Pembrokeshire County Council
Local Development Plan (to 2021)

Renewable Energy Study

Development Plans

December **2010**

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1. Introduction

1.1 Pembrokeshire County Council's Local Development Plan (LDP) policy on renewable energy will present a local response to International and National policies on climate change, renewable energy and building design. As emphasised in Planning Policy Wales Version 3, July 2010 (PPW, Edition 3, 2010) the planning system is seen as having a fundamental role in delivering sustainable development. Responding to increasing evidence of the environmental, social and economic costs of global warming, climate change is now a significant consideration within the planning process, with reduction in greenhouse gases and in particular carbon emissions viewed as essential. The plan area and in particular the land adjoining the Milford Haven Waterway is already established as an energy centre – and it is anticipated that in the future there may be an increasing emphasis on low and zero carbon energy projects.

Aims and objectives

1.2 The aim of this report is to examine the requirements, opportunities and constraints to the development of renewable energy and achievement of energy efficiency within Pembrokeshire[1] and to provide the evidence base to inform decision making in the formation of policies on renewable energy for the Local Development Plan, which will run to 2021.

1.3 Within the current and emerging policy framework, a range of renewable energy generation and carbon dioxide reduction measures are investigated and assessed.

Background

1.4 The Council has undertaken an assessment of the potential of all renewable energy resources, renewable energy technologies, and energy efficiency and conservation measures. This assessment forms the evidence base underpinning the renewable energy policy of the LDP, having particular regard to:

- Making recommendations which will form the basis of land use planning policies on renewable energy generating technology in new developments;
- Examining the contribution that development in the County can make towards developing and facilitating renewable energy and energy efficiency and conservation; and
- Assessing the contribution that can potentially be made by the County towards carbon emission reduction and renewable energy production targets.

[1] All areas of the County excluding the Pembrokeshire Coast National Park Authority.

Scope of the study

1.5 There is a wide range of technologies and techniques available for producing renewable energy for electricity, heat, transportation and for reducing energy demand. The technologies considered in this report include:

- Wind – Onshore and Offshore;
- Solar Photo-Voltaic (PV);
- Solar Thermal / Solar Hot Water;
- Ground Sources Heat Pumps;
- Microgeneration;
- Anaerobic Digesters (Biogas);
- Bio-Mass;
- Landfill Gas;
- District Heating Networks
- Hydro-Power;
- Bio-Fuels for Vehicles;
- Tidal Energy; and
- Wave Energy.

1.6 Having set out the policy context and potential policy emphasis, the body of this report focuses on the main renewable / low carbon technologies considered through this study. The report will provide a brief overview of the technologies and examples of existing or proposed projects in the County, highlighting any general planning issues for each technology. The opportunities and technical constraints for the development of these technologies will also be reviewed.

Approach

1.7 This is largely a desk based study, drawing on a number of sources and knowledge of renewable energy technologies and of the planning system related to renewable energy. In particular this study also draws upon the work conducted by AECOM on behalf of the Welsh Assembly Government in its Practice Guidance "Pilot Study – Pembrokeshire County Council Renewable Energy Assessment" (Pilot Study – PCC REA) (July 2010)

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

2. Policy context

2.1 There are a number of significant items of regulation and policy that are the driving force towards lower carbon dioxide emissions. Those of most relevance to Pembrokeshire County Council are identified and summarised below.

International action

2.2 Climate change is arguably the greatest long-term challenge facing the world today and addressing this issue is a key concern for all levels of government and society as a whole. The release of greenhouse gases into the atmosphere is now widely acknowledged to be a significant contributor to climate change. The most significant of these is carbon dioxide released during the combustion of fossil fuels when they are used for generating electricity, producing heat or when used as a fuel for transportation. Sustainable energy provides a primary means of reducing the output of greenhouse gases.

2.3 The EU Climate and Energy Package 2008 sets out a series of targets to be met by 2020:

- A reduction in EU greenhouse gas emissions of at least 20% below 1990 levels;
- 20% of EU energy consumption to come from renewable resources; and
- A 20% reduction in primary energy use compared with projected levels, to be achieved by improving energy efficiency.

2.4 The EU's Target for Renewable Energy: 20% by 2020 (European Union Committee, 2008) addresses the UK's renewable energy contribution towards the EU's overall target of 20% by 2020. The target for the UK is to achieve 15% by 2020 via renewable sources incorporated into electricity, heat and transport.

Climate change in the UK

2.5 The Energy White Paper: *Meeting the Energy Challenge* 2007 sets out initial ideas for establishing a legally binding carbon target for the UK, developing an international framework to tackle climate change, encouraging energy saving and supporting low carbon technologies. EU targets have been set, seeking to reduce greenhouse gases by 60% by 2050, and increase renewable energy production by 10% by 2010 rising to 20% by 2020.

2.6 The UK renewable energy contribution to the EU target is legally set in the UK Renewable Energy Strategy 2008 at 15% by 2020. One of the mechanisms for delivering renewable electricity is the Renewable Obligation. This places an obligation on licensed electricity suppliers to source an increasing proportion of electricity from renewable sources. The Renewable Transport Fuel Obligation increases the use of biofuels for road transport. Alongside this the Government will offer financial incentives for households, industry, business and communities to use renewable sources and reduce financial pressures by facilitating lending through the European Investment Bank. In aiding delivery the strategy hopes to streamline the planning system, to support renewable development, improve and invest in the renewables industry, promote strategic investment and management of the grid and increase the use of sustainable bioenergy.

2.7 The UK Energy Efficiency Action Plan 2007 details policies to deliver improvements in energy efficiency and contribute to the EU Energy End-Use Efficiency and Energy Services Directive. The target is a 9% saving by 2016; however it is expected to exceed this target and deliver 272.7 TWh in savings by 2016, equivalent to a saving of 18%.

2.8 The Climate Change Act 2008 enhances the UK's ability to adapt to the impact of climate change by establishing the following:

- A UK wide climate change risk assessment every five years;
- A national adaptation programme to address the most pressing climate change risks to England, to be reviewed every 5 years;
- Government powers to require 'bodies with functions of a public nature' and 'statutory undertakers' to report on how they have assessed climate change risks and how they will address them;
- Publication of a strategy outlining how this new power will be used, and identifying the priority organisations that will be covered by it;
- Government Statutory Guidance on how to undertake a climate risk assessment and draw up an adaptation action plan; and
- An Adaptation Sub-Committee of the independent Committee on Climate Change.

