



Office of the
Deputy Prime Minister

Creating sustainable communities

Planning shapes the places where people live and work and the country we live in. It plays a key role in supporting the Government's wider economic, social and environmental objectives and for sustainable communities.



PLANNING

Planning for Renewable Energy
A Companion Guide to PPS22



Office of the
Deputy Prime Minister

Creating sustainable communities

Planning for Renewable Energy A Companion Guide to PPS22

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1 Introduction

“The sources of renewable energy ... are inexhaustible, indigenous and abundant, and their exploitation, properly managed, has the potential to enhance the long-term security of the United Kingdom’s energy supplies and to help us cut carbon dioxide emissions”

House of Lords Science and Technology Committee, July 2004¹

WHAT THE GUIDE IS INTENDED TO DO

- 1.1 As set out in Chapter 4 of the Energy White Paper, the Government target is that by 2010 we should be generating 10% of our electricity from renewable sources, with the aspiration that this increases to 20% by 2020². Current estimates of production are around 3%. Clearly, there is a long way to go. The House of Lords Science and Technology Committee, reporting in July 2004, asserted that “a dramatic change in the rate of introduction of renewable generating capacity will be required if the Government are to come anywhere near their target for 2010”³.
- 1.2 Planning Policy Statement 22 (PPS22) and this Companion Guide are intended to encourage the appropriate development of further renewable energy schemes, throughout England. This will include schemes in urban as well as rural locations, ranging in size from the domestic to the commercial scale. If the targets are to be met, a positive and innovative approach will be required. The planning system can only deliver sufficient additional renewable energy schemes to meet the shortfall if positive planning policies are in place. These need to be backed up by strong leadership, the integration of planning for renewable energy with other more mainstream planning activities and communication between planners, the renewables industry, interest groups and the wider public. Local communities should be involved to a greater extent than in the past.
- 1.3 PPS22 sets out the policy context for action, and this Companion Guide offers practical advice as to how these policies can be implemented on the ground. Success will require action at the regional and local levels, with regard to both strategic/forward planning and development control. Each of these is addressed in the Companion Guide. Case studies are used to illustrate key points and to demonstrate how specific issues can be addressed. The Technical Annex includes specific advice on the range of renewable energy technologies that are covered by PPS22.

¹ *Renewable Energy: Practicalities* House of Lords Science and Technology Committee, 4th Report, 2003-04 Session (paragraph 2.8) <http://www.parliament.the-stationery-office.co.uk/pa/ld200304/ldselect/ldsctech/126/126.pdf>

² *Energy White Paper: Our Energy Future – creating a low carbon economy*, CM5761, February 2003; available online at www.dti.gov.uk/energy/whitepaper/ourenergyfuture.pdf

³ *Renewable Energy: Practicalities* House of Lords Science and Technology Committee, 4th Report, 2003-04 Session (paragraph 2.24) <http://www.parliament.the-stationery-office.co.uk/pa/ld200304/ldselect/ldsctech/126/126.pdf>

WHO THE GUIDE IS FOR

- 1.4 If the targets are to be met, a greater diversity of renewable energy schemes will need to be developed in a wider variety of locations than in the past. The Companion Guide is intended to assist planners, regional and local decision-makers and other stakeholders in understanding the often complex issues associated with the different technologies and their application in different environments.
- 1.5 This Guide discusses the planning and development of renewable energy schemes across England. Many of these will be in rural or semi-urban areas, although there is also scope for renewable energy generation in many urban environments. The Guide is therefore applicable to all local planning authorities in England.

HOW THE GUIDE IS STRUCTURED

- 1.6 A number of principles have influenced the preparation of PPS22. Among the key themes in the new policy statement are the wider benefits of renewable energy schemes, the importance of community involvement, the use of criteria-based policies in plans, and the need for integration with other plans and strategies. These principles are discussed in section 2.
- 1.7 In planning for renewable energy, co-ordinated action is required between regional and local planning authorities. Many of the issues to be resolved are best addressed at the regional planning level, and these are discussed in section 3. Under the new planning system, policies relating to renewable energy will be included in regional spatial strategies and local development frameworks and these policies must complement each other. Local authorities will also be able to prepare supplementary guidance and will be responsible for determining applications for small and medium-sized schemes (up to 50 megawatts). Local planning policy issues are discussed in section 4 while development control and scheme-specific issues are discussed in section 5.
- 1.8 In addition to stand-alone renewable schemes, there is significant scope for renewable energy generation to be integrated into the built environment and located in urban areas. Chapter 6 offers guidance for planners on the relevant issues.

- 1.9 PPS22 applies to a number of different technologies. These are: biomass; energy from waste (biological and thermal processes); small hydro; solar electricity; solar heating; and wind. These are addressed by a separate Technical Annex. Passive solar design is a further method of maximising the effective use of natural resources and is also included in the Annex.

STATUS OF THE GUIDE

- 1.10 The use of examples taken from any development plan prior to its adoption is without prejudice to the Secretary of State's rights of objection or direction in respect of plan policies, or to call in plans for his own determination. The use of any example, whether from an adopted plan or otherwise, is also without prejudice to any decision the Secretary of State may wish to take in respect of any planning application coming before him as a consequence of a policy included in an example in this Guide.

2 Guiding Principles in Planning for Renewable Energy

THE BIGGER PICTURE

- 2.1 Global climate change is a recognised phenomenon of international significance. The continuing production of ‘greenhouse gases’, and carbon dioxide in particular, is contributing to the increasing rate of climate warming. This runs counter to the aims of sustainable development as the effects, including sea level rise and the increased frequency of extreme weather events, have human, environmental and economic costs which can be very great. Tackling climate change is a necessary condition for sustainable development, so the UK has signed up to a number of international agreements in an attempt to address this situation. Under the Kyoto Protocol⁴, the UK aims to reduce a basket of greenhouse gases to 12.5% below 1990 levels by 2008-12.
- 2.2 This reduction may be achieved through a combination of strategies including reducing the need to use energy, using it more efficiently and increasing the proportion of energy from renewable sources. The UK is committed to deliver 10% of our electricity from renewable sources by 2010. The Energy White Paper⁵ sets out the Government’s aspiration to supply 20% of our electricity from renewables by 2020 and put the UK on a path to delivering CO₂ reductions of around 60% by 2050. The Government also recently announced its intention to extend the Renewables Obligation to 15.4% by 2015⁶, which puts further pressure on power suppliers to generate their electricity from renewable sources. The development of renewable energy resources on a commercial scale is a crucial element in meeting the Government’s commitments on reducing emissions and combating climate change.
- 2.3 In addition, there is growing concern that the current supplies of fossil fuel upon which the UK relies for most of its electricity – the North Sea oil and gas fields in particular – will not last indefinitely and the alternative sources are located in regions of the world which are less geopolitically stable than our own⁷. The dual initiatives of reducing energy use and sourcing that which we do use from UK renewable sources are solutions. A number of Government departments will be working towards these aims over the next few years. For example, Defra recently issued a consultation paper on energy efficiency⁸, and the

4 *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, adopted by the Conference of the Parties to the UNFCCC on 11th December 1997 in Kyoto, Japan; ratified by the UK on 31st May 2002. For further details of the formal text, see the UNFCCC website <http://unfccc.int/resource/convkp.html>

5 *Energy White Paper: Our Energy Future – creating a low carbon economy*, CM5761, February 2003; available online at www.dti.gov.uk/energy/whitepaper/ourenergyfuture.pdf

6 for DTI press release, 11th December 2003, see www.gnn.gov.uk/environment/detail.asp?ReleaseID=101781&NewsAreaID=2&NavigatedFromDepartment=False

7 *Renewable Energy: Practicalities* House of Lords Science and Technology Committee, 4th Report, 2003-04 Session (Chapter 2) <http://www.parliament.the-stationery-office.co.uk/pa/ld200304/ldselect/ldsctech/126/126.pdf>

8 *Energy Efficiency: The Government’s Plan for Action* is the Government’s energy efficiency strategy. It is available as PDF online from the Stationery Office Official Documents web site at www.official-documents.co.uk/document/cm61/6168/6168x.htm

Government's Strategy for Combined Heat and Power to 2010⁹. ODPM recently published draft changes to the Building Regulations Part L (energy efficiency) and Part F (ventilation – closely related to energy use)¹⁰. Among other initiatives, the DTI is promoting renewables through its *Renewables: it's only natural* campaign¹¹.

- 2.4 Given current renewable electricity production rates of around 3%, the scale of the challenge is clear. A 'step change' will be required if the targets are to be met, and this has been recognised by the Government in preparing Planning Policy Statement 22.
- 2.5 The successful introduction of renewables in all parts of England will involve the installation of different kinds of schemes in different contexts, from rural areas to densely populated areas, market towns to suburban streets. Every local authority has something to offer in terms of renewable resources, and opportunities to encourage more efficient use of existing energy. The Government expects each authority to contribute to meeting the targets and reducing overall demand for energy. Local authority involvement in planning for renewable energy is discussed in more detail in Chapters 4 and 5. Regional planning bodies will also have an essential role; this is discussed further in Chapter 3.

9 Government's Strategy for Combined Heat and Power to 2010 Defra, April 2004; available online at www.defra.gov.uk/environment/energy/chp/chp-strategy.pdf

10 see ODPM Consultation Papers website: www.odpm.gov.uk/stellent/groups/odpm_control/documents/contentservertemplate/odpm_index.hcst?n=168&l=1

11 see DTI Renewables website for further information: www.dti.gov.uk/renewable/

Sustainability Appraisal and Strategic Environmental Assessment

Under the Planning and Compulsory Purchase Act 2004, Sustainability Appraisal is mandatory for Regional Spatial Strategies (RSSs), Development Plan Documents (DPDs) and Supplementary Planning Documents (SPDs). Sustainability Appraisal (SA) helps planning authorities to fulfil the objective of contributing to the achievement of sustainable development in preparing their plans.

Sustainability appraisal under the 2004 Act has been designed to incorporate the full requirements of European Directive 2001/42/EC on the 'assessment of the effects of certain plans and programmes on the environment', known as the Strategic Environmental Assessment or SEA Directive. The Directive calls for a thorough consideration of the environmental effects of plans and consultation with the public and authorities concerned. SA extends this approach to cover social and economic as well as environmental issues, and also tests the plan against sustainability criteria.

SA incorporating SEA should:

- be integrated into the plan making process, providing assistance at each stage where decisions are taken;
- take into account the views obtained through public involvement and from the environmental agencies and other consultees;
- provide a summary of assessment against objectives, covering alternatives and secondary/cumulative effects.

Regional planning bodies and local planning authorities should consider the effects of renewable energy proposals as a normal part of the sustainability appraisal of their revisions to RSSs, DPDs and SPDs.

ODPM issued guidance on the SEA Directive for both regional planning bodies and local planning authorities in 2003. *The Strategic Environmental Assessment Directive: Guidance for Planning Authorities – Practical guidance on applying European Directive 2001/42/EC* (ODPM, October 2003), can be found at:

www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_026670.pdf

This was needed to help authorities to comply with the Directive, which came into force in July 2004.

However, this guidance was designed to pave the way for full sustainability appraisal, and to be superseded in due course by guidance on the new system of sustainability appraisal incorporating the Directive's requirements. ODPM has now issued a consultation draft of its proposed guidance on sustainability appraisal – *Sustainability Appraisal of Regional Spatial Strategies and Local Development Frameworks* (ODPM September 2004) and can be found at:

http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_030923.pdf

SAs at both regional and local levels will often provide information useful for Environmental Impact Assessment of individual development proposals.

ENVIRONMENTAL, ECONOMIC AND SOCIAL BENEFITS

- 2.6 As well as contributing to a reduction in carbon emissions, renewable energy schemes can have wider environmental, economic and social benefits. Such benefits may arise directly through the development of a renewable scheme, or indirectly through the secondary effects. PPS22 makes clear that the environmental, economic and social benefits of any proposed scheme should be considered in determining the application.

Environmental Benefits

- 2.7 The environmental benefits of renewable energy schemes may be felt locally as well as contributing more broadly to global carbon emissions targets. These benefits may include the following:
- **reducing carbon emissions:** in the long term, reduced carbon emissions are expected to contribute to a deceleration in the rate of global climate change;
 - **creating new environments:** some renewable energy schemes (e.g. growth of biomass crops) may create suitable habitats for rare species;
 - **managing existing environments:** some schemes may result in more intensive forest or woodland management (for example, in order to supply feedstock to a biomass plant). This may foster biodiversity, creating more attractive breeding or feeding habitats for certain species;
 - **reducing flooding and/or flood risk:** hydro schemes can help to regulate river flows and minimise flooding;
 - **air quality improvements:** renewable schemes may have indirect benefits in this regard, through the contribution to reduced fossil fuel emissions; and
 - **landfill reduction:** energy from waste schemes will serve to reduce the volume of material that is currently sent to landfill sites.

Case study 2A: Supporting Biodiversity

Research undertaken over the past decade by the Game Conservancy Trust suggests that Short Rotation Coppice (SRC) plantations provide suitable habitat for a diverse range of bird species. Especially where plantations are harvested in rotation, resulting in plants at different stages of growth being found in close proximity to each other, SRC plantations have been supporting diverse communities of songbirds. The more complex the vegetation structure, the more attractive the plantation is as a habitat. SRC plantations can also offer plentiful food supplies in the form of insect species. Where SRC plantations replace arable land, they can result in a net increase in both the number of species and the total number of birds present.

References: Game Conservancy Trust website (www.gct.org.uk) and RB Sage & PA Robertson (1996) *Factors affecting different songbird communities using new short rotation coppice habitats in spring* in Bird Study vol 43, pp201-213

Economic Benefits

- 2.8 Local economic benefits of renewable power generation can be identified, especially in relation to small and/or rural communities. These include:
- **job creation: direct** (e.g. installing and servicing solar panels; management and operation of biofuels supply chains), **indirect** (e.g. making components for renewables installations – both for use in local areas and additional employment benefits from manufacture for export) and **induced** economic multiplier effects (e.g. re-circulating income in local area);
 - the opportunity for UK innovators/academic institutions to develop **expertise in manufacturing**, and potentially **research and development** (e.g. Vestas turbine factory, Campbeltown; blade manufacture, Isle of Wight);
 - **increased security and reliability of supply**: through more distributed generation, closer to the point of use; more diverse sources and technology types; domestically available feedstocks. In addition, localised generation means less power is wasted in transmission over long distances;
 - direct benefits through **shareholding**: investment clubs can offer an opportunity to invest in turbines, profiting from the sale of the electricity they produce – see case study below;
 - **cheaper fuel bills**: integrating renewable energy generation offers the double benefit of supplying site-generated power which will recoup installation costs before the lifetime of the equipment expires, thus reducing the requirement to buy power from commercial utility companies;

- **tourism potential:** visitor centres at renewable generation sites, such as wind installations (e.g. Swaffham in Norfolk¹²) or major hydroelectric dams, (e.g. Ben Cruachan, Argyll¹³ or Dinorwig at Llanberis, North Wales¹⁴);
- possibilities of indirect benefit through **marketing** of the local area as forward-looking and 'green' (e.g. inward investment by related technologies, or those attracted by improved image of area)¹⁵;
- increased **income for landowners** (and potential for recirculation of wealth in local community);
- **farm diversification/revitalisation** of rural economies.

Case study 2B: Financial Benefits

Baywind Energy Co-operative was the first UK co-operative to own wind turbines. The six turbines at Harlock Hill wind farm, near Ulverston and Millom in Cumbria, were built by a developer and then sold one by one to the co-operative through a series of share offers. Members of the co-operative receive profits from the sale of electricity to the National Grid. They have consistently received a competitive return on their investment.

The co-operative was founded in 1996 by seven individuals from the local area, who now sit on the board of directors. In total, Baywind has over 1300 shareholders, 43% of whom are resident in Cumbria. Publicity about the scheme was initially raised through local mailshots and media coverage. Investors from further afield were attracted by the scheme's initial success. Baywind has raised £2m through share offers to its members, who hold between £300 and £20,000 of shares each. Voting rights are equal regardless of the size of shareholding, and shareholders receive a 20% tax refund on their initial investment under the Government's Enterprise Investment Scheme.

As a voluntary condition for obtaining planning consent for Harlock Hill, Baywind formed the Energy Conservation Trust for the local community, to which 0.5% of the annual income generated is given. The Trust promotes energy conservation by providing energy efficiency grants and energy-saving products to local organisations.

See the Energy Saving Trust website for further details:
www.est.co.uk/cafe/index.cfm?fuseAction=cas.Home

12 see www.ecotricity.co.uk/projects/op_ecotech.html for details of the Ecotech centre at Swaffham

13 see www.visitcruachan.co.uk/ for details of the Scottish Power visitor centre at Ben Cruachan

14 see www.edisonpowerprogramme.com/vap/ed2.htm for details of the Edison visitor centre at Dinorwig, Llanberis

15 for example, see www.renewteesvalley.co.uk/main.asp?User=tvivaxgfbokflgfkakf&View=home&L=True

Social benefits

- 2.9 The social benefits of renewable power generation are likely to be less tangible than the economic benefits, but may be most obvious in remote rural areas with small populations and low levels of employment. Social benefits may include:
- direct employment enabling **retention of population** in remote areas, contributing to social stability;
 - **community pride** around a new renewable energy scheme or proposal (especially where the community invests directly in a scheme);
 - **expansion** of community **capacity** to participate in planning system (e.g. through involvement in preparation of planning briefs, or in negotiations relating to individual planning applications), and **increasing individuals' skills and knowledge** which may in some cases result in improving their employment opportunities;
 - where community has ownership or responsibility for land upon which a scheme is built, **ground rent** may be payable and this source of funding can be put to community use;
 - **educational opportunities** linked to any visitor centre developed alongside a scheme, potentially leading to a wider awareness of renewable energy; increased interest in environmental issues; and an increased sense of environmental stewardship among the local population;
 - **longer term health and quality of life** benefits and **protection of properties** through mitigation of the effects of climate change.

Case Study 2C: Renewable Energy Education

St. Katherine's Secondary School, Ham Green, North Somerset, made a successful bid to become a Specialist Science College in 2003. The school's aim is to become an energy self-sufficient school and to demonstrate to other schools around the country how this can be achieved.

As part of its bid for Science College status the school formed a partnership with two Bristol based leaders in the field of wind technology (Garrad Hassan and Windcluster) with a view to installing a second hand commercial scale wind turbine within the school grounds. Students will use on-site anemometry data and commercial Windfarmer software (donated by the industry) to assess the school's commercial and environmental suitability for installation of its own wind turbine. The school is aiming to generate a large proportion of its electricity from renewable resources and in so doing reducing its own carbon dioxide emissions.

The school is refurbishing four old laboratories, one of which is being redeveloped as a Green Energy digital technology laboratory. This has its electricity supply supplemented from 5kW solar panels on the roof and a 6kW wind turbine is also to be installed. The lab proposal was a key part of the school's success in becoming a Specialist Science College. It is being equipped with wireless networked laptop computers and will be available to local primary schools and local businesses engaged in renewable energy activities. The on-site renewable technologies will bring green energy production directly into the classroom and demonstrate the benefits at the commercial scale. The real data generated within the school grounds and the educational exercises that are planned (including visits to facilities and links to industry and higher education facilities) will have value across the curriculum for the school and its partner school network, and beyond the school gates to the parents, families and wider local community.

Monitoring and recording of meteorological data will enable maths students to correlate the quantity of electricity generated with variations in the weather. Similar data collection is being facilitated in partner primary schools for comparison.

In addition to links with local schools, the school has begun to promote renewable energy and energy conservation learning in the wider community with adult/family learning courses.

Case study 2D: Community Benefits – Awel Aman Tawe

Following public consultation in relation to Neath Port Talbot BC's Agenda 21 programme in the late 1990s, Awel Aman Tawe (AAT) was set up to pursue the idea of a community-led wind farm with tangible local benefits. In addition to its broader environmental advantages, contributing to local social and economic regeneration could be significant: the area has been in economic decline for decades.

AAT aims to contribute to the regeneration of the Upper Amman/Swansea Valley areas through the development and implementation of a Community Energy Scheme. A further aim is to use its experience to promote the development of sustainable community energy schemes elsewhere in the UK.

AAT submitted an application for a 5-turbine windfarm in the Upper Amman and Swansea Valley during the autumn of 2004, following extensive public consultation and data gathering exercises. Wherever possible, local community groups and people from the surrounding areas were actively encouraged to become involved. Volunteers and residents from the surrounding area were trained in local cinemas and halls by lecturers from Swansea University in survey and data collection techniques.

Profits from the sale of electricity will be channelled into community initiatives such as an education centre to attract school groups and tourists. Profits will also be used to support small businesses and local regeneration projects.

Key lessons so far:

- local people's awareness of the broader issues of renewable energy and their exposure to wind farms are key factors in their acceptance of the proposed project;
- there appears to be no pattern with regards age, gender, employment status or proximity to site that can determine what people's opinions will be regarding the wind farm;
- community consultation, decision-making and ownership are new ideas to many people but the majority support these aspects of the project;
- people's approach to change appears to influence the way they view the project; and
- the social and political links of the project are crucial factors in effective information distribution and have an effect on people's opinion.

Photos: a visit to Carno wind farm (owned by National Wind Power), and Children from Ysgol Cwmllynfell, South Wales, learning about renewable energy. Courtesy of Awel Aman Tawe



COMMUNITY INVOLVEMENT

- 2.10 There is a growing awareness of the issue of climate change and the role of renewable energy in combatting it.
- 2.11 Appropriate community involvement at different stages in the planning process can have considerable benefits for all parties involved. It can improve understanding of the issues facing developers, local communities, stakeholders and the local authority, which can help to reduce conflict. It can foster acceptance of new technologies and may lead to community investment in a proposed scheme, not only in financial but also in stewardship terms. Successful community involvement can lead to the development of a platform for ongoing dialogue (e.g. a long-standing community group), which can increase a community's capacity for contributing to civic life.
- 2.12 The Government is keen to promote community involvement in the whole planning system, to improve transparency in decision-making and to encourage people, who would not normally take an interest, to become involved in planning for communities of the future¹⁶.
- 2.13 The Government¹⁷ advises that, at its simplest level, a community involvement process should ensure that people:
- have access to information;
 - can put forward their own ideas and feel confident that there is a process for considering ideas;
 - can take an active part in developing proposals and options;
 - can comment on formal proposals; and
 - get feedback and be informed about progress and outcomes.
- 2.14 There are many methods of community involvement that may be appropriate at different stages of the planning process. See section 3 for more on community involvement at the regional strategic level, and section 4 for further guidance on community involvement at the local level. Under the new planning system, applicants for significant development proposals are also required to undertake a certain amount of community consultation. This is discussed in section 5.

¹⁶ see draft *Planning Policy Statement 1, Creating Sustainable Communities*, for further details: consultation paper on this available online at www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_027494.pdf

¹⁷ *Community Involvement in Planning: the Government's Objectives* ODPM, 2004 (paragraph 2.2)

- 2.15 Community involvement is especially important in planning for renewable energy because it can help provide an opportunity to engage local people actively in the development of schemes; to address concerns about the impacts of potential schemes; and to explain the wider benefits of renewable energy (see paragraphs 2.6 – 2.8).

CRITERIA BASED POLICY

- 2.16 The use of criteria-based policies is an essential part of the approach established under PPS22. The policies at regional level will provide the link between targets and the identification of broad areas where different renewable technologies may be located without causing unacceptable environmental impacts. At local planning authority level, criteria based policies should be developed to reflect specific local circumstances.
- 2.17 This guide includes advice on the framing of appropriate criteria-based policies on the regional level (section 3) and local level (section 4).
- 2.18 However, there are some general guiding principles that are relevant at both levels.
- There is a need to make clear in policy that the planning body or authority will be supportive of renewable energy proposals in locations where environmental, economic and social impacts can be addressed satisfactorily.
 - Discussions with relevant industry representatives will assist in clarifying the potential of broad areas (proposed in the regional spatial strategy) or specific locations where there are schemes being proposed (as part of the local development document preparation process). However, there is no requirement on the planning body or authority to refer in policy to the technical requirements associated with renewables since these may change over time.
 - Only the key criteria relevant to the level of planning should be included in order to assist decision-making at that level. This will ensure that the issues will be considered at the most relevant level with appropriate input from public involvement and statutory consultation. For some more detailed issues inclusion in a supplementary planning document may be more appropriate. Where supplementary planning documents are produced, local planning authorities should ensure that consultation is undertaken, including consultation with industry representative groups (e.g. the British Wind Energy Association and the Renewable Power Association).

INTEGRATION WITH OTHER PLANNING POLICIES AND STRATEGIES

- 2.19 One of the most important considerations in planning for renewable energy will be the scope for integrating it with other strategies and initiatives. Some interrelationships are self-evident but others involve more lateral thinking. The checklist below sets out an indicative list:
- economic development strategies: consider scope for developing renewable energy business clusters, related to proposed or existing schemes – this may include consultancy as well as manufacture of components;
 - rural diversification: growth of biomass crops (or creating a market for agricultural residues) and installation of wind turbines could offer farmers alternative sources of income;
 - residential development: if development is sufficiently concentrated, there is more scope for economies of scale to facilitate renewable schemes that will provide electricity and/or heat;
 - regeneration: small scale renewables can help to alleviate fuel poverty; larger renewable schemes such as biomass plants can be well suited to brownfield sites; new emphasis on ‘green’ schemes can improve the image of an area and bolster confidence;
 - Community Strategies: these relate to the social and economic wellbeing of the population;
 - other planning policy: guidance in the relevant Planning Policy Guidance notes, Planning Policy Statements, Circulars and statements of Government policy may need to be taken into account.

FURTHER INFORMATION

<http://www.dti.gov.uk/renewable/> – Department of Trade and Industry renewables website, with facts and figures, examples of different technologies and links to further information.

<http://test.netgates.co.uk/nre/pdf.html> – AEA Technology/ETSU downloadable publications index.

www.est.co.uk/ – the Energy Saving Trust homepage: many case study examples of successful implementation, and further information. See also:

www.saveenergy.co.uk/renewables/resource/casestudies.cfm – the Energy Saving Trust case study/demonstration projects.

www.caddet.org – the Centre for Analysis and Dissemination of Demonstrated Energy Technologies (CADDET) is a programme operating under the International Energy Agency for the exchange of information on commercial energy efficiency and renewable energy projects. The website includes many international case studies (including the UK and elsewhere in Europe) and news of recent successes or imminent projects. (CADDET contact in Britain is Future Energy Solutions).

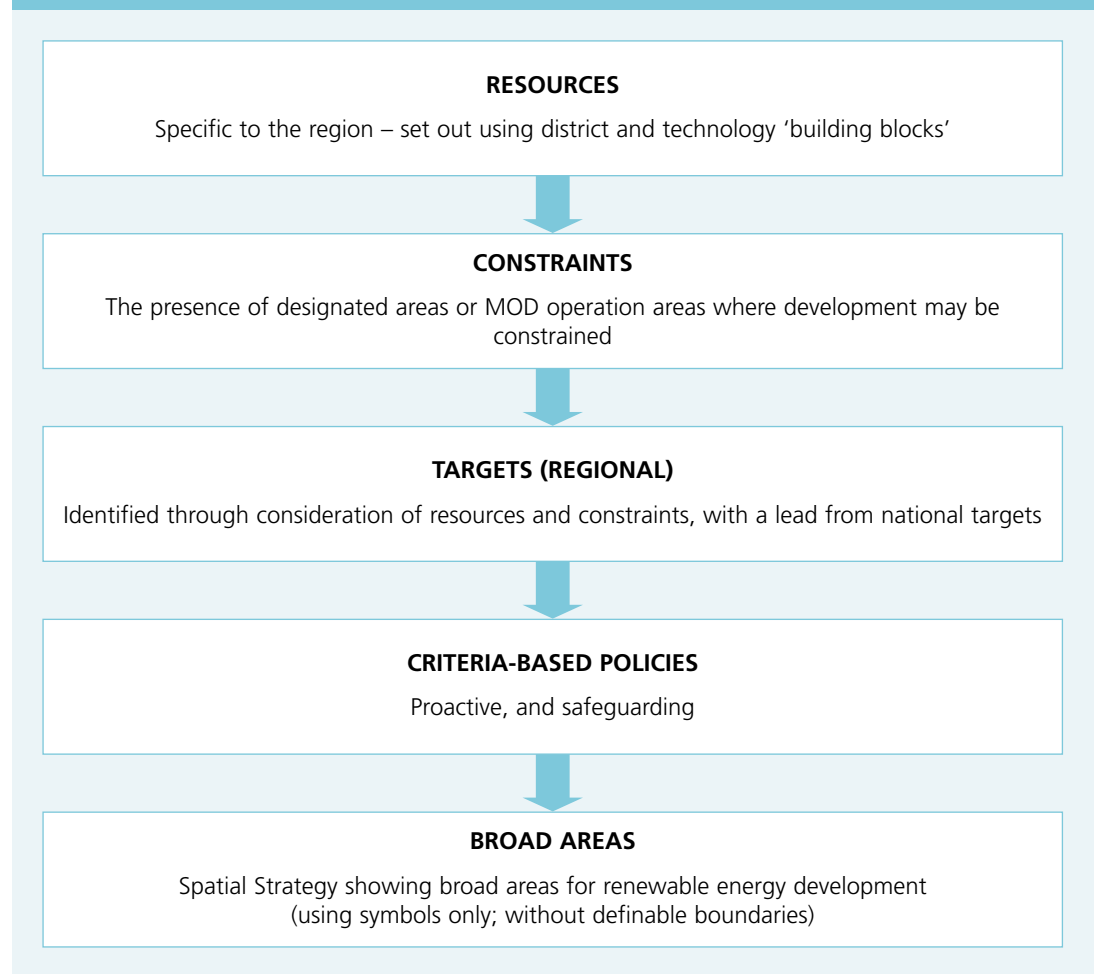
3 Planning Policy Issues : Regional Level

INTRODUCTION

- 3.1 Regional spatial strategies are to set out each region's approach to a very broad range of planning issues, including economic development, housing, transport, energy and the environment. They will be subject to public consultation and examination, and must be approved by the Secretary of State before adoption. Once adopted, they will have statutory weight and subordinate policy tiers (local development frameworks and supplementary planning documents) will be expected to have general conformity with them. The importance afforded to regional spatial strategies in the new planning system means that a wide variety of regional stakeholders will want to influence its development.
- 3.2 In planning for renewable energy the regional level of policy-making will be most important if the national targets are to be met. It is here that policy begins to be applied to specific geographical settings and becomes tangible for many people, leading to debate of the issues.
- 3.3 PPS22 stipulates that the regional spatial strategy framework should contain three elements: targets, criteria-based policies and locational considerations:
 - **targets:** these will be set at a regional level and may be disaggregated to the sub-regional level. They shall be derived from a region's assessment of its renewable energy resource, expressed as a minimum, and revised upwards once they are met. Targets will influence the wording of criteria-based planning policies (see PPS22, paragraphs 2-5).
 - **criteria-based policies:** these may apply to whole regions, sub-regions, or local authority areas as appropriate (PPS22 paragraphs 6-8). This Companion Guide offers advice on the framing of criteria-based policies at different spatial scales.
 - **locational considerations:** the content of criteria-based policies will vary from region to region, and should be tailored in relation to issues such as the presence of internationally designated sites, nationally designated areas of nature conservation or landscape value, and green belts. They should take into account the specific requirements of urban and rural areas (PPS22 paragraphs 9-17).
- 3.4 The interplay between these elements of planning policy is illustrated in Figure 3.1 below. The starting point for any assessment of the renewable energy resource within a given region, or sub-region, is the assembly of data describing the resource potential of each relevant technology (as in the sub-regional work in the South East: see below for details).

- 3.5 Opportunities for tapping these resources take place within a framework of criteria-based planning policies, which will have both proactive and safeguarding aspects and be based on environmental, economic and social considerations.
- 3.6 Bringing together resource assessments and criteria-based policies will help to establish targets for the region, and possibly sub-regions, and lead to the identification of broad areas which are particularly suitable for renewable energy development. The final outcome of these stages of work will vary between regions, for example in parts of the South East biomass may be the most significant resource, in the North East wind may make the largest contribution towards meeting the regional target.

