ENERGY AND NEW DEVELOPMENT SUPPLEMENTARY PLANNING DOCUMENT May 2008

Contents

1 Introduction

The Rio Earth Summit in 1992 set out the principles of sustainable development. Sustainable development is defined as development which meets the needs of the present generation without compromising the ability of future generation to meet their own needs.

The recent publication of the Stern Review into climate change has indicated that the body of scientific evidence points to climate change being the result of human activity; this has taken place because of increased levels of ‘greenhouse gases’ (particularly carbon dioxide) in the atmosphere, and one result is the increased risk of floods and droughts in the UK and throughout the world.

An important element of addressing these issues is the prudent use of natural resources. The Government’s Energy White Paper, published in February 2003, reflected wider sustainability commitments and aimed to ‘give a new direction’ to the UK’s energy policy; it set a target of a 60% reduction in the UK’s carbon dioxide emissions by 2050, which is highly likely to rise to 80%. Energy efficiency in buildings and renewable energy sources are likely to make a significant contribution to achieving this reduction, with the aim being that renewable energy will supply at least 10% of UK electricity by 2010 and at least 20% by 2020.

Additionally, it is recognised that the United Kingdom is on course to become a net energy importer rather than exporter, so it is vital to maintain secure and reliable energy supplies, and it is important to tackle fuel poverty. Energy efficiency and renewable energy can both help in achieving these objectives.

How new development can contribute towards carbon reduction objectives

It should be borne in mind that the cheapest, cleanest and safest way of addressing carbon reduction goals is to use less energy. To this end, national planning guidance is explicit in its requirement for new development to be located in the most sustainable locations, such as in close proximity to public transport routes; these measures help to reduce the carbon emissions associated with new developments, and as well as this the internal layout of the development within the site can also have a significant impact. There are many measures which can be taken to maximise energy efficiency in new developments, and the Government has made it clear that it expects the planning system to promote and support this alongside promoting the take up of renewable sources of energy.

Rochdale Council considers that the use of the Code for Sustainable Homes and BREEAM standards are currently the best mechanisms for demonstrating the achievement of higher levels of energy efficiency in buildings.

Renewable energy sources are those that occur naturally and repeatedly in the environment, and include wind power, wave, tidal, solar, hydro generation, geothermal and biomass (energy from forestry or crops). All of these produce no carbon dioxide at all, except in the case of biomass, which produces only the carbon already absorbed from the atmosphere when the crop was growing. Microgeneration is the generation of heat and/or power on a small scale by individual households and businesses as well as communities.

Other benefits of energy efficiency / renewable energy

- Energy Security / reliability.
- Financial benefits.
- Improved air quality.
- Increased employment through new business opportunities.
- Tackling fuel poverty.

1.1 Purpose of this Document

This document is a Supplementary Planning Document (SPD) which supplements the relevant policies of the Council's Unitary Development Plan. It will form part of the planning framework for the Borough, and will be a 'material consideration' during the assessment of planning applications.

In addition, this document is to respond to the requirements laid down by national and regional planning guidance by promoting and encouraging energy efficiency and the use of renewable energy technologies (including passive solar design) in new developments in Rochdale Borough. It will do this by:

(i) giving detailed advice on how new developments can be constructed, designed and laid out to maximise energy efficiency and best use made of passive solar design, and on how renewable energy technologies can be incorporated to reduce the development's predicted carbon emissions.

(ii) Setting out specific requirements for new developments in terms of energy efficiency and the use of renewables.

The document is aimed at developers considering making planning applications and as a tool for development control planners in their assessment of planning applications.

The Council will be seeking to apply Government policy on Climate Change as currently expressed in 'Planning and Climate Change', a supplement to Planning Policy Statement 1, and this SPD gives guidance on what the Council will expect of developers in order to comply with Government policy.

1.2 Aims

(i) To clarify the Council's requirements for new developments in respect of energy efficiency and renewable energy technologies, supplementing the relevant policies of the Unitary Development Plan (UDP).

(ii) To contribute to the delivery of the Government's Climate Change Programme and energy policies without putting an undue burden which might stifle the economic and social development of the Borough.

(iii) To contribute to local sustainability objectives.

(iv) To assist new development in securing the increasingly high levels of energy efficiency required by Building Regulations.

1.3 Objectives

(i) To ensure future developments in Rochdale are designed and laid out in such a way as to achieve maximum use of natural systems for energy efficiency. This will support the guidance in the Urban Design Guide SPD.

(ii) To ensure that future developments in Rochdale optimise energy efficiency and sustainable construction.

(iii) To ensure that all new developments in Rochdale reduce their predicted carbon dioxide emissions through the use of on-site renewable technologies.

(iv) To promote the use of Combined Heat and Power (CHP) where appropriate.

1.4 Policy Context

1.4.1 National

(i) Energy White Paper (2003)

The Energy White Paper sets out the Government's energy strategy, which has four goals: to mitigate climate change by cutting the UK's carbon dioxide emissions by 60% by 2050 (with real progress by 2020), to strengthen energy security and maintain the reliability of energy supplies, to eliminate fuel poverty and to improve economic competitiveness.

(ii) Planning Policy Statement 1 – Delivering Sustainable Development (2005)

One of the key principles of this document is 'the prudent use of natural resources'. Development plan policies should seek to address, on the basis of sound science, the causes and impacts of climate change, the management of pollution and natural hazards, the safeguarding of natural resources, and the minimisation of impacts from the management and use of resources, including minimisation of the need to consume new resources over the lifetime of developments; and they should seek to promote and encourage, rather than restrict, the use of renewable resources (for example, by the development of renewable energy). 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.

(iii) Planning Policy Statement 1 – Planning and Climate Change Supplement (2007)

This supplements PPS1 by setting out how planning should contribute to reducing emissions and stabilising climate change and take into account the unavoidable consequences. The policies in this PPS are capable of being material to decisions on planning applications, and where there is any difference in emphasis on climate change between the policies in this PPS and others this PPS takes precedence, Local authorities should provide a framework that promotes and encourages renewable and low-carbon energy generation, including expecting a proportion of the energy supply of new development to be secured from decentralised and renewable or low-carbon energy sources. Planning authorities should help to achieve the national timetable for reducing carbon emissions from domestic and non-domestic buildings.

(iv) Planning Policy Statement 22 – Renewable Energy (2004)

PPS 22 states that local development documents should contain policies designed to promote and encourage, rather than restrict, the development of renewable energy resources. In particular, 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. Such policies: (i) should ensure that requirement to generate on-site renewable energy is only applied to developments where the installation of renewable energy generation equipment is viable given the type of development proposed, its location and design, and (ii) 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.

(v) Planning Policy Statement 22 Companion Guide (2004)

The Companion Guide indicates that PPS22 makes the introduction of renewable energy into development projects, and the use of passive solar design principles, 'normal planning matters'; this effectively means that local authorities now have the ability to produce policies on these matters, and to take them into account when determining applications.

This document also advises that, in preparing master plans and development briefs and commenting upon those put forward by others, Passive Solar Design (PSD) requirements should be placed alongside routine matters such as access and infrastructure.

(vi) Code for Sustainable Homes

The Code is intended as a single national standard to guide industry in the design and construction of sustainable homes. It is a means of driving continuous improvement, greater innovation and exemplary achievement in sustainable home building. Code compliance was initially voluntary but from 1st May 2008 it became mandatory for all new homes to have a rating against the code. Homes are rated from one to six stars dependent on their performance across a range of categories, with minimum energy efficiency and water efficiency standards for every level.

In preparation

(i) Changes to Permitted Development Consultation Paper (2007)

This outlines proposed changes to the Town and Country Planning (General Permitted Order) 1995, to enable many microrenewable installations on domestic properties to proceed without the requirement for planning permission. There will be exceptions, however, and under certain circumstances microrenewables will still require permission; the document sets out what these circumstances are.

