Rhondda Cynon Taff Local Development Plan 2006 – 2021

Renewable Energy

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1 Introduction

The aim of this report is to briefly examine the opportunities and constraints to the development of renewable energy and energy efficiency within the County Borough of Rhondda Cynon Taff, to inform decision making in the formation of policies on renewable energy for the Local Development Plan 2006 – 2021.

The technologies considered in this report are :

- Solar Photovoltaics (PV)
- Solar Thermal
- Small Hydro
- Biomass Combustion
- Anaerobic Digestion
- Small Wind Clusters (1 or 2 turbines)
- Passive Solar Design
- Energy Efficiency in buildings

Landfill gas, and large wind projects have been specifically excluded at the request of the Client. Large wind projects have been excluded although part of the County Borough is encompassed by one of the proposed TAN8 Strategic Search Areas. Specific planning policy will be required for this area, once the proposed TAN has been approved by the relevant Ministers in the Welsh Assembly Government following public consultation. (anticipated July 2005).

The report will give a brief overview of the technologies and instances of existing or proposed projects in the County Borough, highlighting any general planning issues for each technology. This section of the report will draw on the new planning policy for renewable energy in England (PPS22) which it is felt is still relevant to the identification of relevant technologies and development control criteria likely to be relevant to them.

The opportunities and technical constraints for development of these technologies will be reviewed. Locational guidance from the viewpoint of available resource will be given where appropriate. This includes opportunities for energy efficiency and demand management at a local level.

2 Methodology

This is largely a desk based study, drawing on a number of sources and the authors' extensive knowledge of renewable energy technologies, and of the planning system related to renewable energy. Sources include:

TAN8 Consultation Draft
Companion Guide to PPS22
British Biogen Best Practice Guidelines to Anaerobic Digestion and Wood Fuel

Existing Development Plans within RCT Borough and elsewhere
Carbon Trust
Energy Savings Trust
Recent Planning Applications made to RCT

Locational issues were researched using GIS software to assess land use and topography to define areas within the Borough where each resource was likely to be available.

3 Technology Overview

Brief Description of Technologies

Solar Photovoltaic (PV)

Photovoltaic (PV) systems exploit the direct conversion of daylight into electricity in a semiconductor device.

The most common form of device comprises a number of semi conductor cells which are interconnected and encapsulated to form a solar panel or module. There is considerable variation in appearance, but many solar panels are available that are dark in colour, and have low reflective properties. Solar panels are typically 0.5 to $1m^2$ having a peak output of 70 to 160 watts. A number of modules are usually connected together in an array to produce the required output, the area of which can vary from a few square metres to several hundred square metres. A typical array on a domestic dwelling would have an area of 9 to $18m^2$, and would produce 1 to 2 kW peak output.

Other forms of solar modules are becoming more common, such as solar tiles, which are modules that are of the size and appearance of roofing tiles or slates, which can take the place of conventional roofing materials. They have the advantage of giving a roof a homogeneous appearance, virtually indistinguishable from conventional roofing materials.

Modules can be fitted on top of an existing roof using a low support structure. In this case, the panels will rarely project more than 120 mm above the existing roofline. Alternatively, and particularly in new buildings, they may form all or part of the weatherproofing element of the roof, replacing conventional slates or tiles. Where the modules form only part of the area of the roof, they can be integrated in a similar way to proprietary roof lights.

Connections between individual panels are made either in the support structure, or inside the roof void, and are rarely visible from the exterior of the building.

<u>*Siting Issues*</u>

For best performance, PV modules need to be inclined at an angle of 30 – 40 degrees, depending on the latitude, and orientated facing due south. In practical terms, this is not always possible on existing buildings, and some degree of flexibility in inclination and orientation at the expense of best performance is acceptable. However to function satisfactorily, collectors need to be inclined at between 10 and 60 degrees, and orientated facing from east to west.

Although roof mounted PV is the most common installation, modules can also be mounted on the sides of buildings, or on free standing support structures on the ground. In some cases, particularly on institutional or commercial buildings, PV cladding on the side of the building may be regarded as an architectural feature. Other examples of the mounting of PV panels in buildings are their use as external sun shading of office windows (*bris – solaires)* and forming the roof of an atrium.

Shadows from buildings, trees or other structures can significantly reduce performance of the PV system and planners and designers should take reasonable steps to minimise overshading of the PV.

There are two ways in which PV is most commonly deployed**:**

Stand-alone systems: PV is widely used to provide power for communications, domestic dwellings and monitoring systems in remote areas. The use of PV to provide energy for lighting of telephone kiosks in rural areas, bus shelter lighting, remote traffic monitoring, and railway trackside signalling is increasing as it can compete in remoter areas with the costs of mains connections and cabling.

Grid connected Schemes: These use PV technologies that are connected to the local electricity grid via power conditioning equipment known as an inverter. Any surplus electricity not being consumed within the building can be exported to the local distribution network with the agreement of the network operator and an electricity supplier. The connection is usually made within the owner's premises, and due to the relatively low capacity of individual systems additional overhead cables are very rarely required.

Although the majority of grid connected schemes will be roof mounted, other applications may occur, such as modules used as sound barriers alongside motorways.

PV technology is expected to decrease in cost over the next decade and PV systems could provide a useful contribution to renewable energy generation.

Planning Issues

There are clearly implications for listed buildings and the sensitive 'front elevations' of some conservation areas but as a generality "solar panels" should be something to be encouraged. In some cases, provided the installation is not of an unusual design, or involves a listed building, and is not in a designated area, PV is regarded as "permitted development" and is thus deemed not to require a planning application. Unless the panels are of an unusual design, they should be treated as being within the plane of the existing roof slope for the purposes of Part 1, Class B1(b) of the Town and Country Planning (General Permitted Development) Order 1995.

Solar Water Heating

Solar water heating systems can be used to heat water for a variety of purposes. Amongst the most common are: domestic use, light industrial and agricultural use and to heat swimming pools. At present, the widest utilisation is in the residential domestic hot water sector. Such systems are rarely used to provide space heating, but occasionally may occur.

There is a common misconception that solar water heating is ineffective in Wales for climatic reasons. Whilst it is clearly not as effective in Wales as it is in Spain for instance, a good modern system will make a significant contribution to water heating requirements. The domestic sector is an obvious priority - a well designed system should provide 50-60% of annual domestic hot water requirements, most of this energy capture being between May and September.

The key component in a solar water heating system is the collector. Two main types are common in the UK: flat plate collectors and evacuated tube collectors, although other designs are occasionally employed. In both types, radiation from the sun is collected by an absorber, and is transferred as heat to a fluid, which may be either water, or a special fluid employed to convey the energy to the domestic system using a heat exchanger.

Flat plat collectors comprise a water filled metal “envelope” with a special black coating which improves absorbtion of solar energy and heat transfer. This is housed in a glazed, insulated box. The collector is connected to the hot water system of the building in a similar way to a conventional boiler, usually using an indirect coil in the hot water cylinder. Water is circulated either by thermo-syphon or, more commonly using a circulating pump. The pump is controlled in such a way that when the temperature of the collector is lower than the temperature in the hot water system, the pump is switched off. Flat plate collectors need to be protected against frost, and this is effected either by the addition of antifreeze to the heating circuit, or by arranging the system such that the collector “drains down” when the pump is switched off.

Evacuated tube collectors comprise a number of vacuum tubes, typically around 100 mm in diameter, and 2 metres in length containing a finned metal collector tube. Each tube is filled with a heat transfer fluid, and the upper ends of individual tubes are connected to a manifold heat exchanger, which is connected to the hot water system of the building as in the case of flat plate collectors. Evacuated tube collectors do not require protection against frost.

Although both types of collector will collect more energy during summer months, a significant amount of energy will be collected on cold winter days, and evacuated tube collectors are more effective in achieving both.

A type of flat plate collector has the storage cylinder as an integral part of the collector, mounted on the roof. Although common in warmer climates these are rare in the UK, and normally the only part of the installation that is visible is the collector.

The collector, together with the glazing and insulation, are generally mounted in a box which is usually coloured grey or black, typically of 1 - 2 m^2 in area. For an average residential domestic installation, some 4 or $5m^2$ of flat plate collector, or some $3m^2$ of evacuated tube, is required. Typically, this would be mounted on a southerly facing roof pitch, or more rarely on a free-standing tilted frame on the ground, or a flat roof. Increasingly, collectors are becoming available that can be incorporated into a new or existing roof in much the same way as proprietary roof windows. Some systems use photovoltaics (PV) to provide power for the system pump. In this case, a separate PV module, typically 20cm by 40 cm, will be mounted adjacent to the solar hot water collector.

Collectors rarely project more than 120 mm above the existing roofline. Connecting pipework is normally run from the back of the collector directly through to the roof void, as it is not normally visible from the exterior of the building.

Solar water heating collectors for swimming pools generally comprise mat of neoprene, or other black rubberised material that is mounted near to the swimming pool. Typically this will have an area of about half that of the surface area of the pool. The collector may be mounted on the roof of an adjacent low building (such as a garage, or more commonly on a low ground mounted frame. The collector is often mounted flat, or only slightly inclined with the outlet higher than the inlet.

Planning Issues
Planning issues are similar to those for Solar PV

Small Hydro

The technology for harnessing waterpower is well established. Water flowing from a higher to a lower level is used to drive a turbine, which produces mechanical energy. This mechanical energy is then turned into electrical energy by a generator, or more rarely to drive a useful mechanical device.

The energy produced is directly proportional to the volume of water and the vertical distance it falls. Thus, a similar amount of energy could be produced from a small volume of water falling over a long vertical distance (high head), as from a larger amount of water falling a much shorter vertical distance (low head).

The great majority of schemes will be "run of river", where water is taken from a river from behind a low weir, with no facility for water storage, and returned to the same watercourse after passing through the turbine. In addition, there is a small potential for small hydro installed on existing reservoirs, but these may also be treated as "run of river", as they do not involve the construction of a new impounding structure.

The essential elements of a hydro scheme are as follows:

- A source of water that will provide a reasonably constant supply. Sufficient depth of water is required at the point at which water is taken from the watercourse, and this is achieved by building a low weir (typically around 2 metres high) across the watercourse. This is called the 'intake'.
- A pipeline to connect the Intake to the turbine. A short open 'headrace' channel may be required between the intake and the pipeline, but long headrace channels are rare due to environmental and economic constraints.
- A building housing the turbine, generator and ancillary equipment - the 'turbine house'.
- A 'tailrace' returning the water to the watercourse.
- A link to the electricity network, or the user's premises.

The Intake
The scale and nature of these elements depend on site conditions, and whether the scheme is low head or high head.

The intake typically comprises a concrete or rubble masonry weir, up to 2 metres high, across the watercourse. A spillway ensures that the downstream watercourse is never totally deprived of flow, and a screen or trashrack prevents floating debris or fish from entering the pipeline. A valve or sluicegate is often incorporated, and where the watercourse has a high silt load, a settling tank may be required. The Environment Agency should be consulted regarding disposal of debris from the trashrack. Current regulations may require that debris is disposed of off site, but an exemption may be granted by the EA under some circumstances.

The Pipeline
The pipeline (sometimes called the penstock) connects the intake with the turbine. This is typically a pipe of steel, plastic or composite material, the diameter of which could be between 10cm and 100cm, depending on the characteristics of the site, and the capacity of the scheme. High head schemes typically have smaller diameter pipes of longer length (sometimes over a kilometre), whereas low head schemes are typified by short, larger diameter pipes. Pipes are often buried for environmental or technical reasons. Anchor blocks to restrain the pipe are required at vertical and horizontal changes of direction, but these are usually buried if the pipe is buried.

Open headrace channels are now rare on new schemes, but may occur if the project involves the rehabilitation of an existing scheme, particularly on old watermill sites.

The Turbine House
The turbine house accommodates the turbine, generator and ancillary equipment, and is typically a single storey building of between 3 metres by 4 metres for a small domestic scheme, to 10 metres by 10 metres for a large grid connected scheme. Occasionally, particularly on old watermill sites, the machinery may be located in an existing building. Vehicular access to the turbine house is required for construction and maintenance purposes.