National planning policies

2.9 Current national planning policy guidance on renewable energy is set out in Technical Advice Note 8 (TAN 8) which requires planning policies to provide an effective framework to encourage renewable energy development. TAN 8 provides technical advice to supplement the policy set out in PPW (Edition 3, 2010).

2.10 PPW (Edition 3, 2010) provides the strategic policy framework for the effective preparation of Local Planning Authorities' Development Plans. It includes reference to sustainable energy production including the requirement for authorities to undertake an assessment of renewable energy generation within their area.

2.11 PPW (Edition 3, 2010) sets out the Welsh Assembly Government's renewable energy aim, which is to secure an appropriate mix of energy provision for Wales, whilst minimising environmental impacts. The UK has signed up to the EU Renewable Energy Directive, which includes a UK target of 15% of energy being generated from renewable sources by 2020. Development of renewable energy is seen as a mechanism by which to reduce the impacts of climate change and secure future energy supplies. There are specific renewable energy production targets for Wales of 4TWh per annum by 2010 and 7TWh per annum by 2020.

2.12 PPW (Edition 3, 2010) explains the meaning of renewable energy[2]. The Welsh Assembly Government identifies an abundant onshore wind resource and is expecting 800MW of renewable energy to be provided from strategic onshore wind energy development, with a further 200MW to be provided from offshore wind and other renewable technologies. Local authorities (or on very large proposals the Infrastructure Planning Commission – those over 50MW) have consenting powers for onshore wind energy proposals, while the Marine Management Organisation has consenting powers for most offshore wind energy development proposals. This is recognition that in the short term, wind power offers the greatest potential for increasing the generation of electricity from renewable energy. It expects the land use planning system to actively steer developments to the most appropriate locations. In that respect, it references the Strategic Search Areas identified in Technical Advice Note 8. However, these do not cover any locations in Pembrokeshire and hence the County is unlikely to be an appropriate location for the few large-scale – 25MW – wind farms that will make the biggest contribution to meeting renewable energy targets in Wales.

2.13 PPW (Edition 3, 2010) emphasises the contribution that wind energy can make towards the achievement of renewable energy generation targets, but adds that Local Planning Authorities should facilitate the development of all forms of renewable energy and energy efficiency, together with complementary conservation measures. It is expected that this will in part be achieved through enabling policies in Development Plans and in part through Development Management decisions that reflect national and international climate change obligations. In that context, Local Planning Authorities are expected to assess renewable energy resources and technologies, energy efficiency and conservation measures, in conjunction with the inclusion of appropriate policies in Development Plans. LDP policies on wind energy developments outside Strategic Search Areas are expected to focus on onshore wind energy developments up to 25MW on urban / brownfield sites and less than 5MW elsewhere.

[2] 'Renewable energy is the term used to cover those sources of energy, other than fossil fuels or nuclear fuel, which are continuously and sustainably available in our environment. This includes wind, water (for hydro-electricity, wave and tidal power), solar, geothermal energy and plant material often referred to as biomass'. (PPW Edition 3, 2010, July 2010)

2.14 The Welsh Assembly Government's Technical Advice Note 22 (TAN 22): *Planning for Sustainable Buildings* states that, as part of preparing their Local Development Plans, "Local planning authorities should assess strategic sites to identify opportunities for higher sustainable building standards (including zero carbon) to be required. In bringing forward standards higher than the national minimum… local planning authorities should ensure that what is proposed is evidence-based and viable". There is now a general requirement that all commercial development exceeding 1000m2 satisfies a Building Research Establishment Environmental Assessment Method (BREEAM) rating of 'very good' with an 'excellent' rating for credit ENE1 and for residential developments of all dwellings, Code for Sustainable Homes (CSH) level 3 with 31% (CSH level 3-4) improvement in CO2 emissions against Part L of the Building Regulations from September 2010 (2006).

2.15 The Welsh Assembly Government's Technical Advice Note 8 (TAN 8) is presents policy advice that will help to deliver the Assembly's renewable energy targets for 2010 and 2020. It identifies a range of potential renewable energy sources and provides further information on each of their power generation characteristics. Furthermore, it identifies which opportunities are most appropriately encouraged through planning policy.

2.16 The Welsh Assembly Government has set targets of 4TWh of electricity per annum to be produced by renewable energy by 2010 and 7TWh by 2020. In order to meet these targets, it has concluded that 800MW of additional installed capacity is required from onshore wind sources and also that a further 200MW of installed capacity is required from off shore wind and other renewable technologies. These requirements are now embedded in PPW (Edition 3, 2010).

2.17 The Ministerial Policy Statement on Marine Energy in Wales 2009 suggests a range of actions to develop and maximise marine energy from around Welsh coasts.

2.18 The Welsh Assembly Government's Renewable Energy Route Map for Wales 2008 sets out actions in achieving self sufficiency in renewable energy generation and sets out details on renewable energy technologies, energy efficiency/micro-generation/distributed generation and contextual issues of planning consents, grid infrastructure and research and development. The main renewable sources put forward are marine including wave-power, tidal stream and lagoon projects, wind, biomass, energy from waste and hydropower.

2.19 The Welsh Assembly Government's Micro-generation Action Plan for Wales 2007 sets out the following targets for micro-generation in Wales up to 2020:

- 20,000 micro heating systems installed by 2012, rising to 100,000 by 2020
- 10,000 micro-electricity systems installed by 2012 rising to 200,000 by 2020
- 50 combined heat and power (CHP) and/or district heating systems in place by 2020

Permitted development rights - micro-generation

2.20 The Town and Country Planning (General Permitted Development) Order 1995 (GPDO) gives a general permission for certain defined classes of development or uses of land, mainly of a minor character. The most commonly used class permits a wide range of small extensions or alterations to dwelling houses.

2.21 The GPDO was amended in England in 2008 to confer additional Permitted Development rights for micro-generation. The Welsh Assembly Government is currently consulting on the issue of Microgeneration and Low Carbon Energy Technologies under the GPDO. If Wales follows England on this issue, then changes to the GPDO would remove the need to apply for planning permission when installing a range of small-scale energy generation equipment.