1.4.2 Regional

(i) Regional Spatial Strategy for the North West (formerly known as Regional Planning Guidance RPG13)

This indicates that development plans in the North West should ensure that development minimises energy use through careful and imaginative location, design and construction techniques, and indicates that the use of energy-efficient technologies and energy from renewable sources in major new developments should be positively encouraged.

(i) North West Best Practice Design Guide

This provides guidance and advice on design issues, with examples in the North West, including energy efficiency and the use of renewable energy.

(ii) North West Sustainable Energy Strategy

This states that the region aspires to deploy sufficient renewable electricity generating capacity to provide: 10% of final demand by 2010, 15% of final demand by 2015 and 20% of final demand by 2020. Meeting these targets will be encouraged through the promotion of micro generation, such as the use of smaller scale community and on-site renewable energy projects via planning frameworks and supporting business and community deployment. Indicates that there should be a requirement in residential and non residential developments and major refurbishment schemes where 10% of the predicted energy requirements should be met by renewable energy production.

(iv) The Northwest Regional Development Agency (NWDA) Sustainability Standard

Following consultation in 2007 this document has been adopted by the NWDA and will be used in the assessment of applications for Agency funding towards built development projects. It sets out a range of sustainable development requirements, including a pathway towards zero net carbon, zero net waste and zero net water buildings by 2020. These standards will be applied to all developments (both new build and refurbishment) where an NWDA funding contribution is sought and the total development cost exceeds £500,000.

In preparation

(i) Submitted Draft Regional Spatial Strategy for the North West of England (2006)

This document, which will replace the Regional Spatial Strategy referred to above, will form part of the statutory development plan for every local authority in the North West of England. The draft document has been subject to a Panel review and Proposed Changes by the Secretary of State. It is now proposed that plans and strategies should actively facilitate reductions in energy requirements and improvements in energy efficiency by, amongst other things, incorporating policies which promote level 3 of the Code for Sustainable Homes by 2010 (level 4 by 2013 and level 6 by 2016) and ‘very good’ BREEAM standards. Additionally, plans and strategies should set out targets for the energy to be used in new development to come from decentralised and renewable or low-carbon energy sources, based on appropriate evidence and viability assessments, and should set out the type and size of the development to which the target will be applied.

1.4.3 Local

(i) Unitary Development Plan part one policy G/EM/12 (2006): Renewable Energy and Energy Conservation

In addition to the role of renewable energy, imaginative design and the location of developments to maximise the potential for energy conservation and efficiency can achieve significant environmental benefits. The plan will promote and encourage all development proposals to seek to reduce energy consumption through layout, design, construction techniques and use of materials and the use of alternative energy sources.

(ii) Unitary Development Plan policy EM/13 (2006): Energy Efficiency and New Development

Development proposals which include measures to conserve and assist the efficient use of energy will be supported where this can be successfully incorporated into the design and layout, and where there are no adverse impacts on the amenity of the surrounding area. Measures which will be especially encouraged include: the maximum use of local materials and recycled building materials for appropriate construction tasks where this would not adversely affect the quality, character and setting of the development; the use of design, layout, landscaping and materials which help to conserve energy through the ongoing use of the development; and the use of sustainable power generation systems such as solar and photovoltaic, small-scale combined heat and power, and other appropriate installations based on renewable and low carbon technologies.

(j) Unitary Development Plan policy EM/16 (2006): Sustainable Energy Sources

Proposals for the development of sustainable energy installations will be permitted where they have no unacceptable adverse impacts on local amenity or environmental quality and are shown to make an appropriate contribution to local or regional energy needs. In considering proposals and their siting, design and operation, particular attention will be given to the following:

- The effect on the amenity of the surrounding area (e.g. residential, recreational);
- The effect on buildings and areas of historic and archaeological importance and their setting and character;
- Measures to successfully overcome and manage any potential hazards created by the installation;
- The effect on landscape character and quality; and
- The effect on nature conservation interest.

An appropriate form of environmental assessment will be expected to accompany proposals where this is required by regulations or where it is necessary to assess the proposal and its effects.

(k) Urban Design Guides Supplementary Planning Document (adopted September 2007)

This document, which sets out best practice design principles to be applied across the whole of the Borough, requires that development proposals must be designed to reduce the demands they make on energy. Where feasible and appropriate they should be designed to provide 10% of their total predicted energy requirements on site from renewable resources. Measures for the conservation of water resources should also be incorporated into new developments, and they must make appropriate provision for the sustainable management and discharge of waste.

The document requires that all opportunities to create sustainable buildings are explored, including winter gardens, conservatories and sustainable technologies such as grey water recycling, photovoltaic and solar panels, thermal mass storage and passive ventilation. Developments should use construction methods which are not only fit for their intended purpose and make a positive contribution to design quality, character and appearance, but also contribute to the sustainable use of resources, and all new residential developments should meet at least level 3 of the Code for Sustainable Homes.

PART 1 - PLANNING REQUIREMENTS AND PROCESSES

2 Requirement for Developers

Residential Developments

All new residential developments of 5 or more dwellings are required to meet at least Level 3 of the Code for Sustainable Homes*, rising to Level 4 from 2013, level 5 from 2016 and Level 6 from 2020.

(* this will include refurbishments / conversions and changes of use that require planning permission).

Non-residential Developments

All new non-residential developments incorporating gross floorspace of 500 sq m or more are required to meet at least BREEAM Very Good standard, with at least a 20% reduction in CO2 emissions against the requirements of the 2006 Building Regulations, rising to 25% from 2011, 44% from 2014 and 79% from 2017. From 2020, zero net carbon will be expected.

On – site Renewables

Within these requirements, for both residential and non-residential developments, the developer must make at least a 10% reduction in the CO2 emissions predicted to result from the energy demand of the development through the provision of on-site renewable or low carbon energy generation or through connection to a decentralised, renewable or low carbon energy supply if available. This requirement is a bare minimum and regard should be had to regional and national policy should it suggest that a greater percentage reduction should be required.

From the 1st April 2010, this will rise to a 20% reduction in the CO2 emissions predicted to result from the energy demand of the development through the provision of on-site renewable or low carbon energy generation or through connection to a decentralised, renewable or low carbon energy supply if available.

Additional Notes

If the Code for Sustainable Homes or the BREEAM standards are replaced by other assessment systems, the equivalent standards to those outlined above should be met.

Developments which are truly exceptional in terms of overall degree of energy efficiency achieved through design may not have to meet the full requirements in respect of on-site renewables.

2.1 Code for Sustainable Homes

The Code for Sustainable Homes was introduced in December 2006 and is expected to become a mandatory requirement for all new homes from May 1st 2008. It has been developed using the BREEAM EcoHomes methodology and sets sustainability standards in

9 categories: Energy/CO_2, Water, Materials, Surface water run-off, Waste, Pollution, Health and well-being, Management, Ecology. There are six levels of achievement, with points awarded in each category counting towards the total award. There are mandatory requirements for Energy/CO2 emissions and Water at each level. The requirements for each level are shown in the table below.

Achieving a sustainability rating

	Minimum Standards				
	Energy		Water		
Code Level	Standard (Percentage better than Part L[1] 2006)	Points Awarded	Standard (litres per person per day)	Points Awarded	Other Points[4] Required
1(★)	10	1.2	120	1.5	33.3
2(★★)	18	3.5	120	1.5	43.0
3(★★★)	25	5.8	105	4.5	46.7
4(★★★★)	44	9.4	105	4.5	54.1
5(★★★★★)	100[2]	16.4	80	7.5	60.1
6(★★★★★★)	A zero carbon home[3]	17.6	80	7.5	64.9

Notes

1. Building Regulations: Approved Document L (2006) – 'Conservation of Fuel and Power.'
2. Zero emissions in relation to Building Regulations issues (i.e. zero emissions from heating, hot water, ventilation and lighting).
3. A completely zero carbon home (i.e. zero net emissions of carbon dioxide (CO_2) from **all** energy use in the home).
4. All points in this document are rounded to one decimal place.