To minimise the length of the tailrace, and to maximise the available head, the turbine house is usually located close to the watercourse.

Such turbine houses should typically be constructed in association with the local vernacular materials used in the area.

The Tailrace
After use, the water is returned to the natural water course via concrete or masonry channel which connects the turbine house to the watercourse. To avoid flooding of the turbine, this channel should have a gradient sufficient to allow free discharge of water. A screen to prevent the ingress of fish is often incorporated, and occasionally the tailrace is an underground structure.

Electricity Connection.
The connection between the turbine house and the local electricity network is typically 3 wires, supported on single wooden poles.

Planning Issues
Planning applications for hydro schemes in excess of 1 MW capacity are considered by the Secretary of State for Energy, under Section 36 of the Electricity Act 1989. In this case, the local planning authority is a statutory consultee. For schemes below 1 MW the local planning authority is the decision making body and they will often be construed as EIA developments under Statutory Instrument No. 293 1999, particularly where greater than 0.5 MW.

The development of hydro – electric power generation schemes should be achieved in a manner which is compatible with the many other uses to which a river is put. Early liaison between the developer, planning authorities, the Environment Agency and statutory consultees such as the Countryside Council for Wales is essential to ensure that all statutory remits are met, and that proposals do not detract from the existing value and interest of the watercourse and its surroundings. There is some potential for environmental improvements through technical and environmental enhancement measures.

In addition to planning permission, any small hydro scheme will require an Abstraction Licence from the Environment Agency. This generally will require an environmental impact assessment, usually covering issues that will be of concern to a planning officer, including:

Siting and landscape considerations
Design considerations
Hydrological issues
Ecological considerations
Fisheries considerations
Noise
Recreation and public access considerations
Construction and operational considerations

Because of this shared interest, it is beneficial for all concerned that there is a high degree of co-operation between planning officials, EA officials and the applicant during the application process.

Biomass

Energy generation based on biomass is technologically well advanced and widely utilised in many parts of the world. For example, in the forested areas of Scandinavia and North America, the use of wood for heat and electricity generation on a commercial scale is well established. In the UK, a 36 MW straw-fired power station was officially opened in January 2002 near Ely in Cambridgeshire. The scheme uses new techniques to burn surplus straw to generate over 270 GWh of electricity a year, enough power to heat and light 80,000 homes. In many rural areas, particularly those with an established forestry industry, woody biomass are used to provide heating for schools and other public buildings.

There are three methods for converting dry biomass fuels into energy:

- **direct combustion** is used for heating water or to raise steam to drive a steam engine or turbine to generate electricity (steam cycle). Equipment ranges from very small wood stoves used for domestic heating to multi megawatt plants for electricity production. The upper limit is restricted by local energy demand and availability of biomass rather than by combustion technology. Equipment design depends on the moisture content and particle size of the fuel;
- **gasification** is a technique in which the solid fuel undergoes incomplete combustion in a limited air supply to produce a combustible gas that can be burned in a boiler or used as fuel for an engine or gas turbine. This technology is more applicable to multi megawatt plants, but smaller plant of under 5 MW are becoming more common;
- **pyrolysis** involves heating in the absence of oxygen (rather like traditional charcoal production) to produce a combustible gas, which is used in a similar way to gas produced from gasification.

Direct combustion is the most commonly used technology for heat only plant, whilst both direct combustion and gasification are used for Combined Heat and Power (CHP) and electricity only plant. Pyrolysis is more commonly associated with the production of transport fuel, such as bio diesel. Combustion technology and generation of electricity using the steam cycle is an advanced, mature technology. Whilst becoming much more common, gasification and pyrolysis are much less mature technologies than direct combustion.

The three technologies appear externally to be very similar, and share much in common from a planning perspective. For a given capacity of plant, the size, extent and appearance of the development will be similar, similar amounts of fuel feedstock will be required, and emissions and other waste products will be similar.

Fuel Sources

Although this report deals with the planning implications of the energy conversion plant itself, and not of the fuel supply, some reference to the different sources is important. There are five main sources of biomass fuel:

- Material from forestry harvesting
- Material from timber processing
- Agricultural residues
- Energy crops
- Waste Streams

A large biomass scheme may use fuel from one or more sources, in order to ensure security of supply.

All 'dry' biomass fuels have a similar gross energy content – 4 to 4.5 MWh per dry tonne. How much of this energy content can be exploited depends on the process, the technology employed, and the moisture content. Some direct combustion technologies can use fuel with a high moisture content (up to 50%), but gasification and pyrolysis generally require fuel to have a moisture content of less than 30%, and fuel may have to be dried as part of the process.

Biomass material from forestry harvesting, agricultural residues and energy crops may have a similar supply strategy. Most biomass plants require fuel to be in a chipped form, and chipping often occurs close to where the crop is grown. Once chipped, fuel tends to deteriorate fairly quickly, hence fuel in long term storage (e.g inter-seasonal) is usually left in the "as harvested" state, either in situ, or in converted agricultural buildings. Chipped fuel is often loaded directly onto lorries for delivery to the energy plant. Generally, only short term storage facilities are provided at the energy plant, and regular fuel deliveries are needed. A useful rule of thumb for fuel deliveries is two 38 tonne lorry deliveries per day, per MW continuous heat input. Thus, a 250kW boiler operating for half of the time (a duty cycle of 50%), supplying heat to a leisure would require 1 or 2 deliveries a week, and a 10 MW plant producing electricity continuously would require around 20 deliveries a day.

Existing large coal fired power stations can use biomass to augment the traditional fuel. This is known as 'co-firing'. Although this may not have implications for the planning system, it is an important way of increasing the critical mass of producers in the fuel supply chain

Planning Issues

The remit of consideration for planners is around the power plant and associated impacts and not the production of the fuel source. However, the impacts of growing and collecting the fuel are key to ensuring the successful development of a facility. Many of the environmental issues associated with the fuel supply (e.g. impact on landscape, ecology, archaeology, land use etc) may be covered by an Environmental Impact Assessment (EIA) undertaken by other bodies in connection with the scheme – for instance the Forestry Commission (FC) for all applications submitted to the Energy Crops Scheme.

New electricity generation plant whose capacity equals or exceeds 50MW needs the Consent of the Secretary of Sate for Energy, under Section 36 of the Electricity Act 1989. This includes deemed planning consent, and for which the Local Planning Authority is a Statutory Consultee. Heat only plant, and electricity plant or CHP, with an electrical output of less than 50MW will require planning permission from the local planning authority under the Town and Country Planning Act 1990 (Section 57).

Local planning authorities may wish to consider the following issues when determining an application:

- Visual intrusion - the plant is an industrial feature with a chimney and may not always be regarded as appropriate to the landscape. In certain weather conditions a plume may be evident from the chimney and/or drying equipment depending upon the design of the equipment.
- Noise from traffic and plant operations. As an industrial development, BS 4142 may be the applicable standard
- Effects on health, local ecology and conservation from airborne and water borne emissions.
- Traffic to and from the site in order to transport biomass fuel and subsequent by-products. Transportation of the fuel is one of the greatest causes of contention for

local communities. Traffic volumes and the associated noise will increase with the introduction of a large biomass power facility, as the scheme may require a continuous fuel supply.

- The sustainability of the fuel supply i.e. could there be an intention to change the operating feedstock over time.
- The positive benefit of the plant to the local economy. The supply of biomass fuel can secure a long term income for farmers, forestry owners and contractors, and transport operators in rural areas.
- Carbon mitigation

Anaerobic Digestion

Anaerobic digestion (AD) is a method of waste treatment that produces a gas with high methane content from organic materials such as agricultural, household and industrial residues and sewage sludge (feedstocks). The methane can be used to produce heat, electricity, or a combination of the two. The process has the benefit of using waste substances that are otherwise difficult to dispose of in an environmentally acceptable manner.

AD is the bacterial fermentation of organic waste in warm, oxygen-free conditions. The process, which is sometimes known as bio-stabilisation, converts complex organic molecules into an inflammable gas comprising methane and carbon dioxide, leaving liquid and solid residues. The gas is usually referred to as *biogas*. During this process, up to 60% of the digestible solids are converted into biogas. This gas can be used to drive a generator, to supply heating systems, or to serve a range of industrial applications.

The digestion process takes place in a sealed airless container (the digester) and needs to be warmed and mixed thoroughly to create the ideal conditions for the bacteria to convert the organic matter into biogas. There are two types of AD process:

Mesophilic digestion. The digester is heated to 30-35°C and the feedstock remains in the digester typically for 15-30 days. Mesophilic digestion tends to be more robust and tolerant than the thermophilic process (see below), but gas production is less, larger digestion tanks are required and sanitisation, if required, is a separate process stage.

Thermophilic digestion. The digester is heated to 55°C and the residence time is typically for 12-14 days. Thermophilic digestion systems offer higher methane production, faster throughput, better pathogen and virus ‘kill’, but require more expensive technology, greater energy input and a higher degree of operating and monitoring.

A typical AD plant will comprise waste pre-treatment equipment, a digester tank, buildings to house ancillary equipment such as a generator, a biogas storage tank, a flare stack and associated pipework. If municipal solid waste (MSW) is digested, pre-treatment facilities will be required to separate organic from inorganic waste. Plants that use sewage sludge or farm slurry will require post-digestion equipment to treat the resulting liquors.

Fuel Sources
The main types of feedstock employed in AD are:

Sewage sludge. This is the sediment that is removed from foul sewage during the course of treatment by a process of settlement. AD of sewage sludge currently takes place at many sewage treatment works and some schemes include energy recovery. The raising of sewage treatment standards – together with tighter controls on the disposal of sludge – has lead to greatly increased arisings, particularly in coastal areas where sludge dumping at sea ceased to be an option since 1998. Water companies are placing a priority on finding alternative methods of safe disposal. Energy recovery will potentially become more economically attractive where AD is the chosen waste treatment measure.

Farm slurry. The intensive rearing of livestock, particularly cattle and pigs, produces large quantities of slurry - manure in liquid form - which is not only odorous but can also present pollution problems if it is not carefully disposed of. Silage effluent can cause similar problems. Farmers can face stiff penalties for causing these substances to pollute water courses.

Municipal solid waste (MSW). Municipal refuse contains large quantities of food, garden waste, paper and packaging with a high organic content, and is therefore suitable for AD. With the introduction of the RO, the market for CAD plant, utilising 100% food processing waste for example, is large and is likely to grow still further.

Digestion does not only reduce the volume of the wastes treated, but it does make them less odorous and can remove harmful pathogens - a particular benefit in the case of farm slurry and sewage sludge. The options for after use or disposal of the residual waste are thus widened substantially.

Feedstocks for AD inevitably contain plant or animal pathogens (such as *Salmonella*) and parasites (such as *Cryptosporidium*) to different degrees in different materials. Precautions are therefore needed in AD projects, especially CAD projects which involve transporting residues from various sources to a central point, which could lead to cross-contamination unless appropriate preventative measures are taken. Mesophilic AD will reduce pathogens and bacteria, but will not eliminate them from waste. Thermophilic digestion will further reduce the levels, but again cannot guarantee total removal. Pasteurisation (holding the waste at 70°C for 30 minutes or at 55°C for four hours) is the only method that will ensure the complete elimination of pathogens

Planning Issues

Site selection, Transport and Traffic
A plant will be located close to the waste source. Small digesters on farms can sometimes be accommodated quite satisfactorily within the existing complex of farm buildings. Similarly, sewage sludge digesters will be built at existing waste water treatment works, and will often be unnoticeable amongst the existing array of tanks and ponds

Centralised digestion facilities handling large quantities of agricultural wastes, sewage sludge or MSW may be more economically viable for farmers, but have the potential to raise more complex siting issues. The most acceptable sites are likely to be beside existing industrial or waste water treatment works or, in the case of digestion schemes using MSW, in close proximity to a landfill site or waste transfer station.

Transport movements at on-farm digesters are not likely to have greater impact than normal farm activities. However, CAD plants will draw traffic to their central location as feedstock is delivered and products are distributed. The impact of these transport movements can be minimised by carefully considering fuel supply logisitics, thereby optimising the distances travelled between the feedstocks, storage tanks, digester and local markets.

