 per cent guidance works
Criteria for achieving the Energy Saving Trust 25 per cent guidance

Achieving a 25 per cent improvement using the Energy Saving Trust guidance can be demonstrated by complying with all of the five criteria listed below, and detailed on the following pages.

**Criterion 1**
The predicted CO₂ emissions from the dwelling (the Dwelling Emission Rate, DER) should be no worse than the Energy Saving Trust Target Emission Rate (TER (Energy Saving Trust 25% guidance)) – see below.

**Criterion 2**
All relevant areas of the dwelling should comply with the design backstops as set out in the table on pages 8 to 9.

**Criterion 3**
Provision should be made to limit the effects of internal temperature rises in the summer due to excessive solar gains, as set out on page 9.

**Criterion 4**
The quality of construction and commissioning should meet the requirements as set out in the table on page 10.

**Criterion 5**
Requirements for provision of information and future proofing should be adhered to, as set out on page 10.

---

**Criterion 1: Predicted CO₂ emissions from the dwelling**

To assess whether a dwelling design achieves the 25 per cent CO₂ reduction, the target carbon dioxide emission rate (TER) methodology should be used (as defined in national building regulations).

The TER is expressed in terms of the annual CO₂ emissions, in kg per m² of floor area.

Different dwellings will have different emissions targets, because the TER is based on floor area, dwelling shape and other factors, such as the heating fuel used. Under national building regulations, the dwelling’s DER (dwelling emissions as designed) should be equal or less than its TER to pass.

A similar method is adopted for assessing compliance with the Energy Saving Trust 25 per cent guidance, but in order to give the desired CO₂ savings the TER is reduced by 25 per cent by multiplying it by 0.75.

\[
\text{TER (national building regulations)} \times 0.75 = \text{TER (Energy Saving Trust 25% guidance)}
\]

Beyond this the method is unchanged from standard national building regulations compliance, i.e. the DER is required to be equal or less than the TER (Energy Saving Trust 25% guidance) to pass.

The following equation clarifies this:

\[
\text{DER (proposed dwelling)} \leq \text{TER (Energy Saving Trust 25% guidance)}
\]

This is usually easiest to achieve using an approved SAP software package.
## Criterion 2: Design backstops

<table>
<thead>
<tr>
<th>Aspect</th>
<th>National building regulations&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Energy Saving Trust 25% solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opaque elements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W/m².K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>roof</td>
<td>0.20</td>
<td>0.13</td>
</tr>
<tr>
<td>walls</td>
<td>0.35</td>
<td>0.25</td>
</tr>
<tr>
<td>exposed floors</td>
<td>0.25</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>Windows and doors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W/m².K</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For further guidance see ‘Windows for new and existing housing’ (CE66)&lt;sup&gt;2&lt;/sup&gt;.</td>
<td>2.2 (area weighted average).</td>
<td>Windows must achieve a BFRC (British Fenestration Rating Council) rating in band C or better. Doors should achieve U-values better than 1.5 if glazed, or 1.0 if solid.</td>
</tr>
<tr>
<td><strong>Space and hot water heating</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For further guidance see ‘Central heating system specifications (CHeSS) – year 2005’ (CE51/GIL59).</td>
<td>Services must comply with the limits set out in the ‘Domestic Heating Compliance Guide’&lt;sup&gt;3&lt;/sup&gt;.</td>
<td>Where gas, LPG or oil central heating systems are specified they should conform to CHeSS HR5 or HC5 (2005).</td>
</tr>
<tr>
<td><strong>Ventilation</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| For further guidance see ‘Energy efficient ventilation in dwellings – a guide for specifiers’ (GPG268). | Purpose provided ventilation should be provided by way of methods accepted in national building regulations. | Mechanical extract ventilation (MEV):  
  - The whole system must have a specific fan power (SFP) of 0.6 Watts per litre per second or less; or  
  - Whole house mechanical ventilation with heat recovery (MVHR):  
    - The whole system must have a specific fan power (SFP) of 1 Watt per litre or less; and  
    - The heat recovery efficiency must be 85% or better.  
To claim full credit under SAP 2005, the performance of an MEV or MVHR unit should be assessed using SAP Appendix Q test methodologies<sup>4</sup>. |
| **Lighting (internal)**         |                                            |                                  |
| percentage of all fixed lighting to be dedicated low energy (i.e. only accept low energy lamps with luminous efficacy of greater than 40 lumens per circuit Watt). For further guidance see ‘Energy efficient lighting – guidance for installers and specifiers’ (CE61). | A. One per 25m² of dwelling floor area (excluding garages) or part thereof; or  
B. One per four fixed lighting fittings. | 75 per cent. The lamp fitting may contain one or more lamps and should include the ballast, appropriate housing, reflector, shade or diffuser or other appropriate device for controlling the output of light. If tubular fluorescent lamps are used, T8 (26mm tube diameter) lamps, or preferably T5 (16mm diameter) lamps should be specified. |
| **Lighting (external)**         |                                            |                                  |
| Maximum lamp capacity of 150 Watts per fitting with controls that automatically switch off:  
1. When there is enough daylight; and  
2. When it is not required at night, or only energy efficient light fittings greater than 40 lumens per circuit Watt. | Maximum lamp capacity of 150 Watts per fitting with controls that automatically switch off:  
1. When there is enough daylight; and  
2. When it is not required at night, or only energy efficient light fittings greater than 40 lumens per circuit Watt and compatible photocell or timer. |
## Criterion 3: Provisions to limit the effects of solar gains

In order to comply with the Energy Saving Trust 25 per cent guidance, care must be taken to use appropriate steps to avoid summer overheating. ‘Reducing overheating – a designers guide’ (CE129) gives information on avoiding overheating by reducing heat gains, solar shading, incorporating thermal mass and providing secure night ventilation.

SAP2005 Appendix P contains a procedure that enables designers to check whether solar gains are excessive. Reasonable provision would be achieved if the SAP assessment indicates that the dwelling will not have a high risk of high internal temperatures.

**In order to comply with the Energy Saving Trust 25 per cent guidance, the use of mechanical cooling (air conditioning) is not permitted.**
Criterion 4: Quality of construction and commissioning

<table>
<thead>
<tr>
<th>Aspect</th>
<th>National building regulations</th>
<th>Energy Saving Trust 25% solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air permeability</strong> m³/(hr.m²)@50Pa</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Confirmed after construction (but prior to completion) by a pressure test carried out in accordance with the procedure set out in the ATTMA publication ‘Measuring air permeability of building envelopes’. For further guidance see ‘Improving airtightness in dwellings’ (CE137/GPG224).</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

Limiting of thermal bridging

Repeating thermal bridges within the planes of the construction will be accounted for within the U-value calculations, however junctions between elements (non-repeating thermal bridges) need special consideration.

For further guidance see ‘Accredited construction details’ and BRE information paper IP1/06 ‘Assessing the effect of thermal bridging at junctions and around openings’.

The use of Accredited Construction Details, or alternatively the assessment of bespoke constructions using IP1/06 is acceptable.

1. Please see http://www.attma.org/ATTMA_TS1_Issue2_July07.pdf
3. Please see http://www.brebookshop.com

Criterion 5: Provision of information and future proofing

Householders should be provided with clear and simple operating and maintenance instructions for both fixed building services and the dwelling as a whole, to help achieve energy efficient operation. Examples of the kind of information to include are:

- How to adjust the time and temperature settings of heating controls.
- How to maintain services and any equipment included with the home at optimum energy efficiency.
- The energy rating of the home.

The Energy Saving Trust produces a number of technical publications on energy efficiency and renewable energy which may be of assistance. These can be found at www.energysavingtrust.org.uk/housing/publications If renewable energy technologies are not installed on a dwelling, it should be designed and constructed to facilitate the installation of renewable energy technologies at some point in the future. This requirement will depend on the renewable energy technologies appropriate to the particular dwelling, for example:

- Roof structure with identified fixing locations for PV or solar hot water panels.
- Space for enlarged hot water cylinder (solar hot water).
- Roof orientated to face between south-east and south-west with minimal overshadowing, to maximise PV and solar hot water panel efficiency.
- Provision of identified and accessible electrical cable ductwork between the electrical consumer unit and proposed location of generating equipment (small scale wind and PV).
Scenarios for achieving the Energy Saving Trust 25 per cent solutions

The following scenarios show various ways that the Energy Saving Trust guidance can help achieve a 25 per cent improvement in energy efficiency over the national building regulations, and thus achieve a 25 per cent reduction in CO₂ emissions in line with level 3 of the Code for Sustainable Homes.

Please note that due to minor regional variations the scenarios shown are for England and Wales only, but suitable specifications for Scotland and Northern Ireland will in most cases be very similar. In all cases, the relevant requirements of current building regulations should always be checked to ensure that they are satisfied.

Certain options may show improvements that are significantly in excess of the required 25 per cent, but it is still important to ensure that the fundamental thermal performance of the building fabric is of a suitably high standard. This is because the lifespan of the dwelling may be up to 100 years, and heating systems may subsequently be replaced with less efficient models. Therefore, even with the inclusion of low or zero-carbon heating technology, best practice backstop U-values, airtightness and other relevant factors should be adhered to.
Detached house (104m²) scenarios

<table>
<thead>
<tr>
<th>Fabric U-values W/m².K</th>
<th>Typical building regulations scenario</th>
<th>Improvements to fabric only</th>
<th>Gas boiler</th>
<th>Biomass boiler</th>
<th>Heat pump</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Solar water heating</td>
<td>PV panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roof</td>
<td>0.15</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Walls</td>
<td>0.30</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Ground floor</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Windows</td>
<td>1.90</td>
<td>1.20</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Doors</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>y-value</td>
<td>0.08 (accredited construction details)</td>
<td>0.04</td>
<td>0.08 (accredited construction details)</td>
<td>0.08 (accredited construction details)</td>
<td>0.08 (accredited construction details)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ventilation</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Airtightness m³/(hr.m²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Ventilation</td>
<td>Extractor fans</td>
<td>MVHR 85% efficiency, 1W/(l.s) specific fan power</td>
<td>MVHR 85% efficiency, 1W/(l.s) specific fan power</td>
<td>MVHR 85% efficiency, 1W/(l.s) specific fan power</td>
<td>MVHR 85% efficiency, 1W/(l.s) specific fan power</td>
</tr>
<tr>
<td>Boiler</td>
<td>Gas condensing 90%, boiler interlock</td>
<td>Gas condensing 90%, boiler interlock</td>
<td>Gas condensing 90%, boiler interlock</td>
<td>Wood pellet independent boiler, 86%</td>
<td>Electric ground to water heat pump</td>
</tr>
<tr>
<td>Controls</td>
<td>Programmer, room thermostat, thermostatic radiator valves</td>
<td>Programmer, room thermostat, thermostatic radiator valves</td>
<td>Programmer, room thermostat, thermostatic radiator valves</td>
<td>Programmer, room thermostat, thermostatic radiator valves</td>
<td>Programmer and at least 2 room thermostats</td>
</tr>
<tr>
<td>Water heating</td>
<td>160 litre cylinder, 50mm insulation</td>
<td>160 litre cylinder, 50mm insulation</td>
<td>210 litre dual coil cylinder, 50mm insulation</td>
<td>160 litre cylinder, 50mm insulation</td>
<td>160 litre cylinder, 80mm insulation</td>
</tr>
</tbody>
</table>

10% secondary heating (as required under building regulations methodology)
Electric heaters

Renewables
n/a

Low energy lighting
30% 75% 75% 75% 75%

CO₂
TER 23.76 23.76 23.76 23.76 25.30
DER 23.46 1757 1760 12.12 19.66
Improvement 1.3% 26.1% 25.9% 49.0% 41.7%*

*Here the TER has changed because the heating fuel for this option has different CO₂ emissions
## Semi-detached house (89m²) scenarios

<table>
<thead>
<tr>
<th>Fabric U-values W/m².K</th>
<th>Typical building regulations scenario</th>
<th>Improvements to fabric only</th>
<th>Gas boiler</th>
<th>Biomass boiler</th>
<th>Heat pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>0.15</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Walls</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Ground floor</td>
<td>0.25</td>
<td>0.15</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Windows</td>
<td>1.90</td>
<td>1.20</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Doors</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>y-value</td>
<td>0.08 (accredited construction details)</td>
<td>0.04</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
</tr>
</tbody>
</table>

### Ventilation

<table>
<thead>
<tr>
<th>Airtightness m³/(hr.m²)</th>
<th>Mechanical ventilation</th>
<th>Boiler</th>
<th>Controls</th>
<th>Water heating</th>
<th>10% secondary heating (as required under building regulations methodology)</th>
<th>Renewables</th>
<th>Low energy lighting</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Extractor fans</td>
<td>Gas condensing 90%, boiler interlock</td>
<td>Programmer, room thermostat, thermostatic radiator valves</td>
<td>160 litre cylinder, 50mm insulation</td>
<td>Electric heaters</td>
<td>n/a</td>
<td>30%</td>
<td>23.00</td>
</tr>
</tbody>
</table>

### Heating

<table>
<thead>
<tr>
<th>Boiler</th>
<th>Controls</th>
<th>Water heating</th>
<th>10% secondary heating (as required under building regulations methodology)</th>
<th>Renewables</th>
<th>Low energy lighting</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas condensing 90%, boiler interlock</td>
<td>Programmer, room thermostat, thermostatic radiator valves</td>
<td>160 litre cylinder, 50mm insulation</td>
<td>Electric heaters</td>
<td>n/a</td>
<td>30%</td>
<td>23.00</td>
</tr>
</tbody>
</table>

### Renewable

- n/a: Not applicable
- Solar water heating 3m² 0.45kWp PV

### CO₂

- TER: 23.00
- DER: 22.69
- Improvement: 1.3%

*Here the TER has changed because the heating fuel for this option has different CO₂ emissions*
## Mid-terrace house (79m²) scenarios

<table>
<thead>
<tr>
<th>Fabric U-values W/m².K</th>
<th>Typical building regulations scenario</th>
<th>Energy Saving Trust 25% solutions</th>
<th>Improvements to fabric only</th>
<th>Gas boiler</th>
<th>Biomass boiler</th>
<th>Heat pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>0.15</td>
<td></td>
<td>0.10</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Walls</td>
<td>0.30</td>
<td></td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Ground floor</td>
<td>0.20</td>
<td></td>
<td>0.15</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Windows</td>
<td>1.90</td>
<td></td>
<td>1.00</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>Doors</td>
<td>2.00</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>y-value</td>
<td>0.08 (accredited construction details)</td>
<td>0.04 (accredited construction details)</td>
<td>0.08 (accredited construction details)</td>
<td>0.08 (accredited construction details)</td>
<td>0.08 (accredited construction details)</td>
<td></td>
</tr>
</tbody>
</table>

### Ventilation

- **Airtightness m³/(h·m²)**: 7.0, 3.0, 3.0, 3.0, 3.0

### Heating

- **Boiler**
  - Gas condensing 90%, boiler interlock
  - Gas condensing 90%, weather or load compensator and delayed start
  - Gas condensing 90%, boiler interlock
  - Wood pellet independent boiler, 86%
  - Electric ground to water heat pump

- **Controls**
  - Programmer, room thermostat, thermostatic radiator valves
  - Programmer, room thermostat, thermostatic radiator valves
  - Programmer, room thermostat, thermostatic radiator valves
  - Programmer and at least 2 room thermostats

- **Water heating**
  - 140 litre cylinder, 50mm insulation
  - 140 litre cylinder, 50mm insulation
  - 190 litre dual coil cylinder, 50mm insulation
  - 140 litre cylinder, 50mm insulation
  - 140 litre cylinder, 80mm insulation