Figure 3.1 **Interrelationship between resources, targets and criteria-based policies at regional level**



KEY ISSUES IN PLANNING FOR RENEWABLES AT THE REGIONAL LEVEL

- 3.7 Regional planning bodies are already working towards regional spatial strategies¹. PPS22 effectively ensures that renewable energy is one of the topics addressed in the RSS. Particular issues that are pertinent to planning at regional level include:
- the regional level is the most appropriate for making decisions on key renewable energy targets and broad areas, as part of the process of preparing regional spatial strategies;
 - regions should consider the potential contribution of all forms of renewable energy specified in PPS22;
 - regional targets have to be established and justified from an evidence base which includes district-relevant and technology-specific estimates of renewable energy resources. Building up the evidence base with district-level information will facilitate policy-making at local as well as at regional level, and the robustness of the evidence base will be tested at the examination in public of the regional spatial strategy. Assessing resources by technology will make it easier to update this information in the light of future changes and improvements in particular renewable energy technologies, or changes in the regulations governing them (see case study example from RPG9, below);
 - resource estimates can be influenced by targets and criteria: if only restrictive criteria are applied, targets are unlikely to be met, while proactive criteria may lead to the identification of broad areas suitable for some technologies, which may raise the overall target. Regional targets should also strive towards meeting and improving upon national aspirations;
 - in assessing resources and preparing targets PPS22 indicates that environmental, economic and social impacts should be taken into account. Impacts and mitigation measures can be dealt with by criteria-based policies, and at regional level they will be considered in the Strategic Environmental Assessment of the spatial strategy.
 - broad areas should be identified at the regional or sub-regional level where development of particular types of renewable energy may be considered appropriate;
 - regional planning bodies and local planning authorities should work closely together on the preparation of criteria-based policies. This work should be co-ordinated by the Regional Assemblies;

¹ as described in *Planning Policy Statement 11: Regional Spatial Strategies*

- renewable energy policies should be integrated with the wider spatial strategy: consider opportunities for links to economic development, infrastructure and growth area policies in particular;
- renewable energy policies should cascade from spatial strategy level to local level: consider implications for local development documents including the core strategy and, where appropriate, supplementary planning documents;
- appropriate tools may include: geographic information systems (GIS), landscape character assessment and landscape sensitivity studies (see following sections for further details); and,
- an inclusive steering group should be set up to guide the work: the Government Office for the region, Regional Development Agency and Regional Assembly (including the Assembly's Social and Economic Partners) need to work closely together and drive the process forward. The diversity of resources also requires input from a range of industry interests to bring a sense of realism, as well as identifying opportunities and barriers.

ASSESSMENT OF RESOURCE POTENTIAL AND CONSTRAINTS

- 3.8 All regions have the benefit of renewable energy resource studies completed since the late 1990s and most have updated, or are currently updating, the information contained in these studies in the light of technological advances and the requirements of the regional spatial strategy process.
- 3.9 Regional planning bodies will wish to create an evidence base which will support targets, provide a spatial steer and stand up to scrutiny at examinations in public, local inquiries and appeals. This will require an assessment of potential by technology using earlier resource studies as a starting point, updated and projected forward with the guidance of an industry perspective.
- 3.10 For some technologies detailed regionally specific work may be required. For onshore wind, a constraints Geographic Information System (GIS) may be needed and a landscape sensitivity study (subsequent to landscape character assessment) may be appropriate for some technologies – see case study 3D below.
- 3.11 For biomass power generation, an assessment of the potential resource within given transport catchment areas will be needed covering both waste wood and fuel crops. Hydro

resources will be closely tied to a particular river, reservoir or lake. Electricity transmission grid studies will be common to most technologies. For other resources generic assessments may be sufficient, for example the UK-wide expectations on the rates of photovoltaic and solar hot water installation.

- 3.12 Regional planning bodies will also wish to consider the constraints present in the region, including (but not limited to) the presence of Ministry of Defence Tactical Training Areas, civil and military radar operations, telecommunications equipment², and nationally or internationally designated sites or areas of nature conservation or heritage importance. Such constraints should not preclude the generation of renewable energy but may in effect limit the nature or scale of development, so regional planning bodies should take the presence of such constraints into account when assessing resource potential. However, they should not include any assumptions about the technical viability of any technology, or about the extent to which these constraints may be overcome by future technological improvements (see PPS22 Key Principle (v)).

TARGETS

- 3.13 The establishment of targets is an outcome of the interplay between resource assessment and criteria-based policies, with reference to national aspirations, as described in paragraph 3.7 above. Targets are important because they have to be followed through into local development frameworks and the development control process.
- 3.14 Targets should be expressed as a minimum amount of installed capacity for renewable energy in the region, in megawatts, and may also be expressed in terms of the percentage of electricity consumed or supplied (PPS22 paragraph 2). It will be helpful to have supporting evidence which sets out the anticipated contribution of different technologies towards meeting the overall target, in part because renewable technologies operate at differing load factors, but also to make clear which make the most significant contributions. However, in the regional spatial strategy itself it will be appropriate to set only broad targets for each technology, since it will be important to retain flexibility to respond to technological changes in future. Expressing targets in terms of regional consumption may provide a spur to achievement by providing a sense of local ownership and a movement towards greater self-sufficiency.

² this may require liaison with OFCOM, the Office of Communications (new regulator of the UK communications sector).

- 3.15 PPS22 (paragraph 5) allows for the possibility of sub-regional targets. In some regions, uncertainty about the intentions of developers or the dominance of a small number of large but uncommitted opportunities may make the disaggregation of an overall target a pointless exercise. However, in other regions establishing targets at a sub-regional level may be technically feasible and may help to engender local commitment and assist the local planning and development control process.

Case study 3A: RPG9 illustration of broad sub-regional targets by technology

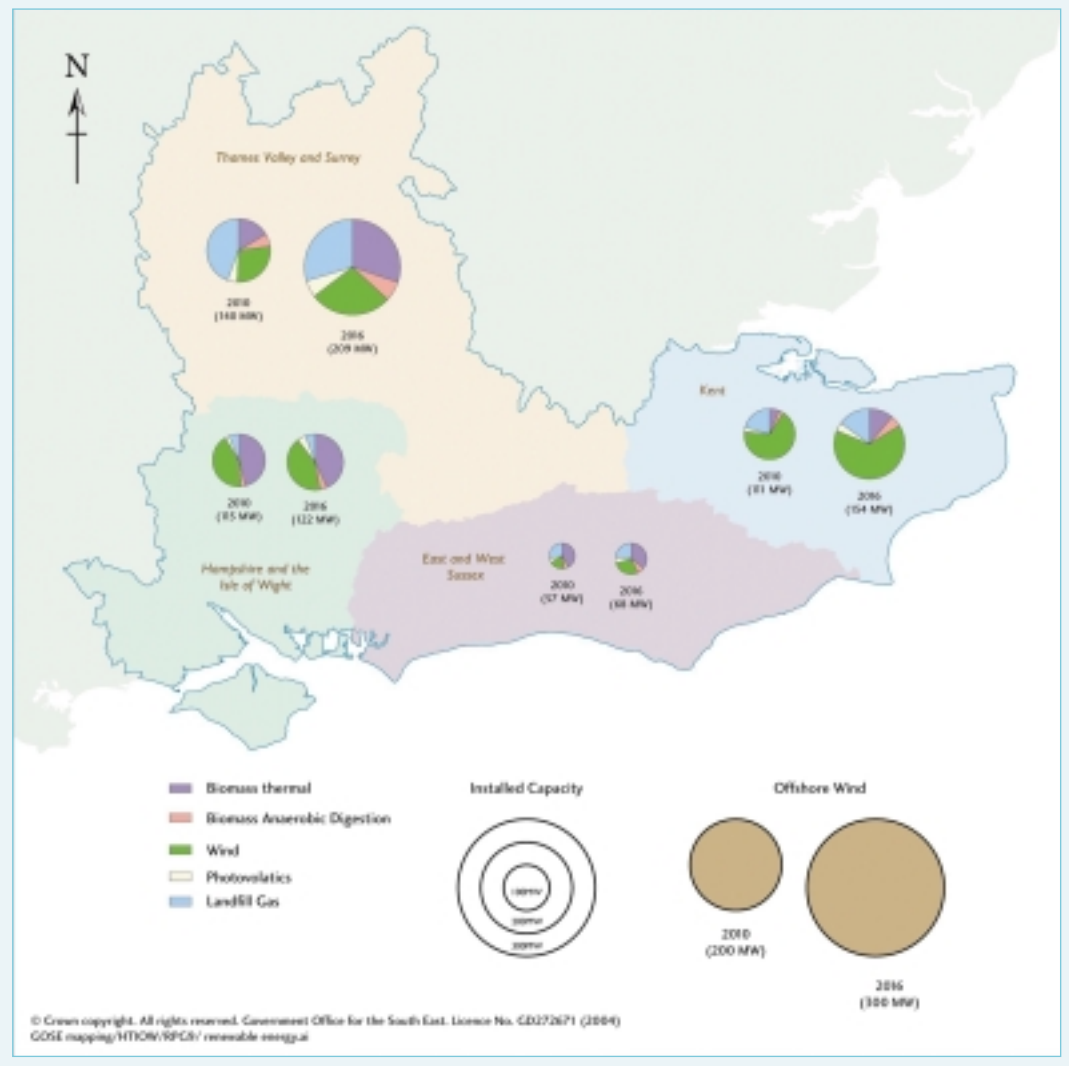
Indicative sub-regional land-based and offshore renewable potential, 2010-2016

The South East region concluded that overall, Kent, Hampshire and the Isle of Wight, and the Thames Valley and Surrey appear to have the greatest potential for onshore wind development and also for the installation of photovoltaics reflecting the likely rate of new development. The Thames Valley and Surrey sub-region appears to have the greatest potential for biomass fuelled electricity generation, reflecting the existing woodland resource and the potential for coppice in the sub-region and in adjoining counties and regions (RPG9 paragraph 10.64).

The region asserted that more detailed local consultation and assessments of potential should be undertaken to refine these indicative targets and define more specific local targets, and this is already underway in some sub-regions. This should involve identification of the technical availability as well as the practicability of development of the full range of renewable energy technologies, the opportunities, and the constraints to their development (paragraph 10.67).

The map opposite shows broad sub-regional targets:

Indicative Sub-Regional Land-Based and Offshore Potential, 2010–2016



Source: www.go-se.gov.uk/rpg9review/energy&tourism/documents/sosProposedChanges.pdf. For further information on the South East, see www.see-stats.org/ – South East England renewable energy statistics: home page of Thames Valley Energy and South East of England Renewable Energy Partnership-funded project.

CRITERIA-BASED POLICY AT REGIONAL LEVEL

- 3.16 Policies in regional spatial strategies should be sufficiently detailed to provide a clear framework for the development of renewable energy in the region, and sub-regions where appropriate. Regional spatial strategies are now part of the statutory Development Plan, and regional planning bodies should take the opportunity to prepare policies at this strategic level where they can be applied to a whole region or to defined sub-regions. Further policies may be included in local development documents, where a genuinely local matter needs to be addressed (see Chapter 4 for further details).
- 3.17 Criteria-based policies may relate to particular types of locality, or technology, or scale of development. The following general guidelines provide a useful starting point for drafting policies:
- **criteria should be positively worded**, rather than a list of negative constraints to renewable energy development;
 - **criteria should not be so restrictive as to prevent the region from meeting its target**
In agreeing the wording of the criteria, there may be a need to ‘test’ their implications against the potential regional renewable energy resource;
 - **criteria should reflect the characteristics of the different technologies** that will be promoted in the region;
 - **criteria should be relevant across the region**, or to clearly identified sub-regions (including nationally designated areas, where appropriate); and,
 - **criteria to be covered by local development documents** will include matters such as: noise, odour, transport considerations. Consistency is best served by outlining these policies at regional level and including them in regional spatial strategies.
- 3.18 It is likely that at regional level there will be two broad types of policy: one type would be associated with sub-regional targets and the identification of broad areas, the second with development criteria to assist in implementation of the regional strategy.

Policy related sub-regional targets and broad areas

- 3.19 For sub-regional targets, it will be appropriate to report on the work carried out in relation to the distribution of resources and potential for development.
- 3.20 For RPG9 (South East), a map has been provided illustrating the relative contribution of different technologies to different parts of the region. Policy INF7 suggests targets for each sub-region, and Policy INF8 outlines the criteria to be applied in identifying broad areas including: 'renewable energy development should be located and designed to minimise adverse impact on landscape, wildlife and amenity... priority should be given to development in less sensitive parts of the countryside and coasts, including previously developed land and in major transport corridors'.
- 3.21 The case study below (from draft regional spatial strategy for the North East) illustrates the possible relationship between policy and the identification of broad areas. It should be noted, however, that these are draft policies that are yet to be tested at public examination. Therefore, particular elements (e.g. the restrictions in sub-paragraph (a) of RE2) will need to be fully justified before they can be adopted as policy. Use of similar policies in other regions will also have to be justified and should reflect the circumstances of the region concerned.

Case Study 3B: Regional renewable energy planning in North East England

A Renewable Energy Strategy for the North East of England was prepared during 2003 under the guidance of a steering group which included representatives from GO-NE, the North East Assembly, government agencies, local authorities, the region's universities, environmental groups and different sectors of the renewable energy industry. In preparing the Strategy the region's potential resources were assessed using a number of tools including a geographic information system, complemented by grid and landscape studies. It was concluded that 10% of the electricity consumed in the region could be supplied by a range of renewable energy sources by 2010, and that this could be increased towards 20% if a strategic wind farm were to be developed within Kielder Forest. These targets were put forward for inclusion within forthcoming RSS.

Having assessed the region's resources and established targets the Strategy also put forward suggested RSS criteria-based policies which would help deliver the targets, and identified the broad areas where hydro, biomass and wind projects may be considered appropriate. These broad areas are shown in the "Draft Indicative Diagram" below.

The suggested criteria policies RE 2&3 below, while giving particular encouragement to developments in the areas shown in the diagram, also make it clear that projects in other areas will also be encouraged. One of the benefits of taking the proactive approach adopted by the NE Strategy has been to highlight the substantial potential of the Kielder area for wind, biomass and hydro power.

RE 2 – Spatial Strategy for Onshore Wind Development

In preparing policies and proposals for onshore wind projects Development Plans should conform to the following spatial strategy, broadly illustrated in the Renewable Energy Indicative Diagram:

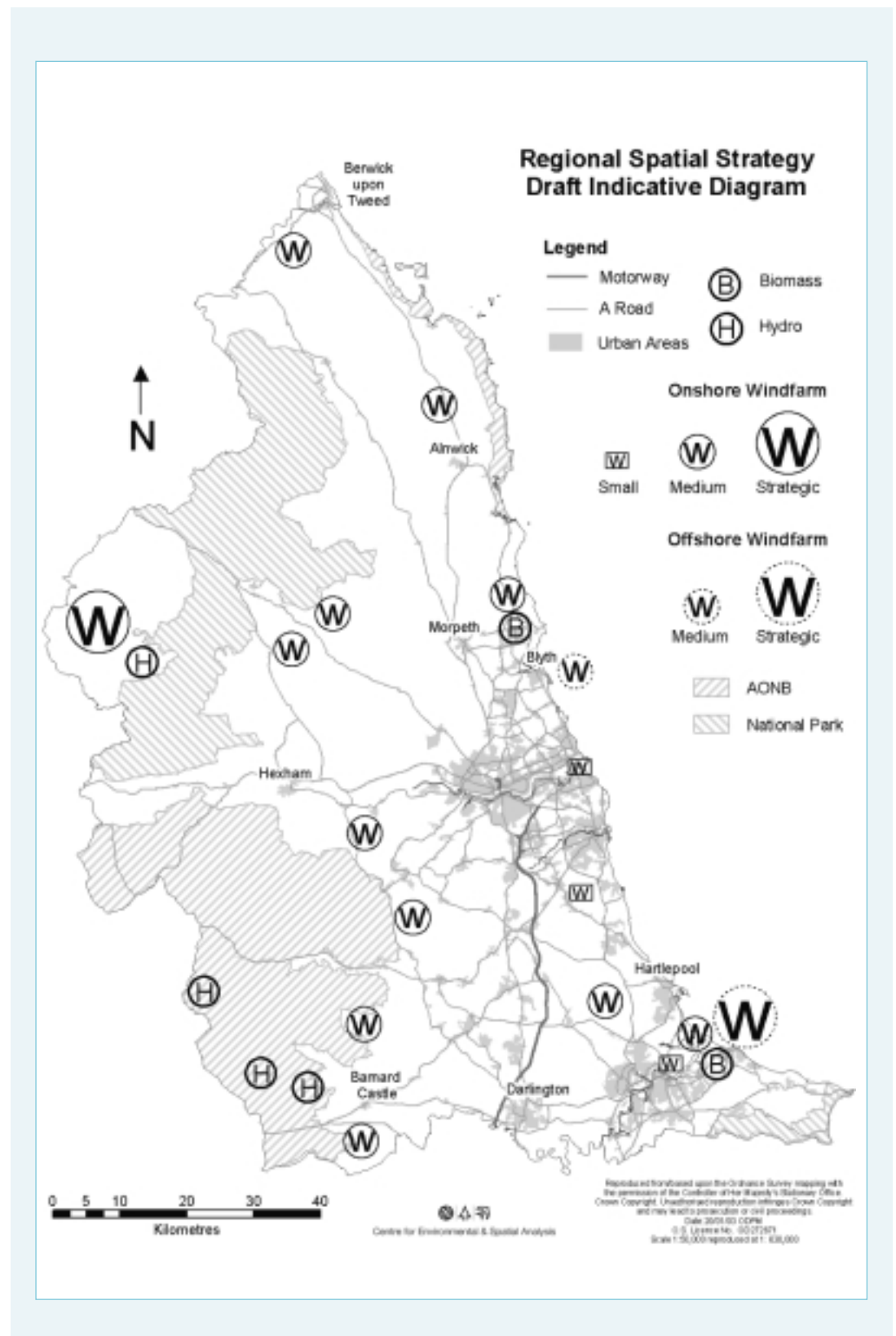
- a) Within designated National Parks, AONBs and Heritage Coasts wind developments should be limited to individual turbines of no greater than 100kW installed capacity, to provide power to off-mains properties and other small users.
- b) Kielder Forest should be the subject of further investigation to see if it could become a Strategic Wind Resource Area, where positive encouragement will be given to major wind farm developments.
- c) Particular encouragement should be given to the development of small to medium scale wind farms in the locations broadly illustrated in the Renewable Energy indicative Diagram and described in Annex 3 of the Regional Renewable Energy Strategy.
- d) Encouragement should also be given for wind developments in other parts of the Region, including appropriate urban and brownfield locations.
- e) Preference should be given to concentrated rather than dispersed or scattered patterns of wind development.
- f) In all cases proposals must be fully assessed against Policy RE3.

Point (d) is especially important in that it does not exclude sites elsewhere in the region, subject to the criteria being met.

RE 3 describes *Factors to be considered in Planning for Wind Farms*. These include: residential amenity (on noise and visual grounds); safe separation distances; nature conservation features; landscape characteristics and visibility; heritage designations; green belts; and any visual impact of new grid connection lines.

The above policies and the diagram below, produced in July 2003, were the subject of a North East Assembly led consultation, and are being modified for inclusion in forthcoming RSS for the North East. Further changes are anticipated as RSS progresses through its formal consultation and examination stages.

The North East of England Regional Renewable Energy Strategy and its supporting reports can be accessed at: www.northeastassembly.gov.uk



Development criteria

- 3.22 With regard to development criteria for inclusion in local development documents, authorities need not begin with a lengthy recommendation to ‘encourage’ or ‘support in principle’ proposals for development of renewable energy, as this is already set out by PPS22: a very brief statement of support should suffice, if one is considered necessary.
- 3.23 Regional planning bodies should seek to move away from recommending criteria for local authorities to apply, and, in collaboration with local authorities, seek instead to write one set of clear criteria-based policies that are applicable across the region and in defined sub-regions. As much as possible should be specified at this strategic regional level, for consistency and in the interests of streamlining local development documents. The previous regional planning guidance approach of recommending actions for others to take forward as they see fit will be unlikely to result in the development of sufficient renewable energy schemes to meet the Government’s targets.
- 3.24 Reference should be made to the full range of technologies (and the potential use of supplementary planning documents to cover the specific locational issues of each technology). Reference should also be made to contributions to renewable energy targets and reducing harmful emissions. The specific criteria can then include the full range of potential effects, or concentrate on a few that are specifically relevant, having already referred to ‘general criteria applicable to all development’.
- 3.25 Other criteria can be included to cover the more positive aspects: for example, opportunities for environmental enhancement, integration with existing or new development; the extent of community involvement; or support for other policies.

RSS policy on Renewable Energy

General statements in support of renewable energy will not be required: this is already set out in PPS22 and does not need to be repeated by individual authorities.

The table below shows how existing RPG-style policies could be updated to reflect the role and status of Regional Spatial Strategies.

RPG style policy	RSS style policy
"in their development plans, local authorities should encourage proposals for the use of renewable energy sources, subject to ..."	"renewable energy generation schemes will be encouraged, subject to...."
"local authorities should include policies for technologies most appropriate to the local area"	The RSS will be supported by an evidence base that has been tested at the EiP: The RSS should refer to this evidence in identifying the technologies that are most appropriate for the region or for defined sub-regions (see South East RPG9 for example) and set these out, e.g. "the potential renewable energy resource and targets for each sub-region are illustrated in Figure F. These are based on the broad regional assessments of resource availability set out in Appendix A"
"local authorities should provide locational guidance on the most appropriate locations for each renewable energy technology"	The RSS should include a proposals map that identifies broad areas that are suitable for specific technologies (see North East draft RSS for example), e.g. "Map M shows the broad areas that may be considered appropriate for different renewable technologies. Encouragement may also be given to schemes in other parts of the region, subject to...."
"local authorities should identify the criteria that will be applied in determining applications for renewable energy schemes, including X, Y and Z"	"the following criteria should be applied in determining applications for renewable energy schemes: X, Y and Z"

- 3.26 It is likely that, in future, regional spatial strategy that includes broad areas for renewable energy development or sub-regional totals will be most helpful if these are related to relevant issues for each of the broad areas or sub-regions, so that the specific issues related to each can be addressed in appropriate local development documents. This can then be accompanied by a policy covering the general criteria for local development documents, including both potentially positive and negative effects, and the relationship to targets and other policies in the plan.

SPECIFIC DESIGNATED AREAS

- 3.27 PPS22 identifies several types of location where specific policies may be appropriate at the regional level:
- internationally designated sites (nature or heritage conservation);
 - nationally designated areas (nature conservation or landscape reasons);
 - locally designated areas (nature conservation or landscape reasons); and,
 - green belts.

In this regard, regional spatial strategies should apply the policies set out in PPS22 paragraphs 9-13. The appropriate treatment of these areas will vary according to the reasons for designation, and may be related to specific landscape, visual or nature conservation characteristics. Authorities may also wish to identify where the submission of “special circumstances” cases would be appropriate, for example in green belt areas.

Case study 3C: criteria-based policy in National Park context

The deposit stage Cumbria and Lake District Joint Structure Plan is supportive of small scale hydro and solar technology in the Lake District National Park, but includes a very protective threshold for wind development: small single turbines with a hub height of up to 25m may be considered, but multiple turbine schemes and larger turbines are classified as “major development” in the Lake District National Park and the County’s AONBs and are subject to very stringent assessment criteria.

More details of the Structure Plan policies can be found at:
www.planningcumbria.org/structureplan/resources.pdf

Similar policies may also be suitable for other nationally designated areas, but regional planning bodies will need to ensure that restrictive policies are fully justified and appropriate for the area concerned.

THE WIDER LANDSCAPE

- 3.28 In addition to nationally designated landscapes, each region contains a variety of landscapes that are typical of the region and offer a sense of distinctiveness. Regional planning bodies will want to take this into account when planning for renewable energy development. Aside from areas with national designations (with their clear criteria against which to judge any potential impacts), these other landscapes may need to be analysed in their own right, with a view to determining whether criteria-based policies for areas outside of national designated areas need to take into account particular landscape characteristics. Such policies will only be needed in regional spatial strategies where the criteria have to be consistent across a number of individual districts – these criteria-based policies will most often be set at local authority level for areas which have local landscape designations (see paragraph 15 of PPS22).
- 3.28 A number of guides have been produced in recent years to assist planners, developers and other professionals in addressing landscape issues³. Several of these guides are in common use, and the methodologies they describe are already applied in many parts of the UK. Key issues for regional level planning are set out below. Section 5 provides guidance on the assessment of landscape and visual impact issues relating to individual development proposals, and cumulative effects.
- 3.29 Where broader landscape issues are to be considered at the regional planning level, the following points should be taken into consideration:
- broad landscape character areas may already be defined within the region – these could be based upon the 159 Countryside Character Areas identified by the Countryside Agency in the late 1990s⁴, or upon more recent Landscape Character Assessments, where available. In addition to mapping the areas, regional planning bodies should ensure that the intrinsic qualities of each landscape character area are set down in writing, and encourage local planning authorities, developers and other interested parties to examine this supporting information before they seek to make reference to particular landscape character areas.
 - regional planning authorities should then identify the sensitivity of the landscape character areas to particular types of change/development at a broad scale. Landscape character areas may be described in relation to their suitability as a location for particular types and scales of renewable energy development. When considering which technologies to include in this assessment, it is important that authorities should take

3 Landscape Institute and Institute of Environmental Management and Assessment (2002, 2nd edition): *Guidelines for Landscape and Visual Impact Assessment* and Land Use Consultants (2002) : *Landscape Character Assessment – Guidance for England and Scotland*.

4 detailed descriptions of these areas, including the reasons for their distinctiveness, are available via the Countryside Agency website: www.countryside.gov.uk/LivingLandscapes/countryside_character/index.asp

into account any existing regional renewable energy generation targets, and any assessment of the technologies that are expected to make a significant contribution. In particular they should ensure that they have regard to the Key Principles set out in PPS22 (paragraph 1).

- The text-based descriptions of each character area resulting from the landscape character and landscape sensitivity assessments may then influence the wording of criteria-based policies in the regional spatial strategy on the types of landscapes that may be considered appropriate for different types and scales of renewable energy development. Those criteria based policies should also follow the approach to “Broad Areas” set out in PPS22 and paragraphs 3.19-3.21 above.

LANDSCAPE CHARACTER

- 3.30 Landscape Character Assessment (LCA), is a method of landscape appraisal developed by the Countryside Agency and Scottish Natural Heritage⁵. LCA is concerned primarily with landscape character, rather than with landscape quality or value. Issues of quality and value will be relevant when LCA is used to inform decision-making, but the LCA methodology itself seeks to distinguish between the identification of landscape character and assessing the quality or value of that character. Key points from the LCA guidance are outlined below.
- 3.31 Landscape character is defined as a distinct and recognisable pattern of elements that occur consistently in a particular type of landscape. Character makes each part of the landscape distinct, where particular combinations of geology, landform, soils, vegetation, land use, field patterns and human settlement contribute to a particular sense of place. In assessing the landscape character of any area, the systematic investigation of these factors is required⁶.
- 3.32 The end product of characterisation will usually be a map of landscape types and/or areas, together with relatively ‘value-free’ descriptions of their character and an identification of the key characteristics which are most important in creating this character. This information can then be used to inform judgements about the suitability of any landscape character area as a location for particular types of renewable energy schemes.
- 3.33 LCA can be applied at several different scales, from national and regional to local planning authority areas or even more detailed areas, where appropriate. Applying LCA at the regional level is recommended to inform strategic planning for renewables.

⁵ *Landscape Character Assessment: Guidance for England and Scotland* Countryside Agency and Scottish Natural Heritage, 2002 and related Topic Papers, available on the Countryside Agency website www.countryside.gov.uk/ccil/guidance

⁶ LCA involves the identification of landscape character **types** (generic in nature, these may occur in different areas of the country but will share common features) and/or landscape character **areas** (single, unique areas, these are discrete geographical areas of a particular landscape type). Criteria-based policy at regional level may more likely be applicable to landscape character types.

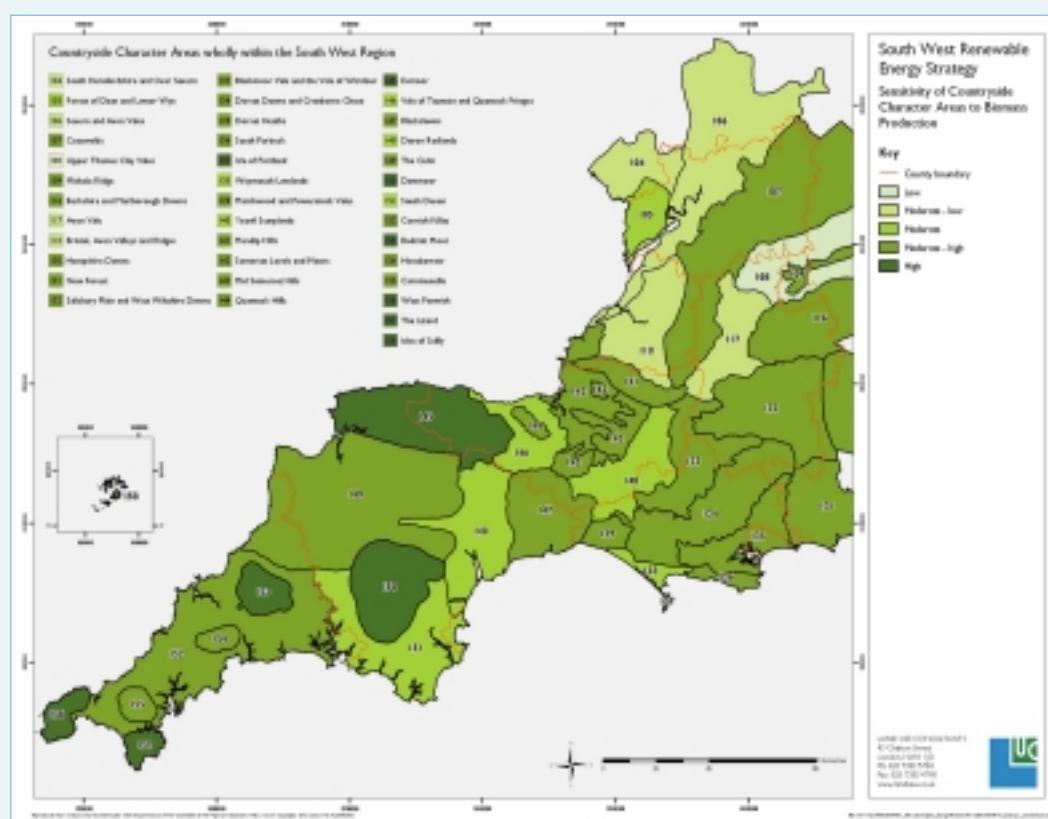
LANDSCAPE SENSITIVITY

- 3.34 One of the judgements to be made in planning for renewable energy is to determine the sensitivity of the landscape. Sensitivity relates to the character of a landscape and how vulnerable this is to change. It is assessed by considering the physical and perceptual characteristics of a given landscape character type/area in relation to particular forms of development.
- 3.35 When discussing landscape sensitivity, a distinction can be made between the ‘overall landscape sensitivity’ and ‘landscape sensitivity to a particular kind of change’:
- **‘Overall landscape sensitivity’** may be used to refer to the inherent sensitivity of the landscape itself, irrespective of the type of change that may be under consideration. This may be described as a combination of: the sensitivity of the landscape resource; the visual sensitivity of the landscape, in terms of the extent to which it is seen by people; and the scope to mitigate visual impact (Swanwick, 2004);
 - **‘Landscape sensitivity to a particular kind of change’** is a separate consideration. Different types of change will affect different elements of landscape character differently. It should not be assumed that because a landscape character area is deemed sensitive to one type of change that it could not accommodate other types of change. For example, a particular landscape character area may be more sensitive to change resulting from one renewable technology than another. In assessing a region’s potential for renewable energy generation, strategic planners should consider the widest possible range of alternative technologies.
- 3.36 Regional planning bodies should note that the concepts and methods of looking at landscape sensitivity are still evolving. Case study 3D demonstrates one approach that has been used .

Consultants undertook this work for the Government Office of the South West, to provide information on the sensitivity of different landscape character areas to two types of possible renewable energy development: wind turbines and biomass crops.

Based on the Countryside Character Areas in the region, the study identified a range of 'landscape attributes' that were considered to indicate suitability to accommodate biomass crops. These were: landscape pattern, land cover/land use; sense of enclosure and settlement pattern/transport network. Using these attributes, a series of sensitivity classes was then defined, on a five-point scale (low; low/moderate; moderate; moderate/high and high).

These classes were mapped at the regional scale, as shown:



There were several important benefits of this regional approach. Firstly, it enabled a consistent region-wide assessment of the different landscape character areas to be undertaken by a single external consultancy, relatively unaffected by local influences. Secondly, it used character areas that were small enough to reflect sub-regional distinctiveness without making the assessment prohibitively complex. Thirdly, each area was assessed against the same criteria, and across the region it was possible to distinguish between them on a five-point scale. If the same exercise had been undertaken at the sub-regional (or local) level, the range of areas against which to benchmark would have been much smaller, raising the possibility that the assessment would be less accurate in relation to the regional picture as a whole.

Further methodological information available in Annexes 7 and 8 of *REvision 2010 – Empowering the Region: renewable electricity targets for the South West*, published by the Government Office for the South West and the South West Regional Assembly, June 2004 (available online at www.oursouthwest.com/revision2010/).

BROAD AREAS FOR DEVELOPMENT

- 3.37 PPS22 makes it clear that criteria should be “used to identify broad areas at the regional/sub-regional level where development of particular types of renewable energy may be appropriate” (paragraph 7). Introducing this spatial element is essential in understanding the implications for the region and for constituent sub-regions.
- 3.38 Regional spatial strategies have a key role to play in considering the broad location of renewable energy projects. However, regional planning bodies should not seek to indicate any boundaries of these broad areas on maps in the spatial strategy. They should use criteria-based policies to identify named areas, but these, if they are to be mapped in any form, should be expressed as indicative symbols rather than as areas with defined boundaries – see, as an example, the North East’s draft regional spatial strategy map (following case study 3B).