Feedstocks and Product Storage
Planning permission may be given to a scheme specifying a certain feedstock and in these circumstances the feedstock will not be able to be changed without the further prior approval of the planning authority. The local authority and/or Environment Agency should be consulted early in the process when considering waste handling issues and classifications.

Odour
The AD of organic materials is, by its very nature, an odorous process. Local authorities should examine predicted odour effects and proposed mitigating measures such as odour control systems. If a location is considered to be sensitive to odour nuisance, the local authority should ensure that all possible sources of odour are accounted for in the proposals for odour control. Odour may arise from:

- waste input storage bays: especially during the summer when the breakdown of organic material can begin before it is even collected for disposal;
- sorting and mixing plant: in which the waste is treated or sorted or mixed with digestate prior to digestion;
- the digester: which, though sealed during use, will release odours when opened to allow cleaning;
- digestate draw-off and de-watering plant digested material is significantly less odorous than raw organic material, but can still give off unpleasant smells.

At the same time, AD can bring benefits in terms of odour reduction. The digestion of slurry, for example, is significantly less odorous than the common practice of storing slurry in pits.

Emissions to Ground and Water Courses
Serious farm pollution incidents can occur through the leakage or run-off of raw agricultural wastes, particularly farm slurry, dirty water and silage effluent. By following the DEFRA Codes of Good Agricultural Practice for the Protection of Land and Water, emissions to ground and water courses should be minimised. The AD of farm waste should reduce the likelihood and capacity of the material to pollute controlled waters.

Emissions to Air
The production and use of biogas through AD results in a number of emissions to air, including those from gas vents, engine exhausts and flare stacks. These emissions are generally minor and are unlikely to present any significant environmental problem, provided the equipment meets relevant design specifications and is properly serviced. The Environment Agency will apply Integrated Pollution Control regulations to larger plant which will control emissions to all media; this will apply to larger on-farm schemes as well as CAD plants.

Wind Clusters
There are essentially two types of wind turbine, and they look very different—vertical axis machines with rotors that rotate about a vertical axis, and horizontal axis machines whose rotating shafts are aligned horizontally. Most wind turbines installed today are of the horizontal axis type. This is likely to remain the case for the foreseeable future in relation to large, grid connected wind turbines. One area in which vertical axis machines may become prevalent is the application of small wind turbines in the built environment. Unless otherwise stated this report is describing horizontal axis machines.

Wind turbines use the wind to generate mechanical power for water pumping or for electricity generation. This report deals only with the electricity-producing variety. It is also limited to consideration of land-based machines (although there is little essential difference with machines that are installed in off-shore locations). Such wind turbines convert the kinetic energy of the wind that passes through the swept area of the rotor into electrical energy by means of a rotor (generally comprising 3 blades), a mechanical drive train (usually including a gearbox) and an electrical generator. These are all mounted on a tower that is at least high enough for the blades to clear the ground by a sensible margin and preferably high enough to maximise the energy capture of the wind turbine.

Wind turbines are defined by the size (diameter) of the rotor and rated power or capacity in kilowatts (kW) or megawatts (MW). The rated capacity of a wind turbine is a measure of the maximum output of the electricity generator which will be achieved in wind speeds greater than 12-15m/s at the hub height of the rotor. There are two things worth noting: An increase in the rotor diameter of a wind turbine does not result in a proportional change in rated power. For instance, doubling a 30 meter rotor diameter to 60 metres will result in a roughly four-fold increase in rated capacity, as the capacity is proportional to the square of the rotor diameter. Secondly, an increase in windspeed does not result in a proportional change in rated power. Rated power is proportional to the *cube* of the windspeed, and hence a doubling of windspeed will result in a roughly eight-fold increase in power output.

Wind turbines are available in a wide range of sizes, from small battery charging units with rotor diameters of less than a metre and a tower height of 15 metres to very large wind turbines with rotor diameters greater than 100 metres rated at several megawatts mounted on towers of 60 metres in height. Wind turbines have increased in size and capacity over time and will continue to do so in the foreseeable future. The choice of turbine size depends on the site chosen and the scale of development required. Commercial wind clusters that supply electricity to the electricity grid tend to use few larger machines. However, farms and businesses using wind power might size their turbines according to the size of their own electricity demand.

The *blades* are usually of a glass-fibre reinforced plastic construction. Other materials used include wood-epoxy laminates and carbon fibres. These may both become more prevalent with future up scaling of current wind turbine designs. They are generally the largest single item that is transported to a wind farm during construction. Smaller turbines (less than 50kW) may use blades made of a variety of other materials such as plastics, metal or wood.

The *blades* are attached to the *hub*, which is in turn attached to the main shaft that drives the generator, usually, but not always, via a gearbox. Any grid connected wind turbine must produce its power output at 50Hz alternating current (AC), in common with the electricity transmission and distribution networks.

The generator, gearbox and yaw drive that turns the rotor to face the wind are the main components housed within the *nacelle*. For large, grid-connected turbines the rotor alignment with the on-coming wind is always controlled actively via the yaw drive and they are designed so that the blades see the wind before the tower does. Such a design is known as an upwind rotor with active yaw control. Smaller turbine designs may use upwind or downwind rotors and may use active or passive yaw control. Vertical axis machines require no yaw control by virtue of their design.

The *nacelle* is mounted on the *tower*, which for large grid-connected turbines is always of a tubular steel construction. Smaller turbines (less than 50kW) may be mounted on similarly designed towers, but may equally use lattice or guyed towers. Turbines designed specifically for the built environment may be mounted directly on to existing structures, such as roofs.

There are a number of technical differences amongst the wind turbines that are currently available. The most obvious difference is in the number of blades. Most machines now have three blades, but there are some two-bladed machines in operation. Other than this the two most important differences are the way in which a turbine regulates its power capture above rated wind speed (pitch or stall regulation) and whether the machine operates at a fixed or variable rotor speed.

Planning Issues

Wind clusters of 1 or 2 turbines may not need a statutory Environmental Impact Assessment, but planners may wish to consider all or some of the issues generally covered in an EIA for a larger project, including:

- Noise effect
- Landscape and visual effect
- Airtraffic Safeguarding
- Proximity to roads, public rights of way and power lines
- Ecological and ornithological effects
- Electromagnetic interference
- Shadow flicker and reflected light
- Archaeology
- Construction and operational disturbance

Although wind clusters are smaller in scale than larger commercial windfarms, and may be associated with other, particularly industrial developments, applicants should be encouraged to follow the British Wind Energy Association Best Practice Guidelines.

Passive Solar Design (PSD)

Virtually all buildings enjoy free energy and light from the sun, the objective in PSD is to maximise this benefit by using simple design approaches which intentionally enable buildings to function more effectively and provide a comfortable environment for living or working. Not all aspects of PSD are of direct concern to Development Control, for example the use of dense materials to store heat and the details of internal layout and use of natural ventilation.

An important distinction must be drawn between the use of PSD in housing and commercial buildings. In housing the primary objectives are to capture light and heat. In the case of commercial buildings light is also important but generally excess heat is a problem during periods of high solar gain, making the main purpose of PSD the removal of excess heat while avoiding the use of air conditioning.

PSD should not be regarded as a technology in the same way as other renewable energy technologies: it is rather the application of a number of design tools and materials to improve the energy performance of a building. These tools include:

Orientation
The capture of solar gain can be maximised by orientating the main glazed elevation of a building within 30 degrees of due south. Orientation is important for housing and schools, which can make effective use of solar gain. The use of dense materials in construction will help to absorb heat during the day and release it at night.

Room layout
Placing rooms used for living and working in the south facing part of the building, and locating storage, kitchens, bathrooms, toilets, stairways and the main entrance on the north side will make most effective use of solar heat and light.

Avoidance of overshadowing
Careful spacing of buildings should seek to minimise overshadowing of southern elevations, particularly during the winter when the sun is low. On sloping and wooded sites careful consideration must be given to siting to maximise solar access. PSD principles can be readily applied to housing layouts achieving up to 35 dwellings per ha. Above this figure a degree of overshadowing becomes increasingly difficult to avoid, but this remains a worthwhile objective. *(To be added: details of software that can be used to evaluate housing layouts and assess overshadowing and PSD performance)*

Window sizing and position
In housing smaller windows should generally be used in north facing elevations. On the south elevation while larger windows increase solar gain this has to be weighed against greater heat losses in the winter and a risk of overheating in the summer. Sloping roof lights facing the sun will increase the solar radiation received.

Conservatories and Atria
Carefully designed conservatories and atria can contribute to the management solar heat and ventilation. To avoid problems of excessive heat gains and losses they should be designed and used as intermediate spaces located between the building and the external environment. Conservatories and atria can be designed to assist natural ventilation in the summer by drawing warm air upwards to roof vents. They can also be used as heat collectors during the spring and autumn. The net thermal benefits of conservatories will however be lost if they are heated for use during the winter.

Natural ventilation
This is particularly relevant to offices, schools and other public buildings. Atria and internal ventilation stacks projecting above the general roof level can be used to vent air as the building warms during the day, with cool air being drawn in through grills in the building

façade. This approach obviates the need for air conditioning, which can be up to four times more energy intensive as providing heating, and makes for a more healthy and pleasant building environment.

Lighting
In offices the avoidance of deep-plan internal layouts and the use of atria, roof lights and light reflecting surfaces can help reduce the need for artificial lighting.

Thermal Buffering
In order to reduce heat losses, unheated spaces such as conservatories, green houses and garages which are attached to the outside of heated rooms can act as thermal buffers, the temperature of the unheated space being warmer than that outside.

Landscaping
Landscaping, including the use of earth bunds, is often used as part of an overall PSD approach providing a buffer against prevailing cold winds and shading for summer cooling.

4 Existing renewable energy sources and energy conservation measures

Whilst a detailed assessment has not been possible within the scope of this report existing renewable energy sources and energy conservation measures within RCT have been identified following consultation with the Energy Saving Trust, the Carbon Trust, the Wood Energy Business Scheme Groundwork and the RCT energy officer.

No exemplars of best practice or innovative energy conservation linked to new buildings have been identified within RCT. In terms of domestic energy efficiency measures RCT is likely to be somewhat behind the national average.

The UK Fuel Poverty Strategy (2001) estimated that 42% of social housing tenants within RCT would be eligible for measures under the Home Energy Efficiency Scheme (HEES) along with 30% of occupants in the private rented sector, and 3.9% of owner occupiers.

In addition to basic insulation, and in some cases heating, measures installed under HEES and its successor Warm Front RCT has developed some insulation schemes in partnership with private sector utilities under the terms of the Energy Efficiency Commitment (which places obligations on energy suppliers to save a set amount of energy through such measures). A British Gas Scheme enabled 172 un-insulated properties receive loft and cavity wall insulation in Brynterion and replaced a number of coal fires with energy efficient gas fires, boilers, and radiators with thermostatic radiator valves. There were also some similar big projects in Gilfach Goch and Llanharan. Smaller projects are currently underway with SWALEC and Scottish Energy

EST Wales are unaware of any grants for PV technology in the RCT area and no examples of grid connected PV installations have been identified. It is likely that there are a number of domestic solar water heating systems within RCT but there were no awards relating to properties within RCT under the Solar Water Heating in Social Housing (SWISH) programme. RCT are hoping to include more renewables in housing projects in the next financial year (most likely solar water heating) although this is highly dependant on funding availability.

Small Hydro

No current or operating small hydro schemes were identified in the Borough. However, given the historic use of waterpower in the mining industry, it is likely that there are a number of abandoned schemes in the area. An extensive inventory of hydro potential in the range 25kW to 5MW was complied by Salford University in 1989 (ETSU Report No SSH- 4063 – P3) based largely on existing or abandoned sites. The study reports a potential site at Nant y Moel, but no details are available

Biomass Combustion

No current examples of biomass combustion were identified within RCT, however Pontypridd & Rhondda NHS Trust are in the process of arranging the installation of medium sized biomass heating plant at the Llwynypia hospital site, and have received grant approval to this end from the Wood Energy Business Scheme.

