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PLANNING OFFICER'S HANDBOOK
CRITERIA BASED PLANNING POLICIES

For use in the consideration of

PLANNING POLICY STATEMENT 22:
RENEWABLE ENERGY

Participating organisations logos

Prepared under the supervision of
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Introduction

Background

This framework document is intended to be read alongside the new Planning Policy Statement 22 (PPS 22): Renewable Energy, and to assist in the development of relevant, criteria based, planning policies for assessing commercial, renewable energy projects, developed in England, where the electricity generation capacity of the proposed project is less than 50 MW.

In all cases, electricity generation plant having an electrical generation capacity of greater than 50 MW, the planning consent process for the project is covered by section 36 of the Electricity Act 1989 as administered by the Department of Trade and Industry. Should the DTI grant permission for the development, then no separate or additional planning permission is required as an automatic 'deemed consent' is then granted under the Town and Country Planning Act 1990.

The new Planning Policy Statement 22 is part of a broader initiative by Government to review all of it's planning policy guidance, as stated within the Government's Planning Green Paper, *Planning – delivering a fundamental change,* published in December 2001.

In July 2002, following consultation on the Green Paper, the Government announced that it intended to proceed with the proposals for the review and reform of national planning policy guidance.

One of the planning policy guidance notes that has been reviewed is the Planning Policy Guidance note 22 (PPG 22): Renewable Energy, first published in February 1993.

On 5 November 2003 the Office of the Deputy Prime Minister published the 'Consultation Paper on Draft New Planning Policy Statement 22 (PPS 22): Renewable Energy.'

It is the Government's intention that this new Planning Policy Statement should, in due course, replace the current Planning Policy Guidance note 22 (PPG22): Renewable Energy. It is currently intended that the new Planning Policy Statement 22 will come into effect in July 2004.

PPS 22 does not cover those renewable energy technologies which are developed offshore, but it should be recognised that, where relevant, any items of secondary plant or equipment which are constructed onshore, to facilitate the transfer and/or utilisation of the energy thus produced, should be deemed to be covered by PPS 22.

As previously stated, these guidance notes are intended primarily for use alongside commercial renewable energy generation developments, but it is recognised that very small scale, domestic renewable energy developments, will also require planning permission. Although PPS 22 does not make any specific recommendations relating to such small scale developments, a guide to small scale, domestic installations is included within the General Guidance notes and as Appendix D.

Renewable Energy

Planning Policy Statement 22: Renewable Energy covers the treatment of planning applications in England for all forms of electricity generation from renewable energy technologies where the total electrical generation capacity is less than 50 MW. Although the new PPS recognises that these technologies may lead to the generation of heat, which may be utilised in combined heat and power projects, PPS 22 does not currently make any reference, or propose any specific guidance, towards the development or utilisation of the thermal energy thus generated.

Renewable energy is defined in PPS 22 as being "those energy flows that occur naturally and repeatedly in the environment – from wind, the fall of water, the movement of the oceans, from the sun and also from biomass."

Biomass is further defined as being "the biodegradable fraction of products, wastes and residues from agriculture (including plant and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste".

PPS 22 is also very specific in that it is not intended for the consideration of offshore technologies or for those issues which are already the subject of other planning policy statements or guidance notes.

Particular attention is given to confirming that PPS 22 does not replicate the policies in PPG 10: Planning and Waste Management.

PPS 22 – Summary

Government recognise that renewable energy resources are vital to facilitating, and the delivery of, their commitments on both renewable energy and climate change. It is also recognised that "Positive planning which facilitates renewable energy developments can contribute to all four elements of the Government's sustainable development strategy."

PPS 22 requires local and regional planning bodies to develop and implement policies which are "*designed to promote and encourage, rather than restrict, the development of renewable energy resources*".

The planning bodies are also required to develop criteria based assessment techniques to consider renewable energy planning applications. Government have reserved the right to intervene in cases where it considers that the "constraints being proposed by local authorities are too great or have been poorly justified".

PPS 22 requires both developers and planning authorities to clearly identify and recognise the wider social, economic and global environmental impact of any schemes or projects relating to renewable energy.

This document seeks to provide, where appropriate, reasonable criteria for the consideration and assessment of the various renewable energy technologies as well as providing reasoned background information to justify these criteria.

It is intended that these criteria would be applicable to all forms of renewable energy technologies. It is however recognised that certain technologies present unusual or unique issues that can only be addressed by technology-specific criteria.

This document is intended for use by the local and regional authorities, and a further document containing the explanatory notes and renewable energy planning criteria will be available to the public.

Renewable energy technologies

This framework document covers the planning criteria applicable to the following renewable energy technologies:

- Solar
- Hydro
- Energy from waste
- Energy crops
- Biomass
- Renewable transport fuels
- Landfill and sewage gases
- Geothermal
- Wind

It is recognised that this schedule of technologies may not be complete, and that other technologies may also be considered to be classified as renewable energy in the future.