Local planning policies

2.22 The Pembrokeshire Community Plan 2010-2025: *Preliminary Policy Statement* 2009 identifies an approach to promote the economic, environmental and social well being of the area. The preliminary policy statement does not include any detail on renewable energy but does highlight the need to reduce per capita carbon footprint and emissions of greenhouse gases.

2.23 The Joint Unitary Development Plan for Pembrokeshire 2000-2016 (which was adopted by Pembrokeshire County Council and the Pembrokeshire Coast National Park Authority in 2006) sets out policies to provide a framework for development in the county. Policies 62 and 63 set out the Council's guiding principles on the generation of power from renewable resources (62) and then specifically wind energy development (63).

2.24 The development of a Renewable Energy Assessment and Target Information for the Pembrokeshire Coast National Park: Draft Final Report (published in 2008 by the Pembrokeshire Coast National Park Authority) provides an overview and information on renewable resources available in the National Park and information on possible targets for renewable energy generation developments for the National Park Authority's Local Development Plan.

2.25 The Local Housing Strategy for Pembrokeshire 2007 – 2012 (published in 2007 by Pembrokeshire County Council) provides an overview of issues relating to housing and provides details of action to be taken to improve housing in the private and public sector. One of the broad priorities and themes is to increase the energy efficiency of homes using renewable energy options. The plan also looks at Environmentally Sustainable Housing to increase the use of renewable energy technologies and encourages the take up of grant schemes for domestic scale improvements.

Emerging planning policy and guidance

2.26 The Welsh Assembly Government has recently published (in October 2010) a Climate Change Strategy which sets targets for reduction in emissions and outlines plans for adaptation to climate change.

2.27 The Welsh Assembly Government's published a draft National Energy Efficiency and Savings Plan for consultation purposes in March 2009. This draft plan proposes actions to tackle fuel poverty and reduce energy use and greenhouse gas emissions in housing, businesses, communities and the public sector in Wales.

2.28 Consultation is underway on Bioenergy Action Plans for Wales these looking at the potential of using Bioenergy to reduce Wales' carbon footprint.

2.29 The Welsh Assembly Government's Low Carbon Energy Policy Statement is currently being prepared and will set out actions to be taken to develop Wales into an efficient, low-carbon-energy, economy.

The Welsh Assembly Government's Practice Guidance: Pilot Study – Pembrokeshire County Council Renewable Energy Assessment, Aecom, July 2010 (Pilot Study – PCC REA, 2010) – summary

2.30 The Welsh Assembly Government published a Renewable Energy Assessment Pilot Study for Pembrokeshire County Council in July 2010. This document was prepared by Aecom under commission from the Welsh Assembly Government. The document identifies key roles for the County Council's planning, waste management, land-ownership and energy procurement services as potential contributors to a low-carbon Pembrokeshire.

2.31 The Pilot Study acts as a Renewable Energy Assessment for the plan area, outlining the potential of the area to contribute to national greenhouse gas emission reduction targets. Its main purpose is to act as evidence to support the Local Development Plan and in that context the Council has referred to its findings in this background paper.

2.32 The recommendations of the Pilot Study are discussed in section 6 of this paper.

3. Technology overview

Onshore renewables

Onshore wind

3.1 Turbines harness wind power to generate electricity either as stand alone applications providing energy locally or as wind farms exporting electricity to the National grid. The amount of electricity produced depends on wind speed and the swept area of the blade.

Opportunities	*Constraints*
• Economically viable • Land diversification opportunity • Significant electricity generation • Direct community investment and involvement benefits • Low maintenance • Quick to install over a range of sizes • Clean energy – no emissions and wind energy is an endless resource	• Intermittent wind speeds • Local concerns over noise, visual impact and possibly damage to habitats/species • Avian/bat mortality • Environmental impacts • Potential interference with radar and telecommunication facilities

Solar photo-voltaic (PV)

3.2 PV panels capture solar energy and transform the solar radiation directly into electricity. PV is a clean, quiet renewable technology and is used across a range of system sizes and uses. Most commonly solar PV cells are used in domestic settings however their use is becoming more widespread and applications now include burglar alarms, parking meters and nautical instruments. In remote areas PV cells provide a cost effective alternative to connecting to the National grid.

Opportunities	*Constraints*
• Decentralised source of energy, good source for rural electricity • Suited for installation in high density settlements as well • Suitable for domestic, community and business uses • Clean energy – no emissions and solar power is an endless resource • No noise • Low maintenance, no moving parts • Permitted development under the GPDO so permission not normally required (Listed Buildings do require consent)	• Output affected by reduced sun • Expensive technology • Manufacturing of PV cells often requires hazardous materials such as arsenic and cadmium • Questions over disposal of PV cells in the long term • Large scale solar plants require large amounts of land

Solar thermal / solar hot water

3.3 This system either heats or conveys energy to hot water systems using solar energy. The energy is collected from either flat plate collectors or evacuated tube collectors. It is typically building mounted, and can provide up to half a households hot water supply over a year.

Opportunities	*Constraints*
• Cost effective • Clean energy – no emissions and solar power is an endless resource • Permitted development under the GPDO so permission not normally required (Listed Buildings do require consent) • Decentralised source of energy, good source for rural electricity • Suited for installation in high density settlements as well • Suitable for domestic, community and business uses • Low maintenance	• Output affected by reduced sun • Expensive technology • Questions over disposal of technology in the long term

Bio-mass

3.4 As a result of burning plant materials, bio-mass utilises the heat produced or converts the heat/steam into electricity via a turbine. There are various categories of Bio-Mass plant ranging from a few kilowatts up to 40 MW. Within the 10-40 MW range are plants designed specifically for the production of electricity, in the 5-30 MW are Combined Heat and Power (CHP) plants and below 5 MW are plants designed solely for the production of heat. Household wood burning stoves and biomass boilers are the main examples of plants focused solely on heat production.

Opportunities	*Constraints*
• No net emissions of carbon dioxide • Decentralised source of energy • Not dependent on weather • Low fuel cost • Employment opportunities • Supplementary income to grow energy crops	• Produces air pollutants including carbon monoxide and nitrogen oxides • Requires land to grow ‘bio-mass’ crops • Labour intensive • Reliable supply of plant material needed • Potential transport costs and negative impacts of increased travel

Combined heat and power (CHP)

3.5 CHP plants primarily generate electricity but also allow the 'waste' heat to be utilised. The system uses either fossil or renewable fuel and can be employed over a wide range of sizes, applications and technologies. Within Pembrokeshire the most suitable places for CHP schemes are likely to be in schools, in community facilities and in public buildings.