No commercial examples of Anaerobic Digestion are thought to exist within the borough. The University of Glamorgan is a centre of expertise for Anaerobic Digestion, and the production of hydrogen through AD processes. The university have operated a number of AD plants over the years and currently operate a pre-commercial digester fed from textile waste on Treforest Industrial Estate.

An energy recovery scheme utilising landfill gas is operated by Amgen Cymru on the Bryn Pica landfill site in Aberdare. The landfill gas management system was commissioned in 2003. It diverts the methane gas from the decomposing waste via a series of pipe manifolds. The gas is then burned in a 1.4 Megawatt generator producing electricity which feeds into the National Grid.

Biofuels

No known examples.

Wind

The Taff Ely Windfarm is just within the Borough boundary with Bridgened in the south west of the Borough. The wind farm comprises 20, 450kW wind turbines with a combined output of 9MW was commissioned in 1993, and is owned and operated by nPower (formerly National Wind Power)

In addition, an application for planning permission for 8, 1.3 MW wind turbines on the uplands above Ferndale was recently refused by the planning committee. The application was made by the Arts Factory, a community based initiative in the Rhondda Valley. It is understood an appeal is being considered.

Passive Solar Design

No known examples

5 Opportunities for development in RCT

5.1 Locational Guidance

Photovoltaics

Photovoltaics have a large number of 'off-grid' applications, and are increasingly integrated into street furniture for use in low power applications including street lighting, public transport information display and parking meters.

Larger grid connected schemes in the UK have tended to be building linked or building integrated, and will typically be sited on a south facing roof. However, in some cases infrastructure such as traffic screening and noise reduction barriers provide an opportunity to mount grid connected PV modules.

In terms of planning considerations the technical requirements of the technology are limited to the availability of a suitably oriented and inclined, unshaded mounting surface or supporting structure. The auxiliary equipment for grid connected schemes is likely to be housed within the building supplied with electricity, whilst stand alone scheme require dry and secure battery housing.

As with solar water heating generalised locational planning guidance is likely to be inappropriate for this technology. As with solar water heating it is estimated that in approximately 50% cases the roof area of existing buildings provides a suitable mounting surface.

In terms of domestic applications, a typical system is between 1-2kWp, covering an area of between 9-18m^2 and providing approximately 25% of annual average domestic electricity demand. An typical output of approximately 750kWh can be expected per kWp installed.
A simple calculation suggests that existing dwellings could theoretically support approximately 70MWp of PV generating a total of around 51GWh of electricity per annum.

PV is currently a relatively expensive source of electricity and installations are highly dependant on capital subsidy. There is currently approximately 7MWp of installed PV capacity in the UK as a whole.

Solar Water Heating

Solar water heating in the UK is primarily a building linked, or building integrated, renewable energy technology. In terms of planning considerations the technical requirements of the technology are limited to the availability of a suitably oriented and inclined, unshaded mounting surface. It is estimated that in approximately 50% cases the roof area of existing buildings provides a suitable mounting surface.

Generalised locational planning guidance is therefore likely to be inappropriate for this technology, although it could be noted that the economic incentive for uptake is likely to be higher in 'off-gas' areas where currently more expensive heating fuels such as oil, LPG and electricity would be displaced.

Small Hydro
Of all the renewable energy technologies, small hydro is perhaps the most site specific. A project must be sited where specific geographic, topographic and climatological features are present. For small hydro, conditions are optimum where streams or rivers with an abundant year round flow fall rapidly in a relatively short distance. A further criteria is proximity to the LV (240 volt) or MV (11,000 volt) electricity network.

Within the RCT boundary, these conditions are most likely to occur towards the north of the area. There are numerous small watercourses which fall steeply into the Rhondda and Taff Rivers, and the urban development in these valleys would indicate that there is sufficient grid capacity to support such projects. Most potential projects are likely to be small in nature – under 100 kW, but there is potential for somewhat larger schemes, particularly associated with reservoirs in the uplands above Treherbert and Maerdy.

There is potential for low head developments on the larger, less fast falling rivers in the Borough, particularly associated with old industrial uses of waterpower. These maybe limited as the proximity to newer development make give rise to concerns of flooding.

Biomass
One of the most important factors affecting the development of biomass projects, whether for heat only, or CHP applications is proximity to the fuel supply. For larger projects, the viable transport distance is generally under 40 km, but for smaller projects this can be considerably less. There is little apparent scope for the growing of energy crops on any scale in the Borough, and the prime source of biomass fuel will be forestry co – product (top and lop, and small round wood). This resource is predominantly located in the central belt of the Borough, and is relatively extensive in nature. It is likely then that any smaller heat only projects will be located close to this resource, but larger CHP or electricity generation projects could be located anywhere in the Borough, but particularly in the industrialised valley areas, where land, grid and transport infrastructure exist.

AD
As with dry biomass, transport of supply material is a critical issue affecting the economic viability of AD projects. The two main sources of supply material are farm waste (particularly animal waste) and food and domestic waste. Of the two, the latter is probably the dominant source in the Borough. It follows, therefore, that the most likely location of AD projects will close to populated areas, and particularly close to food producing industries, and larger food retailing outlets

Wind Clusters
Small wind turbine developments can be classified in three groups:

Very small low voltage DC wind generators
Small wind turbine (under 20kW)
Small clusters (1-3) of larger wind turbines (up to 1.5 MW)

In general, the main technical locational issues associated with wind turbines are the wind speed and proximity to the grid. In the case of the first group, both issues are much less critical. This group may not require a grid connection, and operate at much lower windspeeds, and can often be micro sited in a limited area to gain sufficient wind resource. Thus, technically appropriate sites exist throughout the Borough.

The second group are usually connected to the LV (240 volt) grid, require a lower windspeed than larger turbines, and can be successfully deployed in relatively built up areas. Technically appropriate sites occur in much of the Borough, apart from heavily built up narrow valley locations shielded from the predominant south westerly winds.

Larger wind turbines may either be associated with industrial developments, or as an often local or community owned commercial project. Either type of project will require access to the MV (11 to 33,000 volt) grid network, and be in an area where the windspeed is in excess of 6 metres per second. Such sites are likely to exist in the wider valley complexes in the north, around Hirwaun, or south of Pontypridd, or in the more exposed upland areas. Wind turbines associated with industrial and commercial development are more likely to occur in the former.

PSD

The principles of passive solar design can be adopted on all new development, both domestic and non-residential. Locational guidance is likely to be limited to site specific factors, such as the avoidance of north facing slopes for residential development wherever possible.

5.2 Constraints and opportunities

Photovoltaics

Integration within new build developments offers significant potential for cost reduction. Modules can serve a dual function, and displace expensive cladding, roofing material or glazing material. Glass laminate PV systems can also be attractively employed to provide shading within glazed areas such as atriums, which may otherwise be susceptible to excess solar gain. PV is particularly appropriate for prestige buildings and developments designed to have low energy requirements. Examples of prestige, and building integrated installations are provided within Annex I.

Solar Water Heating

At present the most common application of Solar Water Heating is within the domestic sector. A typical domestic system comprising 4m² of flat plate collector, or 3m² of evacuated tube will deliver around 1400kWh of useful heat per annum. There are currently approximately 91,000 dwellings within the borough, and a simple calculation, based on the assumption of suitability in 50% of cases, suggests that the domestic potential within RCT equates to 63.7GWh of useful heat per annum. The Clear Skies grant scheme has provided a significant boost for domestic Solar Water Heating and over 90% of domestic grant awards have concerned this technology. There have been 288 awards for solar water heating within Wales, however, the number of installations within RCT is unknown.

The most economically effective domestic application for Solar Water Heating is integration within new build housing. Integration at the design stage can significantly reduce the cost of a system, and detailed guidance exists to facilitate this process. A number of Welsh housing associations and local authorities have taken advantage of the 'Solar Water Heating in Social Housing' (SWISH) grant scheme to install a total of 117 new build installations during the lifetime of the project, recipients included a number of RSLs operating within RCT although no SWISH funded installations took place within the borough. A number of installations within social housing have also been funded through the Clear Skies Community strand, again, none are thought to be within RCT.

Solar Water Heating within sheltered accommodation and elderly residential centres provides a particularly good application as such buildings tend to combine fairly high housing / accommodation density with year round above average domestic hot water requirement.

Private new build – Building regulations

'L1A.4 Where technically, environmentally and economically feasible, new dwellings shall incorporate renewable and/or decentralised energy supply systems.'

Proposed building regulations – Consultation Draft July 2004

Private developers have shown little interest in solar water heating to date, however the draft building regulations (July 2004) require that new dwellings meet specified carbon emission targets calculated according to the Standard Assessment Procedure (SAP) methodology. The proposed building regulations encourage, but fall short of requiring, the inclusion of 'low or zero carbon' (LZC) systems, on the grounds that not all LZC systems are currently commercially viable ('although it seems likely that they will become more so as the technology improves and market volumes increase.')

The Standard Assessment Procedure (SAP) calculation methodology specified under the proposed building regulations suggests that solar water heating may provide an increasingly cost effective means of reaching target compliance, particularly in larger properties in off gas areas.

Non-domestic Solar Water Heating is best suited to applications which require significant volumes of low level process heat and/or domestic hot water. As examples, opportunities exist within food processing (particularly dairy farms and dairy processing) and catering operations, and within the leisure, tourism and accommodation sectors.

The proposed building regulations contain provisions in support of renewable energy technologies in non residential buildings. For buildings other than dwellings, it is proposed that, over what might be achieved by a typical package of conventional energy efficiency measures, there should be an additional reduction in carbon emissions of 10%. This 10% can be seen as a "notional" LZC contribution, but leaves the developer to decide how best to achieve the improvement. It could be achieved by:

a. Zero carbon systems like solar water heating,
b. Low carbon systems like CHP,
c. A package of conventional energy efficiency measures with no contribution from LZC systems, or
d. Any combination of these approaches.

This approach is intended to encourage developers to seriously consider LZC systems as part of their overall designs for all new buildings.

Small Hydro

There is a small significant economic and environmental opportunity in the Borough in the exploitation of small hydro. There is some potential, particularly for smaller schemes that may be more attractive for individual landowners and local entrepreneurs than for larger commercial developers. A 50 kW scheme would cost on the range of £60 - £100,000 to develop, and could yield an annual gross income in the region of £9000, and represent a CO2 emissions saving of around 160 tonnes per annum. The main constraint to the development of small hydro is the potential environment effect, particularly the effect on riverine ecology. However, these effects can be mitigated by careful design and use of sensitive construction technique.

Biomass

Biomass energy, particularly for small and medium scale heating projects could present an significant opportunity in the Borough. The local production of wood fuel (chips or pellets) can be carried out by the existing local forestry contracting industry, adding to the long term security of the industry. Wood fuel biomass can now compete economically with oil, and LPG, and can present a real alternative to these fuels for large heat users, such as schools, hospitals and leisure centres. One of the main advantages of local production is that a great proportion of the cost of fuel will circulate within the local community, unlike oil and LPG where all the benefit flows out form the local economy.

District heating schemes based on wood fuel are starting to emerge in Wales and elsewhere in the UK, and could present a significant opportunity in the longer term. The main current constraint is the public acceptance of district heating, and the reluctance of housing developers to take on what they perceive to be an untried and untested technology that adds to the complexity and financial risk of a development.

One potential opportunity for biomass in the Borough is associated with the Forestry Commission's strategy for dealing with large windfarm developments within the forest reserve. One possible outcome could result in the accelerated clear felling of significant areas of upland forestry, which could result in a large supply of biomass fuel which could be used to kickstart the local biomass fuel supply chain.

Electricity generation alone from biomass is currently difficult to justify on economic grounds. One set of circumstances where electricity generation can be more favourable is biomass fuelled CHP, generating electricity and supplying heat to a heat energy intensive industry, such as the dairy and food processing industry.

AD
The UK is bound by the EC Landfill Directive (99/31/EC) which sets mandatory targets to reduce the amount of biodegradable waste going to landfill by 25 % by 2010, 50 % by 2013, and 65 % by 2020. Biodegradable waste includes organic household wastes, and all food waste. It may be composted before either being used as a fertiliser under some circumstance or sent to landfill as an inert substance. Another option is to use the waste as a feedstock for AD, and use the resulting methane as a fuel for electrical generation, producing space or process heat, or as a fuel for transport. Engines converted to liquefied natural gas (LNG) can readily be adapted to use methane, and trials are being undertaken in Europe in this application.