For further information or clarification the following web sites contain additional information regarding renewable energy technologies and may provide guidance.

The Renewables Obligation Order 2002
http://www.dti.gov.uk/renew/ropc.pdf

The draft Renewables Obligation Order (Amendment) 2003
http://www.dti.gov.uk/renewables/policy/roorderamend2003.pdf

It should also be noted that there is still discussion taking place at national and European level regarding the definition of 'waste' and the role of 'waste' as an eligible renewable fuel.

One contentious issue is currently the status of municipal solid waste (MSW) and industrial and commercial waste (ICW). PPS 22 makes a very clear statement that it is not intended to cover "energy from mass incineration of domestic waste" and that it "excludes issues which are the subject of other planning policy statements or guidance notes which should be read with this one; in particular it does not replicate the policies in PPG10: Planning and Waste Management".

It is therefore suggested that the classification of the energy source in any applications which are considered to be 'energy from waste' projects are carefully considered and are verified as being both a 'renewable energy source' by the relevant Government Department.

It should be considered that any renewable energy technology which is capable of being in receipt of 'Renewable Obligations Certification' (ROCs) will be covered by PPS 22 and these guidance notes. Clarification of the eligibility for renewable energy generation technologies and fuels which are eligible to receive ROCs is given in the above documents.

Solar Power

Background

Power from the sun has can be utilised as a means of generating electricity and/or thermal energy.

The range of technologies and applications available for both forms of energy generation are continuing to grow as issues such as energy price, energy conservation, climate change and the advances in manufacturing techniques provide greater financial incentives.

The following sections on photovoltaics and solar heating panels deal with the systems which are currently in common use in England and Wales, but it should be noted that other technologies are in use in other Countries and may be utilised in England and Wales in the future.

These 'other' technologies include:

Solar thermal arrays, which use parabolic mirrors to focus heat energy onto a tube carrying water, can be used to provide energy into a space and water heating and even district heating systems. This technology is modular and there are already examples of this form of solar thermal energy systems which cover over 10,000 m^2.

Parabolic trough concentrator systems. Again, parabolic mirrors are used to heat a medium, usually synthetic oil, to temperatures above 350 ^oC. This is then converted into steam which is then passed through a traditional steam turbine. Examples of this technology in America cover almost a half a million square metres.

Parabolic dish concentrator systems. In this case, the mirrors are arrayed in the form of parabolic dish which moves to track the sun's path. A collector, or even a steam engine is placed at the focus of the mirrors and electricity and/or steam are then generated.

Solar ponds and solar chimneys are also being developed in other parts of the world, but it is not considered likely that the climate in England and Wales would be capable of supporting this type of technology in the foreseeable future.

Photovoltaics

Photovoltaic solar panels (Commonly referred to as PV cells) are available in a large number of sizes and construction types.

PV cells vary in thickness from less than 6 mm thick film up to industrial panels with a thickness of 75 mm or more. Photovoltaics cells are traditionally manufactured in the form of a three component sandwich. The base layer is usually an insulating and isolating/mounting block or board containing the circuitry and connection systems. The actual PV cells are mounted and

connected onto this block/board. The third layer is a glass, acrylic sheet, transparent resin or film.

PV cells are commonly supplied in the form of modules constructed from a number of smaller units. These modules again are inter-connectable. Sizes can range from 150 mm x 225mm up to inter-connected modules which could provide the roof covering for a commercial building.

The PV cell market is growing rapidly and cells in other shapes and forms are becoming commercially available. It is already possible to buy PV cells in the form and shape of replacement roof tiles. PV cells have also recently become available in film form and are capable of being utilised as a covering medium on other structures.

Solar heating panels

Solar thermal accumulator or collector panels utilise the solar thermal energy to either pre-heat domestic hot water, or in conjunction with heat pumps, provide background or space heating.

The range of size and configuration of solar heating panels is vast, but the most commonly encountered units are roof-mounted panels of $1m^2$ to $6m^2$.

Solar thermal accumulator or collector panels are constructed with an insulating baseboard, usually black, onto which a network of water/glycol carrying tubes are bonded. The glass panel is bonded onto the sides of the baseboard to minimise convective losses. In some units, the completed units are evacuated to form a vacuum around the tubes to minimise radiant losses. In some cases, these evacuated solar panels are also in tube form, where the water/glycol carrying tubes are concentrically encased in a in a glass vacuum tube.

Solar thermal units are similar in appearance to PV cell modules but are often significantly thicker, up to 200 mm.

Technology Specific Criteria Based Planning Issues

Until the introduction of PPS 22, planning issues relating to photovoltaics were covered by PPG 22: Annexe on Photovoltaics 2002. The Consultation Draft on PPS 22 states that it intends to replace PPG 22, and the photovoltaic annexe.

Due to the specific requirements laid out in PPS 22 relating to 'National Designation', 'Green Belts', 'Buffer Zones' and 'Local Designations' it is not possible to simply re-apply the planning criteria contained within the photovoltaic annexe, nor are these constraints 'criteria based'

It is not considered that there are any relevant criteria based technology specific planning policies required for solar photovoltaic or solar thermal projects.