COMMUNITY INVOLVEMENT AT REGIONAL LEVEL

- 3.39 In preparing their regional spatial strategies, regional planning bodies are expected to engage creatively with the community, where this is defined as ‘all those who have an interest in and a contribution to make to the content of the revised spatial strategy: individuals as well as local authorities and bodies representing various interest groups’⁷. Communities should have the opportunity to participate in shaping the regional spatial strategy, before it is submitted to the Secretary of State. In drawing up a project plan for the preparation of the strategy, regional planning bodies should consider how they will involve the community and when. When submitting the draft spatial strategy to the Secretary of State for approval, each regional planning body should include a statement detailing all the community involvement that has taken place during its preparation. This is additional to the formal consultation required once the draft regional spatial strategy has been submitted to the Secretary of State.
- 3.38 As the development of renewable energy policies and proposals is a relatively new field of planning work it may be helpful to make them the subject of a specific consultation exercise. This would be additional to the normal process of RSS consultation leading to an Examination in Public. As renewable energy becomes more mainstream the need for specific consultation will probably decrease.

⁷ See PPS11, Annex D,
www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_030921.pdf

- 3.39 There may be thousands of relevant organisations and individuals in any region who would be interested in participating in regional planning. To maximise the use of their resources, regional planning bodies are advised to contact umbrella groups in the first instance, who can then disseminate information to their members. The Social and Economic Partner organisations in each Regional Assembly may be a good starting point, as they contribute directly to the Assembly's work as regional planning bodies, although regional planning bodies should look to involve as broad a range of participants as possible. There may be particular value in consulting with Local Strategic Partnerships.
- 3.40 Community representatives and individuals are more likely to be interested in what the plan will mean for their area. Appropriate community involvement methods at this stage may therefore include workshops and seminars, where people have an opportunity to hear from regional planners what the options would be in order to meet the targets, and to engage in a meaningful debate before the identification of a 'preferred option'. Regional planning bodies may also wish to publicise the benefits of active community-led renewable energy schemes at this stage (see chapter 2 for examples).
- 3.41 In addition to ensuring that the wider public has access to information on renewable energy, regional planning bodies may also wish to offer briefings to their own Members. A number of recent initiatives have offered training for Members, including those described in the case study box below.

Case Study 3E: publicity about renewable energy – Member training

Several initiatives have been offering renewable energy training for Members, including:

NW Region

Concern over a high level of refusals of planning permission for wind projects against positive officer recommendations led Renewables North West to initiate a councillor training programme as a top priority. Preparation included a survey of local media to understand that source of influence on members.

NE Region

A stakeholder group led by GO-NE commissioned an awareness raising project for local authority members and officers piloted with Sedgefield Borough Council and Wear Valley District Council. A CD-ROM, *Guidance for Local Planning Authorities on taking forward renewable energy developments*, has been prepared for local authority Members in particular. This is available from the GO-NE and can be viewed on their website at

www.go-ne.gov.uk/environment_rural/energy/la_guidance_renewable_energy/guidance_index.htm

FURTHER INFORMATION

The Countryside Character Network is considered to be the main forum for ongoing discussion on landscape issues, and a source of good practice information on Landscape Character Assessment: www.ccnetwork.org.uk.

Readers are also recommended to refer to *Topic Paper 6: Techniques and Criteria for Judging Capacity and Sensitivity*. This was prepared by Carys Swanwick for The Countryside Agency and Scottish Natural Heritage; published January 2004 and available online at: www.ccnetwork.org.uk/ca/LCA_Topic_Paper_6.pdf

The DTI commissioned a review of Regional Renewable Energy Assessments in 2001, with the intention of assessing whether the combined output each region anticipated in the RE Assessments would meet the 2010 targets. This report is available on the DTI website at: www.dti.gov.uk/energy/renewables/publications/pdfs/oxera_renew.pdf

4 Planning Policy Issues : Local Level

INTRODUCTION

- 4.1 Although much of the strategic framework for renewable energy planning should be set out at the regional level, with input from local authorities, the local level of policy-making will also be important. Local planning authorities may wish to prepare policies relating to both standalone renewables schemes and to the integration of renewable energy within the built environment, where applicable, and to back up these policies with supplementary planning documents on a range of related issues. The Planning and Compulsory Purchase Act (2004) obliges local authorities to revisit their whole suite of plan policies. This presents opportunities for raising the profile of renewable energy and considering the scope to integrate this particular type of development into the wider policy framework.
- 4.2 Local authorities also have the scope to demonstrate through their own procurement strategies how renewable energy can be a cost-effective alternative to conventionally generated power, and to encourage commercial and other developers to consider incorporating renewables in their developments.
- 4.3 This Chapter outlines how local planning authorities could prepare criteria-based policies for inclusion in their local development frameworks, encourage the take-up of integrated generation and increase community involvement at this level of plan-making.
- 4.4 The key relevant features of the new local development plan system under the new Planning and Compulsory Purchase Act 2004 include:
 - each local planning authority will prepare a local development framework by March 2007. This is the umbrella term used to describe the portfolio of local development documents that will comprise statutory development plan documents, any supplementary planning documents required and a statement of community involvement. There should be a minimum of repetition between the regional spatial strategy and the local development documents: planning issues which are best addressed at the regional level should not be revisited;
 - development plan documents include a core strategy, site specific allocations of land and any area action plans that are considered appropriate, a proposals map and any documents relating to specific policy issues such as housing or employment land that the authority considers relevant;

- supplementary planning documents may be prepared in support of policies which are contained within development plan documents, if further guidance would be beneficial; and
- the statement of community involvement must outline how the local authority will seek to involve the local community in planning, and when.

PPS12 (Local Development Frameworks) sets out the Government's policy on the preparation of local development frameworks.

KEY ISSUES IN PLANNING FOR RENEWABLES AT THE LOCAL LEVEL

- 4.5 Local planning authorities have an important role to play in the implementation of appropriate renewable energy schemes. Both as policy-makers and as more direct agents of change, they have the opportunity to engage with local communities and to achieve real progress towards national and regional targets.
- 4.6 Key issues in planning for renewables at the local level include:
- the introduction of the spatial planning approach within the new system provides an important opportunity for integrating renewable energy generation into the wider local planning framework;
 - local planning authorities should prepare criteria-based policies that focus on key local issues, within the framework set out by national planning policy and the Regional Spatial Strategy, or Spatial Development Strategy in London. Policies may relate to standalone schemes or the development of integrated renewables within developments;
 - supplementary planning documents can be useful in illustrating how particular types of technology, or passive solar design principles, can be applied in the particular local context;
 - some local planning authorities have set specific targets for on-site generation; it may be appropriate for other authorities to do the same, and this should be considered by policy-makers in preparing local development documents;
 - local planning authorities have the scope to demonstrate practical support for renewable energy through their procurement strategies; and

- local planning authorities should encourage community involvement in planning for renewable energy, through consultation exercises during plan-making and also, where possible, by supporting appropriate community-led development proposals.

CRITERIA-BASED POLICY AT LOCAL LEVEL

- 4.7 Planning policy at the local level needs to provide guidance in relation to both standalone renewable energy schemes and the integration of renewable energy into new development.
- 4.8 It is therefore likely that there will be two different policy areas in the plan to cover these issues, most probably contained in an energy development policy document within the local development framework. An overarching policy in the core strategy will clarify the importance of all three areas of policy to the addressing of sustainability objectives established by the local planning authority.
- 4.9 In addition, these policy areas could be supported by supplementary planning documents covering specific aspects:
 - on Renewable Energy – to provide more detailed guidance on the full range of issues;
 - on Design – to include integrated design for renewable energy covering a range of topics related to the built environment.

Standalone renewable energy schemes

- 4.10 It is important that the full range of technologies is considered, even though the regional spatial strategy may have identified only one or two of the most likely sources of energy for the particular sub-region in the short to medium term (i.e. by 2010). Development proposals may come forward for other types of schemes and local policies should also be applicable to them.
- 4.11 Any policy should begin with a statement of general support for renewables. It is usual to then list the issues that will be taken into account in considering specific applications:
 - there will be reference to impact on landscape, townscape, natural, historical and cultural features and areas. These aspects can often be assessed by reference to the landscape character and sensitivity assessment already established at regional or sub-regional level – and are, therefore, unlikely to be burdensome to developer or local authority;

- there will be specific reference to the impacts on the amenity of the area (or particular sub-areas within it) in relation to visual intrusion, noise, dust, odour and traffic generation. Here authorities will need to consider use of zones of visual influence, cumulative effect and separation distance (for noise – see the Technical Annex on wind for further details). The impacts, as above, will differ with the technology, the scale of the proposal and the sensitivity of the local area (for instance, proximity to housing).

Case Study 4A: Criteria-based local plan policies for renewable energy

Basingstoke and Deane Local Plan (Revised Deposit Plan, December 2003)

This policy was developed prior to PPS22 being published in final form, but is a good example in terms of tone and it is expressed positively. However, to reflect PPS22 more fully, it might include issues such as wider environmental, economic and social benefits, and the need to contribute to regional and national targets. Where appropriate it would also need to distinguish between different parts of the local authority area, making it clear that the issue of impacts will vary according to the type of area concerned (ie reflecting the paragraphs in PPS22 on designated areas).

Policy A7 – Renewable Energy

Proposals will be permitted to generate energy from renewable sources provided that:

- i the proposal, including any associated transmission lines, buildings and access roads, has no significant adverse impact on the historic and natural landscape, landscape character, townscape or nature conservation interests and the proposal has no adverse impact on the amenity of the area in respect of noise, dust, odour and traffic generation; and
- ii provision is made for the removal of the facilities and reinstatement of the site, should it cease to be operational.

www.basingstoke.gov.uk/_assets/localplan/lrdd_revised_deposit_draft.pdf

Integration in new development

- 4.12 There are many examples of policy relating to provision for renewable energy in major new developments. It is likely that a general policy could be included in the core strategy, with reference to a separate supplementary planning document. The latter would explore how different technologies could be integrated into the design of development or enabled for future fitting through, for instance, orientation of development.
- 4.13 The proportion of renewable energy that it would be feasible to generate within developments would need to be explored with the development industry before specific targets are set. A number of authorities are following the example of the London Borough of Merton in preparing plan policies to promote a proportion of on-site generation: see the Case Studies below for details.

Case study 4B: Integrated renewable energy policy (non-residential development)

London Borough of Merton UDP (2003)

Policy E.11: Environmental Improvements from Employment Development

“To achieve environmental benefits, employment developments will be expected to be of high quality and layout. All new industrial, warehousing, office and live/work units outside Conservation Areas and above a threshold of 1,000sqm will be expected to incorporate renewable energy production equipment to provide at least 10% of predicted energy requirements...”

LB Merton recognises the potential benefits of such a policy for the wider area:

“...By expecting the installation of renewable power generation equipment in larger developments, it is ... anticipated that the Council will be helping to generate sufficient levels of demand to enable manufacturers of appropriate renewable energy equipment to exploit economies of scale in the production of such equipment...” (UDP paragraph 3.132)

Policy PE.13: Energy Efficient Design and Use of Materials

“The Council will encourage the energy-efficient design of buildings and their layout and orientation on site. All new non-residential development above a threshold of 1,000sqm will be expected to incorporate renewable energy production equipment to provide at least 10% of predicted energy requirements... This will be subject to the impact on the amenity of the local environment, taking into account the character of the area.”

This is explained further:

“... For the purpose of this policy the means of generating renewable energy include photovoltaic energy, solar-powered and geo-thermal water heating, energy crops and biomass, but not energy from domestic or industrial waste. For residential developments the Council will encourage developers to achieve a ‘very good’ or ‘excellent’ rating in the BRE eco-homes standards...” (UDP paragraph 4.166)

For full text see www.merton.gov.uk/udp/acrobat/Udpfinal.pdf

Case study 4C: Integrated renewable energy policy (residential development)

Oldham MBC Revised Deposit Draft UDP (October 2003)

Policy NR3.3: For all major new developments, **including residential developments** comprising 10 or more units, and non-residential developments exceeding 1000m² gross floorspace, the Council will require 10% of total predicted energy requirements to be provided, on site, from renewable energy sources.

13.93... Such energy production could include energy from wind, biomass, photovoltaic equipment or solar powered water heating. The Council would seek to ensure that the technology is appropriate to the location in question in terms of any visual or amenity impact it may have, and will therefore encourage discussion on such schemes at the earliest opportunity. Oldham has a wide ranging energy strategy as well as a proactive approach to demonstration projects.

13.94 Passive solar design, that is designing a building to take maximum advantage of sunlight, can significantly reduce the overall energy consumption of a building. Where developers can satisfactorily demonstrate that a percentage of the development's energy requirements have been reduced through passive solar design, that percentage will be deducted from the 10% target required by this policy.

13.95 Applications for developments where it is claimed that such a requirement would be non-viable should be supported by a development appraisal which substantiates why this is the case.

www.oldham.gov.uk/council/publications/udp/second_deposit/assets/documents/udp_revised_main.pdf

Renewables North West are progressively rolling out the 'Oldham approach' across 46 local authorities in the region, undertaking resource studies and strategies (8 to be completed in 2004).

- 4.14 In preparing policies in relation to on-site generation, local planning authorities should take into account the following considerations:
- policies should encourage developers to consider a range of renewable energy technologies on their sites (but should not specify which technologies to use on named sites – this would be too prescriptive);
 - policies should be flexible: not all technologies are appropriate on all sites and locational constraints should be borne in mind (for example, any requirement for connection to the electricity distribution network);
 - policies should not place undue burdens on developers: local authorities should be mindful of the level of development pressure in their area in setting generation targets; and,

- authorities may wish to lead by example and install schemes at their own premises or develop ‘private wire’ networks in town centres – this can encourage neighbouring developers to follow suit and there may be advantages in developing a local distribution network.

See Chapter 6 for further information and case studies of building integrated renewables and on-site renewable energy generation.

LANDSCAPE ISSUES

- 4.15 The local planning authority may wish to undertake landscape capacity and sensitivity analysis where it considers that there is a need for greater articulation of landscape character, in order to assist them in decision-making outside nationally designated areas (Nationally designated areas will normally be covered by the regional planning body during the development of the regional spatial strategy). This should be carried out on similar lines to those described in section 3 for the local area. In many cases such analysis may already be available. Character areas could form the basis for considering which technologies at which scale may be appropriate in different types of location. However, it will not be appropriate for local authorities to identify specific locations or prescribe a particular technology that should be developed on a particular site as a result of any local landscape assessment.
- 4.16 In relation to highly valued landscapes outside nationally designated areas, PPS7 (Sustainable Development in Rural Areas) states that it is expected that criteria-based policies in local development documents, utilising tools such as landscape character assessment, should provide sufficient protection, without the need for local designations¹. Local planning authorities will be expected to justify any retention of local landscape designations, identifying what it is that requires extra protection and why². Landscape character assessment will therefore be an important basis for developing policy both generally and within any specific designations.

¹ PPS7 paragraph 24.

² PPS7 paragraph 25.

BUFFER ZONES

- 4.17 In avoiding the creation of “buffer zones”, as advised in paragraph 14 of PPS22, authorities will still need to ensure that their criteria-based policies for areas outside nationally designated areas afford appropriate protection to those areas. This is because the impact upon those designated areas from proposals that are close to them will be a material consideration.

PREPARING SUPPLEMENTARY PLANNING DOCUMENTS

- 4.18 Most renewable energy policy should be expressed at the regional level, supported at local level, and worked out through the development control (application-specific) process. However, supplementary planning documents could play a critical role in implementing renewable schemes, and have the potential to act as a tool in raising awareness of the potential of a particular technology or technologies.
- 4.19 Under the new planning system, supplementary planning documents are intended to elaborate on the policies and proposals in development plan documents. They cannot introduce new policy, but must be directly linked to adopted policies. In exceptional circumstances supplementary planning documents can be produced at relatively short notice, pending an amendment to the local development framework. Supplementary planning documents should be consistent with national and regional policy as well as the other Development Plan Documents.
- 4.20 Supplementary planning documents might include:
- design guidance (among other topics, general design guidance may include reference to potential for passive solar design, or building-integrated renewables such as Photovoltaics); and,
 - site development briefs (inclusion of renewable energy generation as a potential future use of specific major brownfield sites, or reference to potential for passive solar gain through careful site layout, for example).

Case study 4D: SPG on Energy Efficiency and Renewable Energy in New Developments

**Leicester City Council,
adopted August 2002**

This Supplementary Planning Guidance Note offers practical guidance on how renewable energy and passive solar design can be incorporated into new development at minimal extra cost, and makes explicit references to the local context. It is illustrated by examples of successful schemes in the Leicester area, and clear diagrams to explain the principles behind energy efficient buildings and development layouts.

www.leicester.gov.uk/endev/spg/EnergyEfficiency.pdf

Courtesy of Leicester City Council

B. Orientation

The orientation of a building has a significant impact on the amount of passive solar gain available. To maximise solar gain buildings should be generally orientated with the longest face within 30 degrees of south. South easterly orientation is generally preferable to south westerly as this maximises early morning gains and reduces the likelihood of overheating in the afternoons.

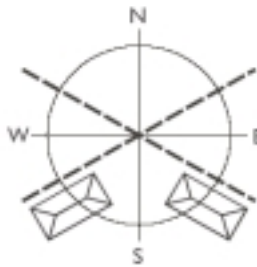


Figure 3: Building should generally be orientated with the longest face within 30° of south

C. Overshadowing

Any nearby building, trees or fences can potentially cast shadow on the southerly face and reduce solar gains. Careful layout can still maximise solar gain within the constraints of higher density developments. The following principles should generally be followed:

- garages should be sited away from southerly elevations
- in mixed height developments taller properties should generally be placed north of detached properties, since they cast a greater shadow
- higher density properties, i.e. terrace properties should generally be placed north of detached properties, since they cast a greater shadow.
- Care should be taken when planning trees within 30 degrees of the southerly aspect as they can significantly reduce passive solar gain. Deciduous trees can, however, be useful for providing shading from glare and overheating during the summer, whilst the bare branches will allow solar access during the winter.

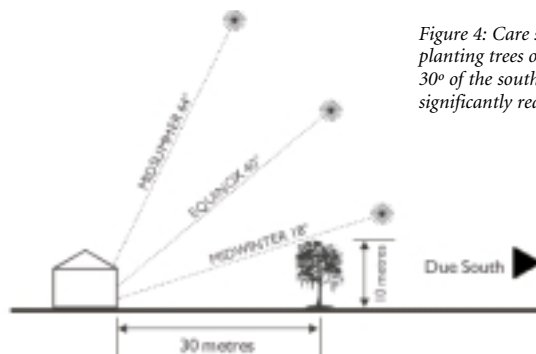


Figure 4: Care should be taken when planting trees or locating buildings within 30° of the southerly aspect as they can significantly reduce solar gain.

LOCAL BENEFITS OF RENEWABLE ENERGY: SOCIAL, ECONOMIC AND ENVIRONMENTAL

- 4.21 Maximising the local benefits of renewable energy schemes will be an important consideration for local planning authorities. Potential benefits are discussed in section 2.

Involving local communities

- 4.22 For most people, renewable energy generation will only become a big issue when they can relate actual proposals to a particular geographical area. In some cases, this may not happen until a developer submits a planning application, by which time several opportunities to engage constructively with local people may have been lost.
- 4.23 Local planning authorities may wish to consider informing local communities about renewable energy, its potential benefits, and any potential negative impacts before any schemes are submitted for planning permission in their area. Offering a balanced view of the issues to the public *before* any specific schemes are under discussion can be of benefit at a later stage, as a better-informed public is more likely to ask more pertinent questions of an applicant and to understand better the issues that are relevant to the application.
- 4.24 The new planning system promotes ‘front-loading’, which is both the early involvement of communities in plan-making and early taking of key decisions ³. Local planning authorities and developers are both encouraged to engage local communities in their work from an early stage.
- 4.25 Each local planning authority’s approach to community involvement will be set out in their Statement of Community Involvement, a document which sets out how they propose to involve local communities in plan-making and in relation to significant planning applications. Further guidance on the Statement of Community Involvement can be found in PPS12 and its companion guide ⁴.

Involvement in plan preparation

- 4.26 In preparing local development documents, local authorities will be expected to involve the public at several stages, from the initial identification of issues and options through to independent examination. Appropriate methods of community involvement will vary depending on the stage in the planning process, but may include any of the following:
- public exhibitions, displays and roadshows;

³ See PPS12: *Local Development Frameworks* and *Creating Local Development Frameworks* (ODPM, 2004) for further details.

⁴ See PPS12: *Local Development Frameworks* and *Creating Local Development Frameworks*.

- presentations at public meetings;
- dissemination of information via the internet, local press or leaflets through letterboxes
- consultation with focus groups (groups of participants selected for their particular characteristics) or Citizens Panels (randomly selected participants);
- consultation with area forums, parish councils, town councils, Local Strategic Partnerships or similar existing groups; and
- convening a steering group to oversee renewable energy policy developments.

4.27 When undertaking consultation exercises, the following issues may need to be addressed:

- a lack of awareness about the technology/technologies and concerns about noise, visual intrusion, odour, and other perceived hazards;
- juxtaposition between the importance of addressing a long term global threat such as climate change and the specific, immediate local impacts arising from a particular project; and,
- difficulties in making the link between regional policy and local delivery.

4.28 The plan preparation process is sufficiently robust to deal with these issues but they require a particular focus. Key requirements are as follows:

- regional planning bodies and local planning authorities need to provide a committed, strong lead throughout the plan preparation process (ensuring community involvement). This requires Member commitment and enthusiasm;
- it is essential that local authority Members are closely involved and informed about wider issues such as the role of renewable energy in combating climate change. Particularly at district council level, ward Members may give considerable weight to the local impact of renewable projects, without considering issues such as the benefits of renewable energy;
- local media should be involved from an early stage; and,
- strategy and options must be described and explained in accessible ways.

Scope for proactive community-led initiatives

- 4.29 Community-led initiatives can generate considerable benefits for local people, as well as providing 'green' energy. An opportunity to engage in the development of a renewable energy generation scheme can offer local people the chance to develop new skills and confidence. This can have many positive effects particularly in areas of social exclusion. Awel Aman Tawe (see case study in **Section 2**) is a good example of a community-led scheme that has flourished as community interest has grown, from its original remit to contribute to the regeneration of the local area through the development and implementation of a Community Energy Scheme.
- 4.30 Where there is nascent local interest, local planning authorities should encourage communities to develop initiatives that may be expected to bring environmental, social and/or economic benefits to an area through the development of a renewable energy project or projects. Such encouragement may include the following:
- offering financial or in-kind support (directly or indirectly) to community groups with ambitions to install an appropriate renewable energy scheme in the area;
 - making planning staff available to answer the community's queries;
 - facilitating public meetings to discuss the proposed scheme; and,
 - providing any information on potential grant funding and other support from which the community may be able to benefit.
- 4.31 The Community Renewables Initiative provides a system of guidance to community groups and community organisations who are considering or pursuing a renewable energy project. The initiative uses project officers to advise such groups, especially where the project in question involves a range of partners in the locality, and demonstrates or explains the project to others who may wish to learn from it. The initiative is backed by central and regional government bodies involved in renewable energy, and its project officers are available for help and advice throughout each region.
- 4.32 Project officers working for the initiative can help groups and organisations to:
- consider options for renewable energy projects in their locality;
 - determine which options are relevant and guide them on assessing the practical and financial feasibility;

- seek funds and resources to make the project viable;
- link with other bodies who may contribute advice, skills and resources to the project;
- address planning and regulation issues associated with the project; and;
- advise on how to explain and demonstrate the project to others.

Case study 4F: CLAREN – Cumbria and Lancashire Renewable Energy

CLAREN is managed through Sustainability Northwest (SNW), and is one of a number of Community Renewables Initiative support teams throughout the UK. Barrow Borough Council is one of the project partners.

The team works with local communities in Cumbria and Lancashire to help them develop and implement small-scale renewable energy projects. It provides advice on technology, funding and implementation, and also direct funding assistance towards the cost of feasibility studies.

CLAREN supports the Baywind Energy Co-operative in Cumbria (see **Section 2** for case study).

See www.claren.org.uk for further details

Photo courtesy of the Baywind Energy Co-operative



FURTHER INFORMATION

Local planning authorities may find the following documents helpful:

Government Office for the North East: Guidance for Local Planning Authorities on Taking Forward Renewable Energy Developments:

www.go-ne.gov.uk/environment_rural/energy/la_guidance_renewable_energy/guidance_index.htm

RegenSW guide for local planning authorities: The Appropriate Development of Wind Energy:

www.regensw.co.uk/documents/guidance-for-local-planning-authorities-on-the-appropriate-development-of-wind-energy.pdf

Planning Officers Society (August 2004) Policies for Spatial Plans: Consultation Draft currently available online:

www.planningofficers.org.uk/documents/spatialpolicies0704.pdf

Community Involvement in Planning: The Government's Objectives (February 2004): available online at:

www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_027497.pdf

There is a considerable volume of case study information, literature and advice on the internet in relation to community involvement. For example, readers are recommended to see the following:

Community Action For Energy: www.cse.org.uk/cgi-bin/projects.cgi?community&13

Awel Aman Tawe community renewables initiative homepage: www.awelamantawe.co.uk

Consulting Communities – a renewable energy toolkit; prepared in 2001 by AAT for ETSU/DTI: www.dti.gov.uk/energy/renewables/publications/pdfs/KBD00236Srev.pdf

Examining approaches to renewables consultation: lessons from AAT community wind farm project, prepared in 2001 by AAT for ETSU/DTI:

www.dti.gov.uk/energy/renewables/publications/pdfs/KBD00236.pdf

Community Renewables Initiative:

www.countryside.gov.uk/NewEnterprise/Economies/CRI.asp

Promoting community heating, including from heat networks that use renewable sources for heat generation:

www.est.org.uk/communityenergy/aboutheating/

5 Development Control Issues

INTRODUCTION

- 5.1 If the Government's targets are to be met, policy support for renewable energy schemes will need to be backed up by development control decisions. These are the responsibility of local planning authorities or the Secretary of State for Trade and Industry, depending on the scale of the scheme¹.
- 5.2 With the publication of PPS22, applications for renewable energy schemes are expected to increase. Applications may range from individual householders seeking permission to install domestic scale schemes, to major development proposals to generate many megawatts of electricity. While some local planning authorities already have considerable experience of determining renewables applications, and have developed sophisticated approaches to issues such as landscape and visual impact, they are in the minority. Many authorities have little or no experience and are seeking guidance on the main development control issues that they are likely to face.
- 5.3 The guidance offered in this section is intended to cover all scales of development, from major installations to retrofitting individual properties, where planning permission is required. It identifies the key issues relevant to development control officers, and describes a number of approaches that have been successful elsewhere in the UK. It also offers guidance for developers seeking to submit applications for renewable schemes.

KEY ISSUES IN DEVELOPMENT CONTROL

- 5.4 In many ways, applications for renewable energy schemes should be approached no differently from other types of planning application. The following are key issues that should be taken into account by development control officers:
 - local authorities should be explicit in setting out what information they wish to be included in a planning application for a renewable energy scheme, and any supporting documentation. Pre-application discussion is strongly recommended;
 - for certain projects described under Schedule 2 to the EIA Regulations, the requirement for EIA will need to be considered;
 - issues of landscape and visual impact should be addressed at the scheme-specific level. Cumulative impacts should also be assessed and mitigated at this level (see below for guidance on the treatment of landscape and cumulative visual impact);

¹ Local planning authorities are responsible for determining applications for onshore renewable energy schemes up to 50 megawatts. Larger onshore applications (and all offshore applications) are determined by the Secretary of State. Local authorities may request that applications approaching the 50 MW limit are called in for determination by the Secretary of State, in which case the authority will remain a statutory consultee.

- local planning authorities should recognise that the landscape and visual effects will only be one consideration to be taken into account in assessing planning applications, and that these must be considered alongside the wider environmental, economic and social benefits that arise from renewable energy projects;
- applications should be determined with reference to criteria-based regional and local plan policies and supplementary planning documents where applicable;
- member training is important. Councillors may begin with limited knowledge of renewable energy technologies and the likely impacts of a proposed scheme upon the local area, but will be expected to make informed judgements in determining applications; and,
- by comparison with most applications, there is likely to be an increased level of public interest in renewables schemes. This makes community involvement essential if the public is to be kept informed about the proposals.

ENVIRONMENTAL IMPACT ASSESSMENT

- 5.5 The 1999 Environmental Impact Assessment Regulations set out those developments that may be subject to an Environmental Impact Assessment (EIA) and describe the procedural requirements involved in the preparation of an Environmental Statement. The EIA enables systematic examination of the environmental implications of a project (and its alternatives) and provides for public involvement in the process. The Environmental Statement describes the significant environmental effects of construction and operation, identifying beneficial and adverse effects, together with relevant mitigation measures.
- 5.6 EIA will be required for certain renewable energy projects where the development falls into a category within Schedule 2(3) to the Regulations and the Planning Authority adopts a 'screening opinion' that EIA is required.
- 5.7 As with Strategic Environmental Assessment it is the identification of key issues that is most important, rather than the provision of information for its own sake. The scoping of the EIA (by the local authority) is therefore of central importance in ensuring that the work is properly focused.

ISSUES TO BE COVERED IN A RENEWABLE ENERGY APPLICATION

- 5.8 In putting forward a planning application, developers should be able to demonstrate that the project:
- meets the requirements of applicable development plan policies;
 - does not compromise the reasons behind any relevant area designation, or if it does, provides a substantive case for allowing the project to proceed (e.g. by demonstrating that any economic, social or environmental benefits clearly outweigh the reasons for the designation²); and,
 - addresses the issue of visual impact, and cumulative visual impact, where relevant (see below for further details).
- 5.9 The developer should also outline any environmental, social and economic benefits that are specific to the proposal (as opposed to, for example, broader environmental benefits that could be applicable to any renewable energy project).

DRAWING TOGETHER AN EVALUATION WHEN DETERMINING APPLICATIONS

- 5.10 In determining a planning application, planning authorities must assess the case for each project put forward by a developer and come to an objective view on:
- the extent to which the project is in conformity with the development plan, in particular relevant criteria-based policies and any 'broad area' policies in RSS;
 - the extent to which the reasons for any area based designations may be compromised;
 - the extent of any positive or negative impacts, and the means by which they may be mitigated, if negative; and,
 - the contribution towards meeting the regional target, but recognising that a small contribution cannot be in itself a reason for refusal of permission³.

² PPS22, paragraph 11

³ PPS22, paragraph 1 (vi)

- 5.11 In considering an application, the following questions should be answered:
- Does the proposal satisfy the relevant criteria-based policies in RSS and detailed policies in the LDD?
 - How significant is any non-compliance? Could this be dealt with by condition or by requiring measures in a planning obligation (Section 106 Agreement) which mitigate adverse impacts?
 - Have application-specific matters such as landscape and cumulative visual impact been properly addressed?
 - Could measures be taken to mitigate impacts during construction and after the plant is in operation?
 - Can a condition be applied to cover restoration of the site should operations cease? (feasibility will need to be taken into account).
- 5.12 Regional planning bodies are expected to identify broad areas that are appropriate for particular types of renewables at a regional or sub-regional level. These areas come out of criteria-based policies at regional level and are identified in the regional spatial strategy. This is a part of the statutory development plan and these areas should therefore be considered as more than a material consideration. At the local level, PPS22 makes clear that authorities may allocate sites for renewable energy developments, but only when there is already a high degree of commitment by a developer. This level of precision in plans will be the exception rather than the rule.
- 5.13 However, the identification of broad areas does not imply that projects coming forward in areas outside them should automatically be considered for refusal. In all areas the compliance with criteria-based policies is the key determinant.

LANDSCAPE AND VISUAL EFFECTS

- 5.14 PPS22 states that landscape and visual effects should be assessed on a case by case basis. It also states that “proposed developments should be assessed using objective descriptive material and analysis wherever possible” (paragraph 19). This section describes a number of common approaches to landscape and visual assessment that may assist local planning authorities in this task.

- 5.15 If landscape character assessment has already been undertaken in the area, the results are also recommended as a basis for consideration of individual schemes. They present a relatively 'neutral' description of an area in landscape terms, which can inform applicants and planning authorities (and other stakeholders) in their discussions over the most appropriate future for the area. If landscape character assessment has provided a framework for the development of criteria-based policies (at regional/local level) it would not be onerous to undertake further analysis against those criteria at the development control level.

Assessing individual applications

- 5.16 Landscape and visual impact assessment will be part of any environmental impact assessment undertaken, but these issues should also be considered in relation to smaller renewable energy applications that do not require full environmental impact assessment.
- 5.17 A widely accepted methodology for landscape and visual impact assessment was first published by the Landscape Institute in 1995 and revised and published as a 2nd edition in 2002⁴. This presents a step-by-step approach to the assessment of individual development proposals. It does not offer specific guidance in relation to renewable energy proposals, but does offer advice that is relevant to these as well as other types of development.
- 5.18 Local planning authorities should note that the assessments of landscape impact and visual impact are generally considered as separate exercises, as set out in 5.22 below.
- 5.19 Factors to consider in analysing the landscape and visual effect of individual applications include:
- national designations (presence or absence; nature and justification of designation);
 - landscape character areas (where already identified);
 - landscape sensitivity (as discussed at regional level, see section 3);
 - landscape and visual analysis (see below); and,
 - cumulative effects (see section below).