The disposal of food waste is going to be a significant problem for local authorities, the food producing and large food retailing (e.g. supermarkets) industries in the future, and AD could provide an opportunity by producing a value product to offset some of the costs associated with complying with the Landfill Directive.

Wind Clusters
Small wind turbines and wind clusters can present opportunities in a number of ways:

- Allows industry to future proof energy costs, and to offset the costs of the Climate Change Levy. A wind turbine on an industrial estate could provide a significant proportion of the electricity demand, and potentially save 0.43 p/kWh in Climate Change Levy for businesses on the estate
- Community financial participation in renewable energy generation. An example of this is Bro Ddyfi Community Renewables near Machynlleth, where local residents own and operate a 75 kW turbine, and are currently negotiating to own and operate a 500kW turbine. Not only does this directly benefit local small shareholders through dividends, but by the creation of a fund to address energy efficiency and energy poverty in the locality
- Private participation in renewable energy generation with domestic small wind turbines (e.g. the “Swift” turbine)

Swift Wind Turbine

Passive Solar Design
Passive Solar Design offers the potential to achieve energy efficiency savings with very few, and in some cases no, additional capital costs. Paragraph 5.67 of TAN12 states *"Local planning authorities can be influential in encouraging resource efficient site layout and building design which incorporates energy efficient features. Changes in site layout such as building orientation, location on slope and planting can reduce significantly the energy requirements of a typical dwelling through the free ambient sources created by passive solar gain and microclimate improvements."*

Opportunities include:

- The orientation and design of new build housing estates to maximise solar gain
- The orientation and design of commercial buildings to avoid solar overheating (and obviate the need for air conditioning)

Solar estate layout also facilitates the incorporation of active solar technologies such as solar water heating and PV. In the period to 2021 a combination of tightened legislative requirement and reduced cost is likely to make such technologies increasingly attractive to both new build and retro-fit markets. The largest single opportunity for solar design and technologies is linked to the design and construction of new build housing estates, and the council may wish to consider designing policy and guidance to capitalise on this potential.

5.69 SPG may be used to provide more detail on issues related to siting with respect to micro-climate, design for solar heating, orientation with respect to sunlight and shelter from prevailing winds, and use of landscaping. Criteria for development layout could include:
• selecting locations to avoid poor micro-climate (hill crests or frost pockets) and make the most of south facing slopes;
• orientation to enable the majority of housing to face within at least 45 degrees of south to maximise solar gain;
• limiting overshadowing to reduce loss of solar gain (not through loss of trees, but by spacing and location ofbuildings); and
• use of land form and planting to provide shelterbelts and improve energy conservation and use of building form and layout to minimise wind tunnelling and eddying.

Paragraph 5.69, TAN 12, Design, 2002

Energy Efficiency in buildings

'Buildings account for approximately half of UK carbon emissions, and so it is clear that improved standards for new construction and the upgrading of the existing stock present important opportunities to make a significant contribution to achieving the reductions aimed for in the White Paper'

Proposed Building Regulations Consultation Draft July 2004

Good energy efficient design results in better quality buildings which have less environmental impact over their lifetime, are more economical to run, and provide an improved environment for their occupiers. In general terms the council should promote energy efficient design across the range of proposed developments, and wherever possible, should encourage developers to go beyond the current requirements of Building Regulations.

Part L of the Building Regulations (Conservation of Heat and Power) specifies minimal legal requirements for the conservation of heat and power in both residential and non-residential buildings. Building regulations encompass the thermal performance of construction elements, heating systems efficiency, controls, and lighting. As a minimum, local authorities have a general requirement to ensure that development and re-furbishment work complies with current building regulations.

In pursuit of wider sustainability objectives some local authorities issue sustainability checklists, Supplementary Planning Guidance on Sustainable Design, or even specify BREEAM or Ecohomes ratings for new development. An enormous amount of detailed guidance material is available to enable specifiers and developers to examine renewable energy and energy efficiency options and achieve significant energy savings at reasonable cost. There is scope for the council to ensure that opportunities are identified, and where possible implemented, by requiring that development briefs and submissions include detailed consideration of energy conservation and generation issues, and that larger developments include appraisals of the viability of district heating and CHP.

> Redeveloped large urban sites and new urban areas are likely to provide the greatest opportunity for development of combined heat and power. Higher densities and a mix of uses to spread demand over different time periods (such as between industrial & residential or with a major institutional use such as a hospital) can help to ensure full use of heat and therefore the viability of the project.
>
> Paragraph 5.68 Technical Advice Note 12, Design, 2002

The Energy Saving Trust website contains an extensive library of publications under the Energy Efficiency Best Practice in Housing (EEBPH) programme. The Carbon Trust maintains a complementary library, the Energy Efficiency Best Practice Programme detailing best practice across non domestic building types and applications. Further details are provided under the heading ‘design guidance’ below.

6 Design Guidance

Local planning authorities are responsible for preparing design advice for their areas which takes account of national policy guidance and also reflects local context and issues. Advice can be disseminated through UDPs and through a wide range of SPG.

Within TAN 12 paragraph 4.2 specifies that UDPs should provide policies setting out the planning authority’s design expectations. Detailed topic based, area based or site specific design guidance can be usefully addressed through SPG. Local planning authorities may wish to prepare an overall design statement which states the authority’s vision, design process, design quality expectation, alternatively types of SPG relating to design issues can be addressed individually. In this case the authority may wish to consider development or planning briefs to explain how UDP policies should apply to a specific site. Such guidance will set out the broad vision for a development but may also usefully state objectives demonstrating how the UDP design policies could be applied to the site; this could include an outline of sustainable energy constraints and opportunities and a requirement to consider specific energy appraisals in some cases.

Alternatively, if a topic based approach is adopted energy conservation and generation may be usefully contained within a specific SPG / design guidance document. Within their 1994 draft deposit UDP Powys County Council has indicated plans to produce such guidance. A more specific existing example of this approach is provided by *Cardiff County Council (1994) Supplementary Planning Guidance* 'Energy Efficient Design for New Residential Development'

UDP policies and SPG should ensure that potential applicants are in a position to appreciate the standard of design that is likely to be permitted by a local planning authority. Policies which are clear in promoting high levels of energy efficiency and/ or incorporation of sustainable energy technologies will encourage applicants to incorporate such features.

High quality design and best practice information is freely available from Action Energy / Carbon Trust and the Energy Saving Trust, and it is recommended that this information be used as the basis for design guidance at the Borough level. Significant publications are detailed below:

Renewables

- Draft 'Guide to the Integration of Renewables into Buildings' produced for the DTI and BRE,
- 'Integrating renewable energy into new developments: Toolkit for planners, developers and consultants' Faber Maunsell on behalf of London Renewables, September 2004 www.london.gov.uk/mayor/environment/energy/london_renew.jsp
- Renewable Energy Sources for Homes in Rural Environments ISBN:CE70 30 March 2004 www.est.org.uk/bestpractice/publications/detail.jsp?pk=646
- Renewable Energy Sources for Homes in Urban Environments www.est.org.uk/bestpractice/publications/detail.jsp?pk=645
- Renewable Energy in Housing: Case Studies Four Studies New Build Housing www.est.org.uk/bestpractice/publications/detail.jsp?pk=459

Energy Efficiency – Dwellings

According to the Building Research Establishment dwellings account for 29% of total UK energy consumption and generate approximately 38 million tonnes of carbon emissions per year (Building Research Establishment, 2000)

Technical Advice Note 12: Design (2002), includes detailed advice for local authorities on energy efficient homes and sustainable housing techniques. Paragraph 5.52 states that Local planning policies and guidance in relation to housing design should aim to: promote energy efficiency in new housing. In addition to the resources found within TAN12 there are extensive external resources available to inform such policies.

Energy Efficiency Best Practice in Housing (EEBPH) case studies and guidance can be found on the website of the Energy Saving Trust www.est.org.uk/bestpractice/ . The site aims to provide a source of tools and training for all stakeholders involved in the design, construction and refurbishment of domestic housing in the UK. In addition the EEBPH programme has established energy efficiency standards for domestic housing which exceed the requirements of current building regulations. These standards provide a valuable resource for local authorities, housing associations and developers who may wish to specify highly energy efficient dwellings.

- An introduction to the EEBPH programme can be found at www.est.org.uk/bestpractice/publications/detail.jsp?pk=1395
- An introductory information leaflet 'Energy efficiency standards - for new and existing dwellings (GIL 72)' can be found at www.est.org.uk/bestpractice/publications/detail.jsp?pk=38

PSD

- DETR Energy Efficiency Best Practice Programme General Information Report 27 Passive Solar Estate Layout
- Good Practice Guide 73 Energy Efficient House Design – Exploiting Solar Energy Littlefair et al. Environmental Site Layout Planning 2000
- Planning for Passive Solar Design (ADH010). This guide discusses the techniques and principles of passive solar design (PSD) as they apply to domestic buildings and other building types. Available from www.thecarbontrust.co.uk/energy/pages/publication

Buildings other than dwellings

Energy Efficiency Best Practice guidance documents are also available for a wide range of buildings and applications. An online library of detailed energy efficiency advice for non-residential buildings can be found on the website of the Carbon Trust www.thecarbontrust.co.uk/energy/pages/publication. Specific guidance is available by sector and by building type. It is likely that a best practice guide will exist for the large majority of proposed developments.

BREEAM – The Building Research Establishment's (BRE) Environmental Assessment Method
BREEAM, including its residential equivalent EcoHomes, is a voluntary scheme that rewards those developers of commercial and residential property who improve environmental performance through good design. BREEAM goes beyond Building Regulation requirements in order to encourage best practice and includes planning control issues such as building location, transport issues, ecology, health and building design. BREEAM results in the award of a certificate and detailed report and gives marketing advantages through a credible label promising energy efficiency, lower running costs and a healthy environment.
BREEAM is a useful benchmark environmental assessment that could be used in support of planning applications.

www.bre.co.uk

7 Planning Policy

Planning Policy Wales 2002 (PPW)

PPW provides a comprehensive review of planning policy as it applies to Wales. It initially sets out the context of planning in Wales followed by the main policy objectives and a description of the planning system and procedures. It then considers a range of subjects and provides advice on how these should be treated both in the Unitary Development Plan process and in the context of development control.

Chapter 2 is entitled Planning for Sustainability and emphasises that this concept is one of the fundamental principles underpinning the planning system. Indeed, paragraph 2.1.3 advises that the Assembly government will place sustainability at the heart of its decision making process which will be achieved through its strategic policies, PPW being one of these.

Paragraph 2.2.1 sets out the Assembly Government's principles for planning policy for sustainable development which include among others:

- Taking a long term perspective to safeguard interests of future generations, whilst at the same time meeting the needs of people today;
- Respect for environmental limits, so that resources are not irrecoverably depleted or the environment irreversibly damaged. This means, for example, contribution to climate protection, protecting and enhancing biodiversity, minimising harmful emissions, and promoting sustainable use of natural resources;
- Using scientific knowledge to aid decision-making.

Paragraph 2.3.2 outlines the key policy objectives and advises that planning policies and proposals should, among other things, "…*contribute to climate protection by encouraging land uses that result in reduced emissions of greenhouse gases, in particular energy-efficient development, and promoting the use of energy from renewable resources*." and "*minimise the use of non-renewable resources, and, where it is judged necessary to use them, maximise efficiencies in their use. The use of renewable resources and of sustainably-produced materials from local sources should be encouraged.*"

Section 12.8 considers sustainable energy and this initially reviews the UK Government commitments to renewable energy. It states in paragraph 12.8.4 that the Assembly Government intends to encourage the development of the renewables sector, and promote energy efficiency and conservation in an economic, environmentally sound and socially acceptable way.