Given that solar thermal panels are not usually a technology which is capable of generating electricity, there is a logic which would exclude them from consideration under PPS 22, but given that both technologies were previously governed by the photovoltaic annexe in PPG 22 and that both technologies are usually of a similar shape, size and appearance solar panels have been retained in this guidance note.

The technology specific criteria based planning policies relating to photovoltaics and solar thermal panels are attached as appendix A of the General and Technology Specific Criteria Based Planning Policies.

One area of the new legislation which should be carefully considered relates to proximity.

It should be noted that the following extract from the previous Planning policy Guidance PPG22 (Annexe on Photovoltaics), in the section 'Planning Implications', would now appear to be in contravention of PPS 22 as it relates to buildings close to a listed building or National Park

> **20.** If an application for a PV array is submitted on 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 PV 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, and to consider the impact the development might have on the setting of the area.

Hydro Power

Background

All hydro power electricity generation systems utilise the kinetic energy released by falling or fast flowing water courses to mechanically turn an electricity generation turbine. The size, flow rate and change in elevation of the water course will all affect the size and generation capacity of the proposed hydro power plant.

For the purposes of this document, it is assumed that tidal barrages and tidal bore schemes are outside of the scope of PPS 22.

Hydro power should not be confused with pumped storage systems. Pumped storage systems utilise off-peak price, or low demand time electricity, to pump and artificially raise the elevation of water into a storage vessel then, at times of high demand/or peak price times, the water is allowed to fall back to it's original level, passing through a turbine shaft and generate electricity.

Hydro electric generation systems are usually classified as follows:

Large scale	Declared net generation capacity > 5 MW
Small scale	Declared net generation capacity > 1.25 MW <5 MW
Micro-hydro	Declared net generation capacity < 1.25 MW

Although for the purposes of this framework document, the primary application for hydro power is for the generation of electricity, it should also be recognised that hydro power is equally capable of performing direct mechanical tasks.

Neither pumped storage nor the application of direct mechanical tasks are considered to be 'renewable energy', and as such, neither this framework document nor PPS 22 would apply to these applications of hydro power.

For the purposes of PPS 22, it is assumed that the hydro electric generation systems will utilise the natural flow rate of the river or water course, with the possible use of weirs or races, and will not require the construction of dams.
The majority of the consents processes which are required for any form of hydro power project lie with the remit of the Environment Agency. It is the responsibility of the Environment Agency to approve an abstraction licence and to impose any conditions it deems fit to protect the water course, the bed and/or banks of the water course, the animal and plant life and to ensure that the flow of the water course is neither impeded nor diverted to the detriment of others or the environment.

Technology Specific Criteria Based Planning Issues

The technology specific planning issues which are likely to be raised on hydro schemes are quite limited and relate to issues such as exposed or buried cables and/or pipelines and the construction of generator housings, switchgear rooms etc. It is not considered that there are any relevant criteria based technology specific planning policies required for hydro power. A number of the general renewable energy planning criteria will apply to a

proposed hydro power station, depending upon its size and location and the projected impact upon the local environment.

Energy from waste, energy crops and biomass - Production of Renewable fuels for energy generation, and transport

Background

PPS 22 (and other related regulatory documents) defines biomass as "*the biodegradable fraction of products, wastes and residues from agriculture (including plant and animal substances), forestry and related industries, as well as the biodegradable fractions of industrial and municipal waste."*

Again, caution needs to be exercised when discussing the biodegradable fractions of municipal and industrial wastes. Careful attention and control needs to be focused upon the type, composition and provenance of the fuel. For example, while the residues from a sawmill are correctly defined as biodegradable, if the timber being sawn has been chemically treated with preservatives or is mixed with certain glues (as used in particle and chip boards) then the residues may be considered to be 'chemical wastes' and as such, the plant may be considered to be a chemical waste disposal plant rather than a renewable energy plant.

Although it is not specifically stated in PPS 22, it is reasonable to expect that the planning process related to the construction of a plant to process energy crops and/or other biodegradable residues into a renewable energy fuel source will also be covered by PPS 22.

There are a number of conversion techniques which can generate electricity and /or renewable fuels from energy crops, biomass and/or waste

Mass combustion

Many biomass fuels are capable of generating renewable energy utilising in mass combustion processes, the most commonly considered biomass fuels such as Miscanthus, Short rotation coppice (SRC) willow and poplar, can be combusted in either traditional and fluidised bed boilers to generate steam for electricity generation (and heat for district or group heating systems). Poultry litter has been successfully used as a renewable fuel for electricity generation for over a decade, oil seeds, such as rape, linseed and olive have also been used as a direct input fuel.

A large number of dry residues, wastes and by-products can also be thermally treated in a mass combustion process

The simplified mass combustion process consists of holding the fuel stock in a store, feeding the fuel into a steam raising boiler and then using the steam to drive an electricity generation turbine.