- **10% secondary heating (as required under building regulations methodology)**
  - Electric heaters
  - Electric heaters
  - Electric heaters
  - Electric heaters
  - Electric heaters

### Renewables

- Solar water heating 3m²
- 0.42kWp PV

### Low energy lighting

- 30%, 75%, 75%, 75%

### CO₂

- DER: 21.04, 15.83, 15.77, 12.07, 16.19
- Improvement: 1.3%, 25.8%, 26.0%, 43.4%, 46.3%*

*Here the TER has changed because the heating fuel for this option has different CO₂ emissions*
## Four-storey flats (61m²) scenarios

<table>
<thead>
<tr>
<th></th>
<th>Typical building regulations scenario</th>
<th>Energy Saving Trust 25% solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Improvements to fabric only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>Fabric U-values W/m²K</td>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>Roof</td>
<td>0.10</td>
<td>0.13</td>
</tr>
<tr>
<td>Walls</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Ground floor</td>
<td>0.15</td>
<td>0.20</td>
</tr>
<tr>
<td>Windows</td>
<td>1.20</td>
<td>1.50</td>
</tr>
<tr>
<td>Doors</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>y-value</td>
<td>0.08 (accredited construction details)</td>
<td>0.08 (accredited construction details)</td>
</tr>
<tr>
<td>Ventilation</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Airtightness m³/(hr.m²)</td>
<td></td>
<td>Extractor fans</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td></td>
<td>MVHR 85% efficiency, 1W/(l.s) specific fan power</td>
</tr>
<tr>
<td>Heating</td>
<td></td>
<td>MVHR 85% efficiency, 1W/(l.s) specific fan power</td>
</tr>
<tr>
<td>Boiler</td>
<td>Electric storage heaters, integrated storage/direct acting</td>
<td>Electric storage heaters, integrated storage/direct acting</td>
</tr>
<tr>
<td>Controls</td>
<td>Automatic charge control</td>
<td>Automatic charge control</td>
</tr>
<tr>
<td>Water heating</td>
<td>Electric immersion</td>
<td>Electric immersion</td>
</tr>
<tr>
<td>10% secondary heating</td>
<td>Electric heaters</td>
<td>Electric heaters</td>
</tr>
<tr>
<td>(as required under building regulations methodology)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Renewables</td>
<td>n/a</td>
<td>2.5kWp PV shared across 4 storeys</td>
</tr>
<tr>
<td>Low energy lighting</td>
<td>30%</td>
<td>75%</td>
</tr>
<tr>
<td>CO₂</td>
<td>Aggregate TER</td>
<td>31.75</td>
</tr>
<tr>
<td></td>
<td>Aggregate DER</td>
<td>31.21</td>
</tr>
<tr>
<td></td>
<td>Improvement</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

*Here the TER has changed because the heating fuel for this option has different CO₂ emissions*
Further information

The Energy Saving Trust provides free technical guidance and solutions to help UK housing professionals design, build and refurbish to high levels of energy efficiency. These solutions cover all aspects of energy efficiency in domestic new build and renovation. They are made available through the provision of training seminars, downloadable guides, online tools and a dedicated helpline.

A complete list of guidance categorised by subject area can be found in Energy Efficiency is best practice (CE279). To download this, and to browse all available Energy Saving Trust best practice publications, please visit www.energisavingtrust.org.uk/housing/publications

The following publications may also be of interest:

General
- Domestic energy efficiency primer (CE101)
- Energy efficiency frequently asked questions (CE126)

For a variety of shorter introductory guides, visit: www.energisavingtrust.org.uk/resources/publications
- Building your own energy efficient house (CE123)

Insulation
- Insulation materials chart – thermal properties and environmental ratings (CE71)

Lighting
- Low energy domestic lighting (GIL20)
- Cost benefit of lighting (CE56)

Windows
- Windows for new and existing housing (CE66)

To view a list of the most efficient windows currently available, please visit www.bfrc.org

Heating system
- Domestic heating by electricity (CE185)
- Domestic heating by solid fuel (CE47)
- Domestic heating by gas (inc LPG) (CE30)
- Domestic heating by oil (CE29)

To view a list of the most efficient boilers currently available, please visit www.boilers.org.uk

Airtightness and efficient ventilation
- Improving airtightness in dwellings (CE137)
- Energy efficient ventilation in housing (GPG268)

Renewables
- Renewable energy sources for homes in urban environments (CE69)
- Renewable energy sources for homes in rural environments (CE70)
- Domestic ground source heat pumps (CE82)
- Solar Water Heating Systems (CE131)

To obtain these publications or for more information, call 0845 120 7799, email bestpractice@est.org.uk or visit www.energisavingtrust.org.uk/housing

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bestpractice@est.org.uk www.energisavingtrust.org.uk/housing

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Appendix 5: Developer Guide
1. Introduction

This guide sets out the required targets that new homes and other buildings should be built to within the Truro & Threemilestone urban extension. It deals with the requirements to reduce carbon emissions from new build and ensure high levels of sustainable construction are used.

The Council considers that it is essential that the development has a low impact and leads to the creation of sustainable, future proofed communities. The aspirations of the Council include to:

- work to the principles of sustainable development;
- help mitigate against, and adapt to, climate change;
- use resources as efficiently as possible;
- create sustainable communities;
- consider ways to make the development carbon neutral by ensuring that energy is used as efficiently as possible and the use of low carbon and renewable energy resources are maximised;
- use good quality design, local materials, and sustainable construction techniques.

Developers will be required to work towards these aspirations, based upon the targets set out within this guide. This will require high quality sustainable forms of construction in line with the national programmes of the Code for Sustainable Homes and BREEAM. It will also require the use of on-site renewable energy generation and high levels of energy efficiency. The aim is to achieve affordable energy-efficient homes, reducing both fuel poverty and CO₂ emissions.

The targets for the urban extension are based upon the 2008 recommendations from the Examination in Public of the draft Regional Spatial Strategy (RSS). These are described in detail below.

It should be noted that this guide was produced in March 2008 and it is likely that more detailed guidance and practical examples of building to high levels of the Code will emerge.

**NB**: It is important to read the whole of this guide to understand the relationship between the different requirements.
2. Target Summary

As well as meeting the requirements of Building Regulations the following targets will need to be met. All development with the urban extension area will be classified as ‘large scale development’.

Developers must ensure that their plans achieve best practice in sustainable construction by meeting the following requirements:

- Follow the principles contained within Future Foundations, the South West’s sustainable construction charter;
- Produce sustainability statements for larger scale residential and/or mixed-use planning applications, the contents of which should meet, or exceed, the South West Sustainability Checklist for Developments;
- Minimise the environmental impact of new and refurbished buildings, including reducing air, land, water, noise and light pollution throughout the building’s lifetime;
- Use sustainable drainage systems to minimise flood risk associated with new developments;
- Take action to improve the energy efficiency of existing buildings, and ensure that all refurbished buildings achieve the best current standards of energy efficiency.
- Produce an energy strategy for larger scale developments which describes how much energy is expected to be used within the proposal, and therefore carbon emissions produced, and considers ways in which the ‘energy hierarchy’ can be put into effect.
- For larger-scale developments, provide, as a minimum, sufficient on-site renewable energy to reduce CO₂ emissions from buildings by the equivalent of 20% of regulated emissions.
- Demonstrate that all renewable energy options have been considered, and design developments to incorporate the renewable energy requirements.

For homes:

- Ensure that all new and refurbished residential buildings achieve, as a minimum, the requirements of Level 3 of the Code for Sustainable Homes in order to minimise lifetime resource use, energy consumption, water use and waste production;
- Design homes which are safe and adaptable, for example by following Lifetime Homes standards and Secured by Design principles and include live/work space;
- Ensure that all larger scale residential developments and, in particular urban extensions, are designed and constructed to meet or exceed the carbon reduction minimum levels set out in table 1 below:

<table>
<thead>
<tr>
<th>Date</th>
<th>Scale of Development</th>
<th>Level of the Code for Sustainable Homes</th>
<th>Of Which, Minimum Requirements for On-Site CO₂ Reduction Required Beyond Requirement of Part L BR 2006</th>
<th>Of Which, Minimum On-Site Renewables To meet requirement of Policy RE5 of RSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 to 2010</td>
<td>10 or more dwellings</td>
<td>Level 4</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td>20% regulated emissions (20% of 2006 TER)</td>
</tr>
<tr>
<td>2011 to 2015</td>
<td>10 or more dwellings</td>
<td>Level 5</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td>2016 on</td>
<td>Residential: 10 to 50 dwellings</td>
<td>Level 5</td>
<td>100% regulated emissions (100% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Residential: &gt; 50 dwellings</td>
<td>Level 6</td>
<td>100% total emissions</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Carbon reduction requirements for residential developments
For non-domestic buildings:

- Ensure that all new and refurbished non-residential buildings achieve, as a minimum, the requirements of BREEAM ‘very good’ standard (or, in the case of buildings for which there is no such standard, the nearest comparable standard for the industry) in order to minimise lifetime resource use, energy consumption, water use and waste production;

- Ensure that all larger scale non-residential developments are designed and constructed to meet or exceed the carbon reduction minimum requirements set out in table 2 below.

<table>
<thead>
<tr>
<th>Date</th>
<th>Scale of Development</th>
<th>Minimum Requirements for On-Site CO₂ Reduction Required Beyond Requirement of Part L BR 2006 to Meet Development Policy G of RSS</th>
<th>Of Which, Minimum Onsite Renewables Required to Meet Policy RE5 of RSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2010</td>
<td>Non residential &gt; 1000m²</td>
<td>25% regulated emissions (25% of 2006 TER)</td>
<td>20% regulated emissions (20% of 2006 TER)</td>
</tr>
<tr>
<td>2011-2015</td>
<td>Non residential &gt; 1000m²</td>
<td>34% regulated emissions (34% of 2006 TER)</td>
<td></td>
</tr>
<tr>
<td>2016 on</td>
<td>Non residential &gt; 1000m²</td>
<td>44% regulated emissions (44% of 2006 TER)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Carbon reduction requirements for non-residential developments

3. Meeting the Targets

3.1 Future Foundations

**Target:** The principles contained within Future Foundations need to be followed.

Future Foundations is the South West’s sustainable construction charter [http://www.futurefoundations.co.uk/](http://www.futurefoundations.co.uk/). It describes sustainable construction in terms of new buildings and refurbishments that promotes environmental, social and economic gains now and for the future. This aims to create a better quality of life for everyone, now and for generations to come. It means recognising that our economy, environment and social well-being are interdependent.

The charter sets out the following basic principles:

<table>
<thead>
<tr>
<th>Siting</th>
<th>Buildings should 'sit' appropriately in their surroundings - be sensitive in scale and style to the character of the existing natural and built environment, reuse previously developed sites, wherever possible, and develop locations already served by transport, communications and utilities infrastructure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials</td>
<td>Construction should prioritise the use of local and natural/recycled materials.</td>
</tr>
<tr>
<td>Construction Techniques</td>
<td>The latest environmental techniques should be specified - to save energy, water and waste during a development’s construction, operation and decommissioning phases.</td>
</tr>
<tr>
<td>ICT</td>
<td>Construction design and specification should maximise future Information Communication Technology capacity.</td>
</tr>
<tr>
<td>Community Involvement</td>
<td>Communities should be informed about, and involved in, the planning and design of buildings in their area which should be safe, secure and accessible to all.</td>
</tr>
<tr>
<td>Local Sourcing</td>
<td>The use of local labour, training, design and creativity should be maximised to support local economies and minimise energy use in transportation/travel.</td>
</tr>
</tbody>
</table>
It is recommended that these issues are covered within the sustainability statements that must accompany planning applications. It is also recommended that developers make an online pledge to this charter.

### 3.2 South West Sustainability Checklist

<table>
<thead>
<tr>
<th>Target: Proposals need to meet or exceed the requirements of this checklist.</th>
</tr>
</thead>
</table>

Developed by Future Foundations and BRE, the checklist has been devised to guide the design of new developments by making sense of current policy, highlighting best practice, and complementing the new Code for Sustainable Homes.

It is intended for use at the design and planning stages of a new development to help developers, local authorities and other interested parties to assess how sustainable designs are for new housing and mixed use developments. The full checklist including background and questions for each category is available from the dedicated website [http://www.checklistsouthwest.co.uk/](http://www.checklistsouthwest.co.uk/).

The eight categories used by the Checklist are reproduced below. Each category contains a list of questions that will need to be answered. In order to be compliant, developers will need to demonstrate that the minimum targets have been met against each category. However, higher standards are encouraged by the Council, and in the event of a conflict between the targets within this guide and those within the checklist, this guide takes precedent.

The Checklist is free, secure and anyone can use it by simply registering and setting up an account. This enables projects to be set up and worked upon. It is possible to generate a variety of reports from the on-line Checklist:
- a summary report which is a simple graphical representation of the project;
- a section report which looks at a whole section;
- a full detailed report that shows a complete breakdown of a project.

It is recommended that the full detailed report is submitted with planning applications.

| Climate Change and Energy | To ensure that new developments are appropriately adapted to the impacts of present and future climate change and to minimise their own impact on greenhouse gases, flooding, heat gain, water resources and water quality. |
| Community | To ensure that the development supports a vibrant, diverse and inclusive community which integrates with surrounding communities. |
| Place Making | To ensure that the most sustainable sites are used for development and that the design process, layout structure and form, provide a development that is appropriate to the local context and supports a sustainable community. |
| Transport and Movement | To ensure people can reach facilities they need by appropriate transport modes, encouraging walking and public transport use and reducing the use of private cars for shorter journeys. |
| Ecology | To ensure that the ecological value of the site is conserved and enhanced, maintaining biodiversity and protecting existing natural habitats. |
| Resources | To promote the more sustainable use of resources related to both the construction and the operation of new developments. |
| Business | To ensure that the development contributes to the sustainable economic vitality of the local area and region. |
| Buildings | To ensure that the design of individual buildings does not undermine the sustainability of the overall development. |
3.3 Code for Sustainable Homes

**Target:** new and refurbished homes will need to achieve, as a minimum, level 3 of the CSH (and level 4 and above in terms of the CSH energy and carbon targets).

For housing, the Code will be the main tool to work towards the targets in terms of energy and the wider sustainability requirements. The Code takes a whole house approach, measuring the sustainability of a new home, using a six level star rating system. One star is the entry level, which is above current building regulations and six stars is the highest exemplar level. In all, there are nine different design categories, some of which have mandatory standards, with others offering developers more flexibility.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Energy/CO₂</td>
<td>Minimum standards at each level of the Code</td>
</tr>
<tr>
<td>• Water</td>
<td>Minimum standard at Code entry level i.e. level 1 and above</td>
</tr>
<tr>
<td>• Materials</td>
<td></td>
</tr>
<tr>
<td>• Surface water run-off</td>
<td></td>
</tr>
<tr>
<td>• Waste</td>
<td></td>
</tr>
<tr>
<td>• Pollution</td>
<td></td>
</tr>
<tr>
<td>• Health and well-being</td>
<td></td>
</tr>
<tr>
<td>• Management</td>
<td></td>
</tr>
<tr>
<td>• Ecology</td>
<td></td>
</tr>
</tbody>
</table>

Points are awarded against each of these design categories in order to gain a Code rating, the more points received, the higher the rating and the more sustainable the home.