4 The Landscape Institute (2002) *Guidelines for Landscape and Visual Impact Assessment (GLVIA)*; 2nd Edition

- 5.20 Local planning authorities, during pre-application discussions, should agree with developers how the latter will undertake landscape and visual impact assessment, and what relevant information will be required to accompany the planning application. Depending on the renewable energy technology in question, this may include:
- diagrams showing the potential zones of visual influence (ZVI) of the proposed scheme: these will be of assistance in identifying the resources (e.g. designated areas, landscape units) and the locations of visual receptors (e.g. settlements, public access land and popular viewpoints), which may be affected by the proposal. Where ZVIs are generated using bare ground terrain data only, they offer an initial impression of the theoretical zones of visibility which, in reality, are likely to be reduced by the screening effects of surface features (e.g. forestry, buildings) and by weather conditions;
 - photomontages and/or computer-generated wireframe views: these should be prepared at an appropriate scale and resolution. The field of view may vary from a single frame (approx 40°) to a panoramic image (90° – 360°). Where panoramic images are constructed by splicing together several frames, the spliced image should be cylindrically projected so that, when curved around the horizontal angle of view and held at the appropriate viewing distance, the image can be viewed correctly. The viewpoint location (NGR), camera type, lens focal length, horizontal angle of view and appropriate viewing distance should be stated on each image.
 - scale drawings to illustrate the physical appearance of the proposed renewable energy scheme: some authorities are likely to be less familiar with specific technologies (e.g. biomass or energy from waste plants); and,
 - in areas where there are existing renewable energy schemes, it may be appropriate to consider the cumulative impact of further schemes (see below).

Assessing cumulative landscape and visual effects

- 5.21 Several areas in England are experiencing much interest from renewable energy developers and cumulative effects have become a factor in the determination of applications.
- 5.22 Cumulative landscape effects and visual effects should be considered separately. The former refers to effects of a proposal development on the landscape fabric, character and quality and so concerns the degree to which renewable energy development becomes a significant or defining characteristic of the landscape. Cumulative visual effects concern the degree to which renewable energy development becomes a feature in particular views (or sequences of views), and the effect this has upon the people experiencing those views.

- 5.23 Cumulative effects may arise where two or more of the same type of renewable energy development are visible from the same point, or are visible shortly after each other along the same journey. Hence, it should not be assumed that, just because no other sites are visible from the proposed development site, the proposal will not create any cumulative effects.
- 5.24 Cumulative impact assessments undertaken to date in the UK relate mainly to wind farms, and have generally been concentrated in Scotland and Wales. Bodies such as Scottish Natural Heritage have developed considerable experience in dealing with these issues and have prepared several volumes of good practice guidance for their own and wider use⁵. In England, the following key points (derived from the Scottish guidance) may assist in assessing cumulative effects:
- a base plan of all existing windfarms, consented developments and applications received should be produced, showing all such schemes within a defined radius of the centre of the proposal under consideration;
 - for those existing or proposed windfarms within a defined radius of the proposal under consideration, a plan showing cumulative zones of visual influence (ZVIs) should be prepared. This plan should clearly identify the ZVI of each windfarm, and identify those areas from where one or more windfarms are likely to be seen;
 - the base plan and plan of cumulative ZVIs should reflect local circumstances – for example, the areas covered should take into account the extent to which factors such as the topography and the likely visibility of proposals in prevailing meteorological conditions may vary;
 - the map of cumulative ZVIs should be used to identify appropriate locations for visual impact studies. These will need to include locations for simultaneous visibility assessments, where two or more schemes are visible from a fixed viewpoint without the need for an observer to turn their head, and repetitive visibility assessments, where the observer is able to see two or more schemes but only if they turn around;
 - sequential effects on visibility occur when an observer moves through a landscape and sees two or more schemes. Common routes through a landscape (e.g. major roads; long distance paths or cycle routes) should be identified, as ‘journey scenarios’ appropriate for assessment;

5 For further information, please refer to the SNH website (Index; Renewable Energy): www.snh.org.uk/index/i-frame.htm

- photomontages should be prepared showing all existing and consented turbines, and those for which planning applications have been submitted, in addition to the proposal under consideration. The viewpoints used should be those identified using the maps of cumulative ZVIs. The photomontages should be annotated to include the dimensions of the existing turbines, the distance from the viewpoint to the different schemes, the arc of view and the format and focal length of the camera used; and,
- at the most detailed level, description and assessment of cumulative effects may include the following landscape issues: scale of development in relation to landscape character or designations; sense of distance; existing focal points in the landscape; skylining (where additional development along a skyline appears disproportionately dominant); sense of remoteness or wildness.

COMMUNITY INVOLVEMENT IN SIGNIFICANT PLANNING APPLICATIONS

- 5.25 Guidance is has been published shortly by ODPM on the new requirement for community involvement in significant planning applications⁶.
- 5.26 Local planning authorities will have the power to identify the level of community involvement that they consider appropriate for different types of ‘significant’ planning application. It is likely that applications for renewable energy generating schemes will be among those specified by planning authorities, but the scale of community involvement expected is likely to vary considerably according to local preference and circumstances. Potential developers should make themselves familiar with individual local planning authority statements of community involvement, which will set out their specific local requirements (see section 4 for further details).

FURTHER INFORMATION

The Countryside Character Network is a discussion forum on landscape issues in the UK, and may be a useful source of further information especially in relation to landscape character assessment. A list of all the LCA topic papers issued to date (including Topic Paper 6 on capacity and sensitivity) is available at www.ccnetwork.org.uk/lca_topic.htm

Guidance on the preparation of an ES is provided in the ODPM guide *Environmental Impact Assessment – a Guide to Procedures* is available at www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_026667.hcsp and in the Department of the Environment good practice guide on the *Preparation of Environmental Statements for Planning Projects that require Environmental Assessment* (ISBN 0 11 753207).

6 Renewable energy in the built environment

INTRODUCTION

- 6.1 Renewable energy is commonly envisaged as stand-alone schemes such as wind farms, hydroelectric dams or industrial scale biomass plants. This is only part of the picture, and the contribution that can be made by building integrated renewables (integrated within the built environment, both new build and retrofitted to existing buildings) should not be underestimated. Especially in heavily built-up areas, there may be a perception that renewable energy schemes are not viable, but this is not necessarily so. Careful design can optimise the potential for installing renewable technologies either at the time buildings are constructed, or at some point in the future. Given the design life of most buildings, and the need to increase the contribution from renewable energy in the future, retrofitting is likely to become increasingly common (see section below on ‘future-proofing’ for further details).
- 6.2 In addition, planners should consider the potential for passive solar design to use the sun’s energy within buildings. Taking account of the sun when designing masterplans and individual buildings can reduce the need for additional lighting and heating or cooling, where appropriate. It is much less expensive to make carbon savings through reducing energy demand than it is to install building-integrated renewables. Passive solar design therefore presents an opportunity for urban areas to contribute to overall carbon reductions even where renewable energy generation may be considered technically or financially unviable. Fundamentals of passive solar design are described below.
- 6.3 PPS22 makes the introduction of renewable energy into development projects, and the use of passive solar design principles, ‘normal planning matters’. This effectively means that local authorities now have the ability to produce policies on these matters, and to take them into account when determining applications.
- 6.4 This Chapter outlines the potential for planners to encourage passive solar design and integrated renewable energy in the built environment. Local and regional planning bodies can also demonstrate through their own procurement strategies that renewable energy can be a viable alternative to traditional power supplies; selected case studies are also included in this Chapter. Information on specific technologies are included in the Technical Annex.

SCOPE FOR URBAN INSTALLATIONS: POSSIBILITIES

- 6.5 Most of the technologies addressed in the Technical Annex to this Guide have the potential to be applied in an urban context. In closer proximity to larger centres of population there may be an increased need to mitigate the local impacts of the different technologies, but this should not preclude the possibility of installing them altogether. Some installations may require planning permission. Where a listed building or conservation area is involved, listed building consent or conservation area consent will need to be obtained.
- 6.6 Some types of scheme are ideally suited to urban areas. Local planning authorities should seek to maximise the contribution from these technologies in their efforts to meet the Government targets. Guidance notes are available from the Energy Saving Trust (www.est.co.uk), on a range of issues that are highly relevant to urban renewable energy schemes¹, including case studies of successful schemes across the UK, and guidance for developers, architects, and local authorities. The following technologies may be the most appropriate in an urban context.

Solar Water Heating

- 6.7 Solar water heating systems, in the form of flat plates or airtight (evacuated) tubes, can be mounted on south-facing roofs. They use solar radiation to heat water, and can operate for most of the year in Britain, although they are most successful in southern regions and during the summer months. They are most commonly used in a domestic context but may also be appropriate for light industrial use.
- 6.8 Installing solar water heating systems does present an additional cost to traditional water heating systems, as the climate is not warm enough to provide sufficient heating all year round.

¹ For example, *General Information Report 27: Passive Solar Estate Layout* – <http://www.est.org.uk/bestpractice/uploads/publications/pdfs/GIR027.pdf> and *Renewable Energy Sources for Homes in Urban Environments*: <http://www.est.org.uk/bestpractice/uploads/publications/pdfs/CE69%20-%20Urban%20Renewables%20Guide.pdf>

Case study 6A: Solar Discount scheme, Hampshire

A number of local authorities in South Hampshire (Eastleigh BC, Fareham BC, Gosport BC, Havant BC and Southampton City), Hampshire County and the Environment Centre (Southampton) combined to promote solar water heating to local residents. Together they sought a high quality contractor to install solar water heating schemes at a discounted price (in the region of £2,000), in return for publicity from the consortium. Around 5 contractors were interviewed, and one was selected. Each partner organisation made a financial contribution to the project and this was used to promote the scheme to local residents, who contacted the contractor directly if they wished to arrange for an estimate for installing the technology in their properties.

The scheme has been running since summer 2003, and in the first year approximately 50-60 householders have expressed an interest. Of these, around 10 have installed schemes so far and there are around 13 more on the waiting list. The consortium is now considering expanding the scheme to include other authorities and appointing an additional contractor to do the work.

Active Solar (photovoltaics)

- 6.9 In the built environment, photovoltaic cells can be added to the outside of existing buildings, on broadly south-facing roofs or walls. Alternatively they can be integrated into the fabric of new buildings in place of roofing materials or wall cladding.
- 6.10 Photovoltaic schemes are commonly installed as part of a package of renewable energy technologies. Photovoltaic cells have been available for a number of years, the technology is continually improving and prices are becoming more competitive. Photovoltaic materials remain more expensive than conventional building materials, although they can be cost-competitive with prestige cladding materials.
- 6.11 However, in many types of built-up area, care should be taken to ensure that photovoltaic installations are not overshadowed by neighbouring buildings or other structures.
- 6.12 Local planning authorities should encourage the installation of photovoltaic schemes in many types of built-up area. Authorities should recognise that although some schemes may make a noticeable contribution to individual developments' energy requirements, much of their present value is to be seen as raising awareness of renewable energy in general.

Case study 6B: Ysgol Gwaun Cae Gurwen, Neath Port Talbot Borough, South Wales

This project, to install 10kW of photovoltaic tiles on the roof of an existing primary school in one of the most deprived wards in Wales, was completed in November 2003 at a cost of £57,000. This was funded entirely by grants from the DTI PV demonstration programme and the National Assembly Local Regeneration Fund

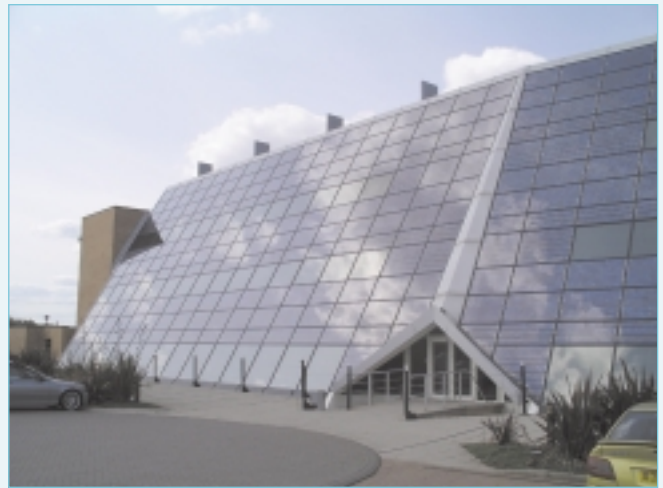


The installation is expected to supply around 14% of the school's energy, making it one of the 'greenest' schools in the UK. As well as saving around £700 per annum in electricity bills, the scheme will generate a modest income for the school in the form of electricity sales when the school is closed, and indirectly through the sale of Renewables Obligation Certificates (ROCs) to traditional power generation companies. After insurance and maintenance are taken into account, the school will earn approximately £500 per annum.

Photo courtesy of Awel Aman Tawe.

Case study 6C: Doxford Solar Office, Doxford Park, Sunderland

Doxford Solar Office provides high specification accommodation and generates 30% of its overall electricity requirements from 352 PV modules encapsulated within its south facing glass façade. As well as producing a peak supply of 73kW the building also uses passive solar design features which draw fresh air through the building to provide natural cooling during the summer. Designed by Studio E Architects and Rybka Battle for Akeler Developments Ltd.



See www.oja-services.nl/iea-pvps/cases/gbr_02.htm for further details

Photos: Adrian Smith

Biomass

- 6.13 The most common biomass technologies to be found in urban areas are heating schemes for individual properties (generally residential) or Combined Heat and Power schemes (CHP) serving larger developments.
- 6.14 In practical terms, individual biomass heating schemes may be appropriate in rural villages (see the case study below) but are not very well suited to urban areas, for a number of reasons. Space is required to store the fuel, commonly in the form of wood chips or pellets. Domestic biomass boilers require more room than standard boilers and are unlikely to fit into small properties. Exhaust gases require a flue vent that rises above the roofline of the building; planning permission may be required for this depending on the height above the roofline.

- 6.15 CHP schemes may be more applicable in an urban context, as they are best suited to users requiring consistently high levels of heat throughout the year (e.g. hospitals, hotels, leisure centres). Biomass CHP plants can also be the drivers of district heating systems, whereby a number of neighbouring properties are linked to a central heat CHP plant and share its output.

Case study 6D: Kielder Village District Heating Scheme

Kielder is a remote Northumberland village of about 200 people close to the Scottish Border. It does not have a gas supply but the village is surrounded by commercial forestry. An innovative wood fired district heating scheme came into operation in 2004 serving a terrace of six newly built houses, a youth hostel, a group of business/workshop units, the village school, and the Kielder Castle Visitor Centre. The picture below includes the boiler house (centre).



Locally grown wood is chipped and supplied by Forest Enterprise to a purpose built store in the village about four times a year. The wood chip fuel is then delivered to the boiler house and fed automatically into a 300kW boiler. A hot water flow and return pipe network supplies the heat to each building, where heat exchangers interface with conventional central heating and hot water systems. Heat meters measure the amount of heat used by each consumer. Kielder Community Enterprise Ltd has been established as the energy service company, and provides a permanent source of local employment.

See: www.NEforestry.info/kielderheating for further details

Photo: Adrian Smith

Energy from waste

- 6.16 Due to the nature of these technologies, they are not generally well suited to integration in urban environments. For example, most energy from waste plants are situated in close proximity to landfill sites, sewage works or farms, and these are unlikely to be found in urban areas. Many energy from waste schemes also require flare stacks or chimneys to dispose of by-products, and may involve equipment of an industrial scale. However, a demonstration anaerobic digestion project is proposed in the London Borough of Southwark, which may be operational by 2005 if sufficient funding can be secured.

Wind

- 6.17 Small and medium scale wind projects can be included within industrial developments and on some urban sites, particularly in cases where the power can be dedicated to on-site use. Wind developers are unlikely to promote projects of this nature, but in cases where the power can be dedicated to on-site use, economically attractive schemes are a strong possibility. Local planning authorities can take a proactive approach to encouraging this form of urban wind development. The box below contains a case study of one such scheme.

Case study 6E: GlaxoSmithKline, Barnard Castle, Co Durham

The GSK factory in Barnard Castle has a constant, high demand for electricity. It is located on the outskirts of Barnard Castle, one of County Durham's most attractive historic market towns. The company recently explored possible sources of on-site renewable energy as part of the Teesdale Renewable Energy Challenge, TREC, which examined ways of putting the district onto a pathway towards 100% renewable energy supply.



Wind was considered to be the only technology offering a meaningful proportion of the factory's electricity requirements. Site constraints, proximity of housing, and visual considerations ruled out the use of turbines of the scale currently deployed by commercial wind developers. Additionally the wind resource at the site is economically marginal. An alternative approach using two second hand wind turbines imported from the Netherlands was evaluated and found to give the company an acceptable payback on investment over a period of less than four years, with a further 10 or so years of very cheap electricity. The turbines have a blade tip height of 45m, they sit comfortably alongside the factory buildings and have no significant impact on the setting and appearance of the town.

Teesdale District Council was a partner in the Teesdale Renewable Energy Challenge (TREC) project and appreciated the value and purpose of the GSK turbines. Completion of the project was achieved within a year of the submission of the planning application.

Photo: Adrian Smith

Passive solar design

- 6.18 Passive Solar Design offers a significant one-off opportunity to reduce lifetime energy requirements at little or no cost. Passive solar design need not add any additional cost to the development, but can offer considerable savings for occupiers by keeping fuel bills to a minimum, as well as the environmental benefits of reduced demand for conventional energy in the form of lighting, heating or cooling. In addition, it can maximise the potential for other forms of renewable energy such as solar power generation, by promoting layouts that maximise the extent of south-facing roof areas.
- 6.19 Local authorities should encourage provision to be made for passive solar design in masterplanning for new development and designing individual schemes. Passive solar design can be incorporated in buildings of many architectural styles, and it should not be assumed that because a building is designed to maximise solar gain, it will sit uncomfortably with the local architectural style. Subtle ways to incorporate passive solar design can include minimising the area of north-facing windows, and placing garages on the north side of homes to act as additional thermal buffers.

Case study 6F: passive solar design can look 'normal'



Front (north)
elevation windows to:

- kitchen
- entrance hall and WC
- two small bedrooms
- bathroom



South elevation
windows to:

- living-room
- dining room
- two main bedrooms

These illustrations show the scope for passive solar design principles to be incorporated in mainstream building styles and estate layouts. Source: Energy Efficiency in New Housing – a guide to achieving best practice. Energy Saving Trust Good Practice Guide 79 (2001)

www.est.org.uk/bestpractice/uploads/publications/pdfs/GPG079.PDF

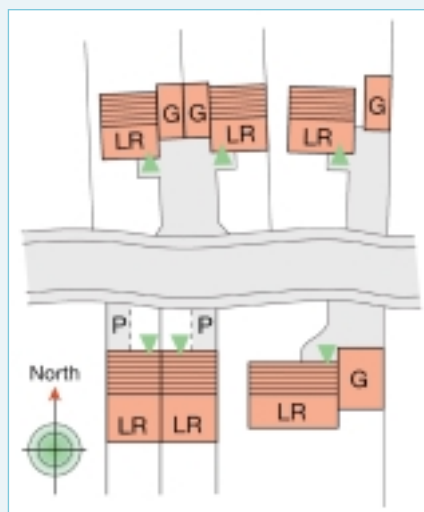
The Energy Saving Trust presents examples of Barrett estates in southern England which were laid out according to solar design principles.

The report seeks to demonstrate potential energy savings of up to 10% with no extra capital cost.

Source : Passive Solar Estate layout – Energy Saving Trust General Information Report 27 (1997)

Illustrations courtesy of The Energy Saving Trust – Energy Efficiency Best Practice in Housing Programme

www.est.org.uk/bestpractice/uploads/publications/pdfs/GIR027.pdf



South-entry houses have the entrance on the south, AND the living room on the south.

North-entry houses have the entrance on the north, BUT the living room on the south.

Combining several technologies

- 6.20 The Beddington Zero Energy Development (BedZED) in the London Borough of Sutton demonstrates how several different building integrated technologies can be included in one residential development scheme.

Case Study 6G: Combining approaches in one development – BedZED

Beddington Zero Energy Development (BedZED) comprises 83 mixed tenure homes (social housing, key worker housing, and for market sale) and some 3000m² of live/work spaces, retail and leisure uses on an urban brownfield site in South London. Construction began in 2000 and the development was occupied in 2002.

BedZED was conceived by Bill Dunster Architects to show that in large-scale construction a high level of sustainability can be practical and cost-effective. The team identified materials and systems (such as air conditioning) which could be 'designed out', thereby creating a building with lower demand for energy, while maintaining high standards of amenity for occupants.

Building orientation was designed to maximise solar gain. Workspaces were designed to face north: high daytime activity levels combined with the heat generated by office equipment during working hours would keep them warm when they were in use, without excessive heat gain that would make the spaces unpleasant. Homes are less densely occupied and have less internal heat gains, so were designed to face south in order to benefit from supplementary solar heat gain.

BedZED has a biomass-fuelled Combined Heat and Power (CHP) system, designed to meet the energy demand of the site. This energy demand is already much lower than other schemes of a similar size, due to the inclusion of energy-saving measures throughout the site and the use of highly efficient appliances in the homes. The biomass-fuelled CHP system means that the buildings at BedZED are 'carbon neutral', not requiring the combustion of any fossil fuels to operate.



that electric cars are exempt from London's Congestion Charging scheme.

The Energy Saving Trust published a General Information Report on BedZED (2002): www.est.org.uk/bestpractice/uploads/publications/pdfs/GIR089.pdf

See also: www.bioregional.com , www.zedfactory.com , www.peabody.org.uk



Buildings at BedZED are ventilated using a wind cowl system, developed by Arup, which brings fresh air into homes and workspaces without the need for electric fans and air pumps. This uses natural air movements and gives rise to the distinctive features on the roof of BedZED (see photo above).

Photovoltaic cells are also installed at BedZED. These are used to provide electricity not for powering the buildings, but for powering the electric cars that are available to occupants through a car hire scheme. Using solar power in this way is currently more cost-effective than petrol or diesel, and offers the residents an additional benefit in

SCOPE FOR URBAN INSTALLATIONS : LIMITS

- 6.21 Local planning authorities should encourage the installation of renewable energy schemes in urban areas, but should be realistic in their expectations. There are a number of practical considerations limiting the suitability of various renewable technologies for urban settings. Among these may be issues of noise, odour, traffic or visual impacts (see the Technical Annex for details relating to specific technologies).
- 6.22 There are a number of issues that are likely to be raised in pre-application discussions between developers and local planning authorities. These are likely to include the following:
- outline applications do not normally include building forms, fenestration, technical services, but do include overall urban block types, overall floor areas of each use type;
 - developers seek to maximise the future flexibility of building use, in order to maximise the value of their investment by appealing to the widest possible range of potential occupiers;
 - future energy use will relate to the behaviour of the occupants: eventual energy use is a function of how an occupier uses the building, what additional appliances and systems are installed and how the building is managed (especially if non-residential); and,
 - the expense of installing e.g. photovoltaics, rather than conventional cladding, is likely to require grant funding to be viable; grants cannot be relied upon at planning application stage.

Hence, proactive support is required from planning authorities, who may find that leading by example can encourage the development of further urban renewable energy schemes, as described in the box below.

Case study 6H: Green energy procurement scheme, LB Harrow

The London Borough of Harrow has a firm commitment to procure renewable energy, demonstrated by its Renewable Energy Purchasing policy which has been in place since 1999. Under the policy the Council seeks to obtain both renewable 'green' and traditional 'brown' electricity price options from mainstream suppliers whenever contracts are tendered. The 'green' option offering the best environmental value for money is adopted if costs are within budget and prices are within a few percent of the conventional alternative.

Harrow's first renewable electricity contract was let in 2000 to supply its schedule of 28,000 street lamps and equipment following deregulation. The electricity supply was provided from a basket of sources including landfill gas and small scale hydro and wind and the contract resulted in Harrow being awarded the Euro Solar prize for good practice.

Currently around 80% of the electricity serving Harrow's corporate premises is supplied from renewable sources.

FUTURE PROOFING

- 6.23 Local authorities should consider energy issues before granting planning permission for all new developments. The decisions made in designing and developing the built environment now will have an impact upon the extent to which some of these technologies and design measures can be used in the future. For example, masterplan layouts can be designed in such a way as to facilitate or hinder the development of south-facing elevations, thereby influencing the possible future application of active solar technologies and passive solar design, and the need for additional power use in heating or cooling space inside particular buildings – this is especially relevant to commercial buildings.
- 6.24 Careful design and selection of building materials can limit the speed with which these will become obsolete and need to be replaced, with effects on energy use required in the fabrication of replacement materials.
- 6.25 The future impacts of climate change should also be borne in mind when designing new buildings, especially with regard to energy requirements for heating and cooling systems. It is now widely anticipated that average annual temperatures will rise across the UK; designers should have regard to the lifespan of their buildings in addition to immediate concerns and should ensure that passive solar design is employed to optimum effect in cooling buildings during hot weather – this is especially relevant to commercial buildings.

FURTHER INFORMATION

The Energy Saving Trust offers guidance to developers, architects and planners on PSD and energy efficiency: see <http://www.est.org.uk/bestpractice/> for a wide range of case study examples. In particular, the following may be of interest:

Guidance on Renewable Energy sources for homes in rural environments (EST, March 2004): www.est.org.uk/bestpractice/uploads/publications/pdfs/CE70%20-%20Rural%20Renewables%20Guide.pdf

Guidance on renewable energy sources for homes in urban environments (EST, March 2004): www.est.org.uk/bestpractice/uploads/publications/pdfs/CE69%20-%20Urban%20Renewables%20Guide.pdf

London Renewables home page: www.london.gov.uk/mayor/energy/london_renew.jsp

Technical Annex

INTRODUCTION

PPS22 relates to a range of renewable energy technologies that currently qualify for assistance under the terms of the Renewables Obligation. In addition, PPS22 also applies to passive solar design, which cannot be considered a ‘technology’ but does involve the utilisation of natural renewable resources (mainly light and wind) to create habitable spaces and reduce the need for power generation.

There are eight sections in the Technical Annex. These relate to the following renewable technologies/approaches:

- Biomass
- Energy from Waste (Biological processes) – including Anaerobic Digestion, landfill & sewage gas
- Energy from Waste (Thermal processes) – including pyrolysis and gasification
- Small Scale Hydro power
- Passive Solar Design
- Solar Electric (photovoltaics)
- Solar Water Heating (solar thermal)
- Wind (onshore)

The Annex is intended to offer lay readers (especially planners) an introduction to each of the technologies, outlining the characteristics of each: their appearance; the mode of operation; implications for the planning system; impact assessment issues; sample planning conditions that local planning authorities may wish to consider; and any other consents required. Further information on all these technologies is available; references are included where appropriate.

1 Biomass

INTRODUCTION

1. This section describes the technology involved in exploiting biomass and energy crops as a fuel on a commercial scale in its variety of forms, and outlines the main planning and environmental implications.
2. Biomass fuels can be categorised as either dry or wet. The energy conversion of dry biomass generally involves heat, whereas the conversion of wet biomass generally involves fermentation or digestion. Because of the two distinct technological approaches, this section deals with dry biomass fuels. Section 2 deals with wet biomass technologies, such as anaerobic digestion.
3. The principal dry biomass fuel sources are as follows:
 - Forestry – co-product from existing forestry operations (small diameter roundwood (SDR), branches, lop and top);
 - Energy crops (short rotation coppice willow and poplar (SRC), Miscanthus and other energy grasses);
 - Primary processing co-product (sawdust, slabwood, points etc);
 - Clean wood waste from industry (e.g. pallets, furniture manufacture);
 - Other crops and bi-products (e.g. whole cereal crops and straw);
 - Poultry litter; and,
 - Biodegradable fraction of Municipal Solid Waste (MSW).
4. Dry biomass differs from most other sources of renewable energy to the extent that the fuel can be grown rather than harnessed, and it gives off carbon dioxide when burned. However, these fuels are regarded as ‘carbon neutral’, because the carbon released on combustion is only that which was absorbed during crop growth – the gas is simply recycled. So, when it is used in combustion in place of fossil fuels, a net reduction in carbon emissions is achieved.
5. There are currently three basic categories of biomass plant:
 - Plant designed primarily for the production of electricity. These are generally larger schemes, in the range 10 to 40MW. Excess heat from the process is not utilised. Typically, 1 MW of electricity generated would require around 4MW of thermal input;

- Combined Heat and Power (CHP) plant. The primary product of these is the generation of electricity, but the excess heat is used productively, for instance as industrial process heat or in a district heating scheme. The typical size range for CHP is 5 to 30 MW thermal total energy output, but some smaller schemes of a few hundred kilowatts have been built in the UK; and,
 - Plant designed for the production of heat. These cover a wide range of applications, including single dwelling domestic or district heating, commercial and community buildings, and industrial process heat. The size can range from a few kilowatts, to above 5MW thermal.
6. As a result of EU directives and Government incentives, it is likely that in the future liquid transport fuels produced from biomass sources will become more common (such as biodiesel and bioethanol), as may other products such as charcoal.

TECHNOLOGY

7. 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. The scheme uses new techniques to burn surplus straw to generate over 270 GWh of electricity a year; enough to power 60,000 homes. The plant also utilises Miscanthus established with the aid of the England Rural Development Programme (ERDP) Energy Crops Scheme grant. In many rural areas, particularly those with an established forestry industry, woody biomass is used to provide heating for schools and other public buildings.
8. There are three main 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 plants 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 or liquid, which is used in a similar way to gas produced from gasification.
9. Direct combustion is the most commonly used technology for 'heat only' plants, whilst both direct combustion and gasification are used for CHP and 'electricity only' plants. 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.
 10. The three technologies appear externally to be 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, although pyrolysis and gasification plant may have a smaller footprint, as the process is more compact.

Fuel Sources

11. Although this section 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; and,
 - waste streams.

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

12. All the 'dry' biomass fuels listed above have a broadly similar gross energy content. 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.
13. 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 interseasonal) 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 thermal continuous heat input. Thus, a 250kW boiler operating for half of the time (a duty cycle of 50%), supplying heat to a leisure development would require 1 or 2 deliveries a week, and a 10MW plant producing electricity continuously would require around 20 deliveries a day.
14. 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.

Residues from forestry harvesting

15. Forestry co-product harvesting makes use of those parts of the tree which, with conventional timber extraction and tree thinning, are normally left on the forest floor. The tops and branches of a tree are known as brash, and can account for 30-40 per cent of the gross weight of a conifer crop and over 50 per cent of the weight of a deciduous crop. Not all brash is available as biomass feedstock, as environmental impacts, extraction methods and ground conditions may render it unusable or undesirable to use.
16. Whole tree comminution is the mechanical felling and chipping of whole small trees, usually undertaken in thinning operations. The main product is wood fuel chips, although higher value 'white' stemwood chips can be screened out for use in the wood processing

industry. The use of SDR is becoming the preferred option for most forestry operators, due to diversification into new markets.

17. Integrated harvesting is the mechanical extraction and processing of whole trees in a single operation. The tree is separated into stem wood and fuel wood products on site. This method leaves clear ground that can be immediately replanted and is considered to offer the most significant long term potential for the cost-effective harvesting of fuel wood. However, whole tree harvesting is not appropriate on all sites, and on some sites loss of nutrients and organic matter as well as soil compaction can be a significant factor.
18. Although most of the fuel in this category arises from commercial softwood production, the use of arisings from the management of smaller hardwood woodlands can also be important to the rural economy, and can form a significant proportion of a small biomass heating plant in a rural area. It has the added advantage of providing another source of income for small woodland owners and farmers.

Co-Product from timber processing

19. Untreated co-products from industries such as saw milling, or production of fencing, including off-cuts, sawdust and wood shavings often form the basis of the fuel supply for a project. In some cases, a biomass plant that is associated with an existing industry may be proposed, either to supply heat for the industry itself (e.g. for kiln drying of timber) or as a separate activity.

Agricultural sources of biomass

20. The most commonly used fuels in this category are straw (which should be viewed as an agricultural product, rather than a residue) and chicken litter. Straw is utilised in whole bale form, and is generally sourced from within a 50 mile radius of the plant. Chicken litter consists of a mixture of wood shavings, straw or other bedding material and poultry droppings. It is a good fuel for electricity generation with nearly half the calorific value of coal.

Energy crops

21. Energy crops offer the opportunity for the full potential of biomass to contribute to meeting renewable energy targets. The two most common energy crops are Short Rotation Coppice and grasses.

22. Technically, the most advanced energy crop for northern European conditions is coppiced willow (*Salix* spp.) commonly referred to as Short Rotation Coppice, or SRC¹. This is a perennial crop harvested on a rotation of 2-4 years to provide a regular and constantly renewable supply of fuel. The crop is established during the Spring (March – June) by planting around 15,000 cuttings per hectare. After one year these are cut back close to the ground, which causes them to form multiple shoots (i.e. to coppice). The crop is then allowed to grow for 2-4 years, after which time the fuel is harvested by cutting the stems close to the soil level. The cut stems again form multiple shoots that grow on for a further cycle to become the next harvest. This cycle of harvest and re-growth can be repeated many times, up to an expected lifespan of 15-20 years. The shoots are usually harvested during the winter as chips, short billets or as whole stems, 25-50mm diameter and 3-4 metres long.
23. Of the grasses, *Miscanthus* has been the most extensively studied². It is of tropical origin and uses sunlight more efficiently to produce higher yields than native plants. It seems to grow well in the south of the UK but is less well adapted to the climate in the north. It is similar to coppice in that it is perennial, and harvested in the winter, but on a one year cycle compared to 2-4 for SRC. The fuel has a similar calorific value per unit weight as wood and could possibly be used in the same power plant or those designed for agricultural residues. The potential advantages compared to SRC are that the harvested fuel is relatively dry, standard agricultural equipment can be used, and the yield potential in the UK is higher (10-20 oven dried tonnes per ha per year as opposed to around 10 oven dried tonnes per ha per year for SRC).
24. The experience of producing these crops on a commercial scale is still limited and the establishment costs can be high. However, *Miscanthus* is now being grown commercially to supply Ely power station.