Opportunities	*Constraints*
• No net emissions of carbon dioxide • Decentralised source of energy • Not dependent on weather • Low fuel cost • Employment opportunities • Supplementary income to grow energy crops	• Produces air pollutants including carbon monoxide and nitrogen oxides • Require areas of land to grow 'bio-mass' • Labour intensive • Reliable supply of waste heat needed • Potential transport costs and negative impacts of increased travel

Anaerobic digesters (biogas)

3.6 This technology produces methane, from decomposing animal, human and/or vegetable matter, to be utilised for electricity production or as a fuel for heating. The waste is deliberately decomposed under anaerobic conditions in a sealed airless container, where bacteria convert up to 60% of the digestible solids.

Opportunities	*Constraints*
• Decentralised source of energy, good source for rural electricity • Less air (methane) and solid emissions than incineration or landfill • Reduces waste to landfill	• If waste water is released directly into a watercourse it may lead to increased eutrophication due to increased chemical content • Odour and dust issues • Expensive technology

Ground source heat pumps

3.7 Ground source heat pumps use pipes buried in the ground to extract or sink heat. Based on the principle that the ground stays at a constant temperature the heat pump circulates water around a pipe in the ground. The water absorbs heat in the winter and sinks heat in the summer. This is then used to heat radiators, for under floor heating systems and to supply hot water.

Opportunities	*Constraints*
• Low maintenance • High annual temperatures • Reliable and long lifespan • Low visual impact • Decentralised source of energy, good source for rural electricity	• Suitable area for excavation • Expensive to install • Needs to be connected to the grid

Bio-fuels for vehicles

3.8 Bio-fuel is usually made from plant oils or animal fat, processed through a series of chemical reactions. The fuel can be used in diesel engines on its own or blended with petrodiesel. Some engines might require some modification before accepting these fuels.

Opportunities	*Constraints*
• Helps to reduce climate change as fuels grown for bio-fuel absorb carbon dioxide • Employment opportunities created • Supplementary income to grow energy crops	• Large land area needed to cultivate crops • Intense cultivation may impact on soil and groundwater • High cost of producing fuel

Hydro-power

3.9 Hydro-power technology utilises energy from moving water to produce electricity. Water is either ‘dropped’ from a dam or the ‘run of the river’ is used to drive a turbine. The amount of energy produced is proportional to the volume of water and the vertical distance it has fallen. The output of a hydro-power system can vary widely, with anything below 100kW termed ‘micro-hydro’.

Opportunities	*Constraints*
• Decentralised source of energy, good source for rural electricity • Low maintenance • Clean energy – no emissions	• Potential impacts on habitats and species • Affected by climatic and seasonal changes – low power in the summer months • Limited by topography • Potentially expensive, depending on size

Landfill gas

3.10 Landfill gas is a mix of Methane and Carbon Dioxide and is formed when biodegradable waste breaks down as a result of anaerobic microbiological action. It can be extracted from the landfill and used as an energy resource either in an engine or turbine for power generation or to provide heat in surrounding buildings.

Opportunities	*Constraints*
• Reduces gas emissions • Reduces odour issues	• Threat of explosion • Expensive technology to install

Microgeneration

3.11 Microgeneration covers a range of renewable sources and technologies generated on a small scale by individuals, communities and small businesses to meet their own needs. Microgeneration can include wind turbines, hydro, solar and CHP.

Opportunities	*Constraints*
• Low carbon energy • Reliability • Low maintenance • Decentralised source of energy, good source for rural electricity • Clean energy – no emissions and exploits renewable resources	• Installation costs can be high • Technical equipment required • Planning and Building Regulations consents may be required

District Heating Networks

3.12 District Heating Network is the term given to a system providing multiple individual buildings with heat generated from a single source. The source is generally a building known as an energy centre in which heat can either be generated from traditional fossil fuels (from a boiler) or from a low carbon source such as biomass.

Opportunities	*Constraints*
• No net emissions of carbon dioxide • Decentralised source of energy • Not dependent on weather • Low fuel cost • Employment opportunities	• Need for individual buildings to be located near an energy centre. • Technical equipment required • Planning and Building Regulations consents may be required

Offshore renewables

3.13 Permission for marine renewable energy proposals lies outside the jurisdiction of the land use planning system. Most such developments will require consent from the Marine Management Organisation (MMO) established under the Marine and Coastal Access Act 2009. However, cases will often arise where ancillary structures onshore that are associated with offshore renewable energy generation will require planning permission from the Local Planning Authority.

Offshore wind farms

3.14 Offshore wind farms generate energy in the same manner as onshore wind farms. Piles are driven into the seabed to provide a foundation for the turbines. Sub-sea cables take the power from the offshore wind turbines back to a substation on land.

Opportunities	*Constraints*
• Significant electricity generation • Clean energy – no emissions and wind energy is an endless resource • Habitat diversification, through monopiles acting as artificial reefs	• Intermittent wind speeds • Visual impacts • Avian strikes/mortality • Potential interference with radar and telecommunication facilities • Electromagnetic fields created by the electric cables and underwater noises and vibrations which could affect orientation and navigational ability of marine species • Alteration of the environment and in particular effects on habitats

Tidal energy

3.15 There are two ways to harness energy from tidal flows, these being tidal barrages and tidal stream turbines. Tidal barrages store water and as the tide goes out the water is released through a turbine to produce electricity. Tidal stream turbines work like wind turbines, but the blades are underwater and are turned by underwater currents. Both require landfall infrastructure to enable connections to the National Grid.

Opportunities	*Constraints*
• Significant electricity generation • Clean energy – no emissions • Tidal currents are a reliable resource	• Electromagnetic fields created by the electric cables and underwater noises and vibrations which could affect orientation and navigational ability of marine species • Alteration of the environment and in particular effects on habitats

Wave energy

3.16 Wave energy collectors harness energy from the surface of waves as they move up and down. The collectors can be based inshore or offshore and work best in windy areas and where waves have long fetches. There are three types of collectors; buoyant moored devices, hinged contour devices and oscillating columns. This technology is still in development and is also dependent on having landfall infrastructure.