A number of organisations are considering the co-combustion of various forms of biomass in fossil fuel fired boiler plants. Co-combustion technologies, except in cases where the fossil fuel is used as a control medium, are not renewable energy technologies, and as such, are not covered by PPS 22.

There are strict guidelines relating to the percentage of fossil fuels which can be consumed as part of the combustion process (usually around 3% to 10% of the gross thermal input of the plant) in renewable energy projects. These are set out in 'The Renewables Obligation Order 2002 (SI 914) and subsequent amendments.

In addition, planning authorities should be aware that consultation on an amendment to the Renewables Obligation Order 2002 is currently taking place. This amendment is likely to increase the levels of fossil fuels which can be consumed in certain co-combustion processes, but also requires the inclusion of specific energy crops over stipulated timescales to allow compliance.

Further information will be supplied as this becomes available.

Anaerobic Digestion

Anaerobic digestion systems are used to process a mixture of wet and/or dry organic materials.

The anaerobic digestion process takes place in a sealed, airless 'digester' where specific bacteria ferment the organic materials through (usually) four processes; hydrolysis, acidogenesis, acetogenesis and methanogenesis.

There are two main types of anaerobic digestion; mesophilic digestion, typically 35^{o}C and 20 to 30 days residence time, and thermophilic digestion 55^{o}C and 14 days residence time. Each system has advantages, costs and weaknesses.

The end products from anaerobic digestion (subject to the levels of impurities and/or pollutants in the feedstock) are normally methane CH_4, carbon dioxide CO_2 and bio-solids. The mixture of gasses produced from anaerobic digestion is usually referred to as 'bio-gas'

Aerobic Digestion

Aerobic digestion processes tend to be associated with wet organic residues such as sewage sludge, bio-solids from anaerobic digestion, farm animal manure, organic industrial process residues (i.e. food process wastes plant and animal residues)

Aerobic digestion simply takes the wet fuel from storage into a controlled environment where the temperature, pressure, oxygen content and biological constituents allow the natural digestion of the input feedstock.

The end products (depending upon the levels of contaminants in the fuel stock) are primarily water H_2O, carbon dioxide CO_2 and bio-solids (sludge).

Aerobic digestion is NOT generally considered to be a renewable energy technique, but is often used as the second stage of treatment from anaerobic digestion plants.

Gasification

Gasification plants can, in theory work on any form of carbon based, organic material. The original production of charcoal is a good example of the gasification process.

The process takes place in a sealed 'gasifier' with a controlled low oxygen environment. The feedstock is heated; controlled amounts of air, oxygen and/or steam are added to allow the reaction process to take place. The relative lack of oxygen and pressurised chamber of the gasifier prevents the ignition of the combustible gasses given off by the feedstock. This gas, along with any ash and tar are recovered. The gas usually has sufficient calorific value to allow combustion in traditional boiler plant without any further treatment.

Pyrolisis

Pyrolisis is a similar technique to gasification except that the temperatures and pressures tend to be higher and the process takes place in a zero oxygen, or near zero oxygen, environment.

For both gasification and pyrolisis, depending on the feedstock, gas and/or oil are produced which can be either used in traditional boiler based plants or, in some cases the oils can be used for vehicle fuel. There can often be additional gasification/pyrolisis residues such as carbon black as well any inert materials.

Gravity pressure vessel converters

Gravity pressure vessel (GPV) conversion technologies are not common in the UK although they are growing numbers in both Europe and the USA.

GPV systems can utilise a variety of organic feedstocks, including MSW and ICW. The process utilises a 600m-800m deep borehole to house a sealed pressure vessel. Dense and insoluble solids are screened and then the feedstock undergoes aqueous suspension, heating, fermentation, pressurisation, acid hydrolysis, further fermentation, distillation and cleaning.

The MSW fuelled process produces primarily ethanol, glycerol and carbon dioxide as well as acetic acid, and other trace chemicals.

Ethanol is widely used as a substitute vehicle fuel, can be mixed with traditional diesel and petrol and burned in boilers and generation turbine engines.

Ethanol as a vehicle fuel already receives taxation reduction and further reduction or exemption may occur in the near future.

Gravity pressure vessels are also capable of carrying out other forms of conversion, such as de-vulcanising and elemental recovery of tyre wastes, chemical waste disposal and clinical waste disposal, it is therefore essential that the licensed form of conversion and authorised operating procedures are

clearly defined and that the planning permission be linked to specific types and forms of input fuel and the resultant end products.

If the primary end product is not electricity, or a fuel that is recognised as being a 'green fuel' from which electricity can be generated which is eligible to receive ROCs then PPS 22 should not be used to consider the planning application.

Proximity

All of the renewable energy and 'green fuel' technologies identified in this section of the guidance note will require the importation of some or all of the feedstock.

Transportation of the 'green fuels' from the areas in which they are grown and/or produced to the renewable energy plant will be a significant issue to be considered during the potential developer's site selection process.