In paragraph 12.8.9 the Assembly Government advises that Local Planning authorities should facilitate the development of all forms of renewable energy where they are environmentally and socially acceptable. It emphasises that development control decisions should be "…*consistent with national and international climate change obligations, including contribution to renewable energy targets, having regard to emerging national and international policy of the levels of renewable energy required and on appropriate technologies… and …the environmental, economic and social opportunities that the use of renewable energy resources can make to wider planning goals and* *objectives and the delivery of renewable energy targets"* should be recognised. Notwithstanding this, PPW also seeks to "….*ensure that international and national statutory obligations to protect designated areas, species and habitats and the historic environment are protected from inappropriate development and ensure that environmental effects on local communities are minimised.*"

Section 12.9 looks at how sustainable energy should be incorporated into the UDPs and paragraph 12.9.4 considers wind energy specifically where it indicates, among other matters, that the large scale deployment of renewable energy may not be appropriate in nationally designated areas.

Paragraph 12.10.2 advises that "…*Whilst having regard to the contribution of renewable energy use to wider planning goals such as the diversification of the rural economy, local planning authorities should ensure that any environmental effects on local communities are minimised, to safeguard the quality of life for existing and future generations.*"

Technical Advice Note (Wales) 8, 1996 (TAN8)

This provides the primary source of Government guidance on the issue of renewable energy as it relates to Wales. Paragraph 3 states that "…*The main advantages of using renewable energy are the substitution of valuable energy sources of finite supply, and the limiting of emissions of greenhouse gasses*."

Annex A specifically concerns wind energy, and paragraph A.2 sets out the distinctive features of wind turbines which should be taken into account in planning and development control. These are:

- the need to site machines in open, exposed locations, with annual wind speeds generally of more than 7.5 metres per second at hub height, often in rural areas, which may also be in attractive landscapes;
- the nature of noise emissions from turbines;
- the movement of blades; and
- consideration relating to safety and electro-magnetic interference.

The implications of these features for planning policy are subsequently outlined, with reference to specific technical and environmental, requirements within Annex A.

TAN 5 Nature Conservation and Planning, 1996

This provides guidance on development in relation to internationally, nationally or locally designated areas of nature conservation interest. However, it also recognises, in paragraph 30, that "…*Certain plants and animals, including all birds, are protected*".. and that these… "*are not confined to designated areas*." Bats and badgers enjoy additional legal protection.

TAN 11, Noise, 1997

Whilst paragraph B19 of Annex B to this advice states that detailed guidance on noise from wind turbines is contained within TAN 8, some parts of this advice are useful in the context of the potential renewable or sustainable energy proposals. Paragraph 8 requires that local planning authorities "… *must ensure that noise generating development does not cause an unacceptable degree of disturbance.*" Paragraph 13 suggests that "*There may be circumstances when it is acceptable, or even desirable in order to meet other planning objectives, to allow noise generating activities on land near or adjoining a noise-sensitive development*." but that the introduction of noise generating activities in some rural areas, where background noise levels may be very low, may be especially disruptive.

TAN 12, Design, 2002

The TAN refers to design as the relationships between all elements of the built and natural environment and specifically refers to the efficient use of energy and natural resources. UDPs should provide policies setting out the planning authority's design expectations which reflect national policies set out in the TAN to secure good quality design in the local context.

Paragraph 3.1 of TAN 12 states that *"At the heart of the design process is the requirement to contribute to the objectives of sustainable development …"* whilst paragraph 3.5 states that *"The planning system has a responsibility to be pro-active in raising the standard of design and in raising awareness of design issues amongst the general public and the private sector…*" And suggests that this is achievable in every area of planning activity; through mechanisms including development plans and supplementary planning guidance (SPG).

Draft Technical Advice Note 8: 2004

The draft TAN 8 was issued for consultation simultaneously with the interim Ministerial Statement on Planning Policy (MIPPS) 2004. The TAN8 refers to the 4TWh target expressed in the draft MIPPS and goes on to state that 20% of electricity should come from renewables by 2020, as contained in the Energy White Paper. However, the TAN has an expected time horizon of 2010 and identifies that, in order to meet the target in this time frame, the majority of renewable energy will come from established and scalable technologies, thus the TAN recognises that 80% of this will be derived from on-shore wind energy projects.

As a consequence, the Assembly engaged consultants to assess the spatial implications. This was basically a GIS sieve mapping exercise which considered a range of constraints to wind energy development, both environmental (such as international and national nature conservation and landscape designations) and technical (including wind speed, gird infrastructure [existing and potentially planned], Ministry of Defence and civil air safeguarding). This process identified areas in Wales, known as Strategic Areas of Search, where these potential constraints were minimal for large scale projects (defined as 25MW or larger schemes in paragraph 32 and in the MIPPS). In the case of Rhondda

Cynon Taff, draft Strategic Search Area F includes the western flanks of the County Borough from Gilfach Goch in the south to the a465 in the north and as far eastwards as Mountain Ash. Consequently the draft TAN8 has considerable implications for wind energy development in the County Borough.

The projected date for the finalisation and issuance of the revised TAN8 is July 2005.

Local Planning Policy Guidance

Rhondda Cynon Taff County Borough Council is a relatively new administrative boundary, created in 1996 when local government was reorganised. Consequently, the Council development plan comprises a structure plan and three local plans, including:

- Mid Glamorgan (Rhondda Cynon Taff County Borough) Replacement Structure Plan 1996 – 2006
- Rhondda Cynon Taff (Cynon Valley) Local Plan 1996 – 2006
- Rhondda Local Plan 1991 – 2006
- Rhondda Cynon Taff (Taff Ely) Local Plan 1991 – 2006

Mid Glamorgan (Rhonddda Cynon Taff County Borough) Replacement Structure Plan 1996 – 2006

The Policies within the Structure Plan that are pertinent to renewable energy and energy efficiency include:

Policy U1
The development of renewable energy facilities, including those for wind power, will not be permitted where such development would result in unacceptable levels of damage or disturbance to sites and their settings recognised as having national or international nature conservation, archaeological, architectural or historic importance.

Policy U2
Proposals for the development of renewable energy facilities and associated development, including those for wind power, in areas other than those referred to in U1, will be permitted where:

- The proposal can be located to reduce damage or disturbance to the environment to acceptable levels, particularly the level of visual intrusion likely to result from the proposal taking into account the cumulative effects arising from other existing and approved schemes in the area.
- Conflicts with surrounding land uses can be reduced to acceptable levels, particularly where the amenity of residential areas in the locality is likely to be affected adversely.
- Provisions for the reinstatement of the site when it ceases to operate are considered adequate
- The availability of identified mineral resources or reserves is not sterilised.

Policies relating to the protection of the environment are contained in Policies EV1 to EV14.

Rhondda Cynon Taff (Cynon Valley) Local Plan 1996 – 2006

Policy ENV1 relates to general development control criteria, whilst ENV2 controls development outside the development limits. Renewable energy is not listed as a development that may be permissible. Policy ENV3 pertains to the protection of the nationally significant Brecon Beacons National Park and ENV6 requires that development should include the provision of landscaping and habitat benefits. Policy ENV7 looks to developers to provide associated environmental and community benefits, very much in line with the draft TAN8.

Policy ENV21, the sole policy on renewable energy, states that proposals will be permitted where the cumulative effects of schemes would not harm the landscape and that proposals should ensure the minimisation of impacts of all on site ancillary infrastructure, such as site access tracks.

Policy ENV22 aims to encourage energy conservation through favouring development proposals that reduce car use and promote public transport or more sustainable modes of transport. Policy ENV23 supports proposals that incorporate energy efficient designs where appropriate to the building's setting.

Lastly Policy Proposals ENVP1 and ENVP2 relate to the protection of Special Landscape Areas and Green Wedges respectively.

Rhondda Local Plan 1991 – 2006

The sole policy in the Plan on renewable energy and energy conservation is Policy PU10: Wind Energy, which states that proposal for wind turbines will only be permitted where they can demonstrate that: they will not form an unacceptable intrusion on the intrinsic landscape quality; access is ensured without compromising highway safety or damage to the environment; they will not have an unacceptable detrimental effect on any scheduled ancient monument, National Nature Reserve, SSSI or any other national, regionally or local environmental designation; amenities of neighbouring occupiers will be unacceptably harmed; and any proposals to reduce environmental impact are included in the schemes.

Policies ENV1 to ENV22 have a bearing on development that may affect the landscape, countryside or built environment.

Rhondda Cynon Taff (Taff Ely) Local Plan 1991 – 2006

Policy u6 states that wind energy proposals should not impact unacceptably on:

- the visual qualities of the landscape,
- the use of land for agriculture, forestry or telecommunications,
- the value of land for archaeology, history, nature, conservation or local amenity,
- residential amenities and
- the water environment.

Removal of all redundant plant will be required.

Policy u7 relates to other forms of renewable energy generation and that they should:

- minimise the impacts on the environment and residential amenity,
- have satisfactory access,
- be removed when redundant,
- not be sited on listed buildings or conservation areas.

Many of the Environment Policies in en1 to en59 have an influence on renewable energy and energy efficiency schemes.

The Rhondda Cynon Taff County Borough Council Development Plan in relation to emerging Planning Policy Guidance in Wales

From a brief review of the above Policies at the structure and local plan level it is clear that they provide consistently for the protection of the landscape, ecology and countryside, and hence heavily constrain the development of sizeable renewable energy schemes. Many of the Policies referenced above could be cited in refusing renewable energy developments as they are, by their very nature, more likely to be situated in the countryside.

Such current development plan policies could be criticised under the revised TAN8 as placing too stringent controls on renewable energy, and particularly wind energy, in light of the designation of parts of the County Borough as a Strategic Search Area suitable for wind energy developments.

Several of the existing Policies provide suitable guidance on maximising the potential environmental enhancement opportunities, ensuring community benefits, and building energy efficiency measures and design specifications into new proposals. Such Policies could be augmented with more recent guidance on the technologies involved.

8 Recommendations for new LDP

Climate change has been referred to as the ‘single most important threat facing mankind’ and has rightly resulted in an increased emphasis upon energy issues at a national and international level. Local authorities have an important role to play and have been encouraged to proactively engage in promoting energy conservation and renewable energy generation.

Any LDP in Wales should reflect the overarching policy guidance set out in Planning Policy Wales and any relevant Technical Advice Note (TAN), which in the case of energy efficiency and renewable energy is TAN8. This is because the national planning policies directly encourage the means to addressing climate change issues. However, the Consultation Draft of TAN8 issued in late 2004 concentrated on large onshore wind development, and although supportive of other technologies gave little by way of specific guidance. The Adopted TAN8, due to be issued in mid 2005, may give further guidance, but the recommendations in this report are given in the light of the Consultation Draft.

Although the terms of reference for this study specifically preclude large scale wind development, it must be highlighted that the Draft TAN8 and the Draft MIPPS on renewable energy (D/01/04) place an onus on local authorities to formulate policies for such developments within any strategic areas lying within their area:

> *"…and local planning authorities are encouraged to undertake more detailed mapping and landscape assessment work in order to formulate policies for on shore wind power developments within the areas identified in the strategic assessment. These policies should be incorporated into development plans…..as appropriate."*

The new LDP should reflect the positive nature of the Draft TAN 8 by providing encouragement to the general public, industry and housing sectors to take the matter of energy efficiency and clean energy production seriously, and not allowing economic consideration to be the ultimate design criteria. Policies should also give positive encouragement to such developments, and not allow other environmental considerations to have a disproportionate weight in decision making.

The importance attached to promoting energy conservation and renewable energy generation could be reflected in appropriately formulated strategic aims within the LDP designed to clearly convey

i) The intention to promote energy efficiency and energy conservation
ii) The intention to encourage appropriate renewable energy generation (including heat)

On the basis of these stated aims the LDP could incorporate a clear and concise strategic policy statement on energy conservation and generation. An example of such a policy is attached below

UDP SP12 - ENERGY CONSERVATION & GENERATION
A. ALL DEVELOPMENTS SHOULD DEMONSTRATE THAT ENERGY CONSERVATION AND EFFICIENCY MEASURES HAVE BEEN CONSIDERED AND, WHERE PRACTICABLE, INCORPORATED.
B. APPROPRIATE PROPOSALS FOR ENERGY GENERATION FROM RENEWABLE SOURCES WILL BE APPROVED PROVIDING THAT THEY MEET THE LANDSCAPE, ENVIRONMENTAL, AMENITY AND OTHER REQUIREMENTS SET OUT IN THE OTHER POLICIES OF THIS PLAN.