From 2008, all new homes will be required to have a Code rating. It is expected higher Levels will become mandatory according to the same timetable as outlined in the requirements section at the beginning of this chapter.

A number of organisations are already requiring Level 3 as a minimum standard, including the Housing Corporation and English Partnerships.

Assessments under the Code are carried out in two stages; a Design Assessment in the planning stage and a post-construction assessment on completion. These must be carried out by registered assessors, who are trained and accredited by BRE.

The requirements relating to the Code for Sustainable Homes set out in section 2 above should be viewed as minimum requirements and the achievement of higher code levels is very strongly encouraged.

2.2 BREEAM

BREEAM standards have been in place since 1990 and cover a range of environmental impacts of new developments: Management, Health and well-being, Energy, Transport, Water, Materials & Waste, Land-Use & Ecology, Pollution. There are four award levels; Pass, Good, Very Good, Excellent. Credits are awarded in each category towards the final score. There are no mandatory minimum standards in any category, so developers have the flexibility to address the most appropriate sustainability issues for their site, although achievement of the highest standards requires action in all areas. Compliance with the requirements for reductions in CO2 emissions against the requirements of the 2006 Building Regulations may be demonstrated by achievement of sufficient credits in the energy efficiency category E01.

BREEAM certification is awarded at the design stage, although there is an option to carry out a post-construction assessment on completion. Assessments must be carried out by registered assessors, who are trained and accredited by BRE. As with the Code for Sustainable Homes standards, the Very Good requirement should be viewed as an absolute minimum, and achieving higher standards is strongly encouraged.

3 Process for Applications

It is important to discuss the proposal with the Planning Office as soon as possible, so that the Planning Officer assigned to your application can provide guidance on how to achieve the standards required.

Developers will be expected to submit evidence that the development meets the requirements outlined in Chapter 2 both as part of the planning application and on completion.

3.1 Planning Application Stage

For **residential** developments, developers will need to submit

1. A Code for Sustainable Homes Design Stage Assessment from a registered assessor or Interim Certification from BRE to at least Level 3

2. An Energy Statement

For **non-residential** developments, developers will need to submit;

1. A BREEAM Pre-Assessment Estimator, or a Design Assessment from a registered assessor or BREEAM Certification to at least the “Very Good” standard, showing the required percentage reductions in CO2 emissions against the 2006 Building Regulations demonstrated in Category E01 in the BREEAM assessment.

2. An Energy Statement

Achievement of the required standards and installation of the energy supply technology proposed in the Energy Statement will form a condition of planning consent.

3.1.1 Code for Sustainable Homes Interim Certification

Technical Guidance on meeting the requirements of the CSH is available on the national planning portal website:

www.planningportal.gov.uk/uploads/code_for_sustainable_homes_techguide.pdf

A Pre-assessment Estimator can be used to understand the issues covered by the CSH rating, and to see the level of information required by an assessor. This is available from the BREEAM Helpdesk – 01923 664462 or email bream@bre.org.uk.

To obtain Interim Certification, a registered assessor must first register the site with BRE and complete a Design Stage Assessment, which is submitted to BRE.

We recommend that developers contact a registered CSH assessor at the earliest opportunity to provide guidance on meeting the criteria. A list of registered assessors is available on the BREEAM website – www.breeam.org/assessors/csh.jsp

3.1.2 BREEAM Certification

For non-residential buildings, pre-assessment estimators are available from the BREEAM website www.breeam.org/page.jsp?id=87 for a range of standard building types;

- Industrial units
- Offices
- Retail units
- Schools

These estimators may be used by developers to understand the requirements of the "Very Good" standard, and identify the information required by an assessor. Note that BREEAM warns users of these estimator tools that non-registered assessors are likely to overestimate their building's performance due to a lack of knowledge about the measurement conventions and the simplification of the weighting system used. Rochdale Council will accept a completed Pre-Assessment Estimator showing sufficient points to meet the Very Good standard and the energy efficiency requirement as evidence for the planning application. However, full certification will be a condition of planning approval.

We recommend that developers contact a registered BREEAM assessor at the early stages to provide guidance on meeting the criteria. Lists of registered assessors for each building type are provided on the BREEAM website: www.breeam.org/page.jsp?sid=15.

3.1.3 Energy Statements

The renewable or low carbon energy requirement is calculated in terms of the CO2 emissions saved through installation of the technology. The baseline against which the 10% or 20% requirement will be calculated should be the sum of the demands for heat, light and power after each has been translated into CO2 emissions.

Conversion from kWh to CO2 may be made using the following factors.

Fuel Type	**Kg CO2 / kWh**
Electricity	0.43
Gas	0.19
Oil	0.265
Coal	0.30
LPG	0.23

The Energy Statement should provide details of;

A. The expected annual energy demand in kWh of each building type within the development including energy used for heating, lighting and electrical equipment.

B. The expected annual energy demand in kWh of the development as a whole, including energy used for heating, lighting and electrical equipment.

C. The CO2 emissions related to the annual energy demand of the development as a whole.

D. A calculation of the reduction in CO2 emissions required through the use of on-site renewable or low carbon energy technologies i.e. 10% of (C) until 1st April 2010, thereafter 20% of (C).

E. An assessment of the feasibility of installing a variety of renewable or low carbon energy technologies, including but not limited to solar thermal, solar PV, wind, hydro, biomass, ground- water- or air-source heat pumps, community heating and CHP. This should include the expected energy outputs and CO_2 reduction potential of each technology assessed, together with limitations to feasibility due to the conditions of the site or surrounding area.

F. A proposal for the renewable and low energy technology to be installed, or combinations thereof.

G. A summary of the energy supplied by the renewable and low carbon technology(ies) in KWh, the CO_2 savings achieved by this installation and a comparison of this against the reduction requirement calculated in (D) above.

H. The Energy Statement may also include details of the overall energy efficiency of the development. Developments which are truly exceptional in terms of overall degree of energy efficiency achieved through design may not have to meet the full requirements in respect of on-site renewables.

Guidance on renewable and low carbon energy technologies is provided in Section 6 of this document. This section also includes websites of the relevant trade associations which can provide details of installers. While the Energy Statement is likely to provide some information on costs of the different types of technology, detailed quotes should be obtained as soon as possible from qualified installers. Further information for developers is available on the Energy Saving Trust website www.energysavingtrust.org.uk

Information provided in the Energy Statement may be checked against a spreadsheet of expected CO_2 savings values for the main energy technology options and confirmation may be requested for figures quotes outside of these ranges. Developers may obtain a copy of the spreadsheet from their Development Control Officer.

3.2 On Completion of the Development

For **residential** developments, developers will need to submit evidence that the relevant CSH level has been achieved and that the required renewable or low carbon energy technologies have been installed. These can be provided by;

- A Post-Construction Stage Assessment for the CSH; and
- Documentary evidence from the installer of the energy supply technology containing details of the installed capacity of the system or renewable energy component of the system.

For **non-residential** developments, developers will need to submit evidence that the BREEAM Very Good Standard has been achieved including the required energy efficiency standard and that the proposed renewable and low carbon energy technologies have been installed. These can be provided by;

- The BREEAM Certification
- Documentary evidence from the installer of the energy supply technology containing details of the installed capacity of the system or renewable energy component of the system.

On certain developments, Rochdale Council may require a BREEAM Post-Construction Review to ensure that all the issues specified have been implemented. The Council may use the Simplified Building Energy Model as a means of assessing compliance with the requirements.

4 Guidance on Achieving Energy Efficiency in Buildings

Incorporating energy conservation features in a building at the design stage will ensure that the building requires the minimum amount of energy to function over its lifetime. As well as reducing the impact of that building on the environment, these measures will make it cheaper to run. Sustainably designed buildings are frequently more pleasant places to live and work, due to the careful design that has gone into the details of managing internal light, heat and ventilation as well as the micro-climate of surrounding spaces.