Opportunities	*Constraints*
• Clean energy – no emissions	• Hazards to navigation • Expensive to install • The electricity produced is expensive • Potential impacts on habitats and species

4. Renewable energy planning submissions and projects

4.1 This section of the report undertakes a review of planning applications made within the Council's planning area over the last 6 years in order to identify those building-embedded schemes that have been implemented. This review identifies the main issues surrounding the proposals and patterns in development and may help guide future renewable energy projects.

Review of planning applications

4.2 There were 48 planning applications submitted over the last 6 years (up to June 2010) for schemes that included a renewable energy element, along with a number of pre-application enquiries.

4.3 The number of applications has been growing steadily. 2007 and 2009 had the highest number of applications, with an overall increase of 82% since 2004. However the numbers of applications with a renewable energy element are very low in comparison to the total number of applications. A summary of yearly applications is below:

Year	*Number of applications*
2004	2
2005	7
2006	7
2007	12
2008	9
2009	11

4.4 Amongst the applications submitted, 5 renewable technologies can be identified, these being wind, solar, CHP, biomass and landfill gas. Only wind and solar have had more than one application, wind receiving 40 and solar 5. None of the 5 solar applications were approved. Of the 40 wind applications, 25 have been permitted. The single CHP and biomass applications were permitted, but the application proposing use of landfill gas was refused.

4.5 In total 56% of applications incorporating renewable technologies have been approved, 30% have been refused, 6% are awaiting determination and 8% have been withdrawn.

4.6 An overview of the planning applications is summarised below, with further detail provided in the Appendix.

Renewable Technology	*Total applications*	*Approved*	*Awaiting determin-ation (June 2010)*	*Withdrawn*	*Refused*
Wind Turbines	40	25	2	3	10
Solar	5	0	1	1	3
CHP	1	1	0	0	0
Biomass	1	1	0	0	0
Landfill Gas	1	0	0	0	1
TOTALS	*48*	*27*	*3*	*4*	*14*

4.7 13 of the 48 applications are based in domestic settings, these comprising 12 wind turbines and one solar application. 4 of the wind turbines have a grid connection which allows excess supply to enter the distribution network. 7 applications were non domestic and each has a grid connection. These comprise 6 wind turbines and 1 CHP plant. 3 wind turbines and a biomass plant are used to supply power to educational establishments. There are 24 further applications, which comprise a mix of refused applications, withdrawn applications and applications on which there is no further information at present. A number of the refusals have been made on landscape grounds, including in some instances impact on nearby National Park locations. Some of the wind turbine applications include information on anticipated generating capacity, but this information was not available with all such applications. None of the applications for other renewable energy technolgies included information on anticipated generating capacity. In that context, it is difficult to be certain about the overall contribution that the consented renewable energy proposals would make.

4.8 An overview of the purpose of the renewable technologies is summarised below, with additional detail presented in the Appendix. Where known, the Appendix also records anticipated generating capacity.

Renewable Technology	*Domestic*	*Domestic and grid connected*	*Non domestic and grid connected*	*Education facility supplies*	*No inform-ation*	*N/A or refused or with-drawn*
Wind Turbines	8	4	6	3	5	14
CHP	0	0	1	0	0	0
Solar	1	0	0	0	0	4
Biomass	0	0	0	1	0	0
Landfill Gas	0	0	0	0	0	1
TOTALS	*9*	*4*	*7*	*4*	*5*	*19*

Residential developments

4.9 The predominant technology for residential settings are small scale wind turbines and solar panels. This is reflective of the cost of installation, size of the technology, scale of energy production and general public acceptance of this type of small-scale installation.

Non-residential developments

4.10 No site for wind turbines in the plan area currently exceeds 3 turbines. The 6 turbines in operation in non-domestic settings are grouped in collectives of 3 and 2 turbines respectively, with one additional stand alone turbine.

4.11 3 turbines are used to supply educational facilities, alongside a biomass plant. The CHP plant is stand alone to supply one of the refineries, with excess supply being exported to the National Grid.

Summary of existing renewable energy capacity in the plan area

4.12 The primary source of renewable energy in the plan area (Pembrokeshire excluding the National Park) is wind which is a popular choice for domestic and non domestic settings. The use of renewable energy is growing in popularity, and applications have been increasing steadily since 2004, albeit that application numbers are still modest.

Marine renewable projects in development

Tidal sea farm:

4.13 The UK's first deep-sea tidal-energy farm is to be built off the Pembrokeshire coast by E.ON and Lunar Energy. Located off St. David's Head eight underwater turbines, each 25 metres long and 15 metres high are to be installed. The landfall infrastructure is to be located at St. Justinians in the Pembrokeshire Coast National Park and will connect to the existing electrical grid network. The planning and consenting process is already underway (involving the Pembrokeshire Coast National Park Authority in their role as Planning Authority) and the farm is expected to be operational by 2011.

Milford Haven wave dragon:

4.14 The current prototype is moored some 2 – 3 miles off St Ann's Head and is a floating slack moored wave energy converter with a rated capacity of 4-7MW. It allows ocean waves to overtop a ramp which elevates water to a reservoir above sea level. This creates a 'head' of water which is subsequently released through a number of turbines and in this way transformed into electricity. Water is returned to the sea via vents in the base of the unit.

4.15 To date following measures have been installed into public buildings within Pembrokeshire County Council's remit:

- Biomass wood fuel heating systems (carbon dioxide neutral);
- High efficiency condensing boilers;
- Replacement of obsolete air handling units with modern ultra efficient air handling units;
- Heat recovery;
- Heating controls and zoning of heating systems;
- Rainwater harvesting;
- Water boreholes;
- Low volume water use technologies, including waterless urinals, infra red controlled taps, spray taps, push taps and low volume cisterns;
- Photovoltaic micro electricity generation;
- Solar hot water systems;
- Wind energy (small scale), with research into potential for larger scale wind power being evaluated;
- Natural ventilation in lieu of air conditioning;
- Use of sustainable materials (e.g. flax/hemp/recycled cotton insulation);
- Lighting control and low energy lighting;
- Combined heat and power (CHP);
- Building energy management systems (BMS);
- Swimming pool covers; and
- The sourcing of electricity for use in public buildings that has been generated from clean and green sources.