The shaded cells in the table below show the required targets which have to be reached for domestic properties within the urban extension. This can be summarised in terms of:

- Sustainable Construction – based on level 3 of the CSH, a total number of 57 points have to be achieved;
- Carbon Emissions – a 44% reduction up to 2010, a 100% reduction up to 2015, a total reduction from 2016 onwards (these points will contribute to the CSH 3 target of 57).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1(★)</td>
<td>10</td>
<td>1.2</td>
<td>120</td>
<td>1.5</td>
<td>33.3</td>
<td>36</td>
</tr>
<tr>
<td>2(★★)</td>
<td>18</td>
<td>3.5</td>
<td>120</td>
<td>1.5</td>
<td>43.0</td>
<td>48</td>
</tr>
<tr>
<td>3(★★★)</td>
<td>25</td>
<td>5.8</td>
<td>105</td>
<td>4.5</td>
<td>46.7</td>
<td>57</td>
</tr>
<tr>
<td>4(★★★★)</td>
<td>44</td>
<td>9.4</td>
<td>105</td>
<td>4.5</td>
<td>54.1</td>
<td>68</td>
</tr>
<tr>
<td>5(★★★★★)</td>
<td>100²</td>
<td>16.4</td>
<td>80</td>
<td>7.5</td>
<td>60.1</td>
<td>84</td>
</tr>
<tr>
<td>6(★★★★★★)</td>
<td>zero carbon home³</td>
<td>17.6</td>
<td>80</td>
<td>7.5</td>
<td>64.9</td>
<td>90</td>
</tr>
</tbody>
</table>

**Notes**

2. Zero emissions in relation to regulated emissions – i.e. Part L 2006
3. A completely zero carbon home (i.e. zero net emissions of carbon dioxide from all energy use in the home).
4. All points are rounded to one decimal place.

It is important that developers understand how the Code works and how the points and standards within it are applied to buildings. The technical guide that accompanies the Code will be a key reference document in terms of the design and construction of new homes. This
is only available on-line as it is regularly updated with the latest best practice. The technical guide is available from:

This web page also has a link to a summary of the Code which provides a useful introduction to it and contains a summary of all the points that are available against each design category.

Assessment against the Code is a two stage process that uses a network of trained and accredited independent assessors. They conduct an initial design stage assessment on each home type within any development to recommend a sustainability rating and issue an interim Code certificate. Once built, the assessor performs a second assessment to verify the rating and issue a final Code certificate of compliance that shows the overall sustainability of the home and a breakdown of how this has been achieved. This post-completion check is carried out on a sample basis within the development. To find an assessor visit:
http://www.greenbooklive.com/search/scheme.jsp?id=8

To reach the required targets developers will need to ensure that:

<table>
<thead>
<tr>
<th>Category</th>
<th>Minimum Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy/CO₂</td>
<td>25% Percentage improvement over Target Emission Rate (TER) as determined by the 2006 Building Regulation Standards - See note 1</td>
</tr>
<tr>
<td>Water</td>
<td>Reduce water consumption to 105 l/p/d Internal potable water consumption measured in litres per person per day (l/p/d)</td>
</tr>
<tr>
<td>Materials</td>
<td>At least three of the following 5 key elements of construction are specified to achieve a BRE Green Guide 2006 rating of at least D – Roof structure and finishes – External walls – Upper floor – Internal walls – Windows and doors</td>
</tr>
<tr>
<td>Surface Water Run-off</td>
<td>Ensure that peak run-off rates and annual volumes of run-off will be no greater than the previous conditions for the development site</td>
</tr>
<tr>
<td>Site waste management</td>
<td>Ensure there is a site waste management plan in operation which requires the monitoring of waste on site and the setting of targets to promote resource efficiency</td>
</tr>
<tr>
<td>Household waste storage</td>
<td>Where there is adequate space for the containment of waste storage for each dwelling. This should allow for the greater (by volume) of the following EITHER accommodation of all external containers provided under the relevant Local Authority refuse collection/recycling scheme. Containers should not be stacked to facilitate ease of use. They should also be accessible to disabled people, particularly wheelchair users and those with a mobility impairment OR at least 0.8m³ per dwelling for waste management as required by BS 5906 (Code of Practice for Storage and On-site Treatment of Solid Waste from Buildings)</td>
</tr>
</tbody>
</table>

Note 1: The regional policy suggests this should be the approximate target for reducing CO₂ through energy efficiency measures. The total CO₂ reduction target is much higher than this and is equivalent to CSH levels 4, 5 and 6 - see table 1 for required target level and timescale.

The above policy will be able to provide between 16.2 to 21.2 points towards a level 3 CSH rating. The energy targets (see below) will deliver additional points as will any additional requirements from the Council – such as SUDs and Lifetime Homes. The remaining points needed to reach a total of 57 points will have to be gained across other areas of the Code – this offers a degree of flexibility.
3.4 BREEAM

**Target:** new and refurbished non-residential buildings will need to achieve, as a minimum, a BREEAM rating of ‘very good’.

In a similar approach to the Code, BREEAM sets technical environmental standards for a wide range of non-domestic buildings, based on the nine design categories highlighted under the CSH. However, it considers a wider range of issues beyond just the individual building. It also does not set minimum standards for the different design categories (although the RSS targets make the energy and carbon criteria of BREEAM mandatory). The rating provided is again based on the total number of points achieved across the design categories and in order to achieve the ‘very good’ standard a total of 55 points needs to be achieved by the developer. The required energy targets will provide points towards this target, see below.

BREEAM sets technical standards for a wide range of non-domestic buildings, including: office buildings; light industrial units; warehouses and workshops; retail outlets and shopping malls; schools and sheltered homes; nursing homes and student accommodation. A bespoke scheme can also be used to assess any other building type. All the versions of BREEAM are regularly updated to ensure that it remains representative of current best practice.

BREEAM assesses the performance of buildings in the following areas:

- management: overall management policy, commissioning site management and procedural issues
- health and well-being: interior and exterior issues affecting health and well-being
- energy use: operational energy and CO₂ issues
- water: consumption and water efficiency
- materials: environmental implication of building materials, including life-cycle impacts
- transport: transport-related CO₂ and location-related factors
- land use: greenfield and brownfield sites
- ecology: ecological value conservation and enhancement of the site
- pollution: air and water pollution issues

BRE publish a range of pre-assessment estimators to show the level of information required to complete a BREEAM assessment and to show how the scoring system works. These are available from [www.breeam.org](http://www.breeam.org). These checklists allow a quick evaluation of the rating that could be achieved under a formal assessment. Actual assessments are carried out by an independent assessor that is licensed and trained by BRE. For each assessment, a report is produced to outline the building or development’s performance, against each of the criteria, to provide an overall score and BREEAM rating. This can be carried out at the design stage and this approach is recommended by BRE as it can help developers and designers to achieve a high BREEAM rating in the most cost effective way. A post-construction review then ensures that the end result achieves the design’s aspirations. To find a BREEAM assessor visit: [http://www.greenbooklive.com/search/scheme.jsp?id=8](http://www.greenbooklive.com/search/scheme.jsp?id=8)
3.5 Energy Targets

**Targets:**

a) produce an energy strategy for larger scale developments
b) provide, as a minimum, sufficient on-site renewable energy to reduce CO₂ emissions by 20% of regulated emissions
c) demonstrate all renewable options have been considered
d) homes will need to meet the carbon reduction targets set out in Table 1 and ensure energy consumption is minimised
e) non-residential buildings will need to meet the carbon reduction targets set out in Table 2 and ensure energy consumption is minimised

The energy targets in terms of energy efficiency, renewable energy and carbon reduction targets are summarised below.

### Homes

<table>
<thead>
<tr>
<th>Energy Efficiency</th>
<th>Renewable Energy</th>
<th>Total CO₂ reductions</th>
</tr>
</thead>
</table>
| To meet the requirements of CSH level 3 it will be necessary to achieve approximately a 25% reduction in emissions from improvements in energy efficiency. | To meet the requirements for renewable energy it will be necessary to generate a minimum of 20% on-site renewable energy generation. | These two targets (left) will result in a reduction of emissions around 45%. This will be the approximate baseline that will need to be achieved to meet the targets set out in Table 1. The total emissions that need to be achieved are:  
- 2008 to 2010 – reduce regulated emissions by at least 44%  
- 2011 to 2015 - reduce regulated emissions by 100%  
- 2016 onwards - reduce all emissions by 100% (net over a year) |

### Non-residential development

| To meet the requirements of BREEAM 'very good' it is suggested that the minimum contribution from energy efficiency will need to be:  
- 5% up to 2010  
- 14% to 2015  
- 24% from 2016 onwards. | To meet the requirements for renewable energy it will be necessary to generate a minimum of 20% on-site renewable energy generation. | These two targets (left) will result in a reduction of emissions of around 25% up to 2010. This will be the approximate baseline that will need to be achieved to meet the targets set out in Table 2. The total emissions that need to be achieved are:  
- 2008 to 2010 – reduce regulated emissions by at least 25%  
- 2011 to 2015 - reduce regulated emissions by at least 34%  
- 2016 onwards - reduce regulated emissions by at least 44% |

3.5.1 Energy Strategy

It is a requirement to submit an energy strategy as part of the planning application. More detailed guidance on the contents of the energy strategy is likely to be available during 2008. Developers should check the final requirements with the Council. A possible approach in the interim is available in the London Renewables Toolkit, hereafter referred to as the Toolkit. More rows and columns can be added, as required.
3.5.2 Energy Hierarchy

The ‘energy hierarchy’ should be the principal tool for decision making within the urban extension. This sets out a priority order of carbon reduction measures to be considered for new developments including:

- reducing the need for energy;
- using energy efficiently;
- using renewable energy sources;
- any remaining use of fossil fuels should use the cleanest and most efficient technologies.

The opportunity to apply the hierarchy to a new development should not be underestimated, as it is possible to address both the demand and supply side, with the aim of achieving zero net carbon emissions, an aspiration highlighted by Carrick. It will help to ensure that energy needs are met in the most efficient, cost effective way, resulting in buildings that will have low energy demand and therefore require a smaller amount of renewable energy to supply the site’s needs. The hierarchy should also ensure that homes are cheaper to run and more comfortable to live in.

The four strands of the energy hierarchy are explained in more detail below.

Reducing the need for energy

The primary approach for any new development should be, as much as is feasible, to design out the need for energy in the first place. All those involved at the concept stage have a key role to play in reducing carbon emissions through careful spatial planning, master planning and building/infrastructure design. Demand reduction measures that could be considered include:

- locating housing, workspace and facilities close to existing public transport links;
- provision of shops and community facilities on new developments;
- maximising the use of southern orientation for solar gain and day lighting (whilst avoiding overheating in the summer);
- utilising natural light in building design.
Using Energy Efficiently
Having designed out the need for energy as much as practicably possible, steps should then be taken to make buildings as energy efficient as possible in terms of their design and build type and the equipment installed as part of the build. This could include measures such as:

- high levels of insulation;
- reduced infiltration;
- responsive, controllable heating systems;
- appropriate use of thermal mass to help retain heat whilst avoiding overheating in summer;
- specifying low energy lighting and appliances;
- passive ventilation and heat recovery;
- specification of minimum U-values for construction materials;
- aerated taps.

Using Renewable Energy
Whilst much can be done to reduce demand for energy and transport through good design and planning practices, it will still be needed within the urban extension. Demand for heat and cooling can be designed out more readily than demand for electricity. Renewable energy should be the first priority for helping to meet the remaining energy demand of the development.

Using the Cleanest and Most Efficient Technologies
In the event that all of a development's energy demand cannot be met by renewable energy, for instance if there is no suitable resource, then the cleanest and most efficient fuels and technologies should be used. For example:

- Combined heat and power (CHP);
- Heat pumps.

3.5.3 Domestic Energy Efficiency
The targets require that energy efficiency is reduced in order to achieve the minimum energy and carbon requirements of the CSH level 3. This implies a reduction of 25% in regulated emissions through the used energy efficiency.

To achieve this, it is recommended that developers use the EST Best Practice Standard. This has recently been updated and is now called “Energy Efficiency and the Code for Sustainable Homes - level 3". A copy of this guide will be available from: http://www.energysavingtrust.org.uk/housingbuildings/professionals/standards/. This will enable a reduction of emissions by 25%, which based upon the examples provided within the guide, should be possible for most housing types. It is based on 5 criteria, which all need to be met:

Criterion 1: Predicted CO₂ emissions from the dwelling
This requires that the TER, as defined by national building regulations, is reduced by 25%

Criterion 2: Design backstops
This provides the minimum energy efficiency backstops that will need to be met in terms of:

- opaque elements;
- windows and doors;
- space and hot water heating;

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1 Care is needed over the use of heat pumps in a mains gas area, as they can increase emissions and running costs in comparison to gas heating. It would be preferable to only use these once they become competitive with gas condensing boiler running costs, or to include renewables to meet the electricity needs of the heat pump.
• ventilation;
• lighting (internal);
• lighting (external);
• white goods (where specified);
• air permeability;
• drying space.

Criterion 3: Provisions to limit the effects of solar gain
This sets out guidance on how to avoid excessive solar gain during the summer.

Criterion 4: Quality of construction and commissioning
This sets out the approach to reducing air permeability and ways to limit thermal bridging.

Criterion 5: Provision of information and future proofing
This sets out what is required in terms of the information that should be provided to
householders, and additional guidance on how to enable additional renewables to be added
to the building at a later date.

3.5.4 Renewable Energy
The choice of renewables will depend on the level of targets that need to be achieved in
terms of the CSH levels 4, 5 and 6, as set out in table 1 and BREEAM as set out in table 2.
This will depend on when planning permission is submitted and gained. It will also be
necessary to:
• ensure the minimum 20% target has been met;
• take account of any site constraints (such as roof space on flats);
• be aware of site wide renewable options that are available;
• demonstrate that all renewable options have been considered in order to gain planning
permission.

It should be noted that the 20% target allows some flexibility in how it is met, as it allows for
different approaches to generate heat and/or power, based on the actual amount of carbon
that is released from regulated emissions. So for example, and for the sake of simplicity, if a
home built to 2006 Building Regulations has a TER of 1,000Kg of CO₂, to meet the 20% target,
developers will need to achieve a saving of 200Kg. A developer could meet this target
by either providing energy in the form of renewable heat or power, as long as at least 200Kg
is saved. This provides developers with a bigger range of renewable energy technology
choices. However, some care is needed, as if the technology chosen does not offset against
regulated² emissions, the savings would not count towards the wider carbon reduction
targets for Code levels 4 and 5 (at level 6 it would, as this is based on total emissions).

Technology Choice
For housing, it will be necessary to model which renewables to use, to meet the required
targets through SAP 2005, in order to identify the TER to work to. For non-residential
buildings the TER is calculated by modelling a notional building of the same size, shape and
use as the proposed building (using 2002 Building Regulations energy performance values).
This should take account of all the options that are available for the type and size of building
and any site constraints. This approach should enable developers to consider the range of
technologies available for the type of building.

² See glossary at end for a definition of regulated and unregulated emissions.
A basic overview of a selection process is shown below, based on the London Renewables Toolkit. This is based upon meeting the targets for levels 4 and 5 of the Code. For level 6, the process would be the same, but the figures would be based on total emissions, i.e. regulated and unregulated. A similar approach can be taken for non-residential developments.

In choosing the most appropriate technologies the approach should follow three basic steps:
1) consider site wide options first and the contribution they can make to the required target;
2) consider building-integrated options to make up shortfall, or meet the required target if no site wide options are available;
3) consider using higher standards of energy efficiency to reduce emissions further.

Whole and Part Site Options
It has been suggested that there are three possible options for generating heat and power for whole or large parts of the site, including:
- Wind power;
- CHP;
- Biomass heating.