Municipal Solid Waste (MSW)

25. Certain types of MSW are classed, under some circumstances, as renewable energy sources. For combustion technologies the biodegradable fraction of MSW, comprising such items as garden refuse, certain wood waste, and domestic waste paper, can be classed as renewable provided that at least 98% of the fuel is biodegradable. For ‘advanced’ technologies such as pyrolysis and gasification, any MSW (biodegradable and non degradable) may be used as fuel, but only the biodegradable fraction qualifies as a renewable resource. MSW is covered more fully in section 3 of the annex.

1 For further details, see Defra Best Practice Guidelines: www.defra.gov.uk/erdp/pdfs/ecs/src-guide.pdf

2 For further details, see Defra Best Practice Guidelines: www.defra.gov.uk/erdp/pdfs/ecs/miscanthus-guide.pdf

26. In planning terms, the same issues apply to MSW that apply to other fuel sources, but MSW may fall into a different category under the Pollution Protection Control regime. See paragraph 54 below for further details.

Additional Products

27. Some technologies and fuels produce products additional to heat and electricity. Pyrolysis projects may produce liquid or solid products for onward sale. Agricultural biomass projects can produce fertiliser.

Emission and Waste Products

28. Emissions and waste products from biomass energy production fall into three categories:

- Airborne Emissions
- Emissions to Watercourses
- Ash

The Environment Agency (EA) has responsibility for the control of water quality, water abstraction and all emissions. Local planning authorities will wish to take account of the Environment Agency's views.

Airborne Emissions

29. All processes that involve combustion, gasification or pyrolysis give rise to emissions to the air. It is therefore important to consider stack emissions produced by a biomass power plant in the existing environmental context. At the local level, this means comparing them with other sources of emissions and with current air quality. In the broader context, it means comparing the stack emissions from a biomass electricity generating plant with those from a power station fuelled by coal, oil or gas. (Carrying out a greenhouse gas emission Life Cycle Analysis (LCA) calculation could be meaningful in this situation).
30. Emissions from biomass fuel combustion include limited quantities of gaseous nitrogen and sulphurous oxides and carbon dioxide. Emissions of nitrogen and sulphurous oxides are significantly less than those from comparable fossil fuel stations. Flue gas is discharged from the plant via a chimney. Under certain conditions (particularly in cold weather) a steam plume may emanate from the chimney. This is non-polluting, the only consideration being the visual effect.

31. Biomass fuel combustion may also give rise to particulate emissions from the chimney, known as 'fly ash'. These can be kept within UK and European particulate emission limits using techniques such as cyclone separation, or electrostatic precipitation in the flue.

Emissions to Watercourses

32. A generating station may require a supply of water for steam production and condensing. Where water supplies present a problem, air cooling can be employed for steam condensing and other duties – thus reducing net abstraction to low levels. Advanced conversion processes such as gasification and pyrolysis may need lower levels of water use, depending on the technology.
33. A generating plant will also have releases to the public sewer system comprising treated boiler drainings and condensate, effluent from the water treatment process and surface water run-off. Effluent from gasification plant may need treatment to remove organic contamination before release to the sewer.
34. Large wood chip piles may produce liquids that could leach to watercourses, so a collection ditch may be required around the storage area. With regard to run-off water quality from wood stores, recent research indicates that nitrate concentrations are likely to be well below the 11.3 mg/l NO₃ N maximum for drinking water specified in the Nitrate Directive. NH₄ N concentrations are also likely to be well below the mandatory limits of 1.5 and 4.0 mg/l specified in the Directive.
35. The Biological Oxygen Demand (BOD) values of run-off water are likely to be low (10 milligrams per litre) in comparison with agricultural effluent like manure slurry (10,000-30,000 mg/l), raw domestic sewage (300-400mg/l) or treated domestic sewage (20-60 mg/l).

Ash

36. The main solid bi-product of the conversion of biomass into energy is ash, usually termed 'bottom ash'. Bottom ash is produced at a rate of around 1 per cent of the total weight of the biomass burned. If residues from forests are used, the inclusion of 'tramp' materials such as soil may increase this ash level to 3-4 per cent. The ash from most fuels, except perhaps MSW, can be safely returned to the soil as a fertiliser.

Locational Issues

37. Three main considerations must be taken into account when deciding upon the location of a biomass-fuelled power plant.

Feedstock availability

38. Biomass is a low value, high volume commodity that significantly increases in cost with even short transport distances. For economic and environmental reasons, the ideal maximum transport distance for fuel is therefore about 40 km; for some larger plant, this may be considerably greater, particularly if fuel can be transported by rail or sea. Generally, it is preferable to locate the proposed plant at the 'centre of gravity' of the proposed feedstock. As it may be necessary to seek a variety of feedstocks for a number of reasons including security of supply and regulatory policy, this centre of gravity will inevitably be influenced by the location of the different feedstocks. Main transport conduits or feedstock concentration points (such as ports or railheads) will be preferred locations for the larger plant. However, these may not be so ideal for locally produced biomass served with energy crops from the Energy Crops Scheme that demands that the crops should serve a biomass plant within a 25 mile radius catchment.

Customers

39. The ability to sell heat directly to an end user has a significant positive effect on the commercial performance of a scheme and therefore it would be very advantageous from an environmental and commercial point of view to locate the scheme close to a potential customer.

Grid Connection

40. Due to cost considerations, the majority of electricity generation projects need to be located close to existing grid infrastructure with the capacity to accept the proposed generation capacity. (It may be possible for a very large plant to bear the cost of infrastructure improvement).

Appearance and site footprint

41. The appearance and site footprint depends on the scale of the plant. For example, in the case of a small heat plant for a school, the boilerhouse could be some 4 metres by 3 metres, with a fuel bunker of similar proportions. The bunker may be semi-underground, only a

metre or so protruding above ground, with a lockable steel lid. The chimney will be 3 to 10 metres high, depending on plant design and surrounding buildings. Sufficient space to safely manoeuvre a large lorry or tractor and trailer is required.

42. In the case of a larger electricity generating plant, a medium sized industrial building of two-storey height will be required, with a slender chimney of 25 or more metres in height. A Dutch barn scale building may be required for on-site storage of fuel, and additional buildings for offices and workshops may be required. An extensive area for lorry manoeuvring will be needed. Typically, a 1.5MW plant producing electricity using gasification technology will require a site area of some 0.5 hectares and a 40MW plant may require 5 hectares.

PLANNING ISSUES

43. 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 in England under the Energy Crops Scheme.
44. New electricity generation plants with capacity of more than 50MW need to obtain consent from the Secretary of State for Energy under Section 36 of the Electricity Act 1989, for which the Local Authority is a statutory consultee. Heat only plants, and electricity plants or CHP with an electrical output of 50MW or less will require planning permission from the local planning authority under the Town and Country Planning Act 1990.
45. Local planning authorities may wish to consider the following issues when determining an application:
 - 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. Some 80 to 90% of operational expenditure on biomass fuel supply can accrue to the local economy;

- visual intrusion – the plant is an industrial feature with a chimney. 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;
- any effects on health, local ecology or conservation from airborne and water borne emissions (as discussed above);
- traffic to and from the site in order to transport biomass fuel and subsequent by-products. Traffic volumes, and the associated noise may increase with the introduction of a large biomass power facility, as the scheme may require a continuous fuel supply; and,
- carbon mitigation.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

46. A planning application for a biomass plant could usefully include the following information:
- maps, diagrams and drawings showing the location and design of the plant, and the general location of fuel sources;
 - details of the technology to be employed;
 - in the case of large schemes, a Zone of Visual Impact map of the chimney, and photomontages of the plant from selected viewpoints;
 - details of vehicular access and movements, and principal transport routes for fuel supply;
 - landscaping provisions;
 - details of noise emissions;
 - site Management measures during construction; and,
 - although consent may be required under Section 37 of the Electricity Act 1989, indicative details of grid connection works, including transmission lines and transformers may be useful.

ENVIRONMENTAL ASSESSMENT

47. Schedule 2 to the The Town and County Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 lists those developments that must be screened to determine whether they are EIA Development. This type of development is likely to come under either of the two categories listed under Section 3, “Energy Industry”, of Schedule 2:
- industrial installations for the production of electricity, steam and hot water, where the development exceeds 0.5 hectare; and,
 - industrial installations for carrying gas, steam and hot water, where the area of works exceeds 1 hectare.

It is also possible that where a development will process waste it could also fall under Schedule 2.11(c) to the Regulations.

48. Where a project exceeds the threshold for a category of development, the local planning authority is required to determine whether there are likely to be significant effects on the environment. If the local planning authority is of the view that significant effects are likely, they will issue a screening opinion requiring EIA. Further details on EIA procedures and links to information on EIA can be found on the ODPM website (www.odpm.gov.uk).

OTHER AUTHORISATIONS/CONSENTS

49. In addition to planning permission, a biomass plant may require any of the following authorisations.

Building Regulations

50. Domestic combustion equipment under 50 kW thermal capacity are covered by Section J of the Building Regulations, and are hence subject to Building Control.
51. Section L 2 covers the carbon intensity of heating appliances. Biomass fuelled appliances are given a rating of zero, but are still subject to the Regulations. The scope of Section L is being extended, but how far it will affect biomass plant is unknown at the time of writing.

Abstraction Licence

52. Developers will need to secure an abstraction licence from the Environment Agency for the abstraction and discharge of the cooling water, if used. An impact assessment of the effects of the cooling water on a river or coastal environment might be required prior to the grant of such a licence.

Pollution control systems

53. Whilst the planning system regulates the broad location and suitability of use of land for waste management activities (particularly in relation to nearby uses), the pollution control systems regulate the technical details of the waste management activity, requiring an operating permit to be obtained prior to start of activities.
54. The main pollution control system for industrial sites and activities is the Integrated Pollution Prevention and Control (IPPC) regime (set up by the Pollution Prevention and Control Act 1999). This system implements an EC Directive and, in a phased manner, replaces the existing Integrated Pollution Control (IPC) and Local Air Pollution Control (LAPC) regimes which were set up under the Environmental Protection Act 1990. IPPC regulates the operations of industrial activities such that appropriate preventative measures are taken to ensure no significant pollution is caused. IPPC also encompasses aspects such as the promotion of energy efficiency and waste recovery, and the planning for cessation of activities.
55. IPPC regulates a wide range of industrial and other activities including: burning fuel from or including waste in any appliance with an aggregate rated thermal input of at least 0.4MW; burning any fuel in a boiler, furnace, gas turbine or compression ignition engine with a rated thermal input above 20MW; and burning of any fuel in any appliance with a rated thermal input above 50MW; activities involving the pyrolysis or gasification of coal, lignite, oil or other carbonaceous material (including charcoal, coke, peat, rubber and wood) with a view to making charcoal.

Ambient air quality

56. Air emissions are controlled by the Environment Agency under IPPC or by LAPC under Part I of the Environmental Protection Act 1990. PPG23 (Planning and Pollution Control) (England only) advises local planning authorities that they should not duplicate the functions of the statutory pollution control bodies in regulating emissions.

Clean Air Act

57. All biomass equipment has to comply with the Clean Air Act 1993.

POSSIBLE PLANNING CONDITIONS

- layout and appearance of plant, drying/storage facilities to be approved;
- mitigation of transport movements (e.g. limiting the maximum number of deliveries or the delivery times);
- screening of plant and/or drying or storage facilities;
- work to be carried out in accordance with method statement agreed by the local authority.

2 Energy from Waste (Biological processes)

INTRODUCTION

1. This section offers guidance on systems using biological processes to extract energy from waste, in terms of their main characteristics, the basic technology and their environmental implications. This covers systems using the following as a fuel to generate heat and/or electricity: landfill gas; sewage gas; biogas from agricultural waste; digestible domestic or industrial waste. All these gases are products of an anaerobic digestion process, which is explained further below. Each section in this section begins by discussing anaerobic digestion in general, and subsequent to this, any differences relating to either sewage gas or landfill gas are described.
2. ODPM recently published a research report into Planning for Waste Management¹; this includes further information about anaerobic digestion.

Anaerobic digestion

3. 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. Energy from AD is also effectively carbon neutral in that the carbon it releases is approximately equal to the carbon absorbed from the atmosphere by the plants which constitute the origin of the organic waste. It can therefore reduce overall quantities of carbon dioxide released in the atmosphere when it is used to replace energy from fossil fuels. When used for heating, the process is simple, with the minimum pre-treatment of the gas required, and the use of simple, well-proven technology.
4. Methane is a significant contributor to global warming (around 21 times more potent than carbon dioxide over a period of 100 years). AD with energy recovery offers an effective means of trapping this gas and converting it to carbon dioxide, which is less potent as a greenhouse gas, while producing a renewable source of energy. By-products of AD may be put to beneficial uses such as compost and liquid fertiliser. Such products can help reduce the demand for synthetic fertilisers and other soil conditioners that may be manufactured using less sustainable methods.

¹ available online at www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_030747.pdf

5. The AD process has been used widely in the UK agricultural sector in the form of small on-farm digesters producing biogas to heat farmhouses and other farm buildings. An AD project is most likely to be part of an integrated farm waste management system in which the feedstocks and products all play a part. However larger scale centralised anaerobic digesters (CADs) are also in existence, using feedstocks imported from a number of sources.

Sewage gas

6. Sewage sludge differs from farm waste in that it generally has a far higher inert content (usually >40% of the dry solid matter in sewage is ash). However, as it is only the organic matter that is digested, the gas produced from sewage is of a similar composition to that from farm waste, and the main difference in the digestion plant is one of scale: as sewage waste treatment is generally more centralised, sewage sludge digesters are usually much larger than farm waste digesters.

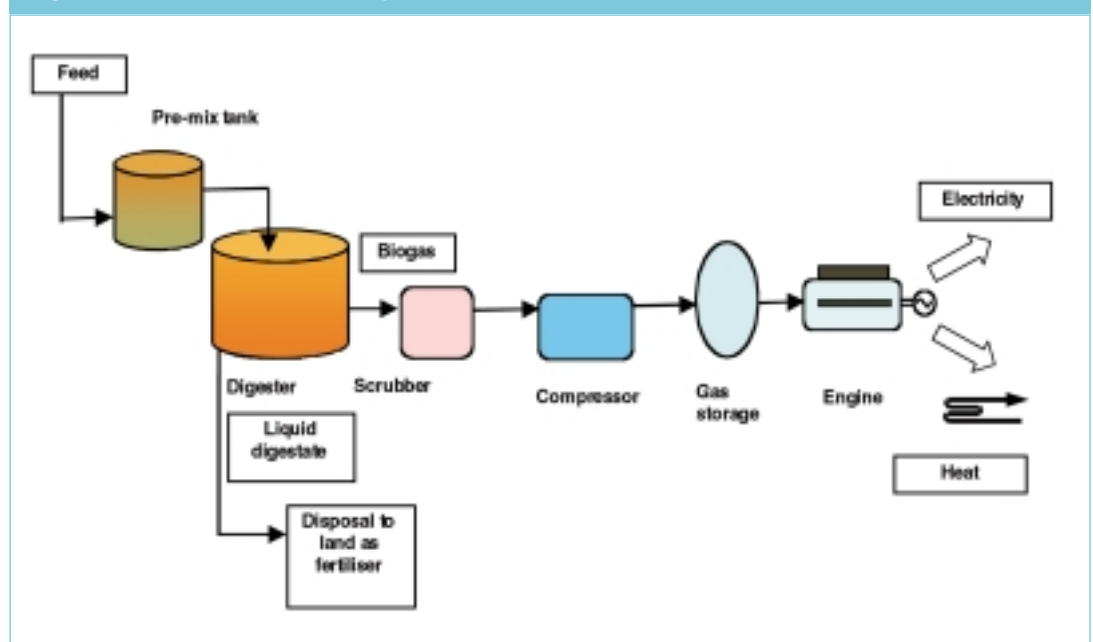
Landfill gas

7. Organic waste materials such as food, paper and garden wastes decompose in landfills to produce landfill gas (LFG), a mixture of methane, carbon dioxide and a wide range of minor components. Using LFG provides energy from a source which would otherwise be flared off or vented to the atmosphere and so wasted.
8. The total waste produced in the UK is estimated to be about 434 million tonnes per year. Different types of waste vary immensely in their fuel values and characteristics. Municipal solid waste (MSW) and business waste are the largest potential sources of waste derived energy. However the composition and calorific value of these materials can vary markedly. The proportion sent to landfill will fall in the long term as a result of changes in waste management practices with, for example, increasing recycling. The EU Landfill Directive, implemented in England and Wales by the Landfill Regulations (2002), will also progressively ensure the diversion of organic material from landfill, reaching 65% of 1995 amounts by 2016. Nevertheless landfill is likely to remain a significant means of waste disposal for some time and the sites will remain biologically active for decades to come.
9. The main difference between landfill gas systems and other forms of anaerobic digestion is that the landfill itself is effectively the digester, so there are no constructed tanks for this purpose. However, the generation plant used to extract the gas is broadly similar to that employed for other forms of anaerobic digestion.

TECHNOLOGY

Anaerobic digestion

Figure 1 Overview of the AD process



(Source: Arup)

10. AD is the bacterial fermentation of organic waste in warm, oxygen-free conditions. This process 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 fuel a generator, to supply heating systems, or to serve a range of industrial applications.
11. 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, and better pathogen 'kill', but require more expensive technology, greater energy input and a higher degree of operating and monitoring.
12. 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 anaerobic digestion is to be carried out on municipal solid waste, 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

13. 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 in the UK, and some schemes already include energy recovery. The raising of sewage treatment standards, together with tighter controls on the disposal of sludge, has led to greatly increased arisings, particularly in coastal areas where sludge dumping at sea ceased to be an option in 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 which 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 watercourses.
 - 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 energy extraction via AD. With the introduction of the Renewables Obligation, the

market for CAD plant, utilising 100% food processing waste for example, is large and is likely to grow still further.

14. Digestion reduces the volume of the waste and also has the benefits of reducing odour and removing harmful pathogens, which is a particular advantage in the case of farm slurry and sewage sludge.
15. 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 cannot guarantee total removal.
16. After any necessary pre-treatment, the waste is fed into a digester tank. The contents are then mixed thoroughly, either mechanically or by pumping gas through suitably located tubes inside the tank. Digesters are usually operated at temperatures of 35°C or 55°C. The rate at which the digestate breaks down through microbial action increases with temperature. At the same time, the survival rate of pathogens such as Salmonella reduces significantly.
17. After the AD process has taken place, the gas generated is collected in a storage tank, with any excess gas being flared off. The contents of the digester will be a mixture of solids and liquids (digestate solids and digestate liquor), which might be suitable for beneficial use as fertiliser or soil conditioner (subject to legislation), or will otherwise require disposal.
18. In 'sequential batch' digesters, the tank is loaded with the feedstocks (farm slurry etc), AD proceeds and the residues (i.e. the digestates) are then removed to make way for a new load. This method is often used in small-scale digestion schemes, such as those on individual farms. Larger scale digesters often employ a 'continuous feed' system in which the incoming feedstock is fed into the tank while an equivalent volume of processed waste is drawn off. The transport implications of peak movements need to be borne in mind for sequential batch digesters.

Gas collection and use

19. The gas collected through the AD process is primarily a mixture of methane (typically 65% of the total) and carbon dioxide (typically 35%). Trace gases are also produced, including hydrogen sulphide.
20. The gas is collected at the top of the digester and piped to a holding tank. Because this tank will have a finite storage capacity, a flare stack is often located nearby to dispose of any excess gas. The gas can be used:
 - as a heating fuel for nearby buildings and for the generation of electricity;
 - in a range of industrial applications;
 - for the drying or incineration of sludge at sewage works; and,
 - to heat the digester itself and to power associated machinery.

The gas can also be bottled, after cleaning, for use as a domestic fuel or to power vehicles.

Other products

21. As well as biogas, two other important by-products of AD are liquors and solid organic materials. The digestate liquor is a nitrogen rich fertiliser and is generally used on the farms on which it was produced. A potentially wider market has yet to be fully developed, although some AD schemes have successfully bottled and sold the liquor as a liquid fertiliser. Solid organic materials that have undergone incomplete digestion can either be used without further pre-treatment as a soil conditioner or further processed to yield agricultural compost which can be an effective substitute for peat.
22. When heavy metals and other potentially toxic materials have been removed from MSW it is possible to complete the stabilisation of the digestate solids by composting. The treated product can then be used as a soil conditioner, an organic mulch or for use in land reclamation. If, however, the digestate solid contains significant amounts of heavy metals and toxins, disposal to landfill will be necessary. In such cases reference should be made to the appropriate waste management licensing controls and legislation.

Digestion Equipment

23. An anaerobic digestion plant typically comprises a digester tank, buildings to house ancillary equipment such as a generator, a biogas storage tank, a flare stack and associated pipework. Plants can vary in scale from a small scheme treating the waste from an individual farm, or a medium-sized centralised facility dealing with wastes from several farms, to a sizeable industrial plant handling large quantities of MSW.
24. Digestion takes place in a tank, which is usually cylindrical or egg-shaped. The size of the tank will be determined by the projected volume and nature of the waste to be handled and the temperature and retention time in the digester. Some indicative tank dimensions are given in table 1. Digesters with a volume of less than 250m³ can operate successfully on farms. Whereas most tanks are constructed from glass-coated steel, these small digesters are often made of glass fibre-reinforced plastic.

Table 1 Digester size and the volume of organic wastes processed

Organic Waste (tonnes per day)	Digester Volume (cubic metres)	Height (metres)	Area (square metres)
50	800–1,500	8–10	75–150
150	2,200–3,500	10–12	180 (or 3 × 120)
350	4,700	10	4 × 120
450	7,700	15	6 × 177

Source: Future Energy Solutions, AEA Technology

Gas handling equipment

25. The collection, movement and storage of gas will require a range of equipment, including pipework and valves, flame traps, condensate traps, flare stacks and control and monitoring equipment. In some cases gas needs to be treated, necessitating the addition of extra plant such as filters and de-misters.
26. The flare stack used for burning off surplus gas comes in two basic types:
 - high level stacks, typically 6m to 10m high with a small diameter; and
 - low level stacks, typically 3m high with a larger diameter.

The flare stack can be enclosed in an open-topped cylinder to provide visual concealment and heat insulation.

Plant containment

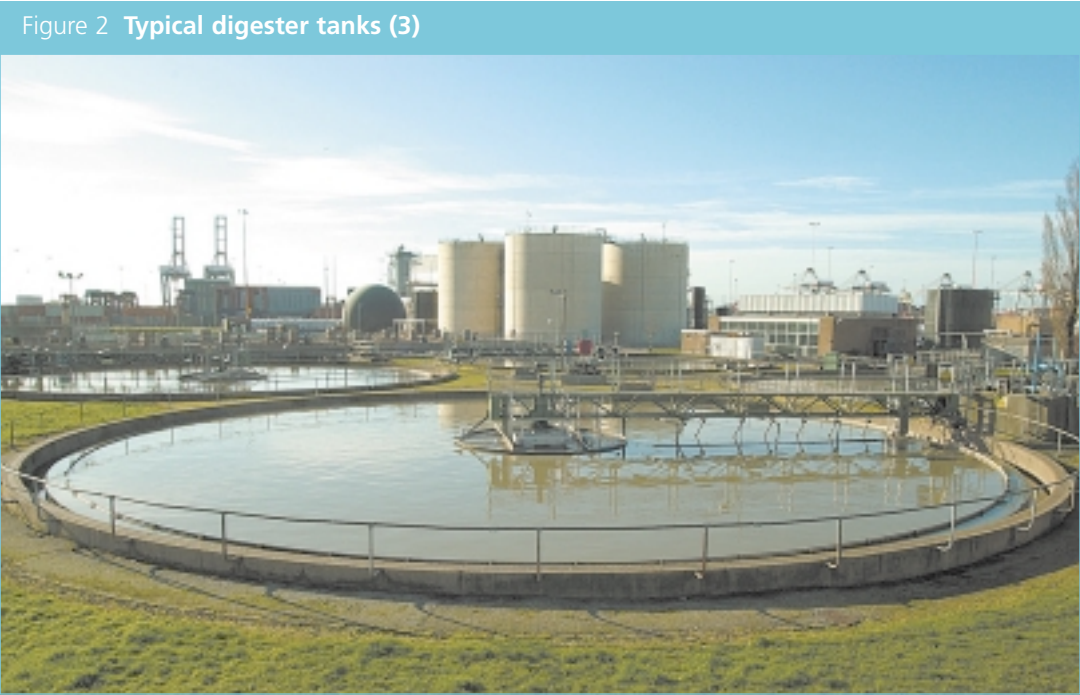
27. The ground around tanks and in waste reception areas is usually paved and bunded (surrounded by a barrier) to prevent pollution from the accidental discharge of spilled wastes. A collection system will often be installed within and around the plant to enable spilled waters to be collected and pumped either directly into the digester, or into a mixing tank used to increase the water content of solid waste.

Electricity and heat generation

28. Biogas can be used to fuel a variety of electricity generation equipment, including spark ignition engines, dual fuel diesel engines and gas turbines. Biogas can also be used to supply heating systems (including that required to maintain the required temperature of the digester), or combined heat and power (CHP) schemes. For small schemes such as farm digesters, the energy can be used to heat the domestic water supply and central heating system. For larger systems, the gas can also be used to heat buildings outside the digestion site.

Sewage gas

29. Anaerobic digesters installed at municipal sewage works typically range in volume from 180m³ to 3,400m³ (table 2). The tank can be as high as 15 metres, although it can sometimes be partly buried. In addition to reducing the visual impact, partial burial offers heat insulation benefits and so reduces the energy demand of the digestion process (figure 2).



(Source: Southern Water Ltd)

Table 2 Digesters at sewage treatment works: some illustrations of the relationship between sewage throughput and tank volume		
Population Equivalent	Daily Sewage Throughput (cubic metres per day)	Total Digester Volume (cubic metres)
7,000	1,000	180
21,000	3,000	380
30,000	4,500	800
60,000	9,000	1,350
200,000	30,000	3,400

Source: Future Energy Solutions, AEA Technology

Landfill gas

30. Most landfill sites containing biodegradable organic matter will produce landfill gas (LFG) through a complex process of microbial decomposition. The period of time over which LFG is actively produced will vary according to local conditions. Under favourable conditions, substantial gas generation from a large municipal landfill site would probably be complete within 25-30 years. However, many factors control the decomposition process, including the proportion and nature of the organic material in the waste, moisture content, temperature, acidity, and the design and management of the site. These in turn affect the quantity and composition of gas produced.

Gas collection and management

31. Many landfill sites are already equipped with LFG collection and control systems to prevent the gas from dispersing. The gas is piped to an extraction plant on the edge of the landfill site. The plant will typically include:
- gas conditioning equipment;
 - extraction pumps;
 - a flare stack;
 - pipework and valves; and
 - control and monitoring equipment.

Figure3 Landfill gas extraction system – 12MW



(Source: Clarke Energy)

32. Gas is drawn from the waste via vertical and/or horizontal wells, each of which is monitored and regulated. It is then conveyed to the extraction plant, usually in polyethylene pipes placed underground. LFG comes out of a landfill site warm and saturated with moisture. As it cools in the extraction pipework, liquid condenses out. The pipework is therefore laid at a gradient and incorporates condensate traps to remove this liquid from the gas flow. The type of gas conditioning equipment required depends on the use to which the gas will be put: gas for heat generation does not need to be purified as much as that used for electricity generation.
33. At any landfill site a flare stack is required to mitigate emission of methane, which will be generated regardless of whether there is energy recovery or not. Where engines are installed the flare will be used where there is excess production or during servicing. In visual terms, flares can be either open (where a luminous flame will be observable) or closed (where the flame will be shrouded).

Electricity Generation

34. LFG can be used to generate electricity via a number of generation systems, including spark ignition gas engines, dual fuel engines (in conjunction with diesel) and gas turbines. These technologies are now very well established. There is also the potential to generate electricity from landfill gas using fuel cells, but this is less well established at present.
35. The electricity generation plant tends to be located at or near the landfill site to minimise the need to pipe the gas over great distances. The generation equipment is usually integrated with the gas extraction plant, in a compound typically 25m × 25m in size.
36. The degree of shelter required depends on the type of equipment installed. The gas extraction pumps and conditioning equipment might be in the open air, under an open-sided roof, or in a building along with the generator. Most engines with their generators are supplied in weatherproof prefabricated containers (typically 3m high, 2.5m wide and 10m long), which are fixed onto a concrete plinth. Transformers, switchgear, control panels and instrumentation are housed away from any gas handling plant in separate rooms or buildings.

Direct-End Use

37. The direct use of LFG as a replacement fuel for coal, oil or natural gas is well established. The gas is pumped direct to a nearby end user, mainly to provide heat in industrial processes such as:
 - firing and drying – as in brick and cement manufacture, stove drying and asphalt coating;
 - boiler firing – to raise steam and heat water for the drying and bleaching of textiles and paper, the heating of commercial greenhouses, and for food processing.
38. Direct end-use systems usually comprise a pressure booster station, a pumping main and the utilisation equipment. The booster station will normally be integrated with the extraction plant. Pumping mains will be placed underground, and tend not to exceed 5 km in length because of the high cost of installation. The utilisation equipment varies greatly depending on the process, and because it will usually be integrated with the process, the impact in relation to planning requirements will be lessened.

PLANNING ISSUES

Anaerobic digestion

Site selection, Transport and Traffic

39. Many AD plants 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. Sewage sludge digesters are likely to be built in conjunction with new or existing wastewater treatment works, and will be less noticeable amongst the array of tanks and ponds performing other treatment functions (figure 4) than as a plant in isolation.
40. Centralised AD facilities (CAD plants) handling large quantities of agricultural wastes, sewage sludge or MSW may be more economically viable for the plant operators, but have the potential to raise more complex siting issues. The most acceptable sites are likely to be beside existing industrial or wastewater treatment works or, in the case of digestion schemes using MSW, in close proximity to a landfill site or waste transfer station.
41. Transport movements at on-farm digesters are not likely to add significantly to the impact of normal farm activities. By comparison, 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 logistics, thereby reducing the distances travelled between the feedstocks, storage tanks, digester and local markets.

Figure 4 Large-scale anaerobic digester – 2.5MW



(Source: Holsworthy Biogas)

Feedstocks and Product Storage

42. 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 the Environment Agency should be consulted early in the process when considering waste handling issues and classifications.
43. The storage of farm slurry is covered by the Control of Pollution Regulations 1991, which specify minimum standards relating to the design, construction and operation of any farm slurry storage system. Storage facilities will also be needed for the processed fibre. The market is seasonal, so storage could be needed for up to six months output. Liquors can be stored on the farm, or at a CAD plant. Once cooled, they can be stored in lagoons or large tanks. For CAD sites, liquid storage facilities will need bunding around storage silos.

Odour

44. 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.
45. Odour may arise from:
 - waste input storage bays: this is especially important during the summer, when the breakdown of organic material can begin before it is even collected for disposal;
 - sorting and mixing plant: here the waste is sorted or mixed with digestate prior to digestion;
 - the digester: although this is sealed during use, this will release odours when opened to allow cleaning; and,
 - digestate draw-off and de-watering plant: digested material is significantly less odorous than raw organic material, but can still give off unpleasant smells.

It should however be noted that 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 Watercourses

46. Serious farm pollution incidents can occur through the leakage or run-off of raw agricultural wastes. The AD of farm waste should reduce the likelihood and capacity of the material to pollute controlled waters. By following the Defra Codes of Good Agricultural Practice for the Protection of Land and Water, emissions to ground and watercourses should be minimised.

Emissions to Air

47. 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; this will apply to larger on-farm schemes as well as CAD plants.

Sewage gas

Site selection, Transport and Traffic

48. In general terms, sites for sewage digestion plant will be influenced by the presence of a suitable wastewater treatment plant. At a site-specific level the location of the sludge digesters is likely to be dictated by the constraints of other systems to which they are linked at a treatment works. It is sometimes the case that some sludge is transported to wastewater treatment plants by tanker, and therefore there may be some local variation in siting in relation to the logistics of sludge transportation.

Feedstocks and Product Storage

49. Sewage sludge is not generally stored in liquid form for extended periods of time. There are however usually intermediate storage tanks which act as buffers for variations in flow or input from sludge tankers.

Odour

50. Given that sewage sludge digesters are normally located at wastewater treatment works, odour emissions are likely to be dominated by the primary treatment processes (settlement/aerobic treatment), which usually take place in open tanks.

Emissions to Air, Ground and Watercourses

51. Issues will be broadly the same as those described under anaerobic digestion. They are likely to be addressed as part of the collection of operations of a wastewater treatment works.

Landfill gas

Site selection

52. LFG plant should be located away from housing and other sensitive land uses, for reasons of safety and amenity. In practice this separation will rarely be difficult to achieve, given the large scale of landfill sites and the fact that they are generally situated away from residential areas.

Figure 5 Small scale farm anaerobic digestion



(Sustainable Waste Systems Ltd.)

53. The visual impact of a landfill gas generation scheme may be relatively insignificant if it is co-located with other activities such as waste disposal on a site adjacent to a completed landfill. If, alternatively, extraction and landfill works have ended and the site is undergoing restoration, the local planning authority may wish to consider the need for mitigating measures to reduce any visual intrusion caused by the plant.