Renewable energy installations in public buildings in Pembrokeshire:

4.16 Specific examples of renewable energy installations in public buildings within Pembrokeshire include:

<u>Solar hot water:</u>

Coastlands (St Ishmaels) School
Spittal CP School
Greenhill School 6th Form Centre
Prendergast New School
Scolton Manor Visitors Centre
Neyland New School (under construction)
Fishguard New School (under construction)

<u>Solar photovoltaic (PV) electricity panels:</u>

Tavernspite CP School
Ysgol Bro Gwaun
Scolton Manor Visitors Centre

Small wind turbine:

Scolton Manor Visitors Centre

Biomass wood pellet boilers:

Crymych CP
Ysgol y Preseli
Spittal CP
Haverfordwest New Leisure Centre
Pembrokeshire Technium at the Science and Technology Park, Pembroke Dock

Mini PV/wind turbine powered streetlights:

Narberth New CP School
Prendergast New CP School

Lake cooling

Pembrokeshire Technium at the Science and Technology Park, Pembroke Dock

Mini CHP (Combined Heating and Power):

Crymych Leisure Centre
Portfield New School
Neyland New School (under construction)
Fishguard New School (under construction)

4.17 The Community Energy Network of Pembrokeshire has compiled a Renewable Installation Map of the County to identify current renewable energy installations. The Map also presents Case Studies of certain significant installation projects. These range from Pembrokeshire County Council's school and leisure installations, which have greatly reduced carbon emissions, to individual homes that have reduced their carbon footprint.

4.18 A link to the map of existing renewable installations in Pembrokeshire is available (http://www.planed.org.uk/leaderplus/energy_map.htm).

5 Recommendations from the Welsh Assembly Government's Practice Guidance: Pilot Study – Pembrokeshire County Council Renewable Energy Assessment (July 2010)

5.1 The Pilot Study PCC Renewable Energy Assessment was published by the Welsh Assembly Government in July 2010 and included the following proposals:

- That the Council could use the REA to inform LDP site selection processes and allocations;
- That area-wide renewable energy targets could be considered;
- That some sites for stand-alone renewable energy development could be identified (for either stand alone renewable energy schemes or for major new developments incorporating renewable energy technologies); and
- That some policy mechanisms to support the development of District Heating Networks for strategic sites could be identified.

Potential use of the toolkit as a means of selecting candidate sites for allocations depending on proximity to existing heat sources or potential for renewable energy

5.2 The findings of the study were provided at too late a date to enable its consideration in the development of Pembrokeshire County Council's strategy and site selection process for the Local Development Plan. Whilst the LDP strategy should be developed in the context of reducing the impact of and mitigating against climate change, it should also take into consideration a variety of issues such as housing demand, social requirements (for example a need for affordable housing), levels of existing services and existing infrastructure.

Consideration of the use of area-wide renewable energy targets

5.3 The study identified what it believed was the total potential capacity for different types of renewable energy in Pembrokeshire for both electricity and heat. This included renewable energy from a range of sources. This potential capacity was compared with current levels of provision. Possible targets for 2020 based on different levels of uptake with capacity were proposed:

Table P1.1: Resource summary for renewable energy for the Pembrokeshire County Council area

Energy type	*Capacity factor*	*Potential accessible resource*		*Current installed capacity*		*Target scenarios for 2020*			
		MWe	*GWh*	*MWe*	*GWh*	*MWe*	*GWh*	*MWe*	*GWh*
Onshore wind	0.27	30.4	64.3	3.2	7.6	13.5	31.9	20.3	48.0
Energy crops	0.90	14.0	110.4	-	-	7.0	50.4	10.5	75.6
Energy from Waste	0.90	-	-	-	-	-	-	-	-
Landfill gas	0.60	1.7	8.9	1.7	8.9	1.7	8.9	1.7	8.9
Anaerobic digestion	0.90	1.8	14.2	-	-	0.9	7.1	0.9	7.1
Sewage gas	0.42	0.3	1.0	0.1	0.4	0.1	0.4	0.3	1.1
Hydro power	0.37	0.1	0.3	0.1	0.3	0.1	0.3	0.1	0.3
Building integrated	0.10	12.9	11.3	0.1	0.1	6.4	5.6	9.7	8.5
Total	-	58.0	210.4	5.2	17.3	29.7	104.6	43.5	149.5
Local authority electricity demand projected in 2020							*1,039.0*	-	*1,039.0*
Percentage electricity demand in 2020 potentially met by renewable energy resources							*10.1%*	-	*14.4%*

(Source: Pilot Study – PCC REA, July 2010)

Table P1.2: Resource summary for renewable heat for the Pembrokeshire County Council area

Energy type	*Load factor*	*Potential accessible resource*		*Current installed capacity*		*Target scenarios for 2020*			
		MWt	*GWh*	*MWe*	*GWh*	*MWt*	*GWh*	*MWt*	*GWh*
Biomass CHP or large scale heat only (energy crops/AD)	0.5	32.0	140.2	1.6	7.0	16.0	70.1	24.0	105.1
Heat from energy from waste (CHP or heat only)	0.5	11.6	50.8	-	-	5.8	25.4	8.7	38.1
Building integrated (solar water heating, biomass boilers, heat pumps)	0.2	10.7	18.7	1.5	2.6	5.3	9.3	8.0	14.0
Total	-	54.3	209.7	3.1	9.6	27.1	104.8	40.7	157.2
Local authority electricity demand projected in 2020						-	*7,915.0*	-	*7,915.0*
Percentage electricity demand in 2020 potentially met by renewable energy resources						-	*1.3%*	-	*2.0%*

(Source: Pilot Study – PCC REA, July 2010)

5.4 The study highlighted the need for scenarios and summary tables to be tested with stakeholders in order to test key assumptions. It states that in using the tables the technology mix for each target should not be interpreted as targets for each technology. The technology breakdown is used only to demonstrate that an overall target is deliverable and only the overall target (for either heat or electricity) will be used in any planning document.