The fact that the 'green fuel' will need to be transported from outside of the area or region controlled by the planning authority should not be considered to be reason or grounds for determining the planning application, nor shall the proximity principal, as laid down in PPG 10: Planning and Waste Management, be considered to be applicable in considering 'green fuels' which are also defined as 'waste'.

In considering relevant waste to energy plants, it is within the wording and spirit of PPS 22 to restrict this type of development into areas which are well served with transport links and which have not been excluded for this type of 'industrial' development.

Many of the technologies described in this section involve industrial scale processes with high temperature and pressure equipment, the storage of hazardous chemicals and the potential for odour release.

Regional and local development plans should recognise these constraints and, for reasons of safety and amenity, identify areas away from housing, schools, hospitals where this type of 'industrial' renewable energy systems would be encouraged.

Technology Specific Criteria Based Planning Issues for energy fro waste etc.

There is no requirement to gain planning permission to grow any of the vegetable based energy crops for use as a fuel for renewable energy developments outlined in this guidance note. Planning authorities should be aware that a change in the type of agricultural use of land may require consent from English Nature in a 'Site of Special Scientific Interest (SSSI), or notification to the National Park Authority in a National Park, under the 'Wildlife and Countryside Act 1981', as amended by the 'Countryside Rights of Way Act 2000'

Planning permission will be required for any plant process or application of technology which converts this energy crop into energy or fuel and developers should be made aware of the requirements to clearly identify the composition and provenance of the anticipated for the biomass and/or waste to energy plant and that planning permission may be conditional upon the nature of the fuel remaining unchanged.

In considering the technology specific planning requirements for the types of energy generation and 'green fuel' projects listed in this section, the implications of the following legislation should be considered.

A waste management licence may be required, depending upon the type(s) of fuel being proposed. This will dictate some of the methods of handling and storage of the feedstock considered to be 'waste'

It is also most likely that any of the processes or technologies listed above will require authority and certification under Part 1 of the Environmental Protection Act 1990, Integrated Pollution Control (IPC). The Local Air Pollution Control (LAPC) will administer those projects where the only emission is to the atmosphere.

The main stated objectives of the IPC are:

> "To use the Best Available Techniques Not Entailing Excessive Cost (BATNEEC) in order to prevent or minimise the release of prescribed substances and to render harmless any such substances which are released".
>
> "To ensure consideration of releases from industrial processes to all media in the context of the environment as a whole".

In compliance with the EC Directive 96/61, both IPC and LAPC are in the process of being replaced by the Integrated Pollution Prevention and Control (IPPC) legislation, which should be fully implemented by 2007.

These various pollution control regimes will have direct impacts upon some of the emissions from the plant, but there are still emissions which the local planning authority may wish to exert further controls such as noise, plume visibility and odour.

General

The technology specific planning issues which are likely to be raised on energy from Waste, energy crops and biomass or the production of renewable fuels for energy generation and transport, are attached as appendix B of the General and Technology Specific Criteria Based Planning Policies.

Landfill and Sewage gas

Background

Landfill gas

Landfill gas is primarily a methane based gas produced by the process of microbiological decomposition of organic materials. The rate of decomposition is determined by the nature of the waste material, the moisture content, acidity, temperature and the effectiveness of the site's management. Land fill sites are required to collect, and safely dispose of, the methane thus generated and to safely combust the gas. Collection and combustion of the gas minimises the very harmful effects of methane upon the ozone layer (Methane CH_4 is generally considered to be 40 times more damaging to the ozone layer than carbon monoxide CO).

Sewage gas

Certain sewage treatment systems produce sewage gas in very much the same process as an anaerobic digestion plant. Sewage gas is typically 65% Methane (CH4) and 35% carbon dioxide (CO2).

By their nature, land fill sites and sewage works tend to occupy relatively remote and/or undesirable sites.

The technologies used to convert these gases into renewable energy range from basic boilers, rotary internal combustion engines and gas turbine engines which are connected to energy generation plant.

The thermal and/or electrical output of these types of machines are usually quite small and tend not to be regulated by any other legislation.

New legislation on emissions from stationary engines is due to be published in the near future. Further guidance will be issued as this information is made available.

Technology Specific Planning Issues

The technology specific planning issues which are likely to be raised on landfill and sewage gas fired renewable energy generation projects are all contained within the general renewable energy planning criteria.

Geothermal

Background
There are two main forms of geothermal energy systems available for developments in England: ground water heat pumps and geothermal steam extraction.

Ground water heat pumps
This technology utilises the relatively small amounts of heat available from water extracted from shallow boreholes, or from a buried network of pipes, through a series of heat exchangers and heat pumps, to provide space heating and cooling to buildings. This type of technology cannot currently produce electricity and therefore is not considered to be a renewable energy technology for the purposes of this document.