Odour and emissions

54. The combustion process definition in the Environmental Protection (Prescribed Processes and Substances) Regulations 1991 (as amended) specifies that “‘fuel’ does not include gas produced by the biological degradation of waste”. As such, the emissions from typical LFG plant are not currently regulated. This is currently under review by the Environment Agency and landfill gas fuelled generators may be regulated under EU stationary engines regulations in the near future. This is expected to result in a tightening of emissions limits.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

Anaerobic digestion

55. A planning application for an anaerobic digestion plant could usefully include the following:
- site plan and elevation drawings to help determine visual impact;
 - photomontage of digester, plant building(s) and chimney stack with clear indication of building material;
 - information on grid connection works, including transformer and transmission lines;
 - details of vehicular access and vehicular movement;
 - landscaping provisions;
 - site management measures during the construction phase;
 - model of emissions dispersion; and,
 - community consultation plans.

Sewage gas

56. An application for a sewage digestion plant could, in addition to the above, include reference to the existing wastewater treatment plant.

Landfill gas

57. An application for a landfill gas plant could, in addition to the information listed above, note that the LFG plant would require the addition of a powerhouse to a typical landfill site.

ENVIRONMENTAL ASSESSMENT

58. Developments that use waste to produce energy may require EIA. Such projects could fall within projects listed in Schedule 2.3 and/or 2.11 to the Regulations. Guidance on relevant issues can be obtained from Defra, the Environment Agency, specialist consultants and the local planning authority

OTHER AUTHORISATIONS/CONSENTS

Abstraction Licence

59. If water is to be abstracted from watercourses or discharged into them, developers will need to secure a licence from the Environment Agency. An impact assessment of the effects of the cooling water on a river or coastal environment might be required prior to the granting of such a licence.

Pollution Prevention and Control

60. Dependent upon the level of energy generation and the details of the facility, the operations may require a permit to operate under the Integrated Pollution Prevention and Control (IPPC) regime or the Local Air Pollution Prevention and Control (LAPPC) regime, introduced by the Pollution Prevention and Control Act 1999. Where the facility falls outside these regimes, the statutory nuisance provisions of the Environmental Protection Act 1990 would apply, concerning dust, odour and noise.
61. Further planning guidance is outlined in PPS23: Planning and Pollution Control (2004). PPG10: Planning and waste management may also be relevant.

Waste Management Licence

62. Agricultural wastes, commercial/industrial wastes and MSW are controlled waste – facilities handling such waste will need to hold a Waste Management licence, issued by the Environment Agency. For some operations, licensing is being progressively replaced by permission under the Integrated Pollution Prevention and Control regime.

POSSIBLE PLANNING CONDITIONS

63. For biological Energy from Waste schemes, possible conditions of planning permission could include the following:
- work to be carried out in accordance with method statement agreed by local authority;
 - plans of digester, powerhouse and contractors compound to be agreed by local authority;
 - digester, building and stack design to be approved by local authority;
 - time limits to be set on use of contractors' compound;
 - time limits to be set on hours of working;
 - prevention of pollution (including odour) procedures to be agreed by local authority;
 - noise limits from the powerhouse to be set by condition;
 - Environmental Liaison Officer procedures to be agreed by local authority (on sensitive sites); and,
 - monitoring requirements to be agreed by local authority and carried out (on sensitive sites).

3 Energy from Waste (Thermal processes)

INTRODUCTION

1. There are various technological configurations adopted to extract energy from waste. These can be broadly subdivided into thermal and biological processes. This section relates to the thermal processes, which use a high temperature process to release the chemical energy in the fuel. Biological processes are covered in Section 2 of the Annex.
2. This section offers guidance on types of thermal plant used to extract energy from the biodegradable fraction of waste. It discusses their main characteristics, the basic technology and their environmental implications. The Government Renewables Obligation Order¹ definition is adopted here as the definition of what constitutes renewable energy in relation to energy from waste, and this is defined below. However, it should be noted that the Order is currently under review.
3. ODPM recently published a research report into Planning for Waste Management²; this includes further information about thermal treatment including pyrolysis and gasification.

Waste in the UK

4. In 2001/02 the majority (77%) of municipal waste in England was disposed of to landfill. Some form of value was recovered from 22%, either through recycling and composting or through energy recovery. For the most recent statistics details can be found at:
<http://www.defra.gov.uk/environment/statistics/waste/index.htm>

Municipal Solid Waste

5. Municipal solid waste (MSW) is the term used to describe those wastes gathered from domestic and commercial premises by the local waste collection authority. The quantity of MSW available is broadly proportional to the population of an area, but its composition will be affected by local factors such as the method of waste collection and the extent of waste recycling.

Business waste

6. Non-hazardous industrial and commercial waste arisings in the UK have been estimated to be around 25 million tonnes per year, consisting mostly of paper, cardboard, wood and plastics. The disposal route for the bulk of this waste is landfill, although a small amount is incinerated along with MSW. In general, non-hazardous business waste can be pre-processed in similar ways to MSW to enable combustion using a range of technologies.

¹ Renewables Obligation Order 2002: Statutory Instrument 2002 no 914. Available online at www.legislation.hmso.gov.uk/si/si2002/20020914.htm

² available online at www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_030747.pdf

Other relevant wastes

7. The main types of other wastes suitable for energy from waste schemes are as follows:
Sewage sludge: in 1999 (latest available figures) the UK produced 1.13million tonnes of sludge (dry solids). This corresponds to an average of about 20kg generated by each person. Many water companies are considering combustion or other thermal processes for the disposal of this material.
Wood processing waste: small quantities of processed wood waste are produced by the furniture industries and can be classed as renewable, in their uncontaminated form.

Waste arisings and collection

8. The source and collection method of the waste material affects the scope for using it in energy generation. MSW arisings are spread through an area, and are collected by local authorities or their contractors and taken to disposal sites. Other wastes arise at specific locations and lend themselves to small-scale energy schemes. There are economies of scale with larger more centralised plants.

Implications of the Renewables Obligation

9. The Renewables Obligation 2002 states that only electricity derived from 'biomass' will be eligible for Renewable Obligation Certificates (ROCs). 'Biomass' is defined here as a fuel of which at least 98% of the energy content is derived from plant or animal matter or substances derived directly or indirectly therefrom (whether or not such matter or substances are waste) and includes agricultural, forestry or wood wastes or residues, sewage and energy crops.
10. A generating station which is fired wholly or partly from waste is excluded from receiving ROCs unless:
 - the only fuel is biomass in accordance with the above definition; or
 - advanced conversion technologies (e.g. pyrolysis and gasification) are used to produce a fuel gas, in which case ROCs can be claimed for the biomass fraction of the fuel. This is an incentive for the development of new technology which is inherently cleaner and can be deployed on a smaller scale.
11. In accordance with this definition, conventional waste incinerators firing MSW will not be able to claim ROCs for the electricity they generate. Only those installations eligible for ROCs are counted as renewable energy generation in the context of this document. Any

firing of non-biomass waste will result in the plant being subjected to far more stringent controls, which needs to be borne in mind when considering MSW as a fuel.

12. The Renewables Obligation is currently under review³.

TECHNOLOGY

13. Conventional incineration and the advanced technologies defined in the Renewables Obligation above are the two technology routes most likely to be used to recover energy from solid waste in the short to medium term. The provisions of the Renewables Obligation may increase substantially the numbers of Energy from Waste installations using advanced processes in the future.

Figure 1 Large scale direct combustion plant



(Source: Onyx, Chineham)

³ Further information is available from the DTI: www.dti.gov.uk/energy/renewables/policy/index.shtml

Direct combustion

14. The majority of MSW incinerators burn the waste stream essentially in the form it is collected. This process is called direct combustion. The combustion gases are cleaned in a sequence of processes which remove particulates, acid gases and trace organic compounds. The ash exits the process as two distinct streams – bottom ash that falls from the combustion grate, and fly ash that is separated from the flue gases. Bottom ash is considered to be inert and, after the separation of metals, is either taken to general landfill or used as aggregate. Fly ash can contain heavy metal contamination and so should be disposed of in a controlled landfill.

Pyrolysis

15. In recent years the concepts of waste pyrolysis and gasification have received considerable attention and a number of companies are offering systems for commercial installation. Pyrolysis is the process of heating fuel in the absence of air to produce charcoal and a gaseous fuel ('syngas'). These can then be burned in boilers, engines or turbines to generate heat and power. Plants with pyrolysis only are less common than those where pyrolysis is combined with gasification.

Figure 2 Pyrolysis and gasification plant



(Source: Compact Power)

Gasification

16. Gasification is a process of partial combustion, which enables operators to effectively control the temperature of the process, with consequent mitigation of pollutants. A gas is formed when the fuel reacts with sufficient oxygen to maintain a high reaction temperature but with insufficient oxygen to complete combustion. This gas can then be used in engines, boilers or turbines to generate power.
17. For all these processes the useful energy in the waste is generally released by combustion, although increasingly syngas from pyrolysis and gasification is being used as a source of hydrogen for fuel cells. In the context of fuel cells, pyrolysis and gasification as processes have the advantage of producing a homogeneous gas from which hydrogen can be extracted.
18. Pyrolysis and gasification are still developing but experience thus far has demonstrated that the superior control of the combustion offered by these processes can create much lower levels of contaminants in the exhaust gas when compared with typical grate combustion. Pyrolysis and gasification systems can generally be implemented at smaller scales than conventional incineration, making them more flexible in meeting the needs of smaller communities, and reducing local air quality impacts through minimisation of waste transportation. The ash resulting from pyrolysis and gasification followed by combustion has also been found to be more stable and less polluting than that from conventional incineration.
19. Waste can be pre-treated in a variety of ways to improve its combustion efficiency and extract recyclable materials such as metal and glass. Treatments include shredding, sorting and separation, and drying. The equipment used for sorting waste will typically include rotating and vibrating screens, magnetic separators, air separators and manual picking belts. Some more innovative systems use high temperature washing. The pressure from recycling targets will mean that all MSW plant will have extensive materials recovery facilities.

Combined Heat and Power

20. The most efficient Energy from Waste schemes generate both electricity and heat, through Combined Heat and Power (CHP) plants. This method is particularly beneficial as most of the energy in the waste can be put to good use and the improvement in energy efficiency leads to a corresponding reduction in emissions. It is desirable for CHP and Community

Heating Schemes to be situated close to local energy users in order to minimise the costs of the heat distribution system.

21. A typical waste-fuelled combined heat and power process will involve some or all of the following:
- waste reception and storage;
 - waste processing, material sorting and recovery;
 - feeding waste into the combustion, pyrolysis or gasification chamber;
 - the combustion, pyrolysis or gasification reactor itself;
 - generation of heat and power using steam turbines, gas engines or gas turbines;
 - treating the waste gases to reduce emissions;
 - handling, storage and disposal of ash; and,
 - handling, storage and disposal of liquid effluents such as boiler water and surface water.

Scale of development

22. Energy from Waste plants vary in size from small installations (serving factories for example) to large-scale MSW plants (see table 1). New projects therefore might either be accommodated within existing or converted buildings, or may require large new sites.
23. The costs of meeting stringent licensing standards mean that MSW plants using incineration need to achieve economies of scale to be viable. Incinerators in the UK have a waste throughput of in the region of 100,000 to 600,000 tonnes per year. A MSW plant consuming 400,000 tonnes of waste per year will produce approximately 34MW of electricity, enough to supply about 46,000 homes.

Table 1 Typical characteristics of waste combustion plants

	Output MW	Area (Hectares)	Building height (Metres)	Stack Height (Metres)
MSW/Business waste	10–35	2.0–3.0	30–45	80
Waste wood	<3	0.2	6	10

Disposal of ash and gas cleaning residues

24. There are two types of ash from conventional incinerators. The ash that falls from the combustion grate (bottom ash) is inert and can be sent to normal landfill. The ash from the flue gas cleaning installation contains heavy metals and traces of other contaminants and should be sent to controlled landfill. The ash from gasification and pyrolysis plants may contain a higher carbon content but this is not thought to be harmful as the carbon is in its elemental form and inert. Heavy metals will still be found in the finer ash and may need disposal in controlled landfill. This will depend upon the process and appropriate treatment of this ash will be a condition of the licence to operate.

PLANNING ISSUES

Siting issues

25. Planning authorities should consider proposals for energy from waste developments in the same way in which they would handle any other industrial scheme. The relevant planning considerations are largely the same. However the siting of an Energy from Waste plant is likely to be influenced by the following factors:
- the source of the waste;
 - the economic implications of transporting the waste;
 - site access; and,
 - proposed energy use, the availability of local heat markets and ease of connection to the electricity distribution network.
26. In general, waste treatment and disposal operations are characterised to a large extent by the high volume of materials entering and exiting the site. In order to minimise the adverse environmental effects of transporting waste, they should, wherever possible, be located close to the waste source. The optimum locations for most MSW and business waste plants are therefore likely to be in or very close to urban areas.
27. Local planning authorities should have regard to the waste management plans drawn up for their area. They should identify the spare capacity at existing plants, sites for new waste management plants, or areas of search for new sites. They should also set out the land-use criteria against which planning applications for new waste management development will be assessed. Further guidance is given in PPS23 Planning and Pollution Control (2004).

Visual Effects

28. In many cases, Energy from Waste developments are likely to be proposed in industrial areas, where they will be broadly in keeping with the existing buildings. Even so, the developments can be prominent features, and therefore local authorities will wish to encourage a high standard of design and landscaping in order to minimise their visual impact.
29. Chimney height will vary with the scale of plant and the technology used. Pyrolysis and gasification plant generally need significantly lower stack height than incineration. Chimney height will be determined by pollution control procedures under the Pollution Prevention and Control Act 1999, or the Clean Air Act 1993, to ensure adequate dispersal of emissions in the exhaust gas.

Ambient air quality and odour

30. A plant that complies with licence requirements for air pollution might still give rise to odours. For large projects such as MSW incinerators odour is covered under the IPPC authorisation, and for smaller projects it is covered under the local authority authorisation. The sources of odour nuisance may not always be emissions through chimneys and vents from the works, but could arise from open-air storage, handling or transport of waste materials or their products. In identifying sites for Energy from Waste plants in local plans and in considering planning applications for them, planning authorities will wish to bear in mind that some problems may be created by odour, particularly where a site is close to housing or other odour-sensitive land uses.

Dust

31. Excluding particulates from stacks, most dust is created during waste processing and ash handling operations. Practical measures for dust control include minimising, or eliminating, open-air storage, water sprinkling and transportation within covered skips or lorries. Emission levels are regulated through the Environment Agency or the terms of a site's Waste Management Licence.

Emissions to water

32. Water may be affected by certain liquid effluents created by particular processes. The main sources of liquid effluent will be from gas cleaning systems, cooling water and surface run off. The Environment Agency has responsibility for the control of water quality. Consultations should take place between the developer, the planning authorities and the Agency if it is proposed that river water is used for cooling.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

33. A planning application for a thermal Energy from Waste plant could usefully include the following:
- site plan and elevation drawings to help determine visual impact;
 - photomontage of plant building(s) and chimney stack with clear indication of building material;
 - information on grid connection works, including transformer and transmission lines;
 - details of vehicular access and vehicular movement;
 - landscaping provisions;
 - site management measures during the construction phase; and,
 - model of emissions dispersion.

ENVIRONMENTAL ASSESSMENT

34. Developments that use waste to produce energy may require EIA. Such projects could fall within projects listed in Schedule 2.3 and/or 2.11 to the Regulations. Guidance on relevant issues can be obtained from Defra, the Environment Agency, specialist consultants and the local planning authority.

OTHER AUTHORISATIONS/CONSENTS

Waste Incineration Directive

35. The Waste Incineration Directive 2000/76/EC has introduced stringent operating conditions and sets minimum technical requirements for waste incineration and co-incineration. The main aim of the Directive is to prevent and limit negative environmental effects of emissions into air, soil, surface and groundwater, and the resulting risks to human health from such processes.

Pollution control systems

36. Whilst the planning system regulates the broad location and suitability of use of land for waste management activities (particularly in relation to nearby uses), the pollution control systems regulate the technical details of the waste management activity, requiring an operating permit to be obtained prior to the start of activities.
37. The main pollution control system for industrial sites and activities is the Integrated Pollution Prevention and Control (IPPC) regime (set up by the Pollution Prevention and Control Act 1999). This system implements an EC Directive and, in a phased manner, replaces the existing Integrated Pollution Control (IPC) and Local Air Pollution Control (LAPC) regimes which were set up under the Environmental Protection Act 1990. IPPC regulates the operations of industrial activities such that appropriate preventative measures are taken to ensure no significant pollution is caused. IPPC also encompasses aspects such as the promotion of energy efficiency and waste recovery, and the planning for cessation of activities.
38. IPPC regulates a wide range of industrial and other activities including: burning fuel from or including waste in any appliance with an aggregate rated thermal input of at least 0.4MW; burning any fuel in a boiler, furnace, gas turbine or compression ignition engine with a rated thermal input above 20MW; and burning of any fuel in any appliance with a rated thermal input above 50MW; activities involving the pyrolysis or gasification of coal, lignite, oil or other carbonaceous material (includes charcoal, coke, peat, rubber and wood) with a view to making charcoal.

Ambient air quality and odour

39. Air emissions are controlled by the Environment Agency under IPPC or by LAPC under Part I of the Environmental Protection Act 1990. PPS23 (Planning and Pollution Control) (England only) advises local planning authorities that they should not duplicate the functions of the statutory pollution control bodies in regulating emissions. The planning system should address any wider land-use impacts of the proposed development.

POSSIBLE CONDITIONS OF PLANNING PERMISSION

40. For thermal Energy from Waste schemes, possible conditions of planning permission could include the following:
- work to be carried out in accordance with method statement agreed by local authority;
 - plans of powerhouse and contractors compound to be agreed by local authority;
 - building and stack design to be approved by local authority;
 - time limits to be set on use of contractors' compound;
 - time limits to be set on hours of working;
 - prevention of pollution (including odour) procedures to be agreed by local authority;
 - noise limits from the powerhouse to be set by condition;
 - Environmental Liaison Officer procedures to be agreed by local authority (on sensitive sites); and,
 - monitoring requirements to be agreed by local authority and carried out (on sensitive sites).

4 Small Hydro

INTRODUCTION

1. Hydropower is well developed in England, where most sites with a potential greater than 1MW have already been developed. However, there are a large number of sites with a potential in the range of 100kW (0.1MW) to 500kW (0.5MW), and the possibility for a few sites of up to 1MW, which could be economically developed as grid connected schemes. In addition, there are a larger number of locations where smaller, domestic scale schemes in the range 10kW to 50kW could be developed. This section deals with smaller hydro schemes of up to 1MW.

TECHNOLOGY

2. 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 usually turned into electrical energy by a generator, or more rarely to drive a useful mechanical device.
3. 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).
4. The 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 some 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.
5. Pumped storage schemes are capable of being used in conjunction with more intermittent forms of renewable energy to smooth out the intermittency by providing an element of energy storage. Although there are currently no pumped storage plants in England, they could play an important role in enabling greater efficiency of energy generation infrastructure. During periods of low demand, but when the prime resource is available, excess energy is used to pump water from a lower level to a higher level reservoir. During periods when demand is high and the prime resource availability is low, the water from the higher reservoir is released via a turbine to the lower reservoir to generate electricity. Such

schemes may require the construction of two new reservoirs, but apart from this, the technology employed, and the implications for the planning system, are similar to those outlined in this section. However, because of the cost involved, pumped storage schemes of less than 1MW are likely to be extremely rare.

6. 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, often known as a penstock, 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; and,
 - a link to the electricity network, or the user's premises.

These are explained below.

The Intake

7. The scale and nature of these elements depend on site conditions, and whether the scheme is low head or high head.
8. 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 sluiceway 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 the Environment Agency may grant an exemption under some circumstances.

Figure 1 Intake for 500kW Hydro Scheme



(Source: DTI)

The pipeline

9. 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.
10. 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

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

Figure 2 Turbine house for a 100kW hydro plant



(Source: DTI)

The tailrace

13. After use, the water is returned to the natural watercourse via a concrete or masonry channel connecting the turbine house to the watercourse. To avoid flooding 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

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

The context

15. High head hydro sites require a significant fall and a significant proportion of river flow. Development is therefore likely to take place in hilly or mountainous areas, many of which may be of landscape or nature conservation interest. This can be a potential barrier to small hydro development although careful consideration of all the benefits and disbenefits of a development is required. Small hydro schemes are costly to build and the scale of the development must be consistent with the amount of energy produced. The developer therefore needs to make the best use of any site in terms of water abstraction. The Environment Agency will put stringent controls on the water abstraction regime, particularly where nature conservation interests are evident, and negotiations are required between all parties at an early stage in order to reach an acceptable solution.
16. The built elements of small hydro schemes are small and usually of a scale in keeping with the river valleys in which they are sited.

PLANNING ISSUES

17. 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 English Nature 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 measures.

Siting and the landscape

18. As with several renewable sources of energy, it is usually only possible to exploit hydropower resources where they occur. Hydro schemes do however enjoy modest locational flexibility as the precise siting of the intake and the turbine house can sometimes be influenced by non-operational factors, including local landscape characteristics.
19. Small hydro schemes have been a prominent part of English rural history and as such, small dams, weirs, leats and turbine houses are not uncommon features in the landscape. Consideration should be given to integrating a new scheme into the landscape as far as possible. Where rivers are lined with trees, for instance, it will be relatively simple to conceal hydropower facilities, particularly if the existing woodland cover is supplemented by new planting. Where the development is taking place in a more open location, built elements should either be designed to be as small as possible, having regard to operational considerations, or should be designed to be in keeping with local landscape and architectural features. In the case of schemes proposed for hillsides or other prominent locations, the landscape impact of the development in close and distant views should be appraised. Careful consideration should be given to burying the pipeline and restoration of the pipeline route.
20. In some cases, the visual appearance of waterfalls may be affected by water abstraction. In these cases, consideration should be given to potential viewers, and to the importance of the waterfall in immediate and longer distance views. Assessment of effects can usefully include photographs of the waterfalls at various flows, as existing summer flows may match the proposed flows after abstraction during the wetter months. Measures could be adopted to overcome visual objections, such as requiring abstraction to be reduced during the day in summer months when visitors are most likely to be present.
21. Measures to minimise the visual impact of pipes and power lines should also be considered carefully at the design and planning application stages.

Design Considerations

22. Although the hydro developments anticipated will generally be small in scale, their waterside location will, in many cases, place them in areas valued for their visual and natural amenity. Such schemes can operate for many decades, and their principal built elements will often become a permanent feature in the landscape. In some circumstances, weirs, fish ladders and turbine houses can become features of interest in their own right.

23. For these reasons, planning authorities may reasonably insist on a high standard of design. Particular attention may need to be given to the architectural quality of built elements, the choice of building materials, and manner in which the development is integrated with its surroundings. Schemes that are in harmony with the surroundings, perhaps incorporating vernacular building materials and styles are to be encouraged.

Hydrological Considerations

24. During operation of a small hydro scheme, water is abstracted over a short stretch of the river. Hydroelectric schemes do not pollute or consume water and usually return the supply to the channel from which it was abstracted. Water that has passed through a turbine is often improved by aeration and is free of debris.

Ecological Considerations

25. The effect of water abstraction on the riverine ecology can be a concern, particularly in areas that are valued or designated for their ecological resource. However, the long-term impacts of 'run of river' schemes on rivers are largely unknown. Where ecological issues are considered to be important, liaison between the developer, the Environment Agency and English Nature will help to establish the required environmental information to be provided at the planning application stage, and the potential impacts that are to be considered. This may include surveys of river corridor habitats, bryophytes, invertebrates, amphibians, birds and mammals. The effects of changed flow regimes and water quality may need to be assessed. It is possible that impacts can be 'designed out' of the scheme with measures such as pulsed flow or seasonal operating of the plant.

Fisheries interests

26. Concern has been expressed that fish, in some instances, have been killed or injured by hydropower schemes. This risk can be minimised by careful design and adjustment of the seasonal operating schedule of the plant. Some types of turbine (such as low to medium head crossflow designs) can oxygenate the river water and may thereby benefit the fish population. Where necessary, dams and weirs should include structures which allow free passage of migratory fish, and afford fish and other freshwater animals protection from the turbines. Further advice on fish passes and screens can be obtained from the Environment Agency.

Noise

27. The noise emitted from a turbine will generally be well contained by the turbine house and not be heard more than a few metres away. If necessary, limits can be set on noise emissions if the site is close to residential properties, by way of a planning condition.

Construction disturbance

28. In general, the construction impact of a hydro-power scheme will be no different to that of other developments of similar size. However, construction on or beside a river will often cause the water to become clouded with silt or mud. Before granting planning permission for a hydro project, the planning authority may, in consultation with the Environment Agency, request that a developer specifies the site management measures that will be adopted to minimise this problem.
29. The construction of the pipeline and weir may have an impact on sensitive habitats. In this instance the planning authority may wish to require a detailed construction specification, and in very important ecological areas, may ask for an environmental liaison officer to be present on site during certain parts of the construction process. This can ensure that construction is carried out in a manner that is most sensitive to the ecology of the site.

Operational disturbance

30. Once in operation, small hydro schemes require little maintenance. A weekly visit is usually all that is required, and a well-constructed remotely operated plant may demand less frequent visits. Depending on the design, daily cleaning of the trashrack may be required during autumn, but self-cleaning screens are increasingly common.

Recreation and Public Access

31. A small hydropower scheme will have a negligible impact on public access, though fisheries interests or other users of the river might be affected. The pipeline route may often be designed to follow the route of an existing footpath alongside a river, but impacts will be confined to the construction stage of the project where temporary diversions or closure may be required.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

32. A planning application for a hydro development could usefully include the following information:
- maps, diagrams and drawings showing the location and design of intake, pipeline, turbine house, tailrace and security fencing and lighting for urban schemes;
 - photomontage of intake;
 - grid connection works, including transformer and transmission lines;
 - provision for fish passes (where required);
 - details of vehicular access and vehicular movement;
 - landscaping provisions; and,
 - site management measures during the construction phase.

ENVIRONMENTAL ASSESSMENT

33. The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI No. 293) include “installations for hydroelectric energy production” within Schedule 2(3)(h). Those with a generating capacity of over 500kW (0.5MW) must be screened for the need for EIA by the planning authority. Projects that lie within sensitive areas as defined in regulation 2(1) must all be screened as the thresholds do not apply. Where a screening opinion is required, Schedule 3 to the EIA Regulations provides selection criteria for screening Schedule 2 development (see regulation 4(5)).
34. An EIA is often required by the Environment Agency as part of the application for an Abstraction Licence. Consultation between the Environment Agency and local planning authority at the scoping stage will minimise duplication of effort. In many cases, one Environmental Statement will be sufficient for both purposes.

OTHER AUTHORISATIONS/CONSENTS

Abstraction Licence

35. Any small hydro scheme in England requires an abstraction licence and possibly an impoundment licence from the Environment Agency, and the applicant may have to produce calculations, or other evidence to justify assumptions in respect of the available flow, and the amount of water abstracted. Abstraction of the entire flow is not permitted, and the design must guarantee a minimum flow to maintain the riverine environment in the deprived reach.

Consent to Work in a Watercourse

36. In addition to an Abstraction Licence, a Consent to Work in a Watercourse will also be required from the Environment Agency before construction can commence. Evidence of Planning Permission is usually required in order to secure a Consent.

Reservoirs Act

37. If the development entails the construction of a new reservoir (or restoration of an existing reservoir) exceeding 200,000 cubic metres capacity, the Reservoirs Act will apply. Under the Act, such reservoirs require certification and regular inspection by an engineer registered under the Act to do so.

POSSIBLE CONDITIONS OF PLANNING PERMISSION

38. For a small hydro scheme, possible conditions of planning permission could include the following matters agreed by the local planning authority:
- work to be carried out in accordance with agreed method statement;
 - scheduling of site work to protect spawning salmonids;
 - plans of turbine house and contractors compound to be agreed;
 - building design to be approved;
 - time limits to be set on use of contractors compound;
 - time limits to be set on hours of working;

- prevention of pollution procedures to be agreed;
- pipeline route and restoration procedures to be agreed and approved on site;
- noise limits from the powerhouse to be set by condition;
- Environmental Liaison Officer procedures to be agreed (on very sensitive sites); and,
- monitoring requirements to be agreed and carried out (on very sensitive sites).

5 Passive Solar Design

INTRODUCTION

1. Passive Solar Design (PSD) has its origins in vernacular architecture pre-dating the Industrial Revolution. A blend of intuition and simple design rules ensured that domestic scale buildings captured maximum light and heat from the sun whilst acting as a buffer against the worst of the elements.
2. PSD is sometimes seen as straddling the boundary between the Building Regulations, which are concerned with energy efficiency standards and can have an influence on window size, and Development Control which is concerned with siting, layout and appearance. Planning has an important role to play in encouraging the greater application of PSD principles, particularly amongst volume housebuilders, and in the design of schools and some commercial buildings.
3. PSD can only be considered at the design stage; it provides a one-off opportunity to save energy during the lifetime of a building, generally at no cost. In modern housing up to 20–25% of heating and lighting energy can be saved by the application of PSD principles.
4. When PSD is applied in conjunction with other technologies as part of a low or zero energy approach, the resulting buildings can be novel or unusual. There is sufficient scope within the parameters of PSD to create interesting and varied layouts and townscape. In the case of offices, schools and other public buildings, features with a PSD function such as ventilation stacks and atria can be designed in ways that add interest and character.
5. However, it is very important to realise that PSD principles can be applied equally effectively in housing and commercial developments which have an entirely conventional appearance. For example, a typical 18th century farmhouse could provide a useful design checklist: orientation towards the south, main living room widows in the south façade with splayed side reveals to maximise light penetration, possibly a long north sloping roofline down to single storey rooms at the rear of the house accommodating the kitchen, larder and few small windows.

TECHNOLOGY

6. 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.

7. 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 whilst avoiding the use of air conditioning.

Tool Kit

8. The items in the PSD 'tool kit' 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 heating and light. Using dense materials in construction will enable the building to absorb heat during the day and release it slowly 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.
 - **Window sizing and position** – In housing, smaller windows should generally be used in north facing elevations. On the south elevation whilst 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. There are more benefits to be gained from reducing the size and number of north facing windows than by increasing south facing ones.
 - **Conservatories and Atria** – Carefully designed conservatories and atria can contribute to the management of 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 upward 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 than 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.

Technical constraints

9. PSD must form part of an overall approach towards reducing the need for conventional energy sources in providing heating, light and ventilation: it should always be used in conjunction with other low energy and efficiency measures.
10. The application of PSD will always be constrained to an extent by building and location specific factors. However at the present time the most significant barriers to its widespread application are lack of familiarity and a perception that PSD will inevitably produce buildings which are unconventional in appearance and difficult to market. Local planning authorities have a vital role to play in highlighting the benefits of PSD and bringing them into use in mainstream housing, commercial and public sector development.

PLANNING ISSUES

A Planning matter?

11. Although the application of PSD principles is primarily a local planning and development control matter there is a strategic issue to be addressed. Planning authorities have been generally reluctant to include PSD requirements within normal development control policy guidelines governing the layout, siting and appearance of buildings. Typically such guidelines seek to ensure that residential buildings, in particular, enjoy adequate natural light and privacy. Going beyond this to require consideration of solar heat and light capture through the use of PSD has not been regarded as a normal planning matter and not something that can ultimately be defended at appeal. Where planning authorities have sought to apply PSD principles this has been done in the past by using Supplementary Planning Guidance, possibly with a reference in the local plan or Unitary Development Plan.
12. In addition to the general requirement that development plans should contain policies designed to promote and encourage, rather than restrict, the development of renewable energy resources, PPS22 now specifically includes “passive solar” in the list of renewable energy technologies to be taken into account in the preparation of development plan policies. In effect this deals with any past uncertainty about the status of PSD by making it a normal planning matter.

Local development document policies

13. The key to realising the benefits of PSD is one of scale; individual exemplars will not make a significant difference to CO₂ reduction targets, but if all new housing, office and public building developments adopted the principles then worthwhile environmental benefits would be achieved. Planning policy and detailed guidance at a local level can make a difference to the application of PSD.
14. A general policy promoting the use of PSD should be included within Local Development Documents. One approach would be to have a dedicated PSD policy, an alternative would be to have a more general policy dealing with renewables in buildings in which PSD plays a part. In either case a general policy should signpost a more detailed PSD policy, or a checklist for assessing developments, elsewhere in the document (See main text section 4).

15. Local Planning Authorities should introduce PSD policies into their local development documents and back these up with more detailed guidelines, possibly in the form of Supplementary Planning Documents.
16. Applying PSD principles will be particularly important at the master plan stage of major developments. It is at this stage that the case for PSD is either won or lost. In preparing master plans and development briefs and commenting upon those put forward by others, PSD requirements should be placed alongside routine matters such as access and infrastructure.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

17. Developers of residential, commercial or other premises should be encouraged to adopt PSD principles during pre-application discussions with the local planning authority. The following points could be used as a checklist when preparing a planning application.

Housing applications

Siting and Layout

18. The potential benefits of PSD can only be realised by careful siting and layout design. Sites should be planned to permit good solar access to as many dwellings as possible:
 - the majority of residential access roads should predominantly run east-west with local distributors running north-south. This should allow one main elevation of the dwellings to face towards the south;
 - houses should be carefully placed to limit the extent of overshadowing. Taller buildings should be placed to the north of the site with lower and low density buildings to the south of the site. Overshadowing resulting from landform, trees and buildings outside the site needs to be avoided as far as possible. Staggering dwellings or using stepped facades can also be of benefit;
 - the majority of building facades should be set within 30 degrees of due south to enjoy the benefits of PSD.