5.5 As an element of the identification of the potential accessible resource for different types of renewable energy, Aecom has identified potential locations for wind farms in Pembrokeshire. In so doing, Aecom have not been constrained by the guidance in Welsh Assembly Government Technical Advice Note 8. TAN 8 places Pembrokeshire outside the Strategic Search Areas for wind farms. The sites in the Aecom study were also identified without testing for impacts on landscape or habitats.

5.6 As no detailed landscape assessments were used by Aecom and the proposals do not fit in with current national planning policy guidance, Pembrokeshire County Council has concerns as to the robustness of the figures surrounding the wind resource capacity. A preliminary assessment by the Council of the seven areas identified as having potential for wind farms by Aecom indicates that a) one area is also within a Landmap area classified as 'outstanding / high' in visual sensory terms and b) every area is within at least one Landmap area classified as 'high' – six of the sites are classified as 'high' for cultural landscape, two are classified as 'high' for geological landscape and two are classified as 'high' for historic landscape.

5.7 These concerns, combined with a lack of time in which to properly engage and consult with stakeholders over potential targets for heat and electricity mean that targets for renewable energy for electricity or heat will not be included within the Deposit Local Development Plan. Further work on capacity (particularly for wind) will be undertaken (including engagement with stakeholders) to examine the feasibility of identifying a target figure for plan monitoring purposes and for the first review of the Plan.

Identification of sites for stand-alone renewable energy development schemes and / or sites for major new developments that could incorporate renewable energy technologies

5.8 The study proposes that the Local Authority should conduct further work on these aspects of renewable energy. It suggests that this could include evaluation of the least constrained areas for wind developments, taking into consideration landscape sensitivity and wind speed. The Council has concerns that the study has not paid due regard to Technical Advice Note 8 and does not accept that Pembrokeshire is appropriate for large wind farm proposals. However, it believes that in accordance with TAN 8, the plan area may be able to accommodate smaller-scale proposals. The study also suggests that the Local Authority should produce guidance on locating biomass generation plants and energy from waste plants. The LDP includes an allocation for an 'Energy from Waste' facility and has a policy framework to enable the assessment of 'Energy from Waste' and biomass-related proposals.

Identification of policy mechanisms to support the development of District Heating Networks on some large development sites

5.9 The main focus of the study in relation to potential District Heating Networks has been to identify potential opportunities to connect to the key anchor heat loads that are likely to be provided by selected larger development sites of the Local Development Plan. However, not all the sites identified by the Aecom study are considered by the Council to be required and / or suitable for LDP allocations, although several of them are identified for future development. A further complication is that the Slade Lane housing allocation sites of the Joint Unitary Development Plan for Pembrokeshire (which are carried forward into the LDP) now also have planning permission.

5.10 Notwithstanding the comments in the paragraph above, proposals to incorporate District Heating Networks into new developments at the sites identified in the Aecom study that are also incorporated into the Local Development Plan as allocations will be welcomed. On those sites where planning consents are in place prior to the adoption of the Local Development Plan, the Supplementary Planning Guidance will nonetheless include references to the potential for incorporating District Heating Networks, so that if consents lapse without implementation and then come forward for renewal, or alternatively where consents are re-negotiated, consideration can be given to the installation of District Heating Networks, in line with the identified opportunities in the study.

6. Conclusion

6.1 To date the use of renewables to produce energy for Pembrokeshire has been on a modest scale. However, the plan area provides opportunities for future generation of energy from renewable sources, building on the existing role of the County (and particularly the Milford Haven Waterway) as an energy centre. To date interest has mainly been expressed in wind turbine developments, but there are other technologies that also have potential to deliver sustainable power and heat to Pembrokeshire. On selected larger development sites of the LDP, the use of District Heating Networks will be encouraged.

Appendix – Planning applications for renewable energy in Pembrokeshire at June 2010

Table 1: Planning applications for wind turbines in Pembrokeshire

40 applications have been made
25 have been approved
2 are awaiting determination
3 have been withdrawn
10 have been refused

Application number	Development description	Decision date	Location	Decision type	Domestic or non-domestic	Capacity
04/1217/PA	6k wind turbine for on-site electricity generation (15M mast)	16/12/2005	Kilgetty	Conditionally Approved	Domestic	6k
04/1243/PA	3 blade wind turbine on 35m tubular steel tower, access road & transformer housing	26/10/2005	Hubberston, Milford Haven	Conditionally Approved	Non domestic, grid connection	---
05/0394/PA	Proposed Wind Turbine Generator	19/12/2005	Steynton, Milford Haven	Conditionally Approved	N/A (part of application above)	300kW
05/0661/PA	Erection of WT6000 Proven Wind Turbine on a 9.0m mast to provide electricity	05/12/2005	Llanwnda, Goodwick	Conditionally Approved	Domestic, Grid connection	6kW
05/0690/PA	Erection of 2 no. Wind Turbines	10/10/2005	Llandeloy, Haverfordwest	Conditionally Approved	Domestic, Grid connection	1 x 6kW 1 x 15kW
05/1039/PA	Wind turbine - up to 60m overall height	24/08/2006	Near Brawdy, Haverfordwest	Refused	N/A	500kW

Application number	Development description	Decision date	Location	Decision type	Domestic or non-domestic	Capacity
05/1416/PA	9 meter high 6Kw wind turbine for domestic electric generation	04/05/2006	Goodwick	Conditionally Approved	Domestic	6kW
06/0065/PA	Wind Turbine	08/06/2006	Treffgarne Rocks, Haverfordwest	Refused	N/A	525kW
06/0115/PA	Erection of 44m conical tower with 3 blade wind turbine generator, transformer	24/10/2006	Rhoscrowther, Pembroke	Refused	N/A	850kW
06/0196/PA	Erection of wind turbine with base 3 x 3m and height 9m	22/08/2006	Penycwm, Haverfordwest	Conditionally Approved	No information	---
06/0557/PA	Conversion of barn to dwelling and erection of wind turbine and shed for sustain	29/11/2006	Shoals Hook Lane, Haverfordwest	Refused	N/A	6kW
06/1169/PA	Domestic micro wind turbine(which will produce 1KW of electricity)	07/02/2007	Martletwy, Narbeth	Conditionally Approved	Domestic	1kW
06/1190/PA	Erection of wind turbine and mast	14/02/2007	Maidenwells, Pembroke	Refused	N/A	---
06/1687/PA	Wind Turbine	17/09/2007	Crinow, Narberth	Conditionally Approved	Domestic	---
07/0079/PA	Installation of two wind turbines	11/09/2007	Templeton, Narberth	Conditionally Approved	Non domestic, grid connection	2 x 500kW
07/0264/PA	Erection of Wind Turbine	15/08/2007	Clunderwen	Conditionally Approved	No information	---
07/0336/PA	Wind Turbine	03/08/2007	Haverfordwest	Refused	N/A	500kW