Geothermal heat extraction
As with the ground water heat pumps, it is possible to either extract heat, or utilise natural vents to utilise natural thermal energy to provide heating and cooling to buildings, but this is outside of the current remit for PPS 22. The main application which is covered by PPS 22 is the utilisation of naturally occurring heat sources to generate electricity.

In England there are no naturally occurring geysers and it is not considered that the natural vents or hot spas would be capable of generating electricity. Any electrical generation from geothermal sources would therefore require deep borehole technology.

Deep borehole systems operate by drilling down to naturally occurring 'hot spots' in the earth's crust, usually between 300 to 3,000 metres below the surface. Depending upon the geology, either naturally occurring ground water is heated to over 100^{o}C to form steam or, water is introduced to the geothermal heat source from the surface to produce steam this steam is then captured and utilised to turn a turbine to generate electricity.

Technology Specific Criteria Based Planning Issues
The technology specific planning issues which are likely to be raised on any future projects which utilise energy from geothermal electricity generation are all contained within the general renewable energy guide.

Wind Energy

Background

Wind turbines

Wind turbines utilise the energy from wind to turn the blades or vanes on a rotor which in turn drives an electricity generation unit. Wind turbines are available in two types, vertical axis rotation and horizontal axis rotation. Wind turbines have also been available as either upwind or downwind machines. The vast majority of the wind turbines available commercially available for the UK market are of the upwind, horizontal rotation type.

The size and electrical output from wind turbines has been increasing at a very rapid rate. At the time of writing, on-shore turbines with an electrical output of 3MW are already available and it should be assumed that both the physical size and electrical output of wind energy turbines will continue to grow.

The electrical output from modern turbines ranges from 6 kW to 3MW, the mast height is currently up to 85 metres and the turbine blades have a diameter of up to 90 metres.

Wind turbines are perhaps the most contentious forms of renewable energy generation in the UK at this time, but also offer the greatest opportunity for renewable energy generation. It is widely accepted that the UK has the greatest potential for wind energy development in Europe. This has been clearly detailed in a number of reports, including the "EU Briefing on Renewable Energies, the Rothe Report, 2000".

In PPS 22 it is clearly stated that regional and local development plans should not include policies relating to the impact of wind turbines upon any other organisation's constraints or infrastructure and the consents of other bodies are not required as part of the planning application process

From research carried out over the last two years with developers, local authorities, the media and other interested bodies it is clear that there is a great deal of misunderstanding, misinformation and that the majority of the Planning disputes relating to wind energy developments are the result of ambiguity in the interpretation of PPG22, and/or the lack of quantifiable parameters against which the proposed developments are being measured.

Further analysis of the Planning disputes and discussions with the British Wind Energy Association reveal that the four main areas where the existing national Planning Policy Guidance Note lacks clarity and/or substance are:

a) Noise emissions and noise measurement
b) Proximity of wind energy turbines to dwelling houses
c) The shadow flicker effect
d) Visual impact/appearance

It is also clear that the existing PPG 22 and the subsequent annexe on wind energy were unhelpful to the local planning authorities, developers or groups opposing the proposed developments.

The lack of clearly identified criteria, parameters and standards in PPG 22 often lead to both parties quoting the same clauses of PPG 22 to support their proposals and substantiate their objections. The noise measurement standards were inappropriate for the technology and the local environment usually encountered for wind energy developments and there was a general misunderstanding of terms such as 'flicker effect'

For these reasons, the majority of technology specific criteria based planning policies relate to wind energy.

Noise

Planning Policy Guidance 24 (PPG24) 'Planning and Noise' should be deemed to apply even though the current guidance note does not specifically identify wind energy turbines as a potential noise producing source.

Although this should not affect the levels of noise which are deemed to be acceptable, there are areas of potential conflict in the nature, extent and type of measurement techniques which may be considered to be appropriate.

Government are proposing that "The assessment and rating of noise from Windfarms" (ETSU R-97) should be used as the model for noise prediction and measurement. This document was originally produced in 1996 but is currently out of print. We are advised that this document is now being brought back into print and will be available shortly.

Although ETSU R-97 is an extension of the work carried out under BS 4142: 1990, which was also specified in PPG 22, there are concerns in the wind energy industry that the ETSU document is not the most appropriate guidance for the measurement of noise from wind energy developments and is not in line with the majority of European guidance in this field. ETSU R-97 still relies upon BS 4142: 1990 for noise measurement techniques and the quoted methodologies relate to wind turbine shaft heights of around 30 metres which is inappropriate for modern wind energy turbines where the shaft height may be over 80 metres. There is also concern that the recommendations for measured noise levels and tonal penalties are out of step with those used in other European countries.

The methods and practices for the calculation and measurement of sound propagation, as well as the issues relating to noise immission measurement techniques are described in the ETSU document W/13/00503 "NOISE IMMISION FROM WIND TURBINES". It is also being recommended that this reference to this document be specifically included into PPS 22.