At the time of writing Carrick is considering the potential for large scale wind and/or CHP. It is possible that a technical and financial feasibility study will be considered for these and developers should check the status of these larger options. If they go ahead the Council may seek a contribution towards these technologies in return for supplying low carbon heat and/or power to the development. If CHP goes ahead it is also likely that a requirement will be made on developments in these areas to connect the heat main and/or private wire. For biomass heating this option could be lead by developers to meet the heating requirements of buildings within the site.
The final choice of any large scale options could also impact the heating systems that will be required within buildings.

**Building-Integrated Options**

Subject to the decision and outcomes for large scale generation options, developers will be able to use a range of building-integrated technologies to work towards the required targets. Even if large scale generation is developed, it may still be necessary to consider the use of building-integrated technologies to reach the required targets. Developers should check with the Council what large scale generation is planned and the potential contribution it can make for the proposed development.

The possible technologies that could be considered include:

- CHP;
- Biomass heating;
- Solar hot water;
- PV;
- Small wind;
- Heat pumps

A factsheet on each of these technologies, showing estimated installed costs is available from Regen South West http://www.regensw.co.uk/

Section 4 of the Toolkit provides a flowchart for each of the above technologies. Developers should refer to this resource to assist with the selection of the most appropriate renewable resource. Section 3 of the toolkit also provides an overview of each technology, estimated costs and case studies. It can be downloaded from http://www.london.gov.uk/

Details on local installers that can supply and fit a range of renewable technologies in Cornwall are available from the CSEP website:

**Consider further use of energy efficiency**

In theory it is possible to reach level 5 of the CSH with just energy efficiency measures. However, it would be necessary to assess the cost of doing this, in comparison to using renewables. Additional standards are available to help achieve this. This includes:

- EST Advance Standard – which can reduce emissions by 60%
- Carbon Lite Standards – the PassiveHaus version of this standard can reduce emissions by approximately 80%

It should be noted, that EST are planning to replace the advance standard with new guides to reach levels 4, 5 and 6 of the Code. This will be available from the EST website and will provide more detailed guidance on both energy efficiency and renewables in terms of meeting these Code levels. In the meantime, information on the Advance Standard is available from http://www.energysavingtrust.org.uk/housingbuildings/professionals/standards/

For more information on the Carbon Lite Standards visit http://www.carbonlite.org.uk/carbonlite/

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3 Ideally the electricity needed to run these should come from a renewable resource, also see note one above.
Links to CSH & BREEAM Targets
The renewable and other energy targets will provide additional points towards either the CSH or BREEAM. This can make the required 57 point target to reach CSH level 3, and the 55 points needed for BREEAM 'very good'. This includes:
• points from the target to provide 20% on-site renewables;
• points from the increasing reductions in carbon emissions as required by tables 1 and 2 will provide further points;
• The use of the EST standard, or similar, will enable further points to be achieved from the range of design features under the energy and carbon categories of the both programmes.

The total points achieved by these methods should be calculated before other design categories are considered in order to estimate the most cost effective way to make up the remaining number of points needed to reach the targets.

3.4.5 Additional Requirements
In addition to the targets set out above the following also need to be met.

<table>
<thead>
<tr>
<th>Targets:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• minimising the environmental impact of new and refurbished buildings, including reducing air, land, water, noise and light pollution throughout the building’s lifetime;</td>
</tr>
<tr>
<td>• requiring the use of sustainable drainage systems to minimise flood risk associated with new developments</td>
</tr>
<tr>
<td>• designing homes which are safe and adaptable, for example by following Lifetime Homes standards, Secured by Design principles and including live/work space</td>
</tr>
</tbody>
</table>

These targets should be considered in terms of the use of the Southwest Sustainability Checklist, CSH level 3 and BREEAM ‘very good’. Good planning should enable the above to met, whilst contributing to these three initiatives, leading to better decisions and more cost effectiveness.

5. Planning Checklist
The following will need to be submitted as part of the planning process. Developers should check with the Council what is needed at the outline planning stage.

1. **A completed sustainability statement, which should:**
   • be based upon the Southwest Sustainability Checklist;
   • include the principles set out in Future Foundations.

2. **An energy strategy which should:**
   • detail the estimated energy and carbon baseline;
   • describe how the energy hierarchy has been applied;
   • show that all renewables have been considered, with a justification for the final choice.

3. **Demonstrate the required targets have been met.**
Glossary

The following definitions are used in the draft RSS:

**Regulated Emissions** are “the carbon emissions resulting from energy used to meet those services in a building that are regulated under the Building Regulations. Currently, these services are: space heating, water heating, fixed internal lighting, cooling and ventilation pumps and fans”.

**Unregulated Emissions** are “the carbon emissions resulting from energy used to meet those services in a building, or on a site, that are not currently regulated under the Building Regulations. Currently, these include: cooking, appliances, small power, communal lighting for flats, lifts, external lighting, IT equipment, etc.”

**Total Emissions** are therefore all the carbon emissions from energy used in a building or on a site and are the sum of both regulated and unregulated emissions.

**Zero Carbon Homes** is defined in the RSS as ‘zero net emissions (over the course of a year) of carbon dioxide into the atmosphere resulting from energy use in buildings’.

**Large Scale Development** includes significant urban regeneration projects covering new build, refurbishment, conversion and change of use and are defined in line with the ODPM Form PS2 definition, used for reporting general developments, as: for dwellings, the development of 10 or more dwellings or sites of more than 0.5 ha if the number is not given; for all other uses, where the floor space will be 1,000 square metres or more or the site is 1ha or more. Floor space is defined as the sum of floor area within the building measured externally to the external wall faces at each level. Basement car parks, rooftop plant rooms, caretaker’s flats etc should be included in the floorspace figure.
Appendix 6: Planning and Large Scale Wind
Planning and Large Scale Wind

Many resources already exist to support local authorities in terms of wind power and support is also available through organisations such as Regen South West. This appendix therefore provides some points for consideration in terms of using large scale wind and contains links to further good practice and sources of information.

A7.1 Community Consultation

As highlighted in section seven, we believe that it is essential that the local community is consulted upon the use of large scale wind before any final decision is taken on its use. Although wind is likely to be the only realistic way to make the development zero carbon in the short term, it is also likely to be the most contentious if the community is not fully engaged with the potential benefits.

The best outcome would be for the community to fully understand the reasoning behind the use of large scale wind, support its use, and have the potential to have a stake in a scheme or receive additional benefits from it. At worst, a well organised anti-wind campaign could emerge that may reinforce some of the other negative feelings about the whole idea of an urban extension.

A good overview of community consultation in relation to wind is provided on the Merton Rule website:

<table>
<thead>
<tr>
<th>Why do we need effective public engagement?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective engagement between a developer, the local authority, statutory consultees (e.g. English Nature, Environment Agency etc) and the local community can help to ensure that proposals for developments in a locality are of a high standard, in the sense that they are likely to:</td>
</tr>
<tr>
<td>• reflect more accurately an understanding and appreciation of local interests and concerns;</td>
</tr>
<tr>
<td>• provide a better quality, more active and more timely consideration of evidence of the potential benefits and impacts of the proposal (enabling better and prompt decision-making in the planning process, focused on the material issues), and;</td>
</tr>
<tr>
<td>• ensure that, if the proposal does go ahead, local communities, the local authority and other consultees have had opportunity to shape the development and their continuing relationship with it.</td>
</tr>
</tbody>
</table>

Supporting effective engagement is not therefore about being in favour or against a particular proposed development. It is about trying to make sure that decisions made in the planning system are as well-informed, evidence-based and timely as possible, and that any development that is permitted reflects an understanding of local interests and opportunities for positive local gain.

<table>
<thead>
<tr>
<th>The principles of effective public engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>First of all it is important to outline what is meant by public engagement. In the context of onshore wind developments, it refers to the dialogue undertaken by stakeholders during the development of a project. Wind energy developers, local planning authorities, local communities, statutory consultees and special interest groups are all key stakeholders. Dialogue may involve discussions about the site, the turbines, mitigation of impacts and the provision of benefits to the local area.</td>
</tr>
</tbody>
</table>

As in other areas of planning, a sound approach to public engagement can be summarised by five key principles:

- Community involvement that is appropriate to the level of planning. Arrangements need to be built on a clear understanding of the needs of the community and to be fit for purpose;
- Early involvement of stakeholders. There should be opportunities for early community involvement and a sense of ownership of local policy decisions;
- Using methods of involvement which are relevant to the communities concerned;
Clearly articulated opportunities for continuing involvement as part of a continuous programme, not a one-off event;
Transparency and accessibility.

Within the English planning system, local planning authorities are now required to embed these principles within a ‘Statement of Community Involvement’ (SCI). These describe how local planning authorities will engage with local communities within their districts in relation to planning policy and any significant development proposals. They should also provide general guidance to developers on the public engagement – or ‘community involvement’ – which they are expected (but cannot be required) to undertake.

Further information on community involvement is available in the PPS 22 companion guide http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable

Regen SW has developed a Protocol and Guidance on community engagement around wind energy. Local planning authorities are invited to sign up to the Protocol to ensure local consultation and benefits result from any wind energy schemes in the region. For local planning authorities, the requirements of the Protocol are to ensure they prepare and apply clear policies on wind energy and to give assistance and guidance to developers in drawing up and implementing their consultation plan. The Protocol is now a national resource. For more information or to sign up to the Protocol, contact: Cheryl Hiles, Senior Policy Manager at Regen SW on 01392 474326.

A7.2 Additional Consultation
An overview of a typical development process of a wind turbine was provided within section seven of this report. As well as consulting the community, a range of other consultations will need to take place at an early stage in order to assess planning implications:

<table>
<thead>
<tr>
<th>Consultations for a wind development</th>
<th>Response time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Aviation Authority</td>
<td>4-6 months</td>
</tr>
<tr>
<td>MOD</td>
<td>12 weeks</td>
</tr>
<tr>
<td>Natural England</td>
<td>4-6 weeks</td>
</tr>
<tr>
<td>HSE</td>
<td>6-8 weeks</td>
</tr>
<tr>
<td>Ofcom</td>
<td>6-8 weeks</td>
</tr>
<tr>
<td>Environment Agency</td>
<td>6-8 weeks</td>
</tr>
<tr>
<td>Scoping Study</td>
<td>Several months</td>
</tr>
</tbody>
</table>

Source: EDF Energy

A7.3 Suitable Locations
The wind map in section seven (figure 19) shows that there is a good resource right across the possible development areas, which suggests that there will be a wide choice over possible locations for any use of large scale wind. The actual locations would need a more detailed study, which takes account of best practice, optimising energy output and discussions with local stakeholders. It will also depend on the size of turbines that are felt to be appropriate within the area.

Additional considerations could include, amongst others:
- the boundaries of land ownership and rights of way; the location of existing site services, e.g. overhead or underground electrical cables;
- public safety, e.g. risks from mechanical failure, ice, etc.;
- the proximity of other turbines, meteorological masts and buildings;
• the effects of fatigue loading;
• vehicular access, e.g. to allow safe access and egress and to reduce the need to reverse vehicles in the site layout;
• contaminated ground;
• aircraft activity including balloonists;
• drop zones for parachutists;
• other factors related to consents.

Fall over distance (i.e. the height of the turbine to the tip of the blade) plus 10% is often used as a safe separation distance. However, this statement is not legally bound by the HSE, but it is imperative that the risk of injury should be As Low As Reasonably Practicable (ALARP) and a safety distance of 110% ensures this. These safety constraints indicate that each turbine will have an area of land around that is cannot be used for development due to the risk caused to those within the risk zones. The HSE state that they would like to see a dartboard type approach to these zones, with 3 accompanying levels of risk. This is demonstrated in the figure below.

Risk areas around a wind turbine

A small area very close to the turbine (coloured red) indicates the area of highest risk. This area should have no public access at any time and be very secure. The yellow area indicates the area of medium risk where public access should be restricted and would typically be the over sailed area. The green area indicates the area of lowest risk where public access is acceptable at all times except those of very high winds and sub-zero temperatures and would typically be the topple distance +10%. It would not be acceptable for buildings or byways to be within the yellow zone. It would not be acceptable for buildings or major highways to be within the green zone.

The PPS 22 Companion Guide from DCLG states that “the minimum desirable distance between wind turbines and occupied buildings calculated on the basis of expected noise levels and visual impact will often be greater than that necessary to meet safety requirements.”

**Noise & Shadow Flicker**
The noise levels and shadow flickering effect need to be assessed at design stage, once the site location has been identified, in order to model the likely impacts on occupied buildings located near the turbine. In practice, the results of an individual site noise study would ensure that turbines are sited further away from habitation than the safety guidance distances, as the noise constraints are much tighter than those for safety. Noise from turbines can be a nuisance to nearby inhabitants and the ETSU/DTI assessment technique was developed to
ensure that a common assessment technique is used to assess all developments.
(ETSU/DTI, The Assessment and Rating of Noise from Wind Farms, September, 1996)

Electro-Magnetic Interferences on Telecommunications
Telecommunication systems use a variety of electromagnetic (EM) signals, commonly described as radio waves. Uses primarily include television, radio, mobile telephony, microwave communications and radar. Interference of EM signals can potentially occur when existing telecommunication systems are not adequately considered during a wind turbine’s design and development. Interference of EM signals can cause distorted sound, image or data transmission. There are two main sources of Electro-Magnetic Interference (EMI):

- **Reflection and scattering**: If a wind turbine or similar large structure obstructs the ‘line of sight’ path between a transmitter and receiver, telecommunication signals may be scattered by reflection (forward scatter). Backward, or sideways, scatter is also caused by the reflection of signals from a wind turbine, producing a delayed secondary signal resulting, for example, in ghosting effects in a TV picture. This can occur when a wind turbine is situated behind the receiver or to one side of the main transmission path.
- **Emissions**: The electrical systems in a wind turbine will emit a certain amount of EM radiation, which can interfere with other equipment or telecommunication signals, depending on relative signal strengths. However installation standards exist for the electrical equipment associated with wind turbines and high voltage switchgear, which are both widely used, which ensure that EM emissions are acceptable.

A consultation with Ofcom needs to be undertaken to identify local telecommunication signals.

More detailed information on these and other issues, in relation to onshore wind, are provided in the technical annex of the PPS22 companion guide (page 155 onwards):
http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable

A7.4 Community Ownership
As discussed in section seven, the direct involvement of a community in a wind scheme could increase local support for its use. This could include community ownership, share options or a local energy fund that supports other work within the community.

Some approaches are illustrated by the following case studies in terms of the potential for community investment in partnership with the developer and/or the Council:

- More information about community ownership of renewables can be found here:
  www.energy4all.co.uk/energy_community.asp
- Bro Dyfi community renewables:
  www.energysavingtrust.org.uk/
- Gigha Renewable Energy Ltd:
  www.energysavingtrust.org.uk/

A7.5 Further Information and Support
There are many guidance and best practice documents which have been produced to assist in the initial development (site prospecting and selection) of a proposed site. These include:

The 'Resource Bank' on the Government’s Planning Renewables website for the local authority planners dealing with planning applications for renewable energy developments has detailed information on wind (and other renewables).

http://www.planningrenewables.org.uk/index.cgi

The PPS 22 Companion guide has detailed information on planning and renewable energy. It covers detailed information on planning for wind and section two contains detailed information on the wider social and economic benefits that renewable energy can bring in terms of local communities.

http://www.communities.gov.uk/publications/planningandbuilding/planningrenewable

**Regen South West**

In October 2003, Regen SW produced guidance on 'The appropriate development of wind energy' to provide local planning authorities with information about the issues that arise when a planning application for a wind energy development is submitted and to provide guidance on where to find more detailed independent information.