Low-energy buildings combine aspects of;

- Orientation and siting of the building to optimise the use of sunlight, solar gain and shading, natural ventilation and cooling to minimise heating, cooling and lighting demands (Passive Solar Design);
- Improving the efficiency of the building envelope through insulation and air-tightness;
- Use of controls, smart metering and building management systems;
- Improving the efficiency of energy supply, including boiler systems, electric heating, and CHP;
- Installing efficient equipment, including lighting and appliances.

Further energy conservation can be achieved through the careful choice of construction materials to minimise the embedded energy of the building, and these issues are considered as components of both the Code for Sustainable Homes and BREEAM certification.

4.1 Passive Solar Design

Passive solar design maximises the potential use of natural sunlight for light and heat and air-flows for ventilation, as well as incorporating measures to avoid over-heating and glare. To make best use of these natural resources, the developer should take into account the location, orientation and internal layout of the building.

Passive solar design uses the design and thermal mass of the building elements to help maintain comfortable living and working conditions. It is only one element of a low-carbon building, and can conflict with other considerations, for example, a high thermal mass building will generate long-term energy savings but the building materials will have a high embedded energy content.

4.1.1 Solar Gain

The orientation of a building can make a significant contribution to heating the building in winter. The principles of solar gain state that the building should be aligned such that the main living areas face between south-east and south-west and have relatively large areas of glazing. Less used rooms should face the north side of the building and be well-insulated with smaller windows. For housing, this is usually interpreted as having the living room facing south, with the bathroom, toilet, utility room, garage etc to the north. In practice, the kitchen is the main room of many family homes and this aspect should be taken into account in the design. Open-plan or flexible space can maximise the benefits of solar gain.

Maximising solar gain may require changes to the layout of the site. Ideally the roads should run roughly east-west, but where this is not possible or desirable, alterations to the position of the buildings relative to the road can overcome this. Overshadowing from other buildings can be avoided by placing the tallest towards the north side of the site, as long as this does not affect neighbouring properties.

For buildings which are mainly occupied during the day, overheating and problems with glare can be caused by large areas of south-facing glass. Solar shading and natural ventilation systems can be incorporated to counter this. Some of the recent low-carbon office buildings have been designed with windows on the east and west faces and high thermal mass heat-absorbing south walls to address these issues.

Isolated solar gain is the practice of using an intermediate space such as a sun-space or conservatory which is thermally isolated from the rest of the building. Heat is captured in the sun-space and then transferred to the rest of the building through vents or doors. Although this can be a very effective means of using solar heat, and such spaces are valued by most inhabitants, the energy saving can be completely negated if the space is used as an integral part of the building and is heated in winter with fossil fuels.

4.1.2 Solar Shading

Designing to maximise solar gain risks over-heating the building in summer and problems with glare, particularly in commercial buildings. There are a number of simple systems which can be installed to overcome this, and are designed to let in sunlight from the lower autumn to spring sun, but will shade the higher summer sun. These include overhanging roofs, brise-soleils, louvers and shutters as well as internal blinds.

Deciduous trees planted to the south of the building can also provide shading in summer but allow light through in winter, but are only useful for low-rise or the lower floors of buildings. These have the added benefit of providing shaded outdoor spaces which are particularly valuable in urban areas.

4.1.3 Natural Daylighting

Designing a building to allow the penetration of natural daylight throughout will significantly lower the consumption of electricity. There is also evidence that natural rather than artificial light has productivity and health benefits in schools and offices.

The most simple means of allowing light to enter is through a window. Some of the limitations to light penetration can be overcome by the use of reflective internal surfaces, but for deeper buildings, daylight can be provided by skylights, clerestory windows, light shelves and sunpipes.

4.1.4 Natural Ventilation

Natural ventilation is the means of supplying and controlling air flow through a building using natural forces. The use of natural ventilation has been shown to have health benefits over air-conditioned buildings. Natural ventilation can be provided simply by including windows that open, although this can have some disadvantages such as draughts, loss of heat and exposure to external noise or pollution. It can also be of little benefit on a hot, still day.

Passive stack systems use the difference in static pressure between warm internal air and cooler external air to create an air flow through the building without the use of mechanical systems. Stack systems have the advantage of not relying on wind, and heat exchangers can be used to warm the incoming air from the exhaust air, thus reducing heat loss. Wind can increase the stack effect, but can also reduce it, depending on its direction and the design of the air inlet, so the prevailing wind direction needs to be taken into account in the design.

4.2 Thermal Efficiency

High levels of insulation and air-tightness are critical to achieving low heat losses from buildings. Historically, the minimum thermal performance of building elements was specified in the building regulations, but since 2006 an overall requirement for carbon emissions has allowed flexibility in the design to either increase insulation or make improvements in the efficiency of energy supply services.

The “Passivhaus” concept, used extensively in Germany and Austria, incorporates very high levels of insulation alongside high thermal mass components and control of solar gain, to eliminate the need for a centralised heating system. Housing designed to this standard can use 60% – 90% less energy than that required to meet the 2006 Building Regulations. Similar levels of insulation are expected to be required to meet the higher levels of the Code for Sustainable Homes.

Air-tightness (reducing heat loss through leaks) is a critical component in low-energy buildings, and minimum leakage rates are specified in the 2006 Building Regulations for both housing and non-residential buildings over 500m2. Air leakage can be designed out through a good understanding of air leakage paths, but one of the most critical factors in determining air-tightness is the standard of construction. Air leakage rates of 10m3/h/m2 are the minimum specified for commercial and industrial buildings, but best practice rates of around 2-3 m3/h/m2 can be achieved for most buildings. Extremely air-tight buildings can reduce energy losses further but additional mechanical ventilation will be required.

4.3 Controls

Controls allow building users to manage internal comfort conditions either manually or automatically and well-designed control systems provide significant energy savings. Integrated control systems are mainly found in non-residential buildings, with Building Management Systems used to optimise facilities such as heating, air-conditioning and lighting through a central monitoring and control system. ‘Intelligent Buildings’ which can link, monitor and optimise a whole range of functions and conditions including climate, energy use security and IT systems are now being introduced.

Lighting is a large proportion of energy use in buildings such as offices and is often left on continuously whether needed or not. Smart design of lighting controls, including daylight and occupancy sensors, zoning and individual switches can substantially reduce electricity consumption for lighting.

Although only recently being developed, the concept of intelligent homes with increased levels of monitoring and automatic control, linked to IT, are likely to be a key component of low-carbon homes.

4.4 Metering

Metering is an essential component of effective control of energy use and costs. Metering of individual functions or areas within a building allows variations in consumption to be identified and can highlight wastage. The BREEAM standard for non-residential buildings includes such sub-metering as a criterion, and overall building metering is an essential component to meet the requirements of the Energy Performance in Buildings Directive, as this will need to be displayed in all publicly-accessible buildings.

For housing, whilst individual utility metering is the norm, new smart meters are available which can be placed in a prominent position in the house to display information on energy use patterns, emissions and costs, and encourage householders to reduce their energy consumption.

4.5 Heating Systems

With higher levels of insulation, the heat supply system needs to be carefully tailored to the demand, as over-sizing of boilers will lead to inefficient operation, as well as unnecessary capital costs. Some highly-insulated buildings are designed to stay warm with such minimal heat input that a central heating system is not necessary and individual room heaters may be the most appropriate solution. In the BedZed development, for example, the only heat provided is for the hot water supply, with the tank providing low-level background heat to the rooms.

For larger developments, community heating should be considered. This reduces the need for individual boilers and allows the use of low-carbon supply options such as biomass and combined heat and power (CHP).

4.6 Lighting and Appliances

Lighting and appliances are responsible for around a quarter of the CO2 emissions from housing. Whilst the 2006 Building Regulations require a minimum of one in four fixed light fittings in dwellings to be low-energy fittings (which only take low-energy bulbs), in the CSH the thresholds for efficient lighting are 40% and 75%, which is feasible for all homes.

Low-energy light-bulbs provide comparable levels of light to a standard bulb whilst using only 20-25% of the energy. They are now produced in a wide range of styles, fittings, and colour tones, and dimmable ones are also available. The bulbs will also last around ten times as long as tungsten bulbs, reducing long-term costs and waste.