Government are also being asked to consider the adoption of BS EN 61400-11 'Wind turbine generation systems. Acoustic noise measurement techniques' as being another appropriate reference document for the measurement of noise generated by wind turbines. The International Electrotechnical Commission (IEC), supported by the International Energy Agency (IEA), has developed BS EN 61400-11 over the last eight years. The latest version of this document was adopted as a BS by the British Standards Institute on 8 August 2003.

The document, EN 61400-11 is currently in use in Denmark, Germany and the Netherlands as part of their statutory regulations.

In the Netherlands, this is further re-enforced by the requirement that the noise levels measurements are carried out while the wind speed is an average of 7 m/s +/- 2 m/s, with the wind speed being measured at a height of 10 m above the ground level.

The Dutch system also refers to a 'Wind Norm Curve' which was prepared by the order of NOVEM (The Dutch Knowledge Centre for Energy and the Environment, Nederlandse Onderneming Voor Energie en Milieu) to identify the allowable increase in measured noise emissions as a result of variation of the wind speeds during normal operation. This research proposed that the maximum permissible noise levels, at the nearest dwelling shall not exceed 45 dB(A) during the night and 50 dB(A) during the day.

To place these dB(A) figures into context, the following table represents the commonly agreed perception of noise.

Sound level	Threshold of hearing	Whisper	Talking	City Traffic	Rock concert	Jet engine at 10m
dB(A)	0	30	60	90	120	150

The adoption of the 45 dB(A) and 50 dB(A) limits is full compliance with the existing Planning Policy Guideline (PPG24), 'Planning and Noise', even though PPG 24 makes no specific mention of noise from wind energy generation systems.

It is being recommended that PPG 24 be amended to acknowledge noise from wind energy generation systems.

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In Denmark the legislation is fairly simple and requires that the maximum noise which may be recorded at the outside walls of a dwelling shall not exceed 40 dB(A) from any single source. The Danish system is also linked to the minimum proximity limits for wind turbine generators. Proximity issues are discussed later.

A number of EU Member States allow a relaxation for both noise and proximity if the affected dwellings are occupied by bodies with a financial stake in the wind energy project.

Proximity

In discussions with other UK wind developers, wind turbine generation systems manufacturers the measurement of noise and the related issue of proximity of dwellings have been a major point of debate and concern.

As previously stated, the European Best Practice Guidelines for Wind Energy Project, as well as the Dutch and Danish approval systems consider proximity as an issue for consents and noise measurement.
The Dutch regulations appear to be the most stringent in that they require that the distance from the closest wind generation turbine to the nearest dwelling is at least four times the height to the wind turbine generator hub axis, or 300 metres, whichever is lower.

The Dutch authorities also require that a predicted noise calculation must be submitted if:

a) The distance to the house is less than 100m and the wind turbine has a rotor diameter of 20m to 30m.
b) The distance to the house is less than 200m and the wind turbine has a rotor diameter of 30m to 50m.
c) The distance to the house is less than 300m and the wind turbine has a rotor diameter greater than 50m.

In Denmark, the generally accepted rule is that dwellings should be at least 300 m from ‘wind farms’ and between 100m and 200 m from isolated wind turbines.

Certain European Countries also require the submission of a risk assessment as part of the proximity issue, but the determination of risk is outside of the parameters of the current Planning legislation. Further information regarding risk assessment may be found in ‘GUIDELINES FOR HEALTH & SAFETY IN THE WIND ENERGY INDUSTRY’, published by the British Wind Energy Association.

Shadow Flicker Effect

In many previous Planning applications for wind turbines, objectors have stated fears of the ‘shadow flicker effect’ without truly understanding the principles behind the title.

Members of the public, to describe a fear that the rotating blades will induce a stroboscopic effect which could provoke an epileptic seizure, have often used the term ‘flicker effect’. The majority of modern wind turbines have a rotation rate of between 7 and 20 revolutions per minute and as such are universally agreed to be too sedate to provoke this type of reaction

This is backed up by research carried out by Professor G Harding of the University of Aston in Birmingham (1996) which identified that only around 3 to 5% of those people suffering from epilepsy had sensitivity to light induced episodes. He also identified that the lower threshold for sensitivity of those suffering from 'photosensitive epilepsy' was 3Hz (3 flashes per second) and that the common threshold was 25 Hz. These thresholds are also recognised by the broadcasting services who utilise 2 Hz as the maximum threshold for flickering images broadcast over public television networks.

Commercial wind energy turbines commonly rotate at around 3 revolutions per minute. With a three-blade rotor, this is likely to produce flickering at a maximum frequency of around 0.15 Hz.

'Shadow flicker effect' refers to the potential nuisance arising from the shadow of the rotating rotors falling across dwellings or public meeting places such as churches. Planning Policy Guidance Note 22 makes brief reference to Shadow flicker effect but does not quantify what could be deemed to be reasonable. The European Best Practice Guidelines for Wind Energy Development also makes passing reference to Shadow flicker effect but do not offer any form of limit or quantification. Only the Dutch and the German legal or regulatory systems appear to provide for quantifiable limits.