Land form and landscaping

19. Working with the landform, landscaping should seek to act as a barrier to cold prevailing winds.

Design and fenestration

20. Given an appropriate site layout, the nature of rooms and window sizing will also influence the extent of passive solar benefit:
 - in applying internal house layouts to the site, rooms which are occupied for much of the time (e.g. living rooms) should be positioned on the south side of the dwelling;
 - generally windows on the north side of the dwelling should be smaller and fewer in number than those on the south; and
 - garages and unheated conservatories can be used to provide thermal buffering on the north side of the dwelling.

Offices, schools and other public buildings

Lighting

21. The design should seek to make the best use of natural light by use of elements such as a shallow floor plan, atria and roof lighting.

Heating/Cooling

22. The design should avoid using excessive glazing that will lead to overheating during the summer. Overhanging eaves and shading features can be used to limit solar access during the summer. Natural ventilation driven by solar design should be used in preference to air conditioning.

ENVIRONMENTAL ASSESSMENT

23. PSD is an environmentally benign approach to building design which allows significant lifetime savings in energy to be made without initial or running costs. As such it should be regarded as the most basic starting point onto which energy efficiency and active renewable energy measures should be added. PSD does not result in any environmental impacts but reduces those which will inevitably arise as the consequence of the occupation and use of a

building for any particular purpose.

OTHER AUTHORISATIONS/CONSENTS

24. PSD does not require any other consent beyond planning control. It is, however, also relevant to the application of the Building Regulations.

POSSIBLE CONDITIONS FOR PLANNING PERMISSION

25. PSD should be dealt with principally by way of LDD policy and guidelines. It does not readily lend itself to the use of planning conditions because it concerns the fundamental design of the building and cannot easily be dealt with by way of conditions.

6 Active Solar (Photovoltaics)

INTRODUCTION

1. Active solar technology can be divided into two categories: Photovoltaic (PV) and Solar Water Heating (SWH). Solar PV is unique among renewable energy technologies in that in addition to generating electricity from daylight, it can also be used as a building material in its own right. PV can either be roof mounted or free-standing in modular form, or integrated into the roof or facades of buildings through the use of solar shingles, solar slates, solar glass laminates and other solar building design solutions.



(Source: Dulas Ltd)

TECHNOLOGY

2. PV systems exploit the direct conversion of daylight into electricity in a semi-conductor device.
3. 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 dark in colour, and have low reflective properties. Solar panels are typically 0.5 to 1m² 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 18m², and would produce 1 to 2 kW peak output.
4. Other forms of solar PV technology are becoming more common in the UK, such as solar tiles, which can be integrated into new buildings or refurbishments alongside conventional roofing tiles or slates. They have the aesthetic advantage of giving a roof a homogeneous appearance, virtually indistinguishable from conventional roofing materials.
5. PV modules can be fitted on top of an existing roof using a low support structure. In this case, the panels will typically lie flush with the existing roof and not protrude above the 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 skylights.
6. 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.

Siting issues

7. For best performance, PV modules need to be inclined at an angle of 20-40 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 is acceptable although this will be at the expense of best performance. To function well PV installations need to be inclined at between 10 and 60 degrees, and orientated facing from east to west (i.e. within 90 degrees of due south).

8. Although roof mounted PV is the most common, 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 can be an architectural feature as well as a supply of electricity. Other examples of building integrated PV include external sun shading of office windows (bris-solaires) and glass atrium roofs.
9. 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 permanent overshadowing of the PV.



(Source for 2 and 3: Dulas Ltd)

Types of system

10. **Stand-alone systems:** PV is widely used to provide power for communications systems, domestic dwellings and monitoring systems either in remote areas or locations where connection to the grid is expensive or otherwise problematic, e.g. for parking meters. 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 is almost always more cost-effective than new connections to the grid.
11. **Grid-connected schemes:** In grid-connected solar PV systems 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. Some electricity suppliers have introduced solar tariffs to buy 'exported' electricity. Others will pay their customers for all of the electricity generated, regardless of the amount exported.

The context

12. 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 authorities can consider the encouragement of PV systems by placing strict energy targets on new build houses and other buildings, and encouraging the incorporation of PV systems where appropriate. This will be made easier with the introduction of new materials, such as PV roof tiles, in a similar way that roofing materials (e.g. slate) are stipulated on new dwellings in some areas.

PLANNING ISSUES

General

13. The technology will be familiar to most and from the planning point of view, whilst there are clearly implications for listed buildings and the sensitive front elevations of some conservation areas, in general 'solar panels' are 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.
14. PV is particularly well suited to the urban environment and is clean and silent in operation.
15. The increasing take-up of solar PV technologies raises a number of considerations which local planning authorities may need to take into account. These include:
 - whether particular systems require planning permission;
 - the importance of siting systems in situations where they can collect the most energy from the sun;

- the need for sufficient area of solar modules to produce the required energy output from the system;
- the colour and appearance of the modules.

Listed buildings and designated areas

16. The installation of a PV array on a building listed for its special architectural merit or historic interest – or on another building or structure within its curtilage – is likely to require an application for listed building consent. This will be so, even if specific planning permission is unnecessary.
17. Permitted development rights to clad the walls or alter the existing roofline of a dwelling do not necessarily apply in Areas of Outstanding Natural Beauty, Conservation Areas, Sites of Special Scientific Interest, National Parks or the Norfolk Broads. When considering applications in these areas the potential impact on the character or appearance of the area should be considered.
18. If an application for a PV module is submitted for a building close to a conservation area, or close to a listed building, its proximity to such area or buildings may be a material consideration for the local planning authority in deciding the application.

Information to accompany a planning application

19. A planning application or application for listed building consent for a solar PV system could usefully include the following information:
 - the design of the module or array;
 - photographs of the existing built environment;
 - detail of the roof mounting arrangement, if applicable;
 - indicative drawings of the module or array in place;
 - connection details to the building or grid if relevant;
 - if the application involves a listed building, a photomontage of the proposed collector array could be useful.

ENVIRONMENTAL ASSESSMENT

21. The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 do not include solar energy systems specifically in Schedule 1 or 2. However large, industrial scale developments (producing over 0.5MW of electricity) are listed in Schedule 2 and would therefore require a Screening Opinion. These, however, are rare in the UK. Domestic or small-scale systems are not covered by Schedule 1 or 2 and are therefore not likely to require an EIA. In National Parks, conservation areas and on listed buildings, the only issues likely to be important are visual amenity and building fabric and these can be covered by a short description accompanying the planning application.

OTHER AUTHORISATIONS/CONSENTS

22. For stand-alone systems not connected to the distribution network, no additional authorisations are required. For systems that are connected to the electricity network, prior consent of the local Distribution Network Operator (DNO) must be obtained. Small PV systems come within the scope of Engineering Recommendation G83/1 – *Recommendations for the Connection of Small Scale Embedded Generators (up to 16A per phase), in Parallel with Public Distribution Networks*, (Issue 1: 2003). Larger systems may be required to meet E.R G59 – *Recommendations for the connection of embedded generating plant to the regional electricity companies' distribution systems*.

POSSIBLE PLANNING CONDITIONS

23. Where planning permission is required, the following conditions may be applicable:
 - scheme to be built to design approved by local authority; and
 - design of solar modules to be agreed by local authority.

7 Solar Thermal (Solar Water Heating)

INTRODUCTION

1. Active solar technology can be divided into two categories: Photovoltaic (PV) and Solar Water Heating (SWH). The technologies appear to be similar, in that they both use roof-mounted equipment to collect radiation from the sun and convert it to a useful form of energy, but they produce two different things: electricity in the case of PV and hot water in the case of Solar Water Heating. This section deals with Solar Water Heating, and describes the basic technology and applications. Solar PV is dealt with in Section 6 of the Annex. Some sections are common to both sections: the repetition between them is intentional.

Figure 7.1 Solar PV panels



(Source: Dulas Ltd)

Figure 7.2 Solar Water Heating



(Source: Filsol Ltd)

TECHNOLOGY

2. 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 the heating of swimming pools. At present, the widest use is in the residential domestic hot water sector. SWH systems are very rarely also used to provide space heating.

3. There is a common misconception that solar water heating is ineffective in England for climatic reasons. Whilst it is clearly not as effective in England as it could be 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, with most of this energy capture being between May and September.
4. 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. 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 plate collectors

5. Flat plate collectors comprise a water filled metal ‘envelope’ with a special black coating which improves absorption 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.
6. 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.

Evacuated tube collectors

7. Evacuated tube collectors comprise a number of vacuum tubes, typically around 100mm 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.

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

Installation

9. The collector, together with the glazing and insulation are generally mounted in a box which is usually coloured grey or black, typically of 1-2m² in area. For an average residential domestic installation, some 4 or 5m² of flat plate collector, or some 3m² of evacuated tube are 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 40cm will be mounted adjacent to the solar hot water collector.
10. Collectors rarely project more than 120mm above the existing roofline. Connecting pipework is normally run from the back of the collector directly through to the roof void, and is not normally visible from the exterior of the building.
11. Solar water heating collectors for swimming pools generally comprise a 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.

Siting issues

12. For best performance, solar water heating collectors 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 is acceptable although this will be at the expense of best performance. To function satisfactorily collectors can be inclined at between 10 and 60 degrees, and orientated facing from east to west (i.e. within 90 degrees of due south).

13. Although roof mounted collectors are the most common, they can also be mounted on the sides of buildings, or on free standing support structures on the ground. The latter is particularly common in the case of swimming pool heaters.
14. Shadows from buildings, trees or other structures can significantly reduce performance of solar hot water collectors, and planners and designers should take reasonable steps to minimise overshadowing.

The context

15. Solar water heating is a mature and recognised technology. A domestic system is within the economic means of many households in the UK, and the technology could provide a useful contribution to renewable energy generation. Planning authorities could consider the encouragement of such systems by placing strict energy targets on new build houses and other buildings with a high domestic hot water demand – for example, those in the tourism/leisure sector – and by encouraging the incorporation of solar water heating systems where appropriate.

PLANNING ISSUES

General

16. The technology will be familiar to most and from the planning point of view, whilst there are clearly implications for listed buildings and the sensitive front elevations of some conservation areas, in general solar water heating schemes are 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, SWH systems are regarded as “permitted development” and is thus deemed not to require a planning application. Unless the collectors 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.
17. Solar hot water systems have some advantage over other renewable energy technologies, in that they are well suited to the urban environment: they are silent in operation and release no emissions.

18. The development of systems for collecting and using solar energy raises a number of considerations which local planning authorities may need to take into account. These include:
- whether particular systems require planning permission;
 - the importance of siting systems in situations where they can collect the most energy from the sun;
 - the need for sufficient area of solar modules to produce the required energy output from the system;
 - the colour and appearance of the modules.

Listed Buildings and designated areas

19. Installation of solar water heating collectors on a building listed for its special architectural merit or historic interest – or on another building or structure in its curtilage – is likely to require an application for listed building consent. This will be so, even if specific planning permission is unnecessary.
20. Permitted development rights to alter the existing roofline of a dwelling do not necessarily apply in Areas of Outstanding Natural Beauty, Conservation Areas, Sites of Special Scientific Interest, National Parks or the Norfolk Broads. When considering applications in these areas the potential impact on the character or appearance of the area should be considered.
21. If an application for a SWH system is submitted for a building close to a conservation area, or close to a listed building, its proximity to such area or buildings may be a material consideration for the local planning authority in deciding the application. If the proposal is to install a SWH system on a building or structure close to a National Park, the planning authority would have a legal duty to have regard to the purposes of the National Park.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

22. A planning application or application for listed building consent for a solar hot water system could usefully include the following information:
- the design of the collector;
 - photographs of the existing built environment;
 - detail of the roof mounting arrangement, if applicable;
 - indicative drawings of the collector in place;
 - if the application involves a listed building, a photomontage of the proposed collector could be useful.

ENVIRONMENTAL ASSESSMENT

23. The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 do not include solar energy systems specifically in Schedule 1 or 2, and small scale solar water heating collectors are therefore not likely to require an EIA. In National Parks, conservation areas and on listed buildings, the only issues likely to be important are visual amenity and building fabric and these can be covered by a short description accompanying the planning application.

OTHER AUTHORISATIONS/CONSENTS

24. No other authorisations are required.

POSSIBLE PLANNING CONDITIONS

25. Where planning permission is required, the following conditions may be applicable:
- scheme to be built to design approved by local authority; and
 - design of solar modules to be agreed by local authority.

8 Wind

INTRODUCTION

1. The principle of harnessing wind energy by wind turbines is well established, and wind turbines make a significant contribution to electricity supply systems in Europe and the UK. There is no doubt about the technical feasibility of wind power. In addition, the UK is particularly well placed to utilise wind power, having access to something like 40% of the entire European wind resource. The UK wind resource is greatest along the western coastline, where wind farms have been concentrated until recently. Developments in the technology and the electricity market over recent years now mean that wind power is found to be viable across the UK. As such wind farm developments can reasonably be expected to be proposed in all regions of the country.
2. This section describes the technology of wind turbines in relation to current turbine sizes (600kW-3MW) that are expected to comprise the bulk of the UK's onshore wind generated electricity provision. In most respects this information will be equally valid for both smaller wind turbines, more suited to locations with higher population densities, and the larger machines that will be developed in the coming years. Where there are differences these will be clearly noted. The section discusses only land-based turbines, although there is essentially little difference between these and machines that are installed off-shore.

TECHNOLOGY

Wind Turbines

3. 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 and unless otherwise stated, this section refers to horizontal axis machines.
4. Wind turbines use the wind to generate mechanical power for water pumping or for electricity generation. This section deals only with the electricity-producing variety. 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. The height of the tower is normally at least twice the length of a

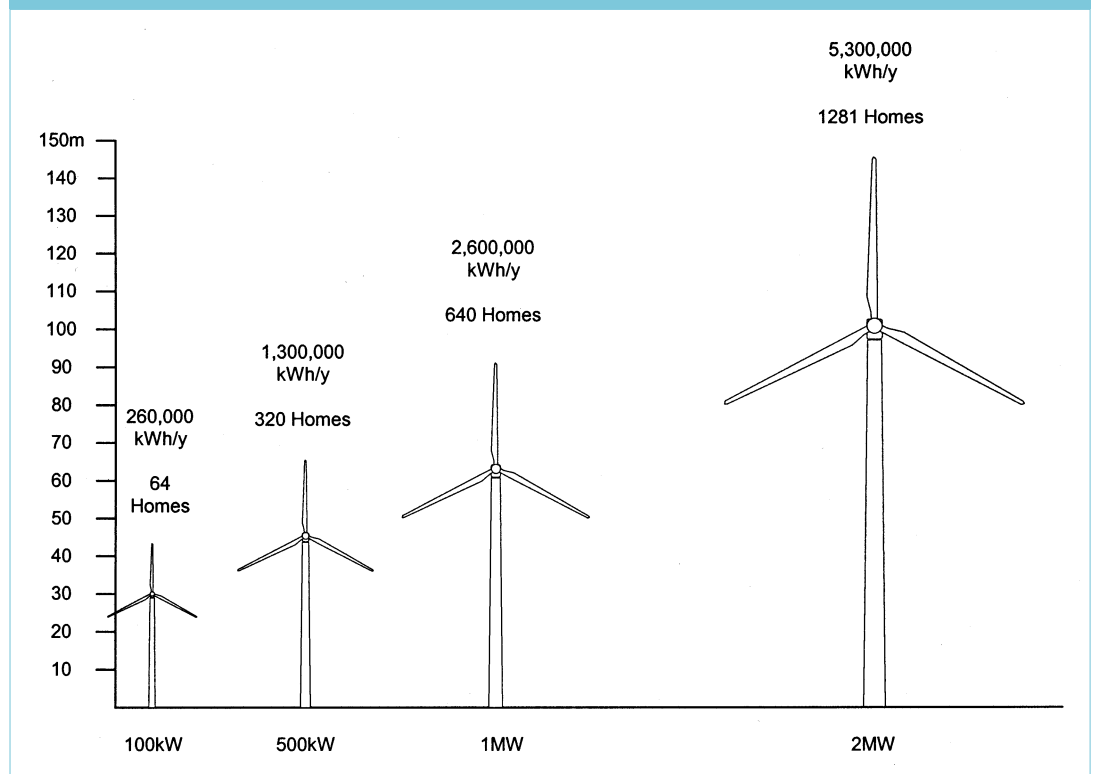
blade. The blades need to be far enough from the ground to minimise turbulence and to maximise the energy capture of the wind turbine. Normally solid tubular towers are used rather than lattice constructed towers.

5. 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 generally 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 will result in a greater than proportional change in rated power. The diagram below (figure 1) illustrates this;
 - an increase in wind speed will result in a greater than proportional change in rated power. Rated power is proportional to the cube of the wind speed, and hence a doubling of wind speed will result in a roughly eight-fold increase in power output.

The observations above relate to the fundamental physical principals behind wind turbine technology. They are, however, somewhat modified by the requirement to maximise efficient energy capture across a range of wind conditions.

6. Wind turbines are available in a wide range of sizes, from small battery charging units with rotor diameters of less than a metre to very large wind turbines with rotor diameters greater than 100 metres with a capacity of several megawatts. Wind turbines have increased in size and capacity over time and will continue to do so in the foreseeable future, although it should not automatically be assumed that the largest turbines will feature in planning applications for onshore locations. The choice of turbine size depends on the site chosen and the scale of development required. Commercial wind farms that supply electricity to the electricity grid tend to use a smaller number of larger machines. However, farms and businesses using wind power might size their turbines according to the size of their own electricity demand. A typical modern wind turbine is shown in figure 2.

Figure 1 Approximate sizes of typical three-bladed turbines by installed capacity, also showing approximate annual energy output based on an average capacity factor of 0.3, the figure for the number of homes supplied is based on the average UK household consumption of 4100 kWh/year (OFGEM)



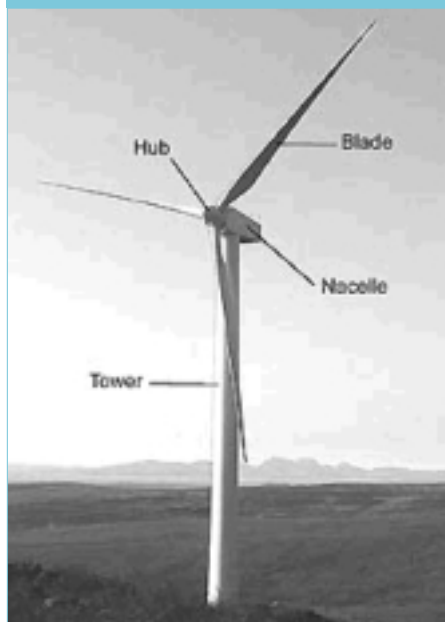
Main components of a wind turbine

7. 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 as current wind turbine designs are scaled up. 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.
8. 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 feed into the grid at a frequency of 50Hz, in common with the electricity transmission and

distribution networks. This can be achieved either by the use of a gearbox to ensure that the generator turns at the correct speed, or the use of power conditioning electronics, or in some cases having more than one generator to accommodate a wider range of different rotor speeds.

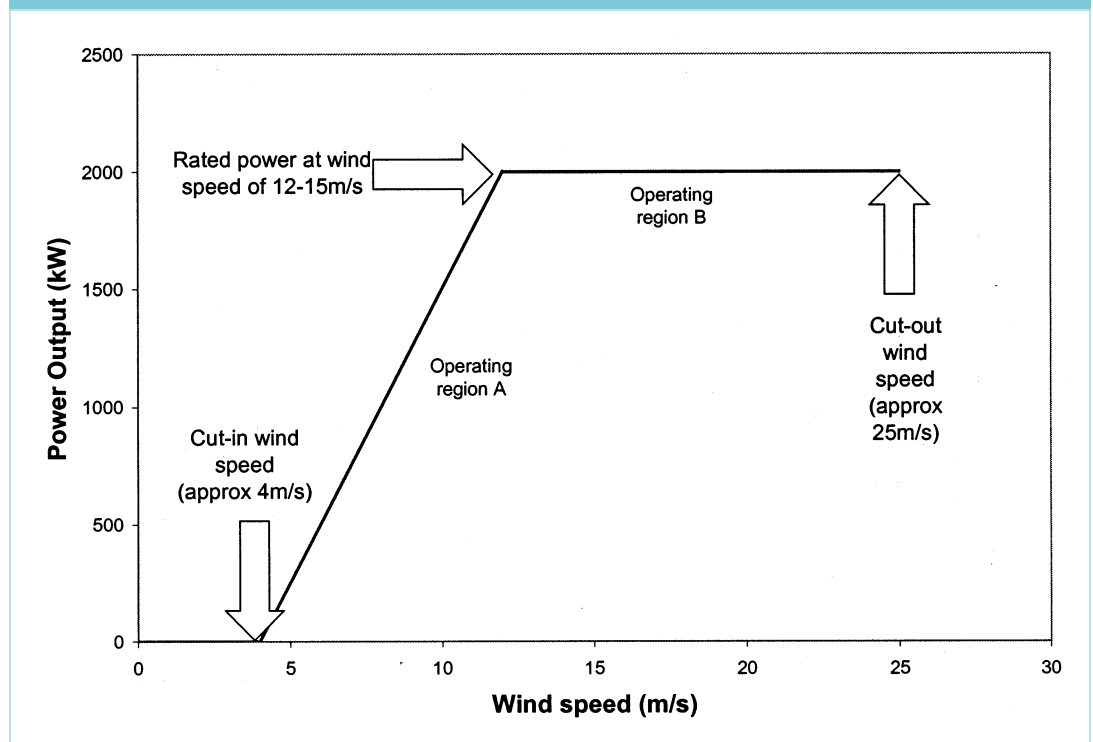
9. The generator, gearbox and yaw drive that turns the rotor to face the wind are the main components housed within the nacelle. For large, grid-connected turbines the rotor alignment with the oncoming wind is always controlled actively via the yaw drive and they are designed so that the blades see the 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.
10. The nacelle is mounted on the tower, which for large grid-connected turbines is normally, but not exclusively, 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 onto existing structures, such as roofs.

Figure 2 Main components of a wind turbine



11. 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. These are both best explained in relation to a wind turbine's operating regime as shown in Figure 3 below, which shows the relationship between the wind speed and power output.

Figure 3 Representation of a wind turbine operating regime

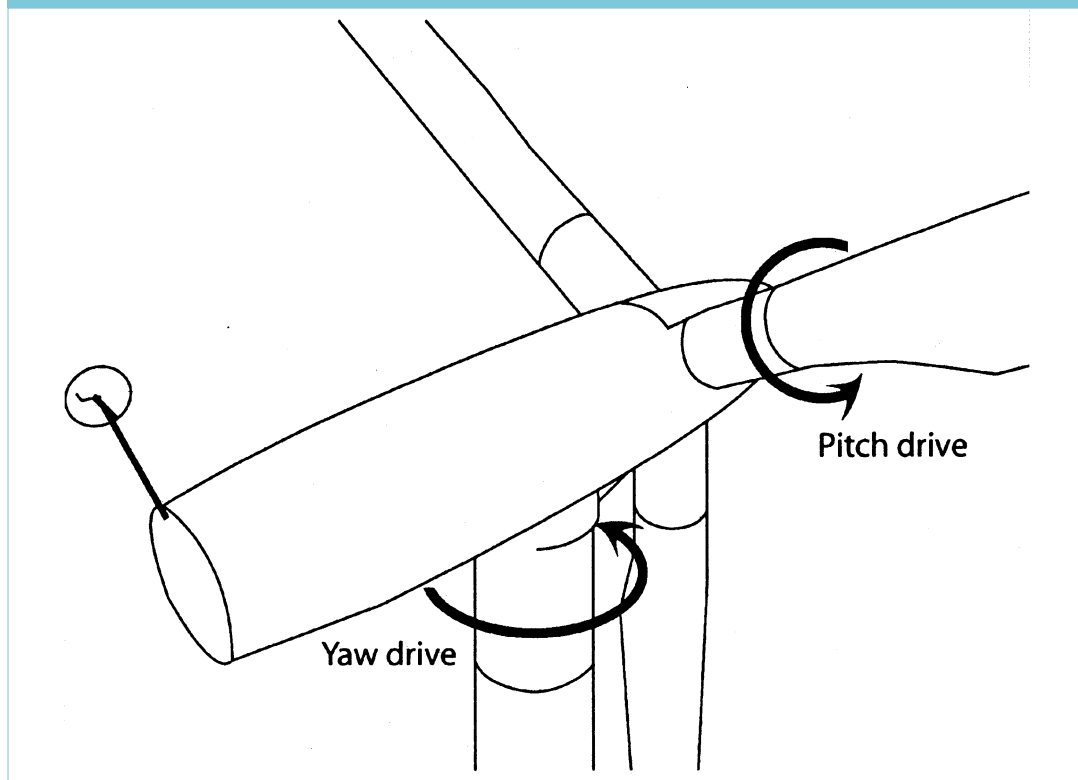


12. Below cut-in there is insufficient energy in the wind for the wind turbine to generate electricity. In the operating region 'A' between cut-in and rated wind speed a wind turbine will attempt to maximise the energy capture from the wind. In the operating region 'B' between rated wind speed and cut-out a wind turbine is required to limit the energy

capture from the wind, such that the rated power is not exceeded. Above the cut-out wind speed the wind turbine must stop and park the rotor in order to protect itself.

13. The turbine is controlled by its own computer system, which provides both operational and safety functions. In addition to controlling blade angle and rotor speed, a wind turbine's control system must also align the rotor with the oncoming wind. This is achieved by rotating the nacelle in relation to the tower top with a yaw gear mechanism.

Figure 4 Pitch and yaw axes for blades and nacelle respectively



14. Modern wind turbines also continuously monitor their own performance and if atypical vibrations caused by component imbalances are detected, or if connection to the local electricity grid infrastructure is lost, all turbines must be capable of emergency stops. Most modern wind turbines undergo test certification procedures, which must conform to the guidelines laid down by the International Electro-technical Commission (IEC).

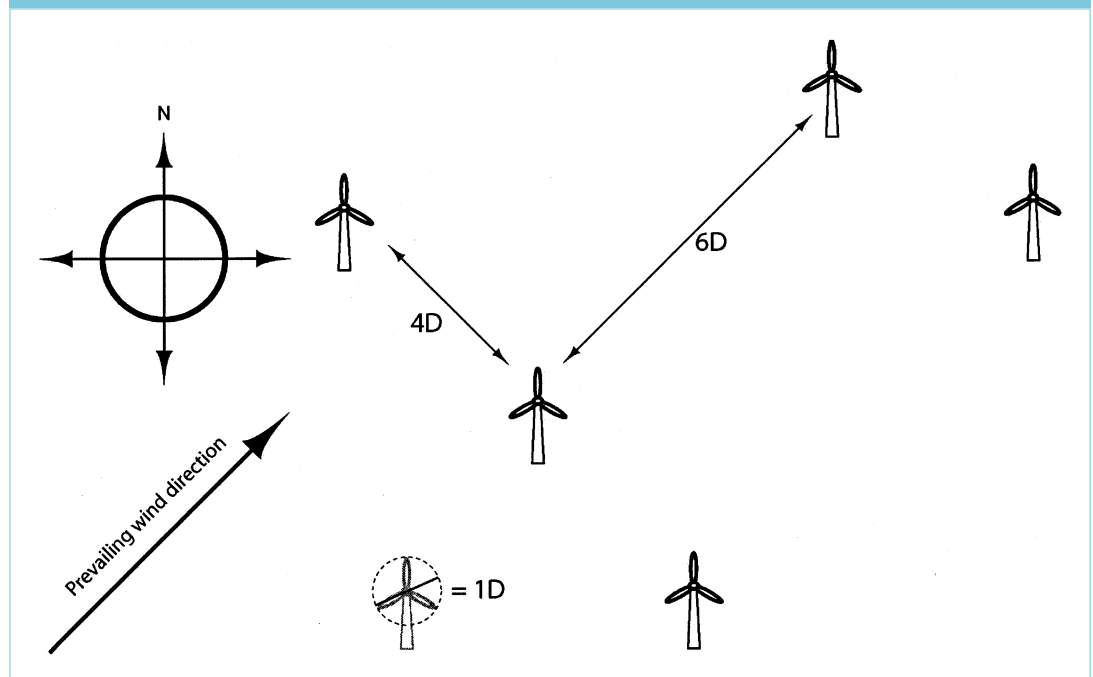
Wind Farms

15. Wind turbines can be deployed singly, in small clusters, or in larger groups known as wind farms. Factors that may influence the size of a development include the physical nature of the site, the capacity of the local electricity distribution network and the organisation undertaking the development. It is likely that the wind resource of the UK will be harnessed most satisfactorily using a mixture of these types of development.
16. The direction of rotation of the wind turbine rotors will be common across a wind farm. Wind turbines are usually semi-matt white, off white or grey in colour, often as a condition of planning permission. The colours of the blades, nacelle and towers are normally the same.

Spacing of Turbines

17. Wind turbines need to be positioned so that the distances between them are around 3-10 rotor diameters (about 180-600 metres for a wind farm using 60m diameter, 1.3MW wind turbines). This spacing represents a compromise between compactness, which minimises capital cost, and the need for adequate separations to lessen energy loss through wind shadowing from upstream machines. The required spacing will often be dependent on the prevailing wind direction as illustrated in Figure 5 below, which shows a possible layout for a UK site with a typical South Westerly prevailing wind direction.

Figure 5 Example turbine spacing in a wind farm with a South Westerly prevailing wind direction



Other Infrastructure

18. In addition to wind turbines, the required infrastructure of a wind farm consists of adequate road access, on site-tracks, turbine foundations, crane hard standings, one or more anemometer masts, a construction compound, electrical cabling and an electrical sub-station and control building. Some of these features are permanent and others are required only in the construction phase and as such are temporary.
19. One or more anemometer masts may also be required on-site. These are generally slender lattice masts built to the hub height of the turbines, with anemometers and wind vanes mounted at different heights. They are necessary to provide control information for the wind farm and to ensure the turbines are operating as per the manufacturer's warranty.
20. A construction compound will generally be specified in the proposal. This is of a temporary nature.

Access and Site Roads

21. The road access to a wind farm site will need to be able to accommodate trailers carrying the longest loads (usually the blades), as well as the heaviest and widest loads (generally the cranes required in erection). Amendments to existing roads required to gain access to site should be detailed in any wind farm planning application.
22. On-site tracks need to meet the weight and dimensional requirements detailed above. A developer may propose that they are left in this condition for the life of the wind farm or may ask to retain them in a reduced state (by, for instance, narrowing the roads and reinstating the verges). In either case there will be an operational requirement for decommissioning and to gain access to the site for routine maintenance with light vehicles, as well as to reach the site with loads potentially as large as those initially used. This would only be required in the case of a major component failure.
23. Larger hard standings are also required next to each turbine to act as bases for cranes during turbine erection and component lay down areas. These are generally treated as temporary features and are decommissioned after construction.

Towers

24. The towers of the turbines are fixed to a concrete foundation whose surface will normally be flush with the surrounding ground. This foundation pad is likely to be square or hexagonal in shape and about 7-20 metres across. The diameter of the base of the turbine tower is likely to be 2-5 metres. The land area actually used by the turbines is therefore very small. On land where public access is allowed, people might walk right up to the base of the towers without interfering with turbine operation. On land normally used for agricultural purposes, agricultural use could continue right up to the edge of the foundations.

Connection to the Electricity Grid

25. A wind farm is likely to be connected to the electricity distribution network just like any other power station. The farm's turbines would be likely to generate electricity at a voltage of 690V and are likely to be connected together at a higher voltage (11kV, 33kV or 66kV). Small transformers will be required to change the generating voltage to the common site voltage and these will usually be housed in the base of each turbine or in separate housings alongside each turbine. The output from the turbines in a farm is normally connected to a single point via underground cables. At this point a small sub-station is required to act as

the point of common coupling to the electricity distribution network at the appropriate grid voltage (usually 11, 33, 66 or 132kV). Access to the sub-station will be required by both the wind farm operator and the electricity Distribution Network Operator (DNO). For this reason the building may be divided in two with separate access points and distinct sets of electrical relays for each of the involved parties.

26. Responsibility for the routing of electrical cabling onwards from the sub-station to the nearest suitable point of the local electricity distribution network (usually an existing sub-station or line) is the responsibility of the DNO. This will be achieved either by a standard 3-wire system mounted on wooden poles or by lines laid underground. It should be noted, however, that laying high voltage cables underground is much more expensive (around 6-20 times greater) than pole-mounted overhead systems and would be likely to be used only for limited lengths and in special circumstances. The distance between the sub-station and the connection point will be of critical commercial relevance because of the relative costs of overhead and underground lines and the impact such costs have on total site development costs.

Operation and Maintenance

27. A wind farm is often equipped with a central monitoring system. This consists of a computer that supervises the operation of the farm and can communicate with a remote headquarters. Wind farms are likely to be un-manned, and their operational status regularly checked through the central monitoring system and remote link. Such a checking system may be housed in a small building somewhere on a wind farm site or may quite normally be combined with the sub-station.
28. When a wind farm reaches the end of its design life, the turbines can easily be removed and the foundations could be re-used for the installation of new turbines (subject to planning permission) or, if required, the land could be reinstated.