Most energy-consuming appliances now carry an energy label, which rates performance on a scale of A+ (best) to G (worst). The Energy Savings Trust also endorses the most efficient appliances with the Energy Saving Recommended Label which includes only A+ fridges and freezers and AAA washing machines for example.

Fitted appliances and lighting should meet the Energy Saving Recommended standard. For information on products in this category see the EST website: www.energysavingtrust.org.uk/energy_saving_products/about_energy_saving_recommended_products

Where appliances are not installed, developers should provide information on the benefits of energy saving equipment, the labelling scheme and sources of efficient products. This should apply to both housing and non-residential developments.

5 Guidance on Renewable and Low Carbon Energy Supply

A range of renewable and low-carbon energy supply technologies are available which can contribute towards achieving the carbon requirement of this policy, either individually or in combination. This section provides information on appropriate technologies for use on developments in Rochdale to which the policy applies. The technologies covered in this section represent those that are considered viable in 2007 and likely to become viable in the near future. It does not include guidance on large-scale renewable energy installations.

Renewable energy technologies are those which, once installed, generate no further carbon emissions related to their operation. These include;

- Solar heating systems
- Solar photovoltaic systems (PV)
- Wind turbines
- Hydro power

Low carbon technologies are those that achieve significant reductions in CO_2 emissions compared to conventional fossil-fuel supply, but require energy either for their operation or for upstream production of the energy source;

- Biomass
- Ground or air source heating and cooling
- Combined heat and power systems

This list is not exhaustive. Developers should contact the planning office for clarification on other technologies which may become appropriate to meet the requirements of the policy.

Typical ranges of outputs from some of these energy technologies, along with the related CO_2 savings, are given in the Energy Statement Checker spreadsheet which may be used by Development Control to assess the suitability of the technologies proposed. Developers may wish to obtain a copy of this spreadsheet from the Planning Office.

Ownership of the technology, as well as connection and distribution issues will need to be considered by the developer for larger schemes supplying energy to more than one user. Guidance on these issues is provided in section 6.8

5.1 Solar Heating

Active solar heating systems are used for heating water, and can provide 40% - 60% of a household's annual hot water needs. On sunny days the system will provide all the hot water required, and on cooler, cloudy days will provide a pre-heat to the water. The system consists of a solar collector, usually mounted on the roof, in which a fluid is heated and a hot water tank to store the heat.

The two main types of solar collector are flat plate and evacuated tube systems. Flat plate collectors have been the most commonly installed in the UK, but the evacuated tube systems, whilst somewhat more expensive, achieve higher levels of efficiency. The hot water tank will usually need a twin coil for heat exchange, although some systems incorporate a second hot water tank, and others heat the water directly in the solar panel, removing the need for either. The hot water tank may need to be slightly larger than normal. Solar heating systems need a back-up heating system, which can be a standard gas boiler, or electric immersion heater.

Solar panels operate most efficiently when positioned at an angle of 35°, facing due south, although they will function properly when facing between south-east and south-west at an angle of between 10° and 60°. It is important that there is no over-shadowing from trees or adjacent buildings during the main sunlight hours.

Solar panels are suitable for any building which has sufficient hot water demand to make use of the majority of the heat generated, within a reasonable distance from the collector. Some systems require a pump, and the electricity consumption of this must be taken into account in the calculation of CO2 emissions saved.

5.1.1 Domestic Applications

Solar panels are appropriate for most houses which have a south facing roof and space for a hot water tank. They are usually installed on individual dwellings. For flats, solar panels may be used either to supply a few individual flats (e.g. the top floor) or to contribute towards a centralised heating system.

Domestic solar collectors are between 2 – 5m², sized to meet the demand of the building.

Typical energy savings are difficult to calculate as they depend on the positioning of the system and the amount of hot water that is actually used. On average, hot water accounts for about a quarter of a household's total energy consumption (in kWh) or just under 20% of CO2 emissions. Systems are usually sized to provide around a half of the hot water demand.

A typical solar hot water system will save between 400 – 750 kg CO2 per year, depending on the system size and fuel replaced.

5.1.2 Commercial Applications

Although solar panels can be fitted to any commercial building which has a suitable roof, there should be sufficient demand for the hot water produced. Care homes, sheltered housing, hospitals, hotels, leisure and sports facilities etc will all have sufficiently large hot water demands, but industrial units, warehousing, retails units and most offices are unlikely to be suitable for this technology.

Any number of panels can be combined to form a system of sufficient size to meet the required output.

5.1.3 Installation and Maintenance Issues

Solar panels are usually installed on a roof, so it is sensible to install the panel as the roof works finish. Installation is relatively straightforward and can be completed in half a day for domestic systems. Connection requires plumbing skills and some panels which use a mains-connected electric pump will require a qualified electrician.

Solar panels are expected to last 20-25 years and require little maintenance, with an inspection recommended every 1-5 years depending on the system size and location.

5.1.4 Compatibility

Because of the need for a water tank, solar panels are not generally installed in conjunction with a combi-boiler, although some boiler manufacturers now supply combination systems designed to take pre-heated water from a solar panel.

They are also not appropriate in combination with heating systems which rely on a regular heating baseload, such as combined heat and power.

A solar panel combined with a wood-burning stove or biomass boiler is a good solution for a very low-carbon house.

5.1.5 Planning Issues

Solar panels usually lie against the roof and are only as visually intrusive as a large roof light. In most areas, solar panels are considered permitted development, except in conservation areas and on listed buildings.

5.1.6 Examples in Rochdale and Surrounding Areas

Solar panels have been installed at Khubsurat House, Deeplish; Cherwell Court, Heywood; and Hollingworth Lake Visitor Centre.

5.1.7 More Information

More information on solar panels and installers of this technology is available from;

- Energy Saving Trust – www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/solar_water_heating
- Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk
- Solar Trade Association - www.greenenergy.org.uk/sta

5.2 Solar Photovoltaic Systems (PV)

Solar PV converts energy in sunlight into electricity. A PV panel or module is made up of a number of cells. These consist of layers of thin semi-conductor material (usually silicon) which generate electric current when exposed to sunlight. Direct sunlight is not necessary, so the panels can still generate on a cloudy day, but the greater the intensity of the light, the higher the output.

Modules come in different sizes and can be linked together to form large systems. PV tiles are also available which replace roof tiles, and PV cells can be integrated into glazing units, although both of these options are currently more expensive than standards panels.

For greatest efficiency, a PV panel should be mounted at an angle of 30° - 40° oriented due south, although good outputs can be achieved at angles from 15° to vertical and with orientations from south-east to south-west. Shallower tilts are recommended for systems facing east or west. Overshadowing from trees or neighbouring buildings should be avoided, as any shadows can considerably reduce the output from the system.

Systems are sized in terms of the peak output of the panel (kWp). The output of a system depends on the efficiency of the module and the area of panel installed. A typical output in the UK on an un-shaded south-facing roof would be 750kWh/kWp (or roughly 75kWh/m2) Depending on the material used, 8-10m2 are required per kWp output.

Grid-connected PV systems do not store the electricity generated, and any not used locally will be exported to the grid. Electricity requirements greater than the PV supply are drawn as usual from the grid. Because of the difference between the value of electricity generated and used within the building, and the lower price gained for sales back to the grid, the economic viability of a PV system is greatest for buildings which mainly use electricity during the daytime.

5.2.1 Domestic Applications

PV panels are appropriate for most houses which have a south-facing roof. The can also be installed on blocks of flats and other communal housing. Although on the roof is the most common location, PV panels can be mounted on any sufficiently strong structure such as a conservatory, wall, or stand-alone structure in the garden or car park. Domestic systems are usually sized at between 1.5-3kWp, requiring a panel area of 16-30 m^2 and generating 1,100 – 2,250 kWh/year.

On a new or replacement roof, it may be worth investigating PV roof tiles for their aesthetic qualities, rather than panels, as the additional cost may be off-set by savings in standard tiles.