The Dutch regulations require that the wind turbine must be fitted with an automatic brake to prevent rotation when the wind speed is below the cut in speed for electricity generation. These regulations also require that the shadow flicker shall not affect any single dwelling, within a distance of twelve times the rotor diameter from the wind generation turbine, for more than thirty minutes over a total of 17 days in any year.

A judge who deemed that 30 hours of shadow flicker per year was reasonable set the German 'case law' example.

In all cases, shadow flicker nuisance can be prevented with a control system fitted to the wind turbines that stops the rotor from turning during the time the rotating shadow would pass across the windows of the dwelling. Such a device is needed when a dwelling is expected to get more then 30 minutes per day of shadow flicker during more than 17 days per year.

Further reference:
Photosensitive Epilepsy, Graham Harding & Peter M.Jeavons
The National Society for epilepsy www.epilepsynse.org.uk
Health & Safety Executive Local Authority Circular LAC 51/1 'Disco lights and flicker sensitive epilepsy' www.hse.gov.uk/lau/lacs/51-1.htm

Radiance or reflection of light.

An issue which is often discussed alongside shadow flicker effect is reflected sunlight glare.

Modern wind turbine generation sets have rotors and hub shrouds which are coated with non-reflective coatings to resolve potential problems.

Visual impact/appearance.

Government are keen that criteria-based policies are used to assess renewable energy projects, but they recognise that visual impact is essentially a subjective issue.

Commercial, meteorological and orographic factors dictate that wind energy projects will usually be developed upon elevated and exposed areas of the country, and as such they may be perceived as having a high visual impact.

Sensitive colour schemes may help to reduce the impact of the wind energy development, but issues such as layout, size and height of turbines, and siting are generally dictated by the prevailing wind conditions and other physical criteria.

There is no current agreed national standard by which visual impact or the effects of change on a landscape can be measured. Many local authorities have made steps towards developing landscape characterisation or other similar techniques, but the methodologies and forms of assessment being used are not uniform, nor do they produce truly comparable results.

It must be also recognised that the nature of the renewable energy project, in particular, the technology being considered, will produce differing results in each of the landscape and/or visual impact assessment techniques being applied.

When evaluating a potential renewable energy project the developers and the planning officers will need to address, as well as the issues already discussed, the landscape's sensitivity to change and capacity to accommodate the specific type of change required by the proposed project under consideration.

For example, when assessing a renewable energy project, the considerations when assessing the landscape's capacity to accommodate change will include a detailed understanding of the nature, type and size of the development under consideration, including any additional road or footpath networks involved. These will then be measured against:

The '**Landscape character sensitivity'**, based upon judgements about sensitivity of aspects most likely to be affected e.g.

Natural Factors
Extent and pattern of semi-natural habitat.
Cultural Factors
Land use, enclosure patterns

Landscape Quality/Condition
Representation of typical Character of the affected and adjoining areas
Aesthetic Factors
Scale, Enclosure, Pattern, Form/Line, Movement

The **Visual Sensitivity**, based upon the nature of change and interaction with visual aspects of landscape e.g.

General visibility
Land form influences
Population
Numbers and type of residents
Number and type of visitors
Mitigation Potential
Scope for mitigation potential visual impacts

The **Landscape Value** e.g.

Designations
International, National, Recognised local
Other Criteria Indicating Value
Tranquillity, Remoteness, Scenic beauty, Cultural associations, Conservation interests, Consensus on value

Visual sensitivity studies are more dependent upon:

The probability of change in a landscape being highly visible, based particularly on the nature of the landform and the extent of tree cover etc, both of which have a major bearing upon visibility.

The numbers of people likely to perceive any changes and their reason for being in the landscape, for example as residents, as travellers passing through, as visitors engaged in recreation or as people working there.

The likelihood that change could be mitigated, without the mitigation measures in themselves having an adverse effect.

When assessing renewable energy projects, the capacity studies and visual sensitivity studies identified above must be specific to the particular type of change or development under consideration.

Much of the above information on landscape character and visual impact is extracted from "*Landscape Character Assessment Guidance for England & Scotland. Topic Paper 6: Techniques and Criteria For Judging Capacity and Sensetivity"* , produced for the Countryside Agency & Scottish Natural Heritage by Carys Swanswick.

This document is recommended for further reference and clarification and is available at www.countryside.gov.uk/livinglandscapes/countryside_character

To mitigate and realistically identify the perceived visual impact, European projects often produce a graphic representation of the ‘zone of visual impact’ that clearly identifies from where, within a radius of 10 kM, the wind energy development will actually be visible.

The map showing the Zone of Visual Impact shall also identify and include the distances from significant feature, such as housing developments, public buildings etc. to the proposed wind energy generation turbines.

Technology specific criteria based planning policies relating to the following aspects of wind energy are attached as appendix C of the General and Technology Specific Criteria Based Planning Policies.

Noise
Proximity
Shadow flicker effect
Radiance or reflection of light
Visual impact