Powys County Council UDP 2001-2016 Deposit Draft, October 2004

The formulation arrived at by Powys County Council has two distinct parts. Part A serves to outline energy conservation and efficiency as a cross cutting policy theme to be incorporated across the development plan. Accordingly, energy issues are a component part of generic policies, environment policies, housing, economy, retail and commerce, transport and tourism, recreation and leisure, community services, minerals and waste and general development policies.

Part B serves as the basis for detailed policy within a specific energy chapter contained within part 2 of the draft deposit unitary development plan. This chapter outlines the legislative and environmental background before moving on to policies largely related to specific technology and types of renewable energy generation.

Whilst we would recommend that RCT adopt a similar approach to Powys in establishing energy issues as a cross cutting theme within the development plan, the scope and scale of this report have largely restricted us to addressing the specific requirements specified by RCT and concentrating on the specific technology-based issues addressed by Powys CC within section 2 of their draft development plan.

A number of general recommendations are discussed below together with possible criteria for each of the major technologies and a number of suggestions for a more robust approach in certain key sectors.

General Recommendations

The council could adopt specific targets and policies stemming from a commitment to promoting energy conservation, energy efficiency and appropriate renewable energy development, and a willingness to translate national commitments into local reality. These could include:

- A commitment to becoming carbon neutral in terms of RCT buildings and resources
- RCT sourcing green energy through a green energy supply company i.e Good Energy
- Identification of large electricity and heat demand centres – with a view to supply from larger installations i.e. Biomass
- Following a more detailed assessment of resource and opportunity the Council could establish targets for specific renewable energy technologies (and perhaps applications) in the period to 2010 and 2021.
- The draft building regulations (2005) will encourage consideration of Low and Zero Carbon (LZC) technologies within new build non-residential developments by requiring a ‘notional’ LZC contribution of 10% additional reduction in carbon emissions. Building regulations allow this reduction to be met by renewable energy provision, combined heat and power or additional energy efficiency measures. The County Borough may wish to consider requiring a minimum renewable energy contribution for specific types of new development such as office, industrial and retail buildings.

Solar Photovoltaics (PV)

The draft TAN 8 indicates that local planning authorities will need to ‘very clearly justify any refusal of planning permission for PV installations’. In general terms PV installations should be supported other than in circumstances where visual impact is considered unacceptable.

- Within the LDP the council may wish to deem PV as permitted development unless the proposed installation is considered to have a critically damaging impact upon a listed building, ancient monument or a conservation area vista.
- Specific guidance may be provided outside the LDP within Design Guidance or Supplementary Planning Guidance on Solar technologies.
- Wherever possible the LDP should require that new build housing developments should be oriented South in line with the principles of Passive Solar Design. This will facilitate the incorporation of PV and solar water heating technology, either as an integral part of the development, or as a retro-fit at a later stage.
- In many cases PV installations may be considered to fall within the category of permitted development. RCT may wish to clarify their interpretation of the General Permitted Development Order, particularly in regard to definition of 'material alteration' of the shape of the dwelling house/ plane of the existing roof, and develop criteria for establishing where planning permission is required.
- There is scope for RCT to clarify criteria for possible refusal by specifying reasons with reference to listed buildings, ancient monuments or conservation area vistas.

Solar Water Heating

The draft TAN8 is strongly supportive of solar water heating, stating that 'Other than in circumstances where visual impact is critically damaging to a listed building, ancient monument or a conservation area vista, proposals for appropriately designed solar water heating should be supported'.

- Within the LDP the council may wish to express strong support for PV and indicate that schemes will be approved and supported unless the proposed installation is considered to have a critically damaging impact upon a listed building, ancient monument or a conservation area vista.
- Specific guidance may be provided outside the LDP within Design Guidance Supplementary Planning Guidance incorporating Solar technologies.
- Wherever possible the LDP should require that new build housing developments should be oriented South in line with the principles of Passive Solar Design. This will facilitate the incorporation of PV and solar water heating technology, either as an integral part of the development, or as a retro-fit at a later stage.
- In many cases SWH installations may be considered to fall within the category of permitted development. RCT may wish to clarify their interpretation of the General Permitted Development Order, particularly in regard to definition of 'material alteration' of the shape of the dwelling house/ plane of the existing roof, and the County Borough may wish to develop criteria for establishing where planning permission is required.
- There is scope for RCT to clarify criteria for possible refusal by specifying reasons with reference to listed buildings, ancient monuments or conservation area vistas.
- RCT may wish to consider a requirement that certain types of development with a large and/or seasonal hot water demand provide a minimum of 10% of their energy demand from renewable sources. Suitable developments may include hotels, elderly residential and nursing homes, high density student accommodation, tourism and leisure centres.

Small Hydro

Small Hydro power is the most site specific of the small renewable energy technologies. Planning officers are likely to operate in close co-operation with the Environment Agency and conservation bodies. There will be a considerable amount of shared interest and responsibility and therefore a highly co-operative approach from an early stage is likely to be beneficial to all parties.

- Within the LDP the council may wish to express strong support for small hydro development provided that Environment Agency requirements are met. In practice the Environment agency is likely to take a lead on the identification and assessment of technical and environmental criteria, although planning officers may lead in regard to issues including;
    - i) Noise
    - ii) Recreation and public access
    - iii) Disruption due to construction and operational procedures
    - iv) Visual impact in terms of siting and landscape considerations

POLICY E6 - HYDRO-POWER
THE COUNCIL WILL APPROVE APPLICATIONS FOR HYDRO-POWER SCHEMES PROVIDING THAT:
1. THERE WOULD BE NO SIGNIFICANT THREAT TO HABITATS OR SPECIES OF INTERNATIONAL, NATIONAL OR LOCAL IMPORTANCE OR FISH MIGRATORY ROUTES OR BREEDING AREAS;
2. THE PHYSICAL FEATURES ASSOCIATED WITH THE DEVELOPMENT ARE SO SITED AND DESIGNED AS TO FIT ADEQUATELY INTO THE LANDSCAPE/TOWNSCAPE AND SHALL NOT UNACCEPTABLY AFFECT ARCHAEOLOGICAL SITES;
3. THE PROPOSAL WOULD NOT EXACERBATE FLOODING OR THE RISK OF FLOODING IN THE VICINITY; AND
4. THERE WOULD BE NO SIGNIFICANTLY DETRIMENTAL IMPACT UPON PUBLICLY ACCESSIBLE OR VIEWABLE FEATURES OF LANDSCAPE IMPORTANCE (E.G. WATERFALLS) THROUGH THE REDUCTION IN THE FLOW OF WATER.
5. APPLICANTS ARE ABLE TO DEMONSTRATE THROUGH LAND MANAGEMENT SCHEMES THAT THERE WOULD BE ADEQUATE MITIGATION OR COMPENSATION FOR ANY ADVERSE IMPACT ON ENVIRONMENTAL QUALITY, WILDLIFE HABITATS OR HERITAGE FEATURES.

Powys County Council UDP 2001-2016 Deposit Draft, October 2004

- The draft TAN8 mentions the possibility of local planning authorities considering ways in which local planning authorities may encourage investment in small hydro schemes. One way to do this might be to consider allowing electricity generated from new small hydro to ‘offset’ a potential 10% renewable energy requirement of certain types of new development

Biomass Combustion

In addition to environmental benefits linked to carbon neutrality, biomass installations can have a positive impact on the local economy and the supply of biomass fuel can secure a long term income for farmers, forestry owners, contractors and transport workers. The planning implications for large scale Biomass and biomass combined heat and power plants will differ from the limited implications of small scale (below 5MW) biomass schemes.

Small Scale Biomass

- Within the LDP the council may wish to express strong support for small biomass heating schemes throughout the County Borough and indicate that such schemes will be supported and approved provided that the following criteria can be met:
  i. Visual intrusion is reasonable, and does not have a critically damaging impact upon the environment
  ii. The development does not have a critically damaging impact upon important archaeological, historic, ecological or conservation sites.
  iii. Access to the site is reasonable in terms of the frequency and method of fuel delivery, and does not prejudice highway safety
  iv. The fuel source is within 15 km of the point of use, unless sufficient justification for a greater distance can be shown.
  v. Development does not significantly impact on the amenity of residents in terms of noise, dust, smell or fumes
  vi. Emissions to the air, ground or water are acceptable
- The LDP may wish to consider a requirement that approval for certain types of development conditional on meeting a minimum of 10% energy demand for proposed development from site linked renewable energy sources.
- The LDP may wish to consider a requirement that, unless a compelling reason is provided ,certain types of development should incorporate low or zero carbon heating systems such as CHP or biomass district heating. These could include:
  i) High density housing or accommodation developments
  ii) Leisure centres
  iii) Hotels
  iv) Hospitals

Large Scale Biomass

Within the LDP the council may wish to express support for larger (in excess of 1MW) biomass schemes, provided that:

i. Visual intrusion is reasonable, and does not have a critically damaging impact upon the environment.
ii. The development does not have a critically damaging impact upon important archaeological, historic, ecological or conservation sites.
iii. The majority of fuel is to be sustainably sourced from within a 40 mile radius of the proposed development.
iv. Noise from traffic and plant operations accords complies with relevant standards (BS 4142 – industrial development may be appropriate).

v. Traffic to and from the site is acceptable and appropriate to the area and does not prejudice highway safety. Development does not significantly impact on the amenity of residents in terms of noise, dust, smell or fumes.
vi. Emissions to the air, ground or water are acceptable.
vii. Additional weight should be given to developments that are able to demonstrate that heat energy is utilised in addition to the generation of electricity.

Anaerobic Digestion

Anaerobic Digestion can provide a convenient method of waste treatment for some materials. Animal waste, sewage sludge and agricultural, household and industrial residues can all be used as feedstock.

Within the LDP the council may wish to indicate that AD facilities will be supported and approved provided that:

i) Visual intrusion is reasonable, and does not have a critically damaging impact upon the environment.
ii) Noise from traffic and plant operations accords complies with relevant standards (BS 4142 – industrial development may be appropriate),
iii) The plant does not create unacceptable levels of odour.
iv) Traffic to and from the site is acceptable and appropriate to the area.
v) The development will not have an unacceptable impact on the amenities of neighbouring residents in terms of noise, dust, smell or fumes.
vi) Additonal weight should be given to developments that are able to demonstrate that heat energy is utilised in addition to the generation of electricity.

The Council may wish to consider a requirement that development proposals for large sewage treatment works and food processing plant include detailed consideration of AD, including, where appropriate, the potential to supply methane fuel to existing or planned nearby heat loads.

The Council may wish to consider that plans for disposal of waste, including AD and the use of resultant gas, for on site energy are a condition for granting planning permission for new large food retailing outlets.

Small Wind Clusters

The Council may wish to consider giving extra weight in planning applications for industrial developments that include the provision of small and medium sized wind turbines for on site power.

The Council may wish to consider very small turbines (e.g Swift turbines) mounted on a dwelling as permitted development in much the same way as television aerials.

In considering the environmental information that is required to accompany a planning application, the LDP should take into account the scale of the development.

Passive Solar Design
In accordance with the polices set out within TAN 12 and the draft TAN 8 the County Borough may wish to incorporate strong support for PSD within the LDP and refer to the information available within TAN12 and best practice guidance documents in developing detailed policies and/or SPG in support of these principles.

Energy Efficiency in Buildings
The LDP arrived at by the County Borough should provide policies setting out the planning authority's design expectations which reflect national policies set out in the TAN to secure good quality design in the local context. LDP policies and SPG should ensure that potential applicants are in a position to appreciate the standard of design that is likely to be permitted by a local planning authority. Policies which are clear in promoting high levels of energy efficiency and/ or incorporation of sustainable energy technologies will encourage applicants to incorporate such features.