A typical domestic PV system will save between 480 – 970 kg CO_2 per year, depending on the system size.

5.2.2 Commercial Applications

Commercial systems account for the majority of the PV market in the UK and there are a range of technologies available to suit different styles of building. As well as the usual flat panels mounted on the building roof, PV can be integrated into the building façade or within glazed units to provide electricity generation and solar shading.

Very large systems may see some economies of scale, but for most applications the cost per kWp for a specific type of panel varies little with size.

5.2.3 Installation and Maintenance Issues

PV panels can lose efficiency if they become over-heated so an air-gap is usually left between the panel and roof tiles. A minimum tilt of 15° is recommended to allow for rainwater run-off. Panels are relatively heavy and although normal roof constructions are sufficient to take this, the weight should be taken into account when alternative support structures are used.

PV systems generate direct current so an inverter is necessary to convert to AC. The system will also require meter(s) to monitor the quantity generated and the quantity exported to the national grid. Many suppliers offer a visible display panel which shows the building occupants the contribution made by the panels.

PV systems require little maintenance, and suppliers will normally offer a warranty on the panel of up to 25 years.

5.2.4 Compatibility

PV panels generate electricity which may be supplied direct to the development and/or to the national grid. There are no compatibility issues with either other renewable sources or standard energy supplies.

5.2.5 Planning Issues

PV panels usually lie against the roof and are only as visually intrusive as a large roof light. In most areas, PV panels are considered permitted development, except in conservation areas and on listed buildings.

5.2.6 Examples in Rochdale and Surrounding Areas

Rochdale Borough Housing has installed PV panels on College Bank Flats and St Edwards Primary School, Castleton.

The largest building mounted system in the UK is the CIS Tower in Manchester which has been clad in almost 4000m2 of PV panels and generates 180MWh/year.

5.2.7 More Information

More information on PV and installers of this technology is available from;

- Energy Saving Trust – www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/solar_electricity
- Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk
- British Photovoltaic Association - www.greenenergy.org.uk/pvuk2

5.3 Wind Turbines

Small-scale wind turbines were initially developed to serve off-grid applications, such as farms and rural communities for which the cost of grid connection is prohibitive, as well as for remote signage, lighting and portable power. Increasing environmental awareness and initiatives to tackle climate change have led to an increase in grid-connected applications. There are two types of wind turbine;

- **Building-mounted turbines** – 0.5-1.5KW turbines specifically designed for mounting on housing, but also appropriate for some other buildings
- **Stand-alone turbines** – for use on rural properties, farms, schools, commercial and industrial estates and housing estates. These are predominantly mast-mounted and can range in output from only 500W to over 1MW

Wind turbines generate direct current, which may be stored in batteries or converted to alternating current through an inverter and connected to the national grid.

Key factors in any wind turbine installation are the wind speed and turbulence. Output is related to the cube of the wind speed, so although the cut-in speed for some turbines is relatively low at 3-4m/s, an installation is unlikely to be viable at speeds of less than 5 m/s. Wind speed depends on location and height above the ground. The DTI website provides the average wind-speeds for locations around the UK, although these are not sufficiently accurate for use in urban areas – see www.dti.gov.uk/energy/sources/renewables/renewables-explained/wind-energy/windspeed-database/page27708.html. Trees and other buildings in the path of the prevailing wind will cause turbulence which both reduces the output of the turbine and can shorten the working life of the turbine.

5.3.1 Building-mounted turbines

Small building-mounted turbines have recently become available and range in output from 500W to 1.5kW. These are usually attached to a pole mounted on the wall of the building and have a rotor diameter of up to 2m. Depending on the turbine size and location, domestic turbines can generate between 500 – 3,000 kWh per year.

Building-mounted turbines can be installed individually on houses or commercial buildings as well as in multiples, such as a row along the roofline of a supermarket, petrol station or warehouse.

The suitability of a particular building depends on its location, so the supplier will normally make an initial assessment of the site based on the average wind speed at that location and any obstructions in the path of the wind before a more detailed assessment can be prepared.

5.3.2 Stand-alone turbines

Stand-alone turbines can supply electricity to a single user or a group of tenants on a site. They are generally larger than building-mounted turbines, with the size determined by the electricity needed, the physical constraints of the site and the budget. Costs vary with size, but in general, the larger the turbine, the more cost-effective the installation.

Many smaller turbines are being installed at schools, small industrial/commercial sites and on farms. These usually have an output in the range 5 – 20kW, generating between 5,000 – 40,000 kWh per year depending on the wind speed. These turbines are installed on either a mast or a lattice tower, standing between 9m and 25m to the rotor hub. The rotor diameter for the smaller turbines will be around 5-6m, but can be up to 11m for the larger models.

Individual large wind turbines of the scale used in wind farms (>1MW) are starting to be installed on industrial developments, such as Ford's Dagenham plant and Pirelli in Carlisle. These are major investments installed to supply a large proportion of a site's electricity demand. These turbines stand on masts over 100m and costing many millions of pounds.

5.3.3 Installation and Maintenance Issues

Building-mounted turbines must be attached to a structurally-sound building wall, which should present no problems for a new development. Space needs to be provided within the building for the inverter and metering.

Stand-alone turbines require the construction of a concrete base to support the tower or mast, which should be sited with enough space to allow the turbine to be erected and dropped for maintenance – usually at least the mast height to both sides of the base. Annual maintenance is recommended.

Installation should be carried out by the manufacturer or registered installer, and the electrical connections must be carried out by a qualified electrician.

5.3.4 Compatibility

Electricity from wind turbines should be compatible with most other energy supply systems.

5.3.5 Planning Issues

Wind turbines have the greatest visual impact of any renewable energy technology and the size of the turbine needs to be considered alongside the overall design, scale and location of the development. For stand-alone turbines, there may be occasions when an Environmental Impact Assessment is required.

Noise is often considered an issue with wind turbines, although recent models, particularly the smaller turbines are relatively quiet. For building-mounted turbines, the noise can be described as a gentle whooshing sound, only slightly above the sound of the wind, and more noticeable at start-up than in operation. However, noise levels vary between models and at different wind speeds. The potential noise impact of larger turbines should be considered against the general background noise level and the potential to disturb neighbours. For example, the noise of a wind turbine is unlikely to be noticeable against that of a busy road, and unlikely to cause a disturbance in a non-residential area. In residential areas, the noise level should be compared against average night-time background levels.

Although there are no definitive requirements on the minimum distance a turbine should be from buildings, many installers of stand-alone turbines work on the basis of at least the "topple distance" from buildings, and for large-scale turbines at least 350m from housing with a preferred distance of 400-500m.

5.3.6 Examples in Rochdale and Surrounding Areas

Building-mounted turbines have been installed on new properties on Selwyn St in Oldham.

5.3.7 More Information

More information on wind turbines and installers of this technology is available from;

- Energy Saving Trust – www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/microwind
- Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk
- British Wind Energy Association - www.bwea.com/small

5.4 Hydro Power

Hydro power is one of the major contributors of large-scale renewable energy in the UK. It is also possible to use small-scale (<100kW) hydro systems to generate power from relatively small streams or rivers. Hydro-electric systems use the energy in a head of water to turn a turbine and generate electricity and the power output is directly related to both the head (height of drop) and the flow rate of the water. Small-scale hydro-generation can provide a relatively steady supply of electricity throughout the year.

Sites suitable for micro-hydro can vary from a small hillside stream to a wide river. There are also many old watermill sites around the UK which are suitable for refurbishment as small-scale hydro schemes. A micro-hydro system consists of a turbine and generator set and channel or pipeline system to direct the water to and from the turbine. The system may require major civil engineering work and the costs of this will be site-specific.

A low-cost very small micro-hydro system (1-2kW) is currently under development within the region, which may provide a suitable system for individual households or buildings with access to small or low-head streams.

As with any renewable electricity scheme, the system may be either stand-alone with battery storage or grid-connected.