Since then, national planning policy guidance has been updated and experience of wind energy developments in the region has spread. There is now a wealth of information relating to wind energy planning applications, including PPS22 and its Companion Guide, Planning Officers and Planning Inspectors Reports.

Regen SW is able to offer assistance to planning officers through the South West Renewable Energy Atlas.
Appendix 7: Regen South West Renewable Factsheets
Introduction

Wind energy has been used for several thousand years. In the nineteenth century, 10,000 wind mills were operating in England alone. The current resurgence of wind power has focused on the production of electricity, where the rotating axle is connected to a gear-box and then a generator. The electricity generated can be used on site, or more typically, sold to the national grid.

Wind energy can be utilised by large off-shore wind farms, large onshore turbines usually sited together in wind clusters or wind farms, and smaller scale turbines for domestic or business-scale use.

UK Wind Resource

The UK is estimated to have around 35-40% of the total European economic wind resource, and the south west region in particular is an ideal location for wind energy generation. Wind energy is one of a range of different energy sources delivering electricity to the UK. Although there is enough energy in the world’s winds to fulfil all of our energy requirements, the resource is limited by the availability of suitable, acceptable sites for wind energy development.

South West England Wind Resource

There are already over 100 wind turbines installed in the region. Most of these form part of seven wind farms in Cornwall, which produce enough electricity to power 25,000 homes and stop over 60,000 tonnes of carbon dioxide pollution entering the atmosphere.

The south west peninsula has a particularly good wind energy resource as it benefits from sea breezes on both its north and south coasts. Sea breezes are formed when coastal land warms during the day more rapidly than the adjacent sea. Hot air rising above the land is replaced by cooler air over the sea, giving rise to an on-shore breeze. At night the situation is reversed, the land cools more quickly than the sea and the breeze is from the land.

Resource studies undertaken for the region suggest that the South West could generate up to 18% of all its power needs from wind energy without encroaching on protected areas. Because of wind energy’s favourable economics and the South West’s strong resource, it is widely expected that the region will need wind energy to contribute at least two thirds of its 2010 target of 509-611MW. The South West still has a long way to go to achieve this.

Technology

The power produced by a wind turbine is proportional to the cube of the wind speed. Therefore, doubling the wind speed increases the power eight-fold so small differences in wind speed can have significant implications for energy output. It also explains why in many cases developers will tend to choose the windiest sites; many of which are in mountainous or
coastal areas where sensitivities about the landscape are greatest. Accurate data on local wind speed is normally required to assess the viability of a site and optimise the site layout. This will usually require long-term on-site measurements and is why developers often request planning permission for an anemometer prior to deciding if a site is suitable for a wind turbine or wind farm.

Currently, wind speeds of over 6.25 metres per second are generally required for commercial wind energy development. However, the economic viability of a wind farm site will also depend on other factors such as the availability and cost of turbines, the distance and cost of connection to the electricity distribution grid and the expected cost of achieving planning permission. The length of wind turbine blades is also an important factor in the energy generated by a wind power project as power output is proportional to the swept area of the wind turbine blades. This means that even quite small increases in the blade length can significantly increase output.

**Maintainance**

Wind turbines should be inspected once a year. Where maintenance is required, single turbines can be shut down whilst work is carried out, allowing the rest of the windfarm to continue generating as normal. Turbines typically last about 25 years. Note: the construction of a wind farm requires access for very long lorries and large cranes, this might not be possible in some locations in the region.

**Issues**

**Environmental Impact**

Wind power has one of the smallest lifecycle environmental footprints of any energy generating technology, however an essential part of getting planning permission for a wind farm proposal is an assessment of its potential environmental impact. An Environmental Impact Assessment (EIA) may be required, particularly for larger developments (usually over 5MW). Ultimately, however, it is up to local authorities to decide whether a wind energy development requires an EIA. Small wind turbines can have a tower made of steel in a lattice formation, like a miniature electricity pylon, however most turbines have towers made of steel or concrete, normally painted either off-white or grey to blend with the predominant sky colour. Wind turbines are normally spaced at least three to five rotor diameters apart to avoid problems with turbulence, however each turbines footprint is relatively small. The land between the turbines can still be used for agriculture and livestock are able to graze right up to the base of wind turbines allowing farmers to gain an additional income stream from wind energy.

Wind turbines are large, visible, man-made structures in the landscape. The planning system takes the role of balancing the effect of wind energy developments on landscape (and other local impacts) against the benefits of the development, such as offsetting fossil fuel use. Developers tend to avoid choosing sites in designated landscapes due to the increased risk that the project will be refused. Guidance on planning policy related to wind energy, including wind turbines in or near designated landscapes is available in PPS22 on renewable energy.
Wind farms should not be sited directly on migration paths of birds and offshore wind farms may also need careful siting in order to avoid discouraging birds from using traditional feeding areas. Although poor siting has resulted in significant numbers of bird strikes at wind farms outside the UK, the UK planning system has ensured that experience in the UK has shown the opposite and collisions are rare. As a statutory consultee in the planning process, Natural England advises on the potential impact of wind energy developments on wildlife and the RSPB has objected to very few wind farms. It should be noted that by far the greatest threat to Britain’s wildlife is climate change.

**Noise and Shadow Flicker**
Turbine blades rotate at anything between 15 and 50 revolutions per minute, usually at a constant speed. If a wind turbine is viewed with the sun behind it, a stroboscopic effect, known as “shadow-flicker” can occur. Although some may find this annoying, modern machines are designed to operate at frequencies lower than those connected to epilepsy. The impact of shadow flicker varies as the sun moves across the sky and is only significant when the sun is low in the sky on a fairly clear, windy day. The movement of wind turbine shadows can be mapped in order to identify any properties that may be effected. If flicker is likely to be a problem, it can be mitigated against by, for example, turning the wind turbine off for the short period of time when the problem would occur. This mitigation can be conditioned by the local authority in a planning application.

Large wind turbines have the potential to interfere with radio, television and radar signals and with microwave communication links. Interference with domestic television and radio systems can be addressed through simple mitigation measures by the developer and can be conditioned by local authorities in planning permission. Potential interference with radar and microwave communications means that developers have to consult with a large number of organisations to ensure that their development will not disrupt mobile phone, emergency radio, airport and military radar systems prior to submitting a planning application. Small-scale installations are unlikely to cause such interference. Some early wind turbines had noisy gearboxes, but modern turbines generate very low levels of noise. Aerodynamic noise is generated by the movement of the blades through the air. There can also be some mechanical noise, mainly from the gearbox and the generator, however by careful design and the use of anti-vibration couplings such noise can be greatly reduced. Some wind turbines use a gearless design which eliminates mechanical noise. Aerodynamic noise is more difficult to prevent and arises from the changes in wind speed experienced by the blades as they pass the tower. The amount of aerodynamic noise can be reduced by lowering the rotational speed or by reducing the angle of attack of the blades, both of which would reduce the power extracted by the machine. Variable or two-speed machines can do this when the wind speed is low and natural masking or background noise is at a minimum. Wind developers should follow detailed guidelines from the Government about noise to ensure background levels of noise are not exceeded and planning authorities can place conditions on the development in line with government guidance. This guidance can be found at ETSU-R-97.

**Energy Payback**
The average wind farm in the UK will pay back the energy used during its manufacture and installation within the first six months of operation. A lifecycle analysis of wind turbines undertaken by the Danish Wind Turbine Manufacturers Association found that during its 20 year design life, an onshore wind turbine will typically produce over 80 times more energy than was used in its manufacture, installation, operation, maintenance and scrapping.

**Intermittency**
As wind speeds vary, wind energy provides an intermittent energy supply so needs to be balanced with other forms of generation that are more constant such as biomass or gas-fired power stations. The majority of UK power generation has a fairly constant load already and backup capacity is already in place (designed to deal with a major coal or nuclear power station going offline at short notice). Therefore most experts suggest that wind energy could deliver at least 10-15% of the UK’s electricity without needing any significant changes to the way the electricity system operates. A higher proportion of wind energy could be accommodated, but additional investment in energy storage or system management would be necessary.
Finance

The cost of electricity from wind energy has fallen dramatically in the last few years and wind turbines can now produce electricity cheaper than any other renewable energy technology. The British Wind Energy Association estimates that a wind farm in a good location can now produce electricity at 2.5p a kilowatt hour (kWh). This is cheaper than the cost of electricity from a new coal fired power station, but slightly more expensive than the cost of power from an existing gas or coal-fired power station. Sites with low wind speeds, room for a small number of turbines or more expensive grid connection may still be viable but will result in wind schemes generating power at a higher price.

Offshore wind currently costs 5-6p kWh, roughly twice that of good onshore schemes, because of the additional cost of turbine installation and maintenance at sea.

Wind farms can generate rents, rates, community funds and employment in construction and manufacturing. Farmers with wind turbines on their land can expect to receive rent of approximately £3,000-4,000 a year per Megawatt (MW). Wind farm owners pay rates on the turbines to local councils, and often also offer profit-sharing with local communities. This is typically paid to local charitable trusts so that the community will have a stake in how it is spent. For more information see the South West Public Engagement Protocol and Guidance for Wind Energy (see “More Information” section).

Costs and Grants

Wind farm developments generally cost around £600 per installed kW, which means an array of five 2 MW machines would cost around £6M. Due to this high capital cost, it is likely that a landowner would allow a development company to build and operate a wind farm and simply obtain income via ground rent. This might equate to 2% of the income from the electricity sales, or £21,000 per annum. The main form of government support for wind energy (and all renewable electricity) is the Renewables Obligation. This is an obligation placed on all electricity suppliers to buy an increasing percentage of renewable electricity each year, to reach 10% by 2010 and 15% by 2015. Tradeable certificates are generated for each unit (MWh) of renewable electricity, suppliers must have enough of these certificates to meet the obligation. The certificates are currently (as of February 2007) worth more than the wholesale price of electricity, more than doubling the price for renewable electricity.

Suppliers and Installers

The British Wind Energy Association has a list of contractors on its website - www.bwea.com/members/CompanyDirectory.asp

Regen SW maintains a list of developers on its web site: www.regensw.co.uk/directory

More Information

Wind farms, CE02, Energy Saving Trust
www.est.co.uk/myhome/publications

For information on connecting to and exporting to the grid see: www.quietrevolution.co.uk/downloads.htm

Best Practice Guidelines for Wind Energy Developments, available for download from - www.bwea.com/ref/bpg.html

The Assessment and Rating of Noise from Wind farms, ETSU report for DTI www.dti.gov.uk/renewable/wind_environment.html and www.dti.gov.uk/renewable/publications.html (also has guidance on aviation).

Introduction

In recent years there has been a resurgence in the use of wood fuel to heat UK homes, public buildings and businesses. Based on current fossil fuel prices woodfuel can often prove to be an economic solution.

Although not common yet in the UK, wood-fired central heating is well established in mainland Europe, with several hundred thousand systems in use. Modern wood heating systems have automatic ignition, thermostatic control and fuel feed. Wood fuel is almost carbon neutral as the CO2 released by burning wood is approximately equal to the CO2 taken in over the tree’s lifetime.

South West Resource

Currently around 200,000 ODT of forestry co-products and arboricultural arisings with no marketable value are available in the south west. The region could potentially make use of energy crops to further increase the volume of fuel available. The REvision 2010 report highlighted that energy crops in the South West may be able to provide 95.9 MWe from a mix of Miscanthus and Short Rotation Coppice.

The South West already has high quality installed biomass systems, which can act as demonstrators. The region has over 65 biomass installations covering a range of scales and technology types. In 2007 the installed capacity was over 10 MW, with seven systems over 300Kw. There is strong local knowledge with many specialised woodfuel and biomass companies.

Technology

Burning wood for heating is the simplest biomass conversion process, and is easily scaled to the size of the resource. Wood fuel has a lower energy density than fossil fuels so needs more storage space. It is also best to use local wood as a fuel to minimise transport costs and emissions.

Wood fuel can be supplied as logs, woodchips or as pelletised sawdust. Wood fuel can provide space heating through direct heating using a wood stove (an example of a wood pellet stove is shown in Figure 1) or a boiler connected to a central heating system (an example is shown in Figure 2) and can be retro-fitted to existing buildings.

Modern wood boilers usually transfer fuel from the store to the boiler via an auger feed (a large screw-like mechanism). Air-flow into the boiler is also regulated automatically to ensure high efficiency combustion. Pellet boilers tend to offer better control because of the uniformity and lower moisture content of the fuel.

In addition to traditional log stoves, automatic pellet stoves are also available (an example is shown in Figure 1). These contain a small fan to force room air over the inner jacket of the stove warming the room, some are available with a back-boiler allowing them to provide heat to radiators or a hot water system.
Pellet stoves have an internal hopper that typically holds enough fuel for around 20 hours of continuous operation, refuelling is usually manual and they are ideal for smaller, well insulated properties. It is worth noting that burning wood on a simple hearth is highly inefficient, compared to wood heating systems that may have combustion efficiencies as high as 90%.

**Auxilliary Equipment**

Although wood heat systems are automatic, in general they work better with fairly constant heating loads. Hot water accumulator tanks can be used to store heat to partially resolve this problem and allow a smaller (and therefore cheaper) boiler to be used. System design may also include a smaller auxiliary fossil fuel system to cover the summer, shoulder and peak loads and allow the biomass system to run at the greatest efficiency. Heat meters may also be incorporated into the system to allow energy users to be billed for heat used instead of fuel supplied.

**Fuel**

Woodfuel for automated boilers generally comes in three common types; woodchip, pellets and logs. Feedstocks can include energy crops such as willow trees and miscanthus, as well as forestry co-products, arboricultural arisings and clean waste streams from wood processing.

Wood can either be sold by weight or by volume. If sold by weight, it is important to know the moisture content. Unseasoned wood can contain up to 50% water whereas reclaimed building wood might be around 15%. The moisture content can be reduced to around 30% by leaving freshly felled timber uncovered or covered in a barn from March-September. If the moisture content is not reduced, combustion efficiency will be lower and greater amounts of tar can build up in the flue. However some boilers are designed to burn fuel with a moisture content of up to 50%. Commercially supplied pellets or briquettes are usually force-dried during manufacture down to a moisture content of 10% or less.

Woodchip heating system suppliers typically specify the size, maximum moisture and ash content of woodchips that can be used in their boilers and fuel delivery systems. It is important that wood fuel meets these criteria. Woodchip size specifications tend to use the classifications contained in the Austrian standard Ö-Norm M7133.

**Transportation and Storage**

The energy density of wood fuels is lower than fossil fuels and woodchips have a lower energy density than wood pellets. This has a significant impact on the planning of fuel storage. The low bulk density of wood fuels also means that more deliveries of fuel are likely to be needed compared to heating oil and that the financial value of each delivery is lower.
### Operation and Site Maintenance

The maintenance requirements will depend on the size and technology chosen, but the ash store will need to be emptied around once a month and the ash gate rotated once a week. Bearings may need to be occasionally greased and the system swept out twice a year. This work can be built into an ongoing maintenance contract.

### Site Suitability

The economics of wood fuel are likely to be most attractive on new-build or for a building heated by bottled gas, oil or coal. The other key issues to consider are whether there is sufficient space for a fuel store and easy access for fuel deliveries.

### Design

As with any renewable energy project, the first stage is to estimate the demand for energy, and then to try to minimise demand through conservation and energy efficiency measures. It should be noted that biomass boilers will work at their most efficient when close to full load. They may be undersized, combined with accumulator tanks and run in a multiboiler set-up to allow the best coverage of the site’s energy demand. Once the likely woodfuel demand for the project is estimated the next consideration is to find a local wood fuel supplier. Sawmills, farms and other landowners may have a large enough resource on site whilst others may buy direct from landowners. In addition, the boiler company may also have arrangements with local fuel suppliers. Having obtained quotes for supplying the wood fuel and the heating system, the cost of the system and fuel should be estimated over the lifetime of the boiler and compared to the cost of using a comparable fossil fuel system.