- The LDP should strongly encourage sustainable building design, and energy conservation generation should be a central consideration.
- The County Borough may wish to adopt a generic policy relating to energy conservation and generation, or more specifically energy conservation and generation in buildings.
- The detailed guidance information available from the Energy Efficiency best Practice programmes should be referred to in developing Design Guidance and/or SPG.

Dwellings
The council may wish to develop a sustainable housing policy, which, amongst considerations might include statements outlining the Council's intention to maximise energy conservation and minimise the environmental impact of new housing. Such a policy could include statements in favour of:

- The use of solar energy in terms of PSD and the inclusion of solar panels/modules or other renewable energy technologies provided these comply with the criteria outlined for each technology
- High levels of insulation, passive ventilation, and the potential for combined heat and power.
- The detailed guidance information available from the Energy Efficiency best Practice programmes should be referred to in developing Design Guidance and/or SPG.

Annex 1

Examples of Best Practice: Technology

Photovoltaics

County Hall, Llandrindod Wells, Powys

A photovoltaic (PV) array of 10.08 kWp was installed on a largely unshaded, south-facing roof on the existing headquarters building of the municipality. The electrical demands of a modern office fit well with the outputs from a PV array and the public building provides a good opportunity for demonstration and promotion of the technology. A digital display in the foyer of the building assists with the public understanding of the potential of PV.

Powys County Council, St John's Offices, Llandrindod Wells, LD1 5ES, Wales, UK Andyb@powys.gov.uk

Solar Thermal

Plas Crug solar water heating retro-fit

Prior to the solar retrofit project, the pool and leisure centre were heated by natural gas boilers, and electricity was used for pumping, ventilation and lighting. Total energy costs were somewhere between £45,000 and £50,000 annum, making it the Council's single biggest energy user.

Typically, solar collectors work best when tilted at a 35° angle, facing south. However, swimming pool absorbers can be installed on horizontal surfaces with only small loss in efficiency, and the leisure centre roof, offering a flat, shade free area of 600m2, provided an ideal surface for the installation of such a system.

Solar absorber units, supplied by Aquasolar, were installed on 45 per cent of the roof surface, providing an absorber area of $270m^2$, while leaving a generous portion of the roof uncovered to allow for access. The capital costs for the collector system were approximately £25,000.
Collection of useful energy on the leisure centre roof totalled 17,000 kWh during the 4 months from June to September 1999.

Biomass combustion

Llanwddyn Woodfuel Project

Llanwddyn is an isolated village at the foot of Lake Vyrnwy in North Powys. The main village consists of about 50 or so houses – 37 of which are in the Abertridwr Estate

A woodfuel boiler and district heating main has been installed to service a school. community centre and 32 surrounding houses The boiler is rated at 500 kW output for fuel at 45% moisture - 630 kW for fuel at 20% moisture. Woodchip for the system is sourced from the surrounding forestry.

The project provides significant opportunities for direct economic benefits to the local economy.

- The partnership has placed the construction contract with a local consortium, using local labour and skills.
- The administration and, fuel and O & M contracts have been placed locally.
- All revenue from the project will be retained within the local economy
- The woodfuel boiler will provide sustainable and affordable heating
- Provision of a demonstration project and educational resource for the development of further woodfuel heating projects

Dulas Wood Energy, Unit 1 Dyfi Eco Park, Machynlleth, Powys, SY20 8AX
Russel.jones@dulas.org.uk

Anaerobic Digestion

South Shropshire Bio-waste Digester (The Ludlow project)

Greenfinch Ltd

The South Shropshire Bio-waste Digester was a joint demonstration project between South Shropshire District Council and AD specialists Greenfinch. The plant operated between October 1999 and April 2001.

The digester is fed via kerbside collection of source-segregated household kitchen waste and garden waste from 1200 households in the Ludlow area of South Shropshire.and provided both renewable electricity & surplus heat. The end process digestate was used as biofertiliser for local agriculture.

- **Input – Biowaste: 5,000 tpa.**
- **Output – Solid Biofertiliser: 1,000 tpa.**
- **Output – Liquid Biofertiliser: 3,100 tpa.**
- **Output – Biogas: 900 tpa.**
- **Surplus Electricity – 1,400 MW.hrs/yr.**
- **Surplus Heat – 2,000 MW.hrs/yr.**

Small Wind Clusters

Bro Dyfi Community Turbine

Bro Dyfi Community Renewables is a community-wind turbine co-operative, owning a 75kW wind turbine, which produces electricity that is sold to the Centre for Alternative Technology (CAT) under a power purchase agreement.
CAT purchases all the power generated (around 163 MWh each year), using about 20% of it to supply its site with electricity and hot water and exporting the rest to the local grid. The turbine is supplying the equivalent of 45 houses with electricity.
The electricity generated will slow climate change by preventing the release into the atmosphere of 70 tonnes of carbon dioxide every year.
The co-operative also uses 30% of profit generated to promote energy efficiency and intends to save an additional 345 tonnes of carbon annually by reducing local energy use.

The project provides significant opportunities for direct economic benefits to the Dyfi Valley economy.

- The work undertaken in developing the project has been carried out by members of the local community.

- The partnership has placed the construction contract with a local consortium, using local labour and skills.
- Many of the people involved in the project construction, planning, finance and legal matters and the landowner agreed for some or all of their work to be paid in shares in the project.
- The project has invested about £55,000 into the local economy (70% of the total project cost).
- The administration and O & M contracts have been placed locally.
- All revenue from the project will be retained within the local economy
- The wind turbine provides renewable electricity to the Centre for Alternative Technology, where the power demand from visitors' activities has outstripped the CAT's own internal supplies
- Provision of an additional demonstration turbine and educational resource for the public activities of Centre for Alternative Technology
- Provision of an information display detailing the wind turbine project and its output
- The project is a community-owned scheme where each shareholder has one voting share irrespective of the amount of investment, thus encouraging local responsibility
- Approximately 30% of the annual project profit will go into a community energy fund for energy efficiency measures

Energy Efficiency in Buildings other than dwellings

Dyfi Eco Park

Unit 1, Dulas offices

Units 4 and 5

Dulas is based in Unit 1 at Dyfi Eco Park in Machynlleth. This building is one of the most energy efficient office and factory units in Britain. Dyfi Eco Park itself is a small, rural, light industry park developed by the Welsh Development Agency on a reclaimed site. Buildings on the park are based around the principles of green/sustainable design and low-energy construction. The units have been built from locally-sourced materials with high energy efficiency.The award winning development represents an exemplar in energy and environmental performance.

Unit 1 was the first of a series of one and two storey light industrial and office units at this brownfield site in West Wales. Built to an environmentally sustainable brief, the unit and the park itself all achieve a maximum as assessed under B.R.E.E.A.M 5/93.

The total energy use/CO_2 emissions are only 25% of B.R.E.C.S.U Best Practice targets.

Healthy and sustainable materials and finishes were used throughout, and the results of a two year objective/subject assessment by the University of East London confirmed in practice the initially predicted low running costs.Construction costs for Unit 1, a fully fitted two storey office and small assembly area, were only 25% above the W.D.A's allowance for a typical single storey industrial unit.

In 1997, Unit 1 was the first recipient of the Association for Environment Conscious Building's (ACEB) 'Sustainable Projects Endorsement Certificate'.The unit occupied by Dulas incorporates a number of energy saving features. In particular, it was constructed with a glazed south-east facing solar gable to optimize passive solar gain. Complemented by high levels of insultaion, through draught-proofing and natural ventilation, this meets a high proportion of the building's heating requirements.

In addition to these features, Dulas HQ employs a photovoltaic bike shed to provide a portion of it's energy needs. The 1.44kWp installation is an integrated design providing both weather protection and solar energy, and is an example of an early G77 grid-linked system.

Examples of Best Practice: Policy

Powys County Council Draft UDP

POLICY GP3 – DESIGN AND ENERGY CONSERVATION
ALL PROPOSALS FOR DEVELOPMENT SHOULD MAKE A POSITIVE CONTRIBUTION TO THEIR LOCAL ENVIRONMENT AND COMMUNITY THROUGH
IMAGINATIVE AND GOOD QUALITY DESIGN, LAYOUT, MATERIALS AND LANDSCAPING IN ACCORDANCE WITH THE POLICIES OF THE UDP. A DESIGN STATEMENT SHALL ACCOMPANY ALL DETAILED APPLICATIONS AND WILL DESCRIBE THE ACTIONS TAKEN TO DESIGN AND ADAPT THE DEVELOPMENT TO FIT ITS LOCATION. WHEREVER PRACTICABLE, DEVELOPMENTS SHALL BE
DESIGNED TO REDUCE ENERGY CONSUMPTION AND MAXIMISE ENERGY CONSERVATION THROUGH THE USE OF APPROPRIATE MATERIALS, DESIGN, LAYOUT AND ORIENTATION.

Brecon Beacons National Park

Parc Cenedlaethol Bannau Brycheiniog
Brecon Beacons National Park

PLANNING ADVICE NOTE 16 (February 2003)

SOLAR PANELS, DO I NEED PLANNING PERMISSION

This note is for householders who need to know whether they require planning permission to install solar panels at their home. It does not apply to buildings other than dwelling houses, or to flats and maisonettes. For advice relating to these types of buildings, please contact the National Park Authority on the number given at the bottom of the advice note.

Dwelling Houses (excluding listed buildings). Most households in Wales enjoy certain permitted development rights (PD rights), detailed in the General Permitted Development Order (1995). This means that there are certain works which can be carried out, without the need for planning permission from the Local Planning Authority (in this case the National Park Authority). Under these PD rights, any alterations to a roof are permitted, so long as they do not enlarge the roof space or alter the shape of the roof. The National Park Authority has taken the view, that as long as a solar panel does not project more than 10cm above the plane of the existing roof, the panel is not considered to alter the shape of the roof and therefore will not require planning permission.

If the panel projects further than 10cm, the Development Control section at the National Park will need to assess the proposal in order to advise whether planning permission will be required. In this case please send us as much information on the proposal as possible, to the address given at the bottom of this leaflet. Information should include: a map identifying your house, a photo of the house, specification of the proposed panels and an indication of where on the roof you wish to place the panel.

Pipework for panels is generally less than 2cm in diameter and normally runs directly from the panel into the roof space. If pipework has a larger diametre than this and needs to be run across the plane of the roof, please contact the Development Control section for advice.

Free standing panels, which are not fixed permanently to the ground i.e. they can easily be moved, are not considered to be development and do not therefore require planning permission. If however they are permanently fixed e.g. concreted into the gro or so large as to not be easily moved, or enclosed by fencing over 1m high, they may require permission and advice should be sou from the Development Control section at the National Park.

Listed dwelling houses.
If your house is a listed building, any works, which are likely to affect the character of the house, will require listed building consent. Always contact the Conservation Architect at National Park Authority (Will Hughes 624437) before installing panels on a listed building.

If you are in any doubt as to whether permiss is required, please telephone 01874 624493 ask for your area planning adviser.

For further information contact:
Brecon Beacons National Park
Plas y Ffynnon, Cambrian Way, Brecon, LD3 7HF
Tel: (01874) 624437
Fax: (01874) 622574

Surrey County Council SPG Design, Chapter 4 Energy

4.1.3 Best practice and innovation should be encouraged. Design statements submitted with planning applications (see principle 1.2) could usefully include information showing how sustainability issues have been addressed during the design process. A statement could be based on a BREEAM assessment (see below) and include an assessment of some or all of the following:

- Energy conservation including layout, orientation and insulation of buildings
- Embodied energy and transport costs of materials including the use of local materials and methods
- Use of renewable energy through passive solar heating, photovoltaic cells and wind turbines
- An assessment of the feasibility of using community heating (CH) in conjunction with combined heat and power (CHP), particularly for larger developments
- How the development encourages walking, cycling and the use of public transport (see Chapter 6 Movement)
- An assessment of quality of life or 'health' of the buildings through utilising natural light and ventilation, sound insulation and non toxic materials
- How water is conserved through the storage of rain water, grey water recycling and permeable storm water drainage systems (SUDS) (see Principles 4.2 & 4.4)
- How waste is to be minimised through the use of recycled material and the recycling of demolition waste