Wind Resource

29. The energy produced by a wind turbine depends on the strength of the wind to which it is exposed. The simplest indicator of the wind resource available at a given location is the annual mean wind speed at the site (usually given at the hub height of the turbine). A machine located on a site which has an annual mean wind speed of 6 metres per second will typically produce only half as much energy as the same machine on a site where the annual wind speed is 8 metres per second.

30. For any given location the wind speed rises with elevation above the ground due to wind shear. The degree of wind shear (the rate at which the wind speed increases when moving vertically away from the ground) is dependent on the surrounding ground conditions; the higher the surrounding obstructions (e.g. vegetation or buildings) the greater the wind shear produced. Due to this, raising the hub height of the turbines, by mounting them on taller towers, can increase the energy capture at any given site. Current hub heights available to developers are between 50-100m.
31. As well as affecting the wind shear, surrounding obstacles such as woodlands and buildings will increase the turbulence in the wind. Higher turbulence levels in the wind adversely affect wind turbine performance and life expectancy and, as such, developers will look to position turbines as far away from obstacles as is practicable. Again, the use of taller towers can ameliorate this effect by placing the rotor in less disturbed air.
32. Assessing whether a particular site will harness wind power satisfactorily entails using historical meteorological data (available from the Meteorological Office) and information derived from anemometers placed on site. Anemometer masts are normally required on a site for at least 12 months; the longer measurements are taken the better the predictions will be. The measurements from the anemometers help to determine whether or not a candidate site is suitable and, if it is, the measurements help to determine the best position for the wind turbines within the site's boundary. The masts should be approximately as tall as the hub height of the planned turbine. However, often when the mast is erected it is not known either if the site is suitable for wind farming or which turbine type would be most suitable. Masts are usually 25-60m tall. Planning permission is required to erect a temporary anemometer mast.
33. The mean wind speed at hub height (along with the statistical distribution of predicted wind speeds about this mean and the wind turbines used) will determine the energy captured at a site. The simplest way of expressing the energy capture at a site is by use of the Capacity Factor.
34. This can be expressed alternatively as the actual energy generated by a wind turbine over the course of 1 year divided by the energy that would have been generated by a wind turbine over the course of 1 year had the wind been consistently blowing at speeds between rated and cut-out (typically 12-25m/s). Capacity factors in the UK may generally fall anywhere between 0.2 and 0.5, with 0.3 being typical in the UK.

PLANNING ISSUES

General

35. A wind turbine development of 50MW or less installed capacity¹ will need planning permission granted by the local planning authority under the Town and Country Planning Act 1990.
36. A wind turbine development of over 50 MW capacity will be considered by the Secretary for State for Energy, under Section 36 of the Electricity Act 1989, and the local planning authority will be a statutory consultee.
37. The successful development of wind energy always entails detailed consideration of a number of factors, and in first appraising a prospective site a developer will take the following into account:
 - Access – Can large delivery vehicles gain access to the site without major modifications to the public road network?
 - Extent of site – Is the site large enough to accommodate sufficient turbines? (as a rule of thumb, 1 km² of unconstrained land can accommodate six 1.3MW turbines).
 - Wind speed – Is there sufficient resource for a viable project?
 - Planning permission – Is there a reasonable prospect of obtaining planning permission?
 - Grid Connection – Is the grid infrastructure within a reasonable distance?
 - Proximity to dwellings – Is the site constrained by a population centre, or scattered dwellings?
 - Air safeguarding and Electromagnetic Interference (EMI).
 - Landscape and ecological designations.
38. Although in the past most windfarm development tended to be located in upland areas due to higher wind speeds, technological advances, and changes to the renewable electricity markets have resulted in wind speed being less pivotal in the site selection process. Generally, whether there is a reasonable prospect of obtaining planning permission is becoming a much more dominant factor in the initial site selection process.

¹ also known as 'rated' capacity

39. The planning system exists to regulate the development and use of land in the public interest. The material question is whether the proposal would have a detrimental effect on the locality generally, and on amenities that ought, in the public interest, to be protected. Each planning application should be considered on its own merits, and the argument that granting permission might lead to another application is not sufficient grounds for refusal.

Specific issues

40. There are a number of issues specific to wind turbine developments that need to be considered when determining an application for planning permission. Where Environmental Impact Assessment (EIA) is deemed necessary (below) the potential issues should be covered in the Environmental Statement but, for smaller developments that do not require a full EIA, the local planning authority may require some or all of the issues to be addressed, forming Additional Environmental Information or an Environmental Report, to accompany a planning application.

Noise

41. Well-specified and well-designed wind farms should be located so that increases in ambient noise levels around noise-sensitive developments are kept to acceptable levels with relation to existing background noise. This will normally be achieved through good design of the turbines and through allowing sufficient distance between the turbines and any existing noise-sensitive development so that noise from the turbines will not normally be significant. Noise levels from turbines are generally low and, under most operating conditions, it is likely that turbine noise would be completely masked by wind-generated background noise. Table 1 below indicates the noise generated by wind turbines, compared with other every-day activities.

Table 1 Noise generated by wind turbines compared with other everyday activities

Source/Activity	Indicative Noise Level dB(A)
Threshold of Pain	140
Jet aircraft at 250 m	105
Pneumatic drill at 7 m	95
Truck at 30 mph at 100 m	65
Busy general office	60
Car at 40 mph at 100 m	55
Wind farm at 350 m	35–45
Quiet bedroom	20
Rural night-time background	20–40
Threshold of hearing	0

42. There are two quite distinct types of noise source within a wind turbine. The mechanical noise produced by the gearbox, generator and other parts of the drive train; and the aerodynamic noise produced by the passage of the blades through the air. Since the early 1990s there has been a significant reduction in the mechanical noise generated by wind turbines and it is now usually less than, or of a similar level to, the aerodynamic noise. Aerodynamic noise from wind turbines is generally unobtrusive – it is broad-band in nature and in this respect is similar to, for example, the noise of wind in trees.
43. Wind-generated background noise increases with wind speed, and at a faster rate than the wind turbine noise increases with wind speed. The difference between the noise of the wind farm and the background noise is therefore liable to be greatest at low wind speeds. Varying the speed of the turbines in such conditions can, if necessary, reduce the sound output from modern turbines.
44. The report, ‘The Assessment and Rating of Noise from Wind Farms’ (ETSU-R-97), describes a framework for the measurement of wind farm noise and gives indicative noise levels calculated to offer a reasonable degree of protection to wind farm neighbours, without placing unreasonable restrictions on wind farm development or adding unduly to

the costs and administrative burdens on wind farm developers or planning authorities. The report presents the findings of a cross-interest Noise Working Group and makes a series of recommendations that can be regarded as relevant guidance on good practice. This methodology overcomes some of the disadvantages of BS 4142 when assessing the noise effects of windfarms, and should be used by planning authorities when assessing and rating noise from wind energy developments (PPS22, paragraph 22).

Recommended Good Practice on Controlling Noise from Wind Turbines

From 'The Assessment and Rating of Noise from Wind Farms' (ETSU for DTI 1997).

The current practice on controlling wind farm noise by the application of noise limits at the nearest noise-sensitive properties is the most appropriate approach.

Noise limits should be applied to external locations and should apply only to those areas frequently used for relaxation or activities for which a quiet environment is highly desirable.

Noise limits set relative to the background noise are more appropriate in the majority of cases. Generally, the noise limits should be set relative to the existing background noise at the nearest noise-sensitive properties and the limits should reflect the variation in both turbine source noise and background noise with wind speed.

It is not necessary to use a margin above background noise levels in particularly quiet areas. This would unduly restrict developments that are recognised as having wider national and global benefits. Such low limits are, in any event, not necessary in order to offer a reasonable degree of protection to wind farm neighbours.

Separate noise limits should apply for day-time and for night-time as during the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance.

Absolute noise limits and margins above background should relate to the cumulative effect of all wind turbines in the area contributing to the noise received at the properties in question. Any existing turbines should not be considered as part of the prevailing background noise.

Noise from the wind farm should be limited to 5 dB(A) above background for both day- and night-time, remembering that the background level of each period may be different.

The $L_{A90,10min}$ descriptor should be used for both the background noise and the wind farm noise, and when setting limits it should be borne in mind that the $L_{A90,10min}$ of the wind farm is likely to be about 1.5-2.5 dB(A) less than the L_{Aeq} measured over the same period. The use of the $L_{A90,10min}$ descriptor for wind farm noise allows reliable measurements to be made without corruption from relatively loud, transitory noise events from other sources.

A fixed limit of 43 dB(A) is recommended for night-time. This is based on a sleep disturbance criteria of 35 dB(A) with an allowance of 10 dB(A) for attenuation through an open window (free field to internal) and 2 dB(A) subtracted to account for the use of $L_{A90,10min}$ rather than $L_{Aeq,10min}$.

Both day- and night-time lower fixed limits can be increased to 45 dB(A) to increase the permissible margin above background where the occupier of the property has some financial interest in the wind farm.

In low noise environments the day-time level of the $L_{A90,10min}$ of the wind farm noise should be limited to an absolute level within the range of 35-40 dB(A). The actual value chosen within this range should depend upon: the number of dwellings in the neighbourhood of the wind farm, the effect of noise limits on the number of kWh generated, and the duration of the level of exposure.

For single turbines or wind farms with very large separation distances between the turbines and the nearest properties, a simplified noise condition may be suitable. If the noise is limited to a $L_{A90,10min}$ of 35 dB(A) up to wind speeds of 10 m/s at 10 m height, then this condition alone would offer sufficient protection of amenity, and background noise surveys would be unnecessary.

Low Frequency Noise (Infrasound)

45. There is no evidence that ground transmitted low frequency noise from wind turbines is at a sufficient level to be harmful to human health. A comprehensive study of vibration measurements in the vicinity of a modern wind farm was undertaken in the UK in 1997 by ETSU for the DTI (ETSU W/13/00392/REP). Measurements were made on site and up to 1km away – in a wide range of wind speeds and direction.
46. The study found that:
 - Vibration levels 100m from the nearest turbine were a factor of 10 less than those recommended for human exposure in critical buildings (i.e. laboratories for precision measurement).
 - Tones above 3.0 Hz were found to attenuate rapidly with distance – the higher frequencies attenuating at a progressively increasing rate.

Landscape and Visual Impact

47. Modern wind turbines are large structures – sometimes over 100 metres tall, and inevitably will have an impact on the landscape, and the visual environment. Due to the importance attached to landscape and visual impact, the subject is dealt with in some depth in the Companion Guide (see Sections 3,4 and 5).

Listed Buildings and Conservation Areas

48. Special care will be needed if proposed sites for wind turbines should happen to be near listed buildings or conservation areas. PPG15 gives advice about the conservation aspects of planning control.

Safety

49. Experience indicates that properly designed and maintained wind turbines are a safe technology. The very few accidents that have occurred involving injury to humans have been caused by failure to observe manufacturers' and operators' instructions for the operation of the machines. There has been no example of injury to a member of the public.
50. The only source of possible danger to human or animal life from a wind turbine would be the loss of a piece of the blade or, in most exceptional circumstances, of the whole blade. Many blades are composite structures with no bolts or other separate components. Blade failure is therefore most unlikely. Even for blades with separate control surfaces on or comprising the tips of the blade, separation is most unlikely.
51. The minimum desirable distance between wind turbines and occupied buildings calculated on the basis of expected noise levels and visual impact will often be greater than that necessary to meet safety requirements. Fall over distance (i.e. the height of the turbine to the tip of the blade) plus 10% is often used as a safe separation distance.

Proximity to Roads, Railways and Public Rights of Way and Power Lines

52. Applicants are advised to consult at an early stage with the Highways Agency for trunk roads and the local highways authority for all other publicly maintained highways. In the case of railway lines authorities are Network Rail (Area Civil Engineering) for operational lines and Network Rail Property Board for non-operational lines.
53. Although a wind turbine erected in accordance with best engineering practice should be a stable structure, it may be advisable to achieve a set-back from roads and railways of at least fall over distance, so as to achieve maximum safety.
54. Concern is often expressed over the effects of wind turbines on car drivers, who may be distracted by the turbines and the movement of the blades. Drivers are faced with a number of varied and competing distractions during any normal journey, including advertising hoardings, which are deliberately designed to attract attention. At all times drivers are required to take reasonable care to ensure their own and others' safety. Wind turbines should therefore not be treated any differently from other distractions a driver must face and should not be considered particularly hazardous. There are now a large number of wind farms adjoining or close to road networks and there has been no history of accidents at any of them.

55. Wind turbines should be separated from overhead power lines in accordance with the Electricity Council Standard 44-8 'Overhead Line Clearances'.
56. The British Horse Society, following internal consultations, has suggested a 200 metre exclusion zones around bridle paths to avoid wind turbines frightening horses. Whilst this could be deemed desirable, it is not a statutory requirement, and some negotiation should be undertaken if it is difficult to achieve this.
57. Similarly, there is no statutory separation between a wind turbine and a public right of way. Often, fall over distance is considered an acceptable separation, and the minimum distance is often taken to be that the turbine blades should not be permitted to oversail a public right of way.

Ecology and Ornithology

58. The impact of a wind farm on the local ecology should be minimal. A typical wind farm will usually leave the land between the turbines totally unaffected. There is little evidence that domesticated or wild animals will be affected by a wind farm – indeed, there are examples of cows and sheep grazing right up to the base of turbines.
59. PPG9 on nature conservation gives advice about the inter-relationship between nature conservation and development control. Apart from the movement of the blades, the development of wind turbines warrants no different approach in terms of ecological considerations from any other development. Applications to harness wind energy may be made in areas designated as of ecological importance, and such applications should be rigorously examined. Evidence suggests that the risk of collision between moving turbine blades and birds is minimal both for migrating birds and for local habitats. The attention of local planning authorities and developers is particularly drawn to the Ramsar Convention on Wetlands of International Importance (Cmnd 6465), EC Council Directive on the Conservation of Wild Birds (Directive 79/409/EEC), the EC Council Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC) and the Berne Convention on the Conservation of European Wildlife and Natural Habitats.
60. Experience indicates that bird species and their habitats are rarely affected by wind turbine developments and the impact of an appropriately designed and located wind farm on the local bird life should, in many cases, be minimal. To date, the most common concern has been the risk of 'bird strike' i.e. birds flying through the area swept by the blades and being hit, causing injury or death. This is most likely to occur if a wind turbine is erected directly

in a migration path, or where there are high concentrations of particular species (i.e birds feeding). Most birds in flight can be expected to take action to avoid obstacles but different species will vary in their reaction. However, some areas are important for a variety of bird species protected under the EU and UK legislation (SPAs, SACs and SSSIs). These could represent potential constraints to wind farm development. As indicated in PPG 9 on nature conservation, the importance of complying with international and national conservation obligations must be recognised and wind farms should not adversely affect the integrity of designated sites. Protected species, such as eagles and hen harriers, occupy many areas outside designated sites and are protected across England. These factors have to be considered against the positioning and size of turbines, including the size of the area swept by the blades in relation to the air space used by the birds in the vicinity of the development.

61. Early consultation between the developer and English Nature/RSPB is important. Most sites will require at least a breeding bird survey (between late March and early June) and a winter bird survey (November to February). Others, where potential ornithological sensitivities are higher, may require substantially more survey work, including studies of wintering/passage birds and detailed observations to quantify bird flight activity across the site.

"The risks of disturbance to bird species during construction and operation of the wind farm is also an important consideration. For some species this is of greater potential significance than collision mortality. Scottish Natural Heritage, in consultation with the British Wind Energy Association (BWEA), is preparing a 'Methodology for assessing the effect of wind farms on ornithological interests'. Whilst this publication tackles the situation in Scotland it is equally relevant to England. In addition, the DTI's Renewable Energy Programme has published a report 'Cumulative effects of wind turbines' in which Section 3 deals with 'Cumulative effects on birds'. Both will be of use to developers when assessing the potential impact of proposed developments on bird life. Royal Society for the Protection of Birds (RSPB), World Wildlife Fund (WWF), English Nature and BWEA have also published 'Wind Farm Development and Nature Conservation'. Another useful source of information is 'Windfarms and Birds: An analysis of the effects of wind farms on birds, and guidance on environmental assessment criteria and site selection issues.'"

RHW Langston & JD Pullan (2003). BirdLife International on behalf of the Berne Convention.

62. Among the other potential impacts to birds, loss of habitat, the deposition of spoil or hazardous substances from construction and operation, and hedgerow removal should also be assessed.

63. In addition, under the EC Habitats Directive, other species or habitats of special interest may be present. For example montane and bog habitats can be adversely affected by track construction unless attention is paid to minimising impact on the hydrology of the site. They may also be affected by any changes in land management, which may be brought about because of improved access. Developers should ensure that their ecological advisers enter into early discussions with English Nature about the presence and importance of species and habitats in and around a proposed development site. Discussions should assess any potential impacts and the scope for mitigation in the design and layout. A Phase1 Habitat Survey could usefully inform these discussions. Further discussions with locally based consultees such as The Wildlife Trust and local authority officers would benefit the ecological assessment procedure.

Electromagnetic Production and Interference

64. A wind turbine can interfere with electromagnetic transmissions in two ways – by emitting an electromagnetic signal itself, and by interfering with other electromagnetic signals. The nature of the interference depends on the size of the structure relative to the wave-length of the radiation. Provided careful attention is paid to siting, wind turbines should not cause any significant problems of electromagnetic interference, i.e. adverse effects on communication systems which use electromagnetic waves as the transmission medium (e.g. television, radio or microwave links).

Emissions from a Wind Turbine

65. Wind turbines contain electrical machines producing power. They will therefore also produce electromagnetic radiation. This is at a very low level, and presents no greater risk to human health than most domestic appliances. Any electrical machine can cause interference to other electrical devices (particularly radios and TVs) and there is no difference between a wind turbine and any other electrical machine in this respect. Most wind turbines and their components comply with the European Commission Directive on Electromagnetic Compatibility (89/336/EEC) and the turbine should not give rise to any unusual problems. Only in very rare circumstances will electromagnetic signals produced by wind turbines be a problem for potential wind farm developments.

Interference with Electromagnetic Transmissions

66. Wind turbines can potentially affect electromagnetic transmissions in two ways: by blocking or deflecting line of sight radio or microwave links, or by the 'scattering' of transmission signals.
67. There are a plethora of line of sight radio and microwave signals throughout England, including radio and TV links to local transmitters (Rebroadcast Links or RBLs), telecommunication links and police and emergency service links. Generally, turbine siting can mitigate any potential impacts, as the separation distance required to avoid problems is generally a matter of a few hundred metres. In some cases, it may be possible to effectively re-route the signal around the development, at the developer's expense, to overcome the problem.
68. Scattering of signal mainly affects domestic TV and radio reception, and the general public may be concerned that a wind farm will interfere with these services. Experience has shown that when this occurs it is of a predictable nature and can generally be alleviated by the installation or modification of a local repeater station or cable connection.
69. Most characteristics of a wind turbine play a part in determining the nature and degree of signal scattering, including the rotor diameter, the number of blades, the rotational speed, the blade construction and material, and the blade and machine geometry. The tower and blades may scatter radiation, and the blades may further interfere with radiation scattered by the tower. The interference effects can often be reduced and this possibility should be discussed with representatives of the consultative bodies listed below.
70. Specialist organisations responsible for the operation of the electromagnetic links typically require a 100m clearance either side of a line of sight link from the swept area of turbine blades, though individual consultations would be necessary to identify each organisation's safeguarding distance. Effects on such links can usually be resolved through careful siting of individual turbines.

Specialist Consultation

71. Since a large number of bodies use communication systems, and some of the users are commercially sensitive or of strategic or military importance, it is often difficult to obtain a definitive picture of all the transmission routes across a potential site. The Office of Communications (OfCOM) holds a central register of all civil radio communications

operators in the UK and acts as a central point of contact for identifying specific consultees relevant to a site. OFCOM will identify any radio installations relevant to a wind farm site. Although OFCOM passes any enquiry on to other interested parties, who should respond to an application, this process is only partial and an applicant seeking planning permission would be well advised to make direct contact with any authorities/bodies which are likely to be interested – a list of potentially interested parties is given at the end of this Section.

72. In addition, it may be necessary to consult the local water company, gas company and electricity company, and also emergency services such as the police, ambulance service and the coastguard.

Shadow Flicker and Reflected Light

73. Under certain combinations of geographical position and time of day, the sun may pass behind the rotors of a wind turbine and cast a shadow over neighbouring properties. When the blades rotate, the shadow flicks on and off; the effect is known as 'shadow flicker'. It only occurs inside buildings where the flicker appears through a narrow window opening. The seasonal duration of this effect can be calculated from the geometry of the machine and the latitude of the site. Although problems caused by shadow flicker are rare, for sites where existing development may be subject to this problem, applicants for planning permission for wind turbine installations should provide an analysis to quantify the effect. A single window in a single building is likely to be affected for a few minutes at certain times of the day during short periods of the year. The likelihood of this occurring and the duration of such an effect depends upon:
 - the direction of the residence relative to the turbine(s);
 - the distance from the turbine(s);
 - the turbine hub-height and rotor diameter;
 - the time of year;
 - the proportion of day-light hours in which the turbines operate;
 - the frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon); and,
 - the prevailing wind direction.

Only properties within 130 degrees either side of north, relative to the turbines can be affected at these latitudes in the UK – turbines do not cast long shadows on their southern side.

74. The further the observer is from the turbine the less pronounced the effect will be. There are several reasons for this:
 - there are fewer times when the sun is low enough to cast a long shadow;
 - when the sun is low it is more likely to be obscured by either cloud on the horizon or intervening buildings and vegetation; and,
 - the centre of the rotor's shadow passes more quickly over the land reducing the duration of the effect.
75. At distance, the blades do not cover the sun but only partly mask it, substantially weakening the shadow. This effect occurs first with the shadow from the blade tip, the tips being thinner in section than the rest of the blade. The shadows from the tips extend the furthest and so only a very weak effect is observed at distance from the turbines.
76. Shadow flicker can be mitigated by siting wind turbines at sufficient distance from residences likely to be affected. Flicker effects have been proven to occur only within ten rotor diameters of a turbine. Therefore if the turbine has 80m diameter blades, the potential shadow flicker effect could be felt up to 800m from a turbine.
77. Around 0.5 % of the population is epileptic and of these around 5 % are photo-sensitive. Of photo-sensitive epileptics less than 5 % are sensitive to lowest frequencies of 2.5-3 Hz, the remainder are sensitive only to higher frequencies. The flicker caused by wind turbines is equal to the blade passing frequency. A fast-moving three-bladed machine will give rise to the highest levels of flicker frequency. These levels are well below 2 Hz. The new generation of wind turbines is known to operate at levels below 1 Hz.
78. Turbines can also cause flashes of reflected light, which can be visible for some distance. It is possible to ameliorate the flashing but it is not possible to eliminate it. Careful choice of blade colour and surface finish can help reduce the effect. Light grey semi-matt finishes are often used for this. Other colours and patterns can also be used to reduce the effect further. (See 'The Influence of Colour on the Aesthetics of Wind Turbine Generators' – ETSU W/14/00533/00/00).

Icing

79. The build-up of ice on turbine blades is unlikely to present problems on the majority of sites in England. For ice to build up on wind turbines particular weather conditions are required, that in England occur for less than one day per year. (See Wind Energy Production in Cold Climates (WECO) (ETSU W/11/00452/00/REP)). In those areas where icing of the blades does occur, fragments of ice might be released from the blades when the machine is started. Most wind turbines are fitted with vibration sensors which can detect any imbalance which might be caused by icing of the blades; in which case operation of machines with iced blades could be inhibited.

Archaeology

80. PPG16 gives advice on the procedures, which should be followed in handling planning applications to ensure that archaeological remains are not needlessly destroyed. Where nationally important remains and their settings are affected by proposed development they should normally be physically preserved. A desktop study, and a site walkover may be required, and a condition of planning permission for an archaeologist to hold a watching brief during construction may be considered.

Construction and Operational Disturbance

81. The degree of disturbance caused by the construction phase of a wind farm will depend on the number of turbines and the length of the construction period. Public perception of the construction phase will derive mainly from physical impact and traffic movements. The traffic movements to be expected will involve:
- vehicles removing spoil from the site;
 - vehicles bringing concrete (for foundations) to the site;
 - vehicles (which may be articulated) bringing turbine components to the site;
 - the vehicles of those working on the site; and,
 - the crane(s) to erect the turbines.
82. Although construction traffic for a wind turbine development will essentially be no different from other developments, many turbines will be sited in areas served by a minor road network. In such cases, local planning authorities may wish to control the number of vehicle movements to and from the site in a specified period and, where possible, the route

of such movements, particularly by heavy vehicles, by imposing suitable conditions on planning permissions, or entering into planning obligations with the developer. Further requirements for strengthening bridges may also be required by the Highways Agency. Where culverting of any watercourse under site roads is planned, a Consent to Work in a Watercourse will be required from the Environment Agency.

83. Once turbines are in operation, traffic movements to and from the site will be very light, probably averaging two visits a month by a light commercial vehicle or car. The need to replace machine components will generate heavier commercial vehicle movements, but these are likely to be infrequent.

INFORMATION TO ACCOMPANY A PLANNING APPLICATION

84. In the first instance it is advisable that the developer contact the local planning authority at least two weeks prior to submission to inform them that a planning application is due to be lodged in the near future, so that the local planning authority can mobilise and resource for processing of the application.
85. Where wind farm developments are not EIA developments (i.e. a screening decision has determined that a full EIA is not required), the developer should submit the following:
 - five copies of the planning application;
 - five copies of the site application boundary at the agreed scale (1:500 or 1:2500 is usually required) exhibiting the site infrastructure (including access tracks, turbine locations, hardstandings, anemometry mast, substation etc) and land ownership in and around the proposed site;
 - five copies of any supporting environmental information as required by the local planning authority; and,
 - planning fee (usually £220 per 0.1ha of the footprint of the development).
86. Where wind farm developments are deemed by the local planning authority as EIA developments, the developer is required to submit the following:
 - five copies of the site application boundary at the agreed scale (1:500 or 1:2500 is usually required) exhibiting the site infrastructure (including access tracks, turbine locations,

hardstandings, anemometry mast, substation etc) and land ownership in and around the proposed site;

- multiple copies of the Environmental Statement (the number should have been prescribed by the local planning authority at Scoping);
 - multiple copies of any further supporting information (such as community benefits packages, appropriate assessments, independent reports, briefs on planning guidance); and,
 - the planning fee.
87. Whilst not material to the application, it is also advisable for the developer to submit company literature regarding experience and competency in the industry, and any further information the developer feels may be useful to the development control office in determining the application.

ENVIRONMENTAL IMPACT ASSESSMENT

88. Wind turbines are projects which are listed under Schedule 2.3(i) to the EIA Regulations. Local planning authorities are required to screen applications for the need for EIA where the development involves the installation of more than 2 turbines or the hub height of any turbine or height of any other structure exceeds 15 metres.

POSSIBLE PLANNING CONDITIONS

89. DOE Circular 1/85 (WO 1/85) gives advice about conditions. In relation to the erection of wind turbines these will mainly concern noise emissions, the type of machine to be employed by reference to size, including rotor diameter, and the colour of the machines. Conditions may also be appropriate to:
- design of ancillary buildings, housing sub-stations and electricity distribution network connections (to be approved by local authority);
 - limit construction activity to certain (specified) times of year to avoid impacts on breeding, passage or wintering birds;

- all wind turbines on a particular site to rotate in the same direction, to minimise visual impact; and,
- an archaeologist to be present during construction.

OTHER AUTHORISATIONS/CONSENTS

Air Traffic Safeguarding

90. Wind turbines may have an adverse affect on two aspects of air traffic movement and safety. Firstly, they may represent a risk of collision with low flying aircraft, and secondly, they may interfere with the proper operation of radar by limiting the capacity to handle air traffic, and aircraft instrument landing systems.

Risk of Collision

91. Risk of collision is likely to occur close to civilian and military airfields, and in military low flying zones. Developments within a specified radius of major airports and aerodromes are subject to mandatory consultation with the Civil Aviation Authority and/or the Ministry of Defence under the Town and Country Planning (Aerodromes and Technical Sites) Directive 1992. The CAA will inform the applicant of any civilian airfields that are likely to be affected, but it is the responsibility of the applicant to consult the airfield management at the airfield in question. The applicant should take account of the airfield management's requirements, which will depend on local topography and the preferred flight paths at the site.
92. Lights are only required on structures that are over 150m high. Currently there are no onshore turbines of this size in the UK.
93. The Ministry of Defence uses several areas of the countryside for low flying training. Further information on military low flying can be obtained from the MoD.

Radar

94. Any large structure is liable to show up on radar, but wind turbines can present a particular problem as they can be interpreted by radar as being a moving object, which is only intermittently seen. Because of this, they might either be mistaken for an aircraft or interfere with the ability of the radar to track an aircraft in the same sector. The effect

diminishes with distance, and hence there is a 15 km consultation zone, and a 30km or 32km advisory zone around every civilian and military air traffic radar respectively, although objections are often raised to developments that lie beyond the 32km advisory zone.

95. In addition to air traffic radar, wind turbines may affect other defence radar installations, and weather radar operated by the Meteorological Office.
96. Because topography, intervening buildings and even tree cover can mitigate the effect of wind turbines on radar, it does not necessarily follow that the presence of a wind turbine in a safeguarding zone will have a negative effect. However, if an objection is raised by either a civil aviation or Defence Estates consultee, the onus is on the applicant to prove that the proposal will have no adverse effect on aviation interests.
97. A DTI-led initiative, the 'Aviation Working Group', was formed in early 2001 to review the issues surrounding wind energy development and civil and military aviation zones. Work is ongoing through this group, comprising a cross-section of stakeholders, including representatives from British Wind Energy Association on behalf of the wind energy industry, the Ministry of Defence, the Department of Trade and Industry, National Air Traffic Services and the Civil Aviation Authority. Three studies have been commissioned:
 - (i) to develop a model to predict the effects of wind turbines on radar installations;
 - (ii) to review European experiences; and,
 - (iii) to devise mitigation measures to reduce the potential effects of wind turbines on radar installations.

The working group has produced a general guidelines document 'Wind Energy and Aviation Interests – Interim Guidelines' (ETSU W/14/00626/REP 2002) for all stakeholders involved in wind farm development. Updated guidelines are expected before the end of 2004.

98. The working group has also developed a standardised methodology to be used by a wind developer to consult with stakeholders. A proforma is available from the BWEA website or the air safeguarding consultees, which is completed by the developer and sent with a location map and site layout plan to the Defence Estates (Safeguarding), the Civil Aviation Authority and the National Air Traffic Services, who will carry out internal consultations and inform the developer whether there is an objection to the proposal.

Grid Connection

99. Where the works required to connect the wind farm to the local electricity distribution network are not permitted under the General Development Order it will be necessary to submit either a separate planning application or, in the case of an overhead line, an application for consent of the Secretary of State for Trade and Industry under Section 37 of the Electricity Act 1989 (in which event the local planning authorities are statutory consultees). Either the wind farm developer or the local electricity distribution company may make such an application. However, notwithstanding that a separate application to a separate decision-maker may be necessary, electricity companies are encouraged to co-operate with the local planning authorities during consultations about the application to construct the wind farm, in order that any preference or need for overhead or underground connection may be demonstrated. Developers should provide information on the most likely route and method for the grid connection to the farm with their planning application and as part of any EIA. The connection of the farm to the electricity grid forms an intrinsic part of the project and both should be considered together.

CONSULTEES

100. In addition to the statutory consultees, applicants for wind turbine developments may wish to refer to the following technical consultees:
- **Ministry of Defence:** Defence Estates, Kingston Road, Sutton Coldfield, West Midlands, B75 7RL
 - **Civil Aviation Authority:** Directorate of Airspace Policy, CAA House, 45-49 Kingsway, London WC2B 6TE
 - **National Air Traffic Services:** Navigation, Spectrum and Surveillance; Spectrum House, Gatwick, West Sussex, RH6 0LG
 - **OFCOM:** Wind Farm Site Clearances, Operations-Licensing, Desk 02-49, Ofcom, Riverside House, 2a Southwark Bridge Road, London, SE1 9HA
 - **BT Wholesale,** Radio Solutions Unit: Post Point 500, Angel Centre, 403 St John Street, London EC1V 4PL

- **BBC:** BBC Research Department, Spectrum Planning, Kingswood Warren, Tadworth, Surrey, KT20 6NP
- **NTL:** Crawley Court, Winchester, Hampshire, SO21 2QA/Trinity House, Engineering Department, Trinity House Depot, East Cowes, Isle of Wight, PO32 6RE
- **Department of Transport: Marine Directorate Navigation and Communication,** Official Post Branch, Room 653, Sunley House, 90-93 High Holborn, London WC1V 6LP
- **Maritime and Coastguard Agency:** Bay 2/25, Spring Place, 105 Commercial Road, Southampton, SO15 1EG
- **Communications operators** including Crown Castle UK, MLL Telecom, Orange, Vodafone, Cable & Wireless, O2 and T-Mobile.

PPS22 sets out the policy context for action, and the Companion Guide offers practical advice as to how these policies can be implemented on the ground. Success will require action at the regional and local levels, with regard to both strategic/forward planning and development control. Each of these is addressed in the Companion Guide. Case studies are used to illustrate key points and to demonstrate how specific issues can be addressed. The Technical Annex includes specific advice on the range of renewable energy technologies that are covered by PPS22.

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