### Issues

#### Planning

Planning requirements for biomass heating systems are similar to those for installation of a fossil fuel system with no requirement for domestic scale systems. Larger systems may need to seek planning permission for the flue and larger structures such as the boiler house and fuel store. Additional traffic on the road from fuel deliveries will also be considered.

#### Noise

Noise will be similar to a fossil fuel system, though as wood is a solid fuel there can be noise from the fuel delivery system. Very large commercial systems can generate considerable additional lorry movements in the local area for fuel deliveries. If producing wood chip, noise from the chipping machine and associated plant may need to be considered.

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### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Heating Oil</th>
<th>Wood Pellets</th>
<th>Wood chips</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4 bedroom house</strong></td>
<td>2</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td><strong>Medium-sized public building</strong></td>
<td>5</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td><strong>Large Secondary School</strong></td>
<td>20</td>
<td>60</td>
<td>200</td>
</tr>
</tbody>
</table>

Shows typical fuel volumes for various buildings.
Environmental Credentials
Wood fuel is almost carbon neutral as the CO₂ released by burning wood is approximately equal to the CO₂ taken in over the tree’s lifetime. However there are some carbon emissions from the production and transportation of the wood. This is around 0.025 kgCO₂/kWh, or one tenth the value for oil. Unlike coal, the ash can be used as a fertiliser in the garden or on farmland, or returned to the land where the wood was grown. Due to its low carbon emissions, wood heating can help projects to meet the energy performance criteria for Building Regulations.

Finance

Costs
The main operational cost of the system will be fuel cost. Wood chips are usually cheaper than fossil fuels and pellets roughly comparable to oil at current prices. However, wood-heating systems tend to be more expensive due to higher cost boilers and fuel storage.
Large systems have a whole life cost similar to fossil fuels: the initial capital cost and maintenance costs are higher, but the fuel cheaper. Expect to pay £150 to £300 per kW of boiler heat output for larger, non-domestic boilers, and £200 to £400 per kW for domestic units.

Grants
The Bioenergy Capital Grant Scheme can support the installation of biomass heating and combined heat and power projects in the industrial, commercial and community sectors, including local authorities and schools.
Documents can be found at http://www.aaa-energy-and-environment.com/index2.htm.

The Low Carbon Buildings Programme from the DTI can offer a maximum £600 grant for stoves with an overall 20% limit (ex VAT) for stoves and a maximum of £1,500 subject to an overall 30% limit (ex VAT) for boilers; for home owners. For larger buildings a maximum of 40-50% of total costs (excluding VAT) is available for boilers. See funding factsheet for more details.

Sizing Tools
A very simple but approximate sizing tool for schools is available for free download from The Centre for Energy and the Environment (www.ex.ac.uk/cee/re). For homes and other buildings, a more accurate but complicated free sizing tool can be downloaded from RETSCREEN (www.retscreen.net/ang/t_software.php).

More Information
- Regen SW maintains a list of installers and woodfuel suppliers on its web site: www.regensw.co.uk/directory
- The Biomass Energy Centre, www.biomassenergycentre.org.uk
- The Carbon Trust, www.carbontrust.co.uk/technology/technologyaccelerator/biomass.htm
- The Centre for Sustainable Energy, Woodfuel Advice Line, 08450 74 06 74, www.cse.org.uk
Introduction

Anaerobic digestion is the decomposition of organic matter within an almost airless environment. This can take place in specially designed tanks or in landfill. Suitable feedstocks include farm wastes, sewage and the organic fraction of general municipal waste. Anaerobic Digestion produces methane, which can be burnt to produce heat and electricity, and digestate, which can be used as fertiliser and a soil improver.

South West Resource

The South West, with its large rural sector and a growing population, has considerable potential for more biogas plants. With waste disposal being such a great problem, biogas production could provide many benefits to the region in addition to the production of energy. The greatest proportion of the region’s renewable energy generation is from biogas with 71 MW coming from landfill gas and 11 MW from Sewage Gas (2007 Project Survey, Regen SW). There is also expertise in the region from projects such as the Holsworthy Biogas Plant.

Technology

A slurry of organic matter and suitable bacteria held in an airtight container at a temperature of around 50°C will decompose to produce large quantities of biogas; a mix of 50-70% methane and carbon dioxide. This can be used on-site or burned in internal combustion engines to produce electricity (Figure 1). A similar process will also occur in the semi-anaerobic conditions found in many landfill sites.

The bacteria can either be those naturally existing in the slurry, as is the case with animal manure, or artificially introduced. The digestate left after digestion can be returned to the land and includes fertilising compounds rich in nitrogen. Such a system is sustainable in that an equivalent amount of carbon dioxide would have been produced if the waste had degraded naturally.

Figure 1. Schematic of a biogas plant.
There are four stages to the process.

1. **Pre-Processing.** The feed stock is pre-treated to remove non-biodegradable materials, provide a uniform small particle size for efficient digestion and remove material that may decrease the quality of the digestate or damage downstream plant. For farm wastes this process will be simple and confined to grit removal and mixing with other organic wastes to ensure a near-optimum carbon:nitrogen ratio. For municipal wastes the process will be more complex and involve separation at source, or mechanical separation using manual sorting (to remove items such as batteries, building materials and other inorganics), rotating trammels or screens to remove large items, a hammermill to crush the waste and a hydropulper (a device that separates materials according to density).

2. **Sterilisation.** It may be important to sterilise the digestate if it contains animal products. In digesters operating at high temperatures this may occur naturally, with low temperature, mesophilic systems pre- or post-treatment at a temperature of 70°C will be needed.

3. **Digestion.** This can be single-stage, multi-stage or batch. Single stage digesters originated in the waste-water industry and consist of a single large reaction vessel. Multistage systems contain two or more vessels each concentrating on a different part of the digestion process and offer more control over the rate of the reaction. In batch processors the digester is filled once with fresh waste and allowed to go through all stages of digestion before more waste is introduced. Batch systems are technologically simple, often more robust and cheaper, however they need a greater floor area (as the reactor is typically only one fifth the height of an equivalent continuous system) and have a lower gas yield. Mesophilic systems are considered more reliable and require less heat to maintain the reaction, however they take longer to process the waste.

4. **By-Product Use.** Anaerobic digestion produces biogas and digestate.

**Biogas.** This has a similar calorific value to landfill gas at around 22 MJ/m³, compared to 36 MJ/m³ for natural gas, with the exact composition linked to the type of waste used. It may be necessary to remove some of the hydrogen sulphide and water vapour in the biogas to avoid corrosion within the boiler, or combined heat and power (CHP) engine. The gas can be burned within a boiler, used to run a CHP unit to provide electricity and heat or used as a transport fuel.

**Digestate.** The quality and therefore value of the digestate will depend on contamination, and nutrient content. Digestion concentrates these nutrients and produces a less odorous product. Single-farm digesters can usually make use of the digestate for soil improvement without any post-processing and it is relatively simple to separate the liquid and solid fractions, thereby producing a liquid fertiliser and a peat substitute for re-sale. Units processing municipal solid waste will usually require the use of post-processing technologies.

**Suitable Wastes |**

Most organic wastes are suitable. Wet wastes, such as manure or catering waste are particularly suited because the high water content makes them unsuitable for combustion. Industries producing wet wastes include: food, beverage, starch, sugar, paper, slaughterhouse, chemical, pharmaceutical, dairies, cosmetics, fish processing, sewage and agriculture. It is perfectly feasible to use a mix of these wastes and create a community scale facility. Municipal solid wastes can also be used, although a high level of pre-processing may be required.

**Scale |**

Traditionally most anaerobic digestion plants have been small-scale units, working at low temperatures and low solid content serving a single farm (with several thousand examples in Germany alone). There is now a move to much bigger units serving a community. This offers the potential for improved efficiency, economies of scale and the co-digestion of farm and municipal waste. Table 1, shows typical sizes and throughputs for wastes and Table 2 shows the same but for sewage. For the treatment of municipal solid waste, a throughput in excess of 15,000 tonnes per annum is probably required [IWM Report on AD of MSW]
Landfill

Water content in a landfill site is much lower than within slurry (which might be 95% water) and the waste is not kept artificially warm, so decomposition takes place much more slowly, typically over several decades. Methane escapes naturally from landfill and is a powerful greenhouse gas (twenty times that of carbon dioxide by mass). Being such a strong greenhouse gas gives an extra justification for capturing the gas and burning it to produce carbon dioxide to reduce the overall impact on the greenhouse effect.

The site is covered with a layer of clay to keep air out and to keep the gas from escaping. The landfill gas is extracted via a grid of interconnected pipes buried within the waste. Production rates of 3500 m³/hour of methane are possible from a large, well developed site, with around three GJ of methane being produced per ton of waste. Newer landfill sites will have some form of methane recovery, although it might only be flaring without energy recovery. Older sites may simply vent the methane to air.

Issues

Traffic. For plants taking waste from more than one farm, there will be an increase in local traffic, potentially causing a nuisance to neighbours. If the waste travels a large distance, the greenhouse gas emissions from the lorries will reduce some of the environmental benefit of the scheme.

Visual Impact. This will depend on the size of the digester and associated plant. Table 1 can be used to get an idea of the height of the digester.

Odour. This is a potential problem from untreated waste coming into the plant.

Noise. There will be noise from vehicles and potentially from a CHP unit.

Emissions. Provision needs to be made for dealing with the flaring of excess gas and measures introduced to reduce the possibility of liquid effluent polluting ground water.

Cost Payback. It is unlikely that a small-scale digester will be financially viable solely through electricity production. A reasonable payback is much more likely if the heat and the waste it produces can be used on the farm or nearby. There are examples of much larger facilities which have been financed on a commercial basis.

Maintenance

Maintenance will be dependent on the type and scale of the biogas system and the type of feedstock used. The operation and maintenance requirements of a proposed project should be detailed in the initial development stages to ensure costs and man-hours are included in the business case.

Planning Permission and Licences

Depending on the general scale of the system, planning permission will be focused on the visual impact of additional buildings and storage facilities, as well as issues such as odour. Larger systems may raise concerns regarding increased haulage of feedstock on local roads to the site. In general regulations and licences will be required with regard to which wastes are suitable for digestion, the way they must be handled and stored, and the production and use of any co-product. For example, a facility handling controlled wastes will require a licence under the Environmental Protection Act 1990.
Connecting to the Grid

Large biogas plants export electricity directly to the grid, small-scale installations can also be connected to the grid so that electricity that is not used on-site can be exported to the grid and so that the site can use grid electricity when needed. By buying an export meter (around £150) this surplus can be sold to an electricity supplier for around 2.5p per kWh. In addition, the owner of the plant would probably be able to receive Renewable Obligation Certificates (ROCs) for all the electricity generated, these can then be sold via a third party.

Finance

Estimating the Potential of the Site

The amount of biogas produced will depend on the amount and type of waste, and the type of anaerobic digestion system installed. However, it may only be economic to process a fraction of the waste if there is not sufficient demand to use all of the energy generated (particularly the heat energy). Conversely, it might be worth considering involving others in the project in order to increase the size of the plant and generate economies of scale, or to ensure a year-round supply of waste.

For a farm of 600 cattle, of which approximately one-third of the waste could be collected, there would be a waste stream equivalent to 600/3 = 200 cattle. This should produce 333 m³ of biogas per day, which could be burnt in an 83 kW CHP engine. Over a year, this could produce around 83 x (1/3) x 365 x 24 = 242,360 kWh of electricity and 484,720 kWh of heat, although the actual output is likely to be slightly less as the plant will not operate 100% of the time due to maintenance requirements. This electricity could be used on-site or exported, however the heat would have to be used on site, or nearby.

Costs and Grants

Costs for biogas plants are dependent on scale and system type. For example, a basic farm scheme may cost under £100,000 whereas commercial scale systems will start from several million pounds. Important factors to take into account when costing a plant and formulating a business plan include additional expenditure, such as operational costs and required licenses, as well as potential income from gate fees for feedstock where relevant. Biogas plants do not generally fall under the same grant schemes as other renewable energy technologies. In some cases feasibility studies for smaller projects have been funded through community renewable energy funds, however, projects generally have difficulty in obtaining grant funding for capital costs. Funding streams accessed by previous biogas projects include European funding, Regional Development Agencies and rural economic development companies.

More Information

- The Renewable Energy Association (www.r-e-a.net) has contacts for member companies working within the biogas sector.
- The International Energy Agency has a group dedicated to bioenergy and a UK-based expert to help answer your questions: see www.aboutbioenergy.info/technologies.html
- For information on connecting to and exporting to the grid see: www.quietrevolution.co.uk/downloads

Introduction

Solar collectors provide a simple and effective way to supplement water heating and reduce fossil fuel use. There are over 40,000 solar water heating systems operating in the UK. Most of these are only used to heat water for washing and bathing, but there are systems available that pre-heat the central heating water.

In the UK, the energy captured by a solar water heating system is much greater in summer and is therefore out of phase with the demand for heating in winter. This problem can be solved in part by using a very large storage tank.

Technology

There are two common designs of solar collectors for water heating: flat plate and evaluated tubes. Both contain a fluid which is heated in the collector to transfer heat to a storage cylinder which is usually larger than a domestic hot water cylinder. The collector will still heat water on overcast days, however most systems are designed to work with an existing boiler or an electric immersion as a supplementary heat source.

Evacuated tube collectors consist of an array of tubes, an insulated manifold header where heat is transferred from the tubes to the fluid and a supporting frame. Each tube measures approximately 50 mm in diameter x 1500 mm long and panel sizes range from 10 to 30 tubes.

A flat plate collector consists of a thin absorber sheet (usually copper, to which a black or selective coating is applied) backed by a grid or coil of tubing and placed in an insulated casing with a glass cover. The absorber collects solar heat which is transferred to a fluid circulating through the tubing. A heat exchanger then delivers the heat to the hot water system. Some systems circulate water through the collector so that it is heated directly before being circulated to the hot water cylinder.

Because of their curved shape, evacuated tubes maintain a more constant area of collector perpendicular to the sun and therefore a more even heat output over the day. Their higher efficiency means the area of collector will be smaller, however they tend to have a higher profile and tend to be more expensive. In practice, the efficiency of the collector is not the only important aspect in overall performance and a quote for both types of system should be obtained.

A variety of solar hot water panels

Top & middle photos: Examples of flat plate collectors.

Bottom: Evacuted tube collectors and PV panels.
Site Suitability

Solar water heating can easily be integrated into pre-existing buildings, or added to new designs. Solar collectors perform best when mounted facing due south at an angle between 25-65°. This angle corresponds to the roof pitch of most domestic properties in the UK. Panels can be mounted facing anywhere between southeast and southwest see fig 1.

Solar panels can be expected to produce around 40 to 60% of domestic hot water needs. The area of collector needed will depend on the amount of hot water needed per person per day, the number of people in the building and the orientation of the roof to be used. Table 1 can be used to roughly size a system in the South West region (where insolation is slightly higher than the UK average) and is based on allowing 40 litres per person per day, typical of domestic use.

<table>
<thead>
<tr>
<th>Orientation of collector</th>
<th>W</th>
<th>SW</th>
<th>S</th>
<th>SE</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of people in house</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
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<td>5</td>
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<td>6</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

The table assumes that the system will be used for water heating only, not for space heating and that a flat plate system is used (an evacuated tube system would require around two thirds of the area).