5.4.1 Installation and Maintenance Issues

Hydro installations can last over 100 years. The equipment is proven and highly reliable, but will need annual maintenance and some parts will need replacing after 10 years.

One of the key differences between this type of renewable energy and building-mounted systems is that of ownership. While smaller systems linked to single properties should become the responsibility of that property, for schemes linked to a larger development, a separate organisation may need to be responsible for the management of the system and distribution and billing of the electricity generated.

5.4.2 Planning Issues

Issues to be considered will include the visual impact of the turbine house and water diversion system, as well as potential noise intrusion on neighbours. The scheme may also need;

- An environmental impact assessment covering the impact on water quality, fisheries, river ecology, flood defence, nature conservation and public recreation;
- An abstraction license if water is being diverted away from the main line of flow of the river;
- An impoundment licence, if changes are being made to structures which impound water, such as weirs and sluices, or if new structures are to be built;
- Land Drainage Consent, for any works being carried out within 8 metres of a main channel.

5.4.3 More Information

More information on micro-hydro and installers of this technology is available from;

- Energy Saving Trust - http://www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/hydroelectricity
- Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk
- British Hydro-power Association http://www.british-hydro.co.uk

A NW research project is underway at Lancaster University to identify the region's potential hydro sites and investigate development barriers - see http://www.joulecentre.org/research/grants_north_west_hydro.htm.

An example of hydro power nearby which can be viewed in action is Gibson Mill at Hardcastle Crags near Hebden Bridge.

5.5 Biomass Heating

Biomass is the term used for fuel made from plant material. Biomass is considered almost carbon-neutral, as the carbon emitted during burning has been captured relatively recently by the plant, although some energy is used in its production and transport. For building heating systems, biomass usually means wood, either as logs, chips, pellets or compressed waste wood logs. These can be sourced from forestry residues, short-rotation coppice such as willow, energy crops such as miscanthus as well as from waste wood from the timber industries and municipal parks, urban trees and gardens. Energy crops are being grown around Greater Manchester and Rochdale Council is working with Red Rose Forest and Pennine Edge Forest on developing a sustainable supply of biomass for the borough.

Although biomass is widely used in Northern Europe and America, it has not been developed as a major heating fuel in the UK. However, as well as the considerable reductions in CO2 emissions through greater use of wood as a fuel, there are likely to be additional benefits in terms of local jobs in the forestry and fuel supply businesses and longer-term security in the supply of heat energy.

5.5.1 Domestic Applications

For housing, the wood-burning stove is becoming a more common feature, although this is usually a supplementary heating device and may be installed more for aesthetic reasons than carbon-saving.

There is a wide range of wood-pellet boilers available for domestic applications. These include automatic pellet-feed and controls similar to a standard gas or oil boiler, but do require manual cleaning.

Wood-burning stoves with back-boilers can supply all of a home's heating needs. There are also a few wood-burning cookers on the market which can either provide just cooking facilities, or with an integral boiler will provide cooking, heating and hot water. Most of these take wood in the form of logs.

One of the key issues to consider with wood-fuel heating is the ease of use. Systems which rely on manual loading and emptying may be unacceptable to many householders.

5.5.2 Commercial Applications

There is a wide range of biomass boilers suitable for commercial and industrial applications of up to 2MW output, fuelled by wood chips or pellets as well as gasifying log burners. Some of these are CHP units for generation of both heat and electricity.

5.5.3 Installation and Maintenance Issues

All wood-burning appliances require an adequate flue and ventilation, and regular maintenance checks. There are also usually minimum requirements on the distance of the appliance from combustible materials including floor-coverings.

For all wood-burning appliances, there are a number of issues which should be considered at the design stage;

- Local availability of fuel (either logs, chips or pellets)
- Space for storage of the fuel (chips and pellets must be kept dry and logs may need seasoning)
- Access for delivery of the fuel
- Facilities for disposal of ash
- Ease of use and controllability.

5.5.4 Compatibility

Biomass boilers are usually installed as the main heat source, although there should be no compatibility issues if installed in parallel with conventionally-fuelled boilers in larger applications. For domestic applications, wood-fuelled heating works well in combination with a solar hot water supply for the summer months.

5.5.5 Planning Issues

Most of the Borough is covered by smokeless zones. Approved biomass installations should be acceptable in these areas. However, because of possible nitrogen dioxide emissions, they may be inappropriate in the Amended Air Quality Management Area 2005 (around roads).

Lists of approved biomass appliances and fuels which have been exempted under the Clean Air Act 1993 are given on www.uksmokecontrolareas.co.uk. Further advice may be obtained from the Manchester Area Pollution Advisory Council www.mapac.org.uk.

5.5.6 Examples in Rochdale and Surrounding Areas

A biomass boiler has been installed at Bowlee Plant Nursery.

5.5.7 More Information

More information on biomass heating and installers of this technology is available from;

- Energy Saving Trust - www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/biomass
- Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk
- The National Energy Foundation –Logpile - www.nef.org.uk/logpile

5.6 Heat Pumps

Heat pumps transform low-grade heat from an external source (the earth, water or air) into higher grade heat through a compressor.

The most common form of heat pump is a ground-source heat pump (GSHP). This system comprises a heat collector, a heat pump and a distribution system. The heat collector is generally looped flexible pipework buried in trenches approximately 1-2m underground, through which a mix of water and anti-freeze is pumped. For sites with limited external space it is possible to lay the pipe loops vertically in a borehole. The heat pump is effectively a refrigeration cycle in reverse and contains an evaporator to absorb the heat from the ground, a compressor to compress the refrigerant to the required temperature and a condenser, which exchanges the heat with the distribution system. The distribution system can be a traditional wet heating system, but greater efficiencies are achieved through installing larger radiators or underfloor heating, which are more appropriate for lower grade heat. The heat pump can also be used to heat a hot water tank.

Ground source heat pumps provide renewable heat to the whole building, so are an effective means of reducing carbon emissions from heating. However, electricity is needed to run the heat pump, so although the heat is from a renewable source, this electricity demand means that the system can only be classed as renewable if the electricity also comes from a renewable source. A heat pump generally produces 3-4 times as much heat as the electricity used, with the actual efficiency dependent on the Coefficient of Performance (CoP). Current heat pumps can achieve CoPs of 3-4, although systems achieving a CoP of 6-7 are under development. With a high CoP, CO_2 savings of up to 75% can be achieved if the heat pump replaces a high-carbon fuel such as electricity, and up to 40% if the fuel replaced is gas.

Ground source heat pumps can also be used as a cooling system in summer when the ground temperature is much lower than the ambient air. This makes them an appropriate and efficient solution for developments with an expected cooling demand as they achieve significantly higher efficiencies than standard air-conditioning systems.

Air source heat pumps work on the same principal, but take in heat from the outside air and do not require a collection system. An air source heat pump looks rather like an air conditioning unit and can be placed on the outside of the building or in the roof space, and can be combined with heat recovery ventilation systems. Air source heat pumps become less efficient as the external air temperature falls but can operate down to –15ºC.

5.6.1 Domestic Applications

Until recently there were relatively few domestic GSHP installations in the UK, although they are common in Europe, and were confined to homes without mains gas, due to the relatively high capital cost. Domestic systems range in size from 3.5-25kW, with the smaller versions suitable for well-insulated small homes. The heat pump is similar in size and appearance to a large gas boiler. The ground loop size depends on the output, with an average 3-bedroom house requiring 40-50m of trench, with the smallest loop systems being accommodated in a trench of around 10m by 2m deep. This can be hidden underneath the garden or driveway of the property.

5.6.2 Commercial Applications

The vast majority of heat pumps systems sold are for non-domestic applications, particularly where there is a demand for cooling or dehumidification as well as heating. They are suitable for most heating applications including offices, schools, leisure centres, retail and industrial units. The main constraint is adequate space for the ground loops, for example under a car park, or ground suitable for a borehole, although it is possible to lay the ground loops under the footprint of the building.