Conventional systems use a mains powered circulation pump whenever the hot water tank is positioned below the solar panels. Most systems in northern Europe are of this type. The storage tank is placed inside the building, and thus requires a controller that measures when the water is hotter in the panels than in the tank. The system also requires a pump for transferring the fluid between the parts. Newer zero-carbon solar water heating systems use solar electric (photovoltaic or PV) pumps. These typically use a 5-20 W PV panel which faces in the same direction as the main solar heating panel and a small, low flow diaphragm pump to pump the water.

A conventional system uses a twin-coil, indirect hot-water tank. This tank is normally 200 litres or more, making it 1500 mm high. The lower part of the tank is heated from the solar coil, and the upper part is heated by the boiler. Alternatively, a single-coil tank can be used, with the upper part heated by an electric immersion heater.

Although solar water heating systems are usually designed to work with a hot water cylinder, it is possible to install a solar water heating system if you have a "combi" boiler that has no hot water tank. If you have a combi boiler, the solar panel would "pre-heat" water that passes through the boiler, reducing
the amount of fuel needed to bring the water up to temperature. Solar heated water would be stored in new a hot water tank that would feed the boiler. Solar-heating systems can be sealed, in which the system is full of water all the time, or ‘drain-back’ systems, in which the water in the collector drains back into the storage tank when the pump is not running. The benefit of the ‘drain back’ system is that it is not necessary to fill the system with anti-freeze to prevent winter freezing, nor is it necessary to install heat-escape mechanisms to prevent boiling on hot days when the water is not being used - such as when the house is unoccupied.

Issues

Solar panels should ideally be mounted on south-facing, unshaded roof areas, as shading will reduce the energy output of the panels. Panels are, therefore, usually mounted in a visible position.

Planning Permission

Planning permission will not normally be needed for a domestic system, unless it is a listed building or in a conservation area. It is best to talk to the local planning department before starting the project, providing them with details of the technology, its scale and location will ease the planning application process.

Maintenance

Solar water heating systems should last for around 25 years. They generally come with a ten-year warranty and require very little maintenance. A yearly check by the householder preferably with a cleaning of the collector surface, and a more detailed check by a professional installer every three to five years should be sufficient maintenance. Some systems which do not drain back out of the collector use anti-freeze that many have to be replaced approximately every 10 years.

Finance

Output and Payback. A domestic solar water heating system might generate around 1500kWh/year. For a typical house, at current fuel prices this equates to around £45 per annum saving if you have a gas boiler and £160 if you currently use electricity to heat your water [LR]. Domestic scale systems have payback periods of more than 10 years.
Sizing Tools

A very simple but approximate sizing tool for schools is available to download from The Centre for Energy and the Environment (www.ex.ac.uk/cee/re). For homes and other buildings, a more accurate but complicated free sizing tool can be downloaded from RETSCREEN (www.retscreen.net/ang/t_software.php).

Costs and Grants

The price for a complete DIY domestic solar water heating system ranges from £1100 to £2500—depending on size, type and manufacturer. Installed price ranges from £2500 to £5000, including VAT at the reduced rate of 5%. Prices for non-domestic systems vary widely depending on system size.

The Low Carbon Buildings Programme from the DTI can offer a maximum £400 regardless of size, subject to an overall 30% limit (exclusive of VAT) for home owners; for larger buildings a maximum of 40-50% of total costs (excluding VAT) can received. For further information see www.lowcarbonbuildings.org.uk

For more details see Grants section

More Information

- A list of installers can be found on the Regen SW website at www.regensw.co.uk/directory
- See Chapter 5 for case studies.
- New and renewable energy technologies for existing housing (CE102) Energy Saving Trust (www.est.co.uk/myhome/publications/)
- Solar hot water systems in new housing - a monitoring report (GIR88) Energy Saving Trust (www.est.co.uk/myhome/publications/)

References

LR  Based on data in the London Renewable Guide
Introduction

The sun is the source of most renewable energy. For many years researchers have been striving to develop methods of turning sunlight into electricity with high efficiency at low cost. In 1833 Charles Fritts constructed the first true photovoltaic (PV) cell capable of generating solar electricity using slithers of selenium but his device had an efficiency of less than one percent. Modern PV equipment has much higher efficiencies and can generate electricity in overcast conditions.

PV panels or tiles can be built into the fabric of a building, or bolted on afterwards. A variety of products are available, with differing performance and weight, the latter being important when retrofitting large areas of PV to roofs.

PV is expensive compared to other renewable energy technologies, but offers the advantage of generating electricity simply and silently. PV is not used for commercial power generation in the UK as very large areas would be needed to generate significant amounts of energy. However it is well suited to building integrated power generation and can make a significant contribution to the electricity needs of a wide range of different buildings, especially when combined with high efficiency lights and appliances.

South West Resource

Many PV systems provide power to isolated equipment and are therefore off-grid. This makes it difficult to estimate total power production. The International Energy Agency states that PV produced 17 GWh in 1990 and that this increased to 361 GWh in 2002, thus achieving 29% annual growth. This makes it the fastest growing sustainable energy technology. Germany alone produces 188 GWh/year from PV.

The UK has a relatively low exploitable solar resource compared with other countries, with an average annual solar insolation figure of 40kWh/m²-day compared to 65 kWh/m²-day in Madrid. However, the South West receives the highest levels of solar radiation in the UK - up to 1300kWh/m² on a solar collector inclined at 30° facing due South, compared to only 900 kWh/m² in Scotland.

The REvision 2010 report estimates that 1000 PV installations could be installed in the region by 2010 with a total capacity of 2 MW.

Technology

PV systems are usually modular, allowing almost any area of roof to be used. PV modules can be mounted in frames then fixed to a roof, facade or a pole (Figure 1), or integrated into the building fabric in the form of roofing tiles or other elements (Figure 2). Integrated systems tend to be more costly and have lower efficiencies but have less visual impact. A third option is to use very thin, flexible sheets of PV material bonded to the roof or integrated into glazing (Figure 3). See case study 10 for examples of PV systems from the region.

Figure 1. Framed PV modules
Figure 2. A PV roofing system
Figure 3. PV can be incorporated into glazing to provide shading and electricity.
PV modules must be properly angled and orientated for the best performance. A reasonable compromise is to use an angle of 30-40° to the horizontal, facing between southeast and southwest. North facing facades are best avoided.

Most PV cells are made from silicon, which is an insulator. Adding a small amount of another substance such as boron or arsenic, produces a material with either an excess or a deficiency of electrons. Light shining on a junction of the two materials produces a small electric current. There are three main types of silicon based PV:

- **Mono-crystalline** - expensive, but with good cell efficiency
- **Poly-crystalline** - cheaper to manufacture but lower cell efficiency
- **Amorphous** - cheapest to produce, but with the lowest efficiency, however can be made into light weight flexible sheets which can be bonded onto roofs

A number of non-silicon based PV systems are now being developed. An individual PV cell only produces a very small amount of electricity, so cells are usually grouped into modules to provide a higher voltage. The modules are then linked together to provide a useful amount of power. Because PV cells produce direct current (dc) an inverter is used to convert this to alternating current (ac) at 240 volts for use in the home or export to the grid. The capacity of a PV system is usually given in terms of the peak power in kW the device could produce, and is termed kWpeak or kWp. The relative performance of the types of cells is illustrated in the table below.

<table>
<thead>
<tr>
<th>Type</th>
<th>Efficiency (%)</th>
<th>Area required to mount 1 kWpeak (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono-crystalline</td>
<td>13-17</td>
<td>8</td>
</tr>
<tr>
<td>Poly-crystalline</td>
<td>8-12</td>
<td>10</td>
</tr>
<tr>
<td>Amorphous</td>
<td>4-8</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 1 Efficiency of different PV technologies Source London RE tool kit
Issues

- **Vandalism.** In some areas it might be necessary to consider the potential for vandalism of the fragile modules.
- **Visual Impact.** If a system of inclined panels is mounted on a flat roof of a tall building it may not be visible. Framed systems on tiled roofs will be visible because of their blue colour and reflections from glass covers and aluminium frame. Integrated systems which follow the tiling line are far less visible. Some individuals, schools and businesses may decide to design systems so as to make a visual statement.
- **Ecological Impact.** There are some concerns over the chemicals and manufacturing techniques used in the production of the cells.
- **Energy and Cost Payback.** A PV system should pay back the energy used in its manufacture within around three years. However, currently PV systems usually never payback the capital cost without major subsidy.

Maintenance

PV modules have very few maintenance requirements, although there have been problems with inverters. Rain usually keeps the cells clean. PV modules are expected to last 18-40 years although most systems have yet to see a lifetime of use so this is difficult to judge.

Planning Permission

Depending on the technology type the householder wishes to install and the age and location of the house, it may be that planning permission will be required, especially if it is a listed building or in a conservation area. It is best to talk to the local planning department before starting the project as there may be local issues to overcome. Providing them with details of the technology, its scale and location will ease the planning application process.

Connecting to the Grid

PV systems can be connected to the grid via an electronic control unit and the consumer unit (fuse box) in a house. Top-up electricity is imported from the grid and surplus electricity is exported. An export meter (costing around £150) is required to sell surplus electricity to a purchasing company for around 2.5p per kWh. In addition, Renewable Obligation Certificates or ROCs can be claimed and sold via a third party. Some electricity suppliers now have tariffs for customers with renewable electricity systems and will trade ROCs on the customers behalf and provide a credit for each unit of electricity generated.

Small PV arrays can also be used to charge batteries, although normally only in off-grid properties using a diesel generator. Batteries can typically store two to three days worth of electricity.
Finance

As with any micro-renewable energy project, the first stage is to estimate the demand for energy and then try to minimise demand through conservation and energy efficiency measures. The PV system can be sized to meet the reduced maximum demand of the building, or some proportion of it. It is common to export any excess PV electricity via a grid connection and import electricity when the PV system is not providing enough electricity.

Example Calculation
A typical new, gas-heated four bed roomed terraced house uses approximately 2,500kWh/year for lights and appliances. Assume half this demand will be met from PV. In the UK 1 kWpeak of installed PV will generate around 750 kWh/year and each kWpeak will require 10 m² of space if poly-crystalline modules are used. Thus the house would require a system of size 1.7 kWpeak (calculated as (2500/750) x ½ ), which would take up 1.7 x 10 =17 m² of roof. PV costs are about £7,000/kWpeak installed for a non-integrated system. Thus the system would cost around £11,900 to provide about half the electricity required by the house. Costs would be higher for integrated PV modules.

Note: the average annual electricity use per year in the UK is around 4,400 kWh (including older homes and homes heated by electricity), illustrating the importance of addressing energy efficiency before investing in PV.

Sizing Tools

A very simple but approximate sizing tool for schools is available for free download from The Centre for Energy and the Environment (www.ex.ac.uk/cee/re). For homes and other buildings there is a much more complicated but more accurate free sizing tool from RETSCREEN at www.retscreen.net/ang/t_software.php.

Costs and Grants

Various grant schemes are available for home owners, farmers and other businesses. Under the DTI’s Low Carbon Buildings Programme grants of £3,000/kWp installed are available:

- households: to a maximum of £15,000 subject to an overall 50% limit of the installed cost (excluding VAT)
- larger buildings: to a maximum of 40-50% of total costs (excluding VAT).

For more details see Grants section.

More Information

Regen SW maintains a list of installers on its web site: www.regensw.co.uk/directory

See the case studies section for examples.
Various EST guides are available at (www.est.co.uk/myhome/publications/);
For more information see the British Photovoltaic Association’s web site: www.greenenergy.org.uk/pvuk2/about/index.html

For information on connecting to and exporting to the grid see: www.quietrevolution.co.uk/downloads.htm

Companion Guide to PPS 22: The technical annexes Also has information on PV available at www.odpm.gov.uk/planning
**Introduction**

The temperature below the surface of the earth is warmer than typical winter temperatures, yet cooler than summer temperatures above the ground. This even environment arises from the capture of solar energy during the summer, the huge thermal mass provided by the earth and because the top few metres of soil provide a layer of insulation to stop the ground losing heat during the winter.

A ground source heat pump (GSHP) can use and upgrade this stored energy to provide useful heat for a building - conversely the reduced temperature below ground in summer can cool a building using the same GSHP system. Ground-source heat pumps are one of the fastest growing applications of renewable energy in the world. The worldwide installed capacity is over 12 GWth with an annual energy use of over 20 TWh from around one million GSHP systems worldwide [Lund].

**South West Resource**

The South West is well suited for the increased deployment of heat pump systems. The natural resource available is good as the South West receives the greatest level of solar radiation in the UK. In addition, the rural nature of South West England means there are a high number of off-gas heat users reliant on oil, LPG and electricity. Heat pumps show a better financial case against these more expensive fossil fuels.

The South West also has strong expertise in delivering heat pump technologies with at least five specialised companies based in the region and over 4.4 MWth of systems installed as of April 2007.

**Technology**

A heat pump system collects heat from the ground and upgrades it before distributing it through a building via hot air ducts, low temperature radiators or under floor heating. The heat pump itself is electrically driven, and typically, each kilowatt (kW) of electricity used extracts more than 3 kW of renewable energy from the ground. The ratio of heat delivered to the building to the electricity used is the coefficient of performance (COP) and values of 3 to 4 are typical.

A ground-source heat pump system comprises three elements: a heat pump, a ground loop and an interior heating/cooling distribution system.

**The Ground Loop**

The ground loop consists of long lengths of pipe buried in either horizontal trenches or vertical boreholes. Water or an antifreeze/water mix circulates around the pipe-work and carries heat back to the heat pump in a "closed loop."

A horizontal collector system consists of a series of pipes laid out in trenches, usually one to two meters below the surface, which are backfilled. Afterwards, normal landscaping can be applied and the area used as parkland, gardens or car-parking. In cases where there is not enough space for a horizontal ground loop vertical boreholes can be used.
The Heat pump

The heat pump is the central point within the whole system where heat transfers between the ground loop and heating/cooling system within the building.

The heat pump operates using the same cycle as a refrigerator. In heating mode, heat from the ground loop arrives at the heat exchanger (the evaporator). On the other side of this heat exchanger is cold refrigerant in a mostly liquid state and heat flows into the refrigerant. This heat causes the liquid refrigerant to evaporate, but raises its temperature little. This gaseous, low pressure and relatively low temperature refrigerant then passes into an electrically-driven compressor which raises the refrigerant’s pressure and, as a consequence, its temperature. This now higher temperature, higher-pressure gas within the compressor, feeds into a second heat exchanger, called the condenser.

Air or water is pumped through this condenser and since the refrigerant is hotter than the air in the building or the water in the heating circuit, it transfers heat to it. As a result, the refrigerant’s temperature drops slightly and it condenses back to a liquid. This still warm liquid refrigerant then passes through an expansion valve. The valve reduces the pressure of the refrigerant, thereby suppressing its temperature further. Finally, this low temperature liquid flows to the evaporator, and the cycle repeats.

In addition, a desuperheater can be used to provide domestic hot water from the circuit. The desuperheater is an auxiliary heat exchanger at the compressor outlet which transfers excess heat from the compressed gas to water that circulates through a hot water tank.

The Heating and Cooling distribution system

Under-floor heating is the ideal heat distribution system for a GSHP as it operates at a low temperature. Oversized radiator systems and air-duct distribution systems can also be used - traditional radiator systems with higher flow temperatures may result in lower efficiencies from the heat pump unit.

Site Suitability

The main decision on the chosen ground source option is whether there should be a horizontal or vertical ground loop. Horizontal systems can be particularly cost effective if excavating and trenching equipment are available during the early phase of a new build. Borehole systems, although more expensive, will be attractive on sites where space is at a premium.
When using a horizontal ground loop system, trenches really need to be at least two metres deep to harness a reasonably consistent year-round heat source. A typical domestic installation is 7-8 kilowatts (kW), and for trenches you’ll need about 50 to 80 metres of pipe per kW, or 10 metres of ‘slinky’ (coiled pipe) per kW. The trenches could be straight or curved and laid in any direction to suit your site, providing they are always a minimum of five metres apart to avoid heat transfer between pipes.

For vertical ground loop systems, boreholes will need 20 to 50 metres of pipe per kW, and will usually be 100-150 metres deep - which means you may need two to four pipes per borehole, or possibly more than one borehole. Pipe diameter should be 20-40mm for best performance - large enough to reduce pumping power but small enough to increase flow velocities so causing turbulent flow (better heat transfer).

GSHPs use electricity to run. Unless this is coming from a renewable source, such as a wind turbine, or via a green tariff, this will result in emissions of carbon dioxide from the generation of the electricity.

Design

Sizing of the heat pump and the ground loops is essential for the correct operation of the system. If sized correctly a GSHP can meet 100% of space heating requirements. Please note that sizing is a job for specialists. GSHP systems are most effective when applied to properties with high energy efficiency standards, particularly new build. It is a good idea to explore ways of minimising space heating and hot water demand by incorporating energy efficiency measures.

Issues

- Noise levels will be similar to a refrigeration unit of a similar scale.
  The only real concerns centre on noise from the pumps and compressors - it is best to place the heat pump away from bedrooms and other noise sensitive locations.
- Heat pump systems have minimal visual impact as the ground collectors are buried and there is no requirement for a flue or any fuel storage and delivery.
- As there is no combustion there are no regular maintenance requirements for a ground source heat pump system.
- There are no planning issues for most systems. For borehole systems, the underlying geology will need to be carefully assessed.
Finance

The capital cost of the heat pump and the ground loop will be considerably more than a gas or oil boiler. The payback period will depend on whether the trenches were dug during the construction of the building and whether the original heating system is electric, gas or oil, and whether off-peak electricity can be used.

Sizing tools

A very simple but approximate sizing tool for schools is available for free download from The Centre for Energy and the Environment (www.ex.ac.uk/cee/re). For homes and other buildings, a more complicated but more accurate free sizing tool can be downloaded from RETSCREEN (http://www.retscreen.net/ang/t_software.php).

Costs and Grants

The cost of a professionally installed GSHP ranges from about £1,000 to £1,700 per kW of peak heat output. A rule of thumb is that the heat pump itself will be £400 to £600 per kW, with trenches £300 per kW or boreholes £500 per kW. Vertical borehole systems would be at the higher end of this scale, due to greater installation costs. Suppliers should be contacted for up to date costs.

Various grant schemes are available for home-owners, farmers and other businesses. The Low Carbon Buildings Programme (LCBP) from the DTI can offer a grant of £1,200 subject to an overall 30% limit of the installed cost (exclusive of VAT) for home owners. Public buildings and not for profit organisations are eligible for a 35% grant through Phase 2 of the LCBP program.

For more details see Grants fact sheet.

References

RET Retscreen, Clean energy project analysis, GSHP Chapter, ISBN 0-662-39150-0.

More Information

- Regen SW maintains a list of local installers on its website: www.regensw.co.uk/directory
- Various EST guides are available from the EST website (www.est.co.uk/myhome/publications/):
  - Ground source heat pumps
  - Domestic Ground Source Heat Pumps: Design and installation of closed-loop systems (CE82 / GPG339)
  - Heat Pumps in the UK - a monitoring report (GIR72)
- Heat Pump Association www.feta.co.uk
- International GSHP Association: www.igshpa.okstate.edu
- Geothermal Heat Pump Consortium www.geoexchange.org
- Canadian Earth Energy Association www.earthenenergy.ca
Appendix 8. Glossary
## Abbreviations used within this Strategy

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AAP</td>
<td>Area Action Plan</td>
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<tr>
<td>BER</td>
<td>Building Emissions Rate</td>
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<td>Department for Business, Enterprise and Regulatory Reform</td>
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<td>BREEAM</td>
<td>Building Research Establishment Environmental Assessment Method</td>
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<td>CEP</td>
<td>Community Energy Plus</td>
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<td>CHP</td>
<td>Combined Heat and Power</td>
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<tr>
<td>CO₂</td>
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<td>CoP</td>
<td>Coefficient of Performance</td>
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<td>CPR</td>
<td>Camborne, Pool and Redruth</td>
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<td>Cornwall Sustainable Energy Partnership</td>
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<td>Department for Communities and Local Government</td>
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<tr>
<td>Defra</td>
<td>Department for Environment, Food and Rural Affairs</td>
</tr>
<tr>
<td>DER</td>
<td>Dwelling Emissions Rate</td>
</tr>
<tr>
<td>DIT</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>DTE</td>
<td>Dried Tonnes Equivalent</td>
</tr>
<tr>
<td>EiP</td>
<td>Examination in Public</td>
</tr>
<tr>
<td>EPC</td>
<td>Energy Performance Certificate</td>
</tr>
<tr>
<td>ESCo</td>
<td>Energy Service Company</td>
</tr>
<tr>
<td>EST</td>
<td>Energy Saving Trust</td>
</tr>
<tr>
<td>GHa</td>
<td>Global Hectares per person</td>
</tr>
<tr>
<td>GPDO</td>
<td>General Permitted Development Order</td>
</tr>
<tr>
<td>GIFA</td>
<td>Gross Internal Floor Area</td>
</tr>
<tr>
<td>HLP</td>
<td>Heat Loss Parameter</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change.</td>
</tr>
<tr>
<td>LDF</td>
<td>Local Development Framework</td>
</tr>
<tr>
<td>LTP</td>
<td>Local Transport Plan</td>
</tr>
<tr>
<td>MSW</td>
<td>Municipal Solid Waste</td>
</tr>
<tr>
<td>MUSCo</td>
<td>Multi Utility Service Company</td>
</tr>
<tr>
<td>NGS</td>
<td>National Green Specification</td>
</tr>
<tr>
<td>NOx</td>
<td>Nitrous oxides</td>
</tr>
<tr>
<td>ODT</td>
<td>Oven Dried Tonnes</td>
</tr>
<tr>
<td>PPS</td>
<td>Planning Policy Statement</td>
</tr>
<tr>
<td>RAB</td>
<td>Renewable Advisory Board</td>
</tr>
<tr>
<td>ROC</td>
<td>Renewable Obligation Certificate</td>
</tr>
<tr>
<td>RSS</td>
<td>Regional Spatial Strategy</td>
</tr>
<tr>
<td>SAP</td>
<td>Standard Assessment Procedure</td>
</tr>
<tr>
<td>SPD</td>
<td>Supplementary Planning Document</td>
</tr>
<tr>
<td>SUDS</td>
<td>Sustainable Drainage Systems</td>
</tr>
<tr>
<td>TCPA</td>
<td>Town and Country Planning Association</td>
</tr>
<tr>
<td>TER</td>
<td>Target Emissions Rate</td>
</tr>
<tr>
<td>TTAAP</td>
<td>Truro &amp; Three Milestone Area Action Plan</td>
</tr>
<tr>
<td>UKCIP</td>
<td>UK Climate Impacts Programme</td>
</tr>
</tbody>
</table>
Energy Units used within this Strategy

| UNITS OF POWER                      | A Watt is a unit of power.  
| Watts (W), Kilowatts (kW),          | Kilowatt = 1000 W, Megawatt = 1000 kW |
| Megawatts (MW)                     | |

| UNITS OF ENERGY                     | Energy = power x time.  
| Kilowatt-hour (kWh)                 | Thus a kilowatt-hour is the energy of a 1kW device running for 1 hour or a 100W device running for 10 hours.  
| Megawatt-hour (MWh)                 | Megawatt-hour = 1000 kWh, Gigawatt-hour = 1000 MWh |
| Gigawatt-hour (GWh)                 | |

| kWe                                  | The use of 'e' refers to electrical energy |
| kWth                                 | The use of 'th' refers to thermal energy  |
| kWp                                  | Kilowatt Peak (used for rating PV systems) |

Glossary

This glossary is mainly taken from the draft RSS and the accompanying EiP.

Affordable Housing
Definition of ‘affordable’ as given in Annex A of the Consultation Paper on a New Planning Policy Statement 3 (PPS3) – Housing (ODPM, December 2005): "Non-market housing provided to those whose needs are not met by the market, for example, homeless persons and key workers. It can include social-leased housing and intermediate housing. Affordable housing should: meet the needs of eligible households, including availability at low enough cost for them to afford determined with regard to local incomes and local house prices, and include provision for the home to remain at an affordable price for future eligible households, or if a home ceases to be affordable, any subsidy should generally be recycled for additional affordable housing provision".

Biodiversity
Biological diversity in the environment, indicated by the numbers of different species of plants and animals in a given habitat or area.

Biomass
Biomass is anything derived from plant or animal matter and includes agricultural, forestry wastes/residues and energy crops. It can be used for fuel directly by burning or extraction of combustible oils.

BREEAM
A way of assessing the environmental performance of both new and existing buildings.

Carbon Footprint
A representation of the effect human activities have on the climate in terms of the total amount of greenhouse gases produced (measured in units of carbon dioxide).

Climate Change
Commonly used term to imply a significant change over time in global, national and local climate, primarily as a result of man-made greenhouse gas emissions. Previously, climate change has been used synonymously with the term global warming; scientists now, however, tend to use the term in the wider sense to also include natural changes in climate.

Combined Heat Power (CHP)
CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process, thereby discarding less wasted heat.

Dwelling Emissions Rate (DER), and Building Emissions Rate (BER)
The DER is the actual emissions rate calculated for a dwelling and must be equal to or less than the TER in order to comply with Building Regulations. BER is the equivalent term for non-residential buildings.
Ecological Footprint
The area of land and water which is required to support a defined economy or human population at a specified standard of living indefinitely, using prevailing technology.

Environmental Limits
Respecting the limits of the planet’s environment, resources and biodiversity – to improve our environment and ensure that the natural resources needed for life are unimpaired and remain so for future generations.

Energy Security
Being able to access energy as and when it is needed without interruption

Fuel Poverty
The common definition of a fuel poor household is one needing to spend in excess of 10% of household income to achieve a satisfactory heating regime (21°C in the living room and 18°C in the other occupied rooms).

Future Proofing
Actions which are needed to ensure that development takes into account predicted future conditions, for example, by being built to adapt to potential climate change impacts.

Green Infrastructure
Strategic networks of accessible, multifunctional sites (including parks, woodland, informal open spaces, nature reserves and historic sites) as well as linkages (such as river corridors and floodplains, wildlife corridors and greenways). These contribute to peoples well-being, and together comprise a coherent managed resource responsive to evolving conditions.

Greenhouse Gases
A range of gases, including carbon dioxide and methane, which contribute to the greenhouse effect or global warming.

Large Scale development
For the purpose of Policies G, RE5 and W4, ‘larger scale development’ proposals include significant urban regeneration projects covering new build, refurbishment, conversion and change of use and are defined in line with the ODPM Form PS2 definition, used for reporting general developments, as: for dwellings, the development of 10 or more dwellings or sites of more than 0.5 ha if the number is not given; for all other uses, where the floor space will be 1,000 square metres or more or the site is 1ha or more. Floor space is defined as the sum of floor area within the building measured externally to the external wall faces at each level. Basement car parks, rooftop plant rooms, caretaker’s flats etc should be included in the floorspace figure.

Local Development Framework (LDF)
The Local Development Framework is a non-statutory term used to describe a folder of documents, which includes all the local planning authority’s LDDs. An LDF is comprised of Development Plan Documents (which form part of the statutory development plan) and Supplementary Planning Documents. The LDF will also comprise: the Statement of Community Involvement; the Local Development Scheme; and the Annual Monitoring Report.

Low and Zero Carbon Energy Sources (LZCs)
This is the standard term used in the Building Regulations to cover both renewable energy technologies, such as solar panels, as well as low carbon energy sources such as micro-CHP, absorption cooling, ground cooling and heat pumps. It does not include energy efficiency measures. It is often used interchangeably with “renewable energy” but strictly speaking, as explained above, it also covers low carbon technologies.
On-site Renewable Energy Generation
The definition of what counts as “on-site” generation allows for a site to connect up to an existing or proposed energy network off site, e.g. to a district heating or cooling network. It also allows for on-site electricity generation where electricity is supplied directly into the grid, and does not require there to be a private wire distribution network on site. It does not include the purchase of electricity on a “green tariff” generated at a facility which would not be considered a part of the wider development.

Peak Oil
This describes the issue that the output of easily extractable, cheap, crude oil will peak and then start to decline. Once it has peaked it will become increasingly difficult, and expensive, to extract and oil supply will drop quickly, driving up prices rapidly.

Potable Water
This is drinking quality water that is taken from the mains water supply in the dwelling and used for toilets, washing, drinking, cooking, and outside of the house.

Regulated Emissions
This refers to the carbon emissions resulting from energy used to meet those services in a building that are regulated under the Building Regulations. Currently, these services are: space heating, water heating, fixed internal lighting, cooling and ventilation pumps and fans.

Renewables Obligation
The obligation placed on licensed electricity suppliers to deliver a specified amount of their electricity from eligible renewable sources.

Renewables Obligation Certificate (ROC)
Eligible renewable generators receive ROCs for each MWh of electricity generated. These certificates can then be sold to suppliers. In order to fulfil their obligation, suppliers can either present enough certificates to cover the required percentage of their output, or they can pay a ‘buyout’ price of £30 per MWh for any shortfall. All proceeds from buyout payments are recycled to suppliers in proportion to the number of ROCs they present.

SAP
The Standard Assessment Procedure (SAP) is adopted by Government as the UK methodology for calculating the energy performance of dwellings

Sustainability or Sustainable Development
The simple idea of ensuring a better quality of life for everyone, now and for generations to come. A widely used international definition is “development which meets the needs of the present, without compromising the ability of future generations to meet their own needs”.

Sustainable Communities
Places where people want to live and work, now and in the future.

Sustainable Construction
New building and refurbishment that promotes environmental, social and economic gains now and for the future. It involves the use of design and construction methods and materials that are resource efficient and that will not compromise the health of the environment or the associated health of building occupants, builders, the general public or future generations.

Target Emissions Rate (TER)
TER means the Target carbon dioxide Emissions Rate measured in kilograms of carbon dioxide per square metre of floor area per year. This is the target for the maximum regulated emissions that any building is allowed to produce in order to comply with Part L1A of the Building Regulations, for housing, and Part L2A for non-residential buildings.

Total Emissions
This is the total carbon emissions from energy used in a building or on a site and is the sum of both regulated and unregulated emissions.
**U-Value**
The heat transfer coefficient of a material or an assembly of materials. It is measured in terms of Btu per hour, per square foot of area, per degree of temperature difference across the material. The reciprocal of the U-value is the thermal resistance of the R-Value. The lower the U-Value number, the greater the heat transfer resistance (insulating) characteristics of the material or assembly of materials.

**Unregulated Emissions**
This refers to the carbon emissions resulting from energy used to meet those services in a building, or on a site, that are not currently regulated under the Building Regulations. Currently, these include: cooking, appliances, small power, communal lighting for flats, lifts, external lighting, IT equipment, etc.

**Urban Extension**
The planned expansion of a city or town that can contribute to creating more sustainable patterns of development when located in the right place, with well-planned infrastructure including access to a range of facilities, and when developed at appropriate densities.