5.6.3 Installation and Maintenance Issues

Heat pump systems are designed to last around 25 years, with a properly installed ground loop expected to last up to 100 years. They require little maintenance and unlike gas boilers, do not need an annual safety inspection. This makes them particularly valuable in social housing and homes for elderly people, where safety and accessibility for inspections may be an issue.

5.6.4 Compatibility

Heat pump systems are specified to provide all the heating requirements of the building, in the same way as a gas boiler. For a zero-carbon solution, it would be desirable to supply the electricity used from a renewable source such as a PV panel or wind turbine.

5.6.5 Planning Issues

There are unlikely to be planning issues related to ground source heat pumps, but developers should check with the planning office for specific sites.

5.6.6 More Information

More information on ground and air source heat pumps and installers of these technologies is available from

- Energy Saving Trust - www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/ground_source_heat_pumps
- Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk
- Ground Source Heat Pump Association www.nef.org.uk/gshp

UK Heat Pump Network www.heatpumpnet.org.uk

5.7 Combined Heat and Power

Combined heat and power (CHP, or sometimes called co-generation) is the generation of heat and electricity in the same process. The heat is produced as a by-product of the electricity generation process and can be used to provide space and water heating. Initially developed for large-scale applications in industries with a high steam demand, CHP units are now available which provide heat for buildings.

CHP is a low-carbon rather than renewable energy technology, as the overall efficiency of the combined heat and electricity produced can be as high as 85%, whereas the efficiency of centrally generated electricity is around 36%. At the point of use, energy consumption measured in kWh (usually gas) will increase, but the emissions related to that energy use will be lower than for a comparable gas boiler and grid electricity.

CHP units usually run on gas but biomass units are available which provide a very low carbon heat and electricity supply.

5.7.1 Larger-scale Individual CHP Applications

CHP is an appropriate technology for systems with a roughly constant heat demand, and units should be sized to this demand rather than the electrical output. If demand fluctuates significantly over the day or seasonally, then either a group of modular CHP units will be needed or an alternative heat source such as a boiler may be used to meet these fluctuations.

CHP is suitable for a range of building types, where there is a need for heat and power for over 4000 hours per year (roughly half the year). It is particularly appropriate for healthcare establishments, hotels, large educational establishments, leisure centres and swimming pools which have is a constant demand for heat.

CHP systems can also be fitted with a chiller to provide cooling as well as heat – such systems are known as “tri-generation” and are more common in hotter climates.

5.7.2 Community CHP Applications

CHP is also an extremely viable option in community heating schemes serving groups of homes or a mixed development of homes, schools, offices, shops and light industry. For these, the CHP unit is installed centrally and heat distributed to users via a distribution network. The user has a heat exchange unit installed in their property rather than an individual boiler, and a heat meter to measure consumption. Within the home or building, the heat is thermostatically controlled as normal. For tenanted properties, this type of system has the additional benefit of not needing an annual boiler inspection to be carried out in the individual homes or buildings. CHP can provide a very cost-effective system for blocks of flats, and where fuel poverty is an issue, can provide ongoing low cost energy.

The energy supply system is usually owned and managed by a separate company (an Energy Services Company or ESCo) who are responsible for all plant operation and maintenance, billing of heat and sales of electricity. Electricity is usually sold direct to the properties involved with any over- or under-supply of power generated being exported or imported from the grid. The price to tenants takes into account both the self-generation and net purchases from the grid and is usually less expensive than the standard tariffs.

5.7.3 Micro-CHP

Individual micro-CHP units for homes have been under development for the last few years, but it looks unlikely that any units will come to market until 2009.

There are a few larger units available which are aimed at providing heat and power to larger individual or multiple homes.

5.7.4 Installation and Maintenance Issues

CHP systems comes as package units replacing a conventional boiler, and must be fitted by qualified professionals. Regular maintenance is required.

5.7.5 Compatibility

As CHP units are designed to supply a baseload of heat, and maximise efficiency on that basis, combining CHP with renewable heat sources such as solar panels is not recommended. The electrical output can be supplemented by technologies such as PV or wind, although the economic case for these will depend on the local demand being higher than the output of the CHP plant.

5.7.6 Planning Issues

There are no specific planning issues related to combined heat and power as a technology.

5.7.7 More Information

More information on ground and air source heat pumps and installers of these technologies is available from

- Energy Saving Trust (micro-chp) - www.energysavingtrust.org.uk/housingbuildings/calculators/hardtotreat/matrix/microchp.cfm
- Energy Saving Trust (community heating CHP) www.energysavingtrust.org.uk/housingbuildings/calculators/hardtotreat/matrix/gaschp.cfm
- Combined Heat & Power Association www.chpa.co.uk

5.8 Connection and Distribution Issues for Renewable Energy Systems

5.8.1 Electricity Generation

Most renewable electricity installations will be connected to the national grid, so that electricity not used on-site can be exported and, conversely, grid electricity can be imported when the renewable device is not producing sufficient output. Connection requirements will usually be the responsibility of the installer. At present, generators under 16A (approximately 3.5kW) can connect to the local distribution network without needing permission from the Distribution Network operator (DNO), although the generator is required to inform the DNO that they have connected a supply. Over this limit, the DNO will normally grant permission automatically for domestic-scale individual installations, unless there are a number (over 3-4) installed in close proximity.

Some DNOs will charge for a search on the network connection to ensure the line is capable of taking the power exported. It is also possible that the DNO will charge an annual fee for connections over 16A.

The Electricity Safety Council publishes guidance on grid connection for microgeneration – see http://www.electricalsafetycouncil.org.uk/pdf/BestPracticeGuide3.pdf.

In order to sell electricity back to the grid, it is necessary to fit an accredited export meter. It is also worthwhile to fit a generation meter in order to benefit from the value of Renewable Obligation Certificates (ROCs). Although initially only offered for larger installations, some utility companies will now pay a ROC purchase tariff on all electricity generated from accredited renewable sources, making the generation equipment more valuable to the building owner. The value of ROCs varies but in early 2008 these were worth 5.1 p/kWh generated. Up-to-date prices can be obtained from the Non-Fossil Purchasing Agency - www.nfpa.co.uk/nfpas/trackrecord.htm. Developers should advise the building occupants to investigate the best combination of tariff and ROC purchase arrangements from a variety of electricity suppliers.

Ownership of the technology and distribution of the electricity are issues which will need to be considered by the developer for installations which are either independent of the user or are intended to supply several users. In this case the developer will need to put in place systems to manage long-term the billing of electricity generated and sales to the national grid. Usually this is in the form of an Energy Services Company, which takes over ownership of the equipment and responsibility for the energy supply.

5.8.2 Heat Generation

The cost of heat supplied from a centralised system to a number of homes or commercial units needs to be allocated to those users in a fair way. In some instances, such as offices and retail units, it may be appropriate to include heat in a service charge, but metering is usually the fairest option. In the UK, heat is less usually metered than electricity or fuel supplied, but heat meters are available which can be remotely read or linked to pre-payment systems.

As with electricity generation, ownership, operation, maintenance, distribution and billing systems need to be in place where the equipment supplies more than one user.

APPENDIX 1 – SOURCES OF INFORMATION

Advice on Energy Conservation and Renewable / Low Carbon Energy Supply

Energy Saving Trust - www.energysavingtrust.org.uk

The Carbon Trust – www.carbontrust.co.uk

Advice on Renewable Energy Technologies and Grants Available

Low Carbon Buildings Programme - www.lowcarbonbuildings.org.uk

Energy Technology Trade Associations

Solar Trade Association - www.greenenergy.org.uk/sta

British Photovoltaic Association - www.greenenergy.org.uk/pvuk2

British Wind Energy Association - www.bwea.com

British Hydro-power Association - www.british-hydro.co.uk

The National Energy Foundation (Biomass) - www.nef.org.uk/logpile

Ground Source Heat Pump Association - www.nef.org.uk/gshp

UK Heat Pump Network - www.heatpumpnet.org.uk

Combined Heat & Power Association - www.chpa.co.uk