Application number	Development description	Decision date	Location	Decision type	Domestic or non-domestic	Capacity
07/0473/PA	Erection of Wind Turbine and mast	10/10/2007	Maidenwells, Pembroke	Conditionally Approved	No information	---
07/0560/PA	Wind turbine	05/09/2007	Pembroke	Withdrawn	N/A	---
07/1007/PA	Wind turbine and 2 barns	19/12/2007	Whitland	Conditionally Approved	No information	---
07/1048/PA	Erection of 6KW wind turbine at 15M height	18/12/2007	Mathry, Haverfordwest	Refused	N/A	6kW
07/1348/PA	Installation of 2 no. Vertical Axis Wind Turbines.	03/03/2008	Pembroke Dock	Conditionally Approved	Non domestic, Grid connection	---
07/1519/PA	Erection of 6kw wind turbine, 15m height (Re-siting)	14/04/2008	Mathry, Haverfordwest	Conditionally Approved	No information	6kW
07/1567/PA	Erection of wind turbine with access track, transformer housing and crane pad.	09/07/2008	Milford Haven	Conditionally Approved	Non domestic, grid connection	---
08/0005/PA	Installation of two 800Kw wind turbines (50M in height to the hub and 48M rotor	14/08/2008	Templeton, Narberth	Conditionally Approved	Non domestic, grid connection	2 x 800kW
08/0043/PA	Installation of Windsave WS1200 Micro-wind Turbine (In Retrospect)	27/05/2008	Kilgetty	Conditionally Approved	Domestic	---
08/0078/PA	Conversion of barn to dwelling and erection of wind turbine and shed for sustain	03/06/2008	Haverfordwest	Conditionally Approved	Domestic	---

Application number	Development description	Decision date	Location	Decision type	Domestic or non-domestic	Capacity
08/0118/PA	Erection of wind turbines (2 No.)	16/06/2008	Llanfyrnach	Withdrawn	N/A	---
08/0589/PA	Siting of Domestic Wind Turbine	23/09/2008	Pembroke	Refused	N/A	1kW
08/0610/PA	Erection of Wind Turbine	08/10/2008	Templeton, Narberth	Conditionally Approved	Domestic	5kW
08/0975/PA	Erection of wind turbine	22/01/2009	Clunderwen	Conditionally Approved	Domestic, Grid connection	6kW
08/1140/PA	Erection of 15m wind turbine and mast	06/05/2009	Haverfordwest	Withdrawn	N/A	---
08/1281/PA	Installation of wind turbine mounted on building	29/04/2009	Pembroke	Conditionally Approved	Education supply	12v
09/0020/PA	Erection of 50v wind turbine on 6 metre lattice tower in garden of Anchor Down	01/12/2009	Burton ferry	Refused	N/A	500W
09/0157/PA	Erection of 15kw wind turbine	02/11/2009	Haverfordwest	Conditionally Approved	Domestic, grid connection	15kW
09/0544/PA	Erection of 4 no. wind turbines (70m to hub, 105m to the tip of a rotor blade in		Llanstadwell	Awaiting determination	Non domestic, grid connection	8mW - 10mW
09/0642/PA	Erection of a 15 metre high 6KW wind turbine.	22/12/2009	Merlins Hill, Haverfordwest	Conditionally Approved	Education supply	6kW

Application number	Development description	Decision date	Location	Decision type	Domestic or non-domestic	Capacity
09/0727/PA	Erecting of 4 solar panels and domestic wind turbine.		Hook, Haverfordwest	Refused	N/A	---
09/0890/PA	Installation of 3 wind turbines with associated underground cabling	11/02/2010	Merlins Bridge	Conditionally Approved	Education supply	5,000kWh to 11,000kWh per year
09/1066/PA	Erection of a grid connected 11kw wind turbine		Whitland	Awaiting determination	Domestic	11kW

Development - wind	Numbers
Domestic	**8**
Domestic, grid connection	**4**
Non domestic, grid connection	**4**
Non domestic, no further information	**2**
Education supply	**3**
No information	**5**
N/A	**14**

Table 2: Planning application for combined heat and power plants in Pembrokeshire

1 application has been made
1 has been approved
0 are awaiting determination
0 have been withdrawn
0 have been refused

Application number	**Development description**	**Decision date**	**Location**	**Decision type**	**Domestic or non-domestic**	**Capacity**
07/1639/PA	Combined heat and power plant and associated natural gas pipeline and terminals	23/05/2008	Milford Haven Refinery, Milford Haven	Conditionally Approved	Non domestic, grid connection	---

Table 3: Planning applications for solar panels in Pembrokeshire

5 applications have been made
0 have been approved
1 is awaiting determination
1 has been withdrawn
3 have been refused

Application number	**Development description**	**Decision date**	**Location**	**Decision type**	**Domestic or non-domestic**	**Capacity**
05/0021/LB	Installation of solar panels to roof surface	18/01/2006	Fishguard	Refused	N/A	---
07/0289/LB	Installation of Solar Panels to Principal Building	07/08/2007	Pen Y Cwm, Haverfordwest	Refused	N/A	---
09/0727/PA	Erection of 4 solar panels and domestic wind turbine.	27/09/2009	Hook, Haverfordwest	Refused	N/A	---
09/1091/PA	Solar panels, erection of porch, garage & store		Wiston, Haverfordwest	Awaiting determination	Domestic	---
09/1157/PA	Solar Panels	10/03/2010	St Dogmaels	Withdrawn	N/A	---

Development	**Numbers**
Domestic	**1**
Domestic, grid connection	**0**
Non domestic, grid connection	**0**
Non domestic, no further information	**0**
Education supply	
No information	**0**
N/A	**4**

Table 4: Planning application for bio-mass in Pembrokeshire

1 application has been made
1 has been approved
0 are awaiting determination
0 have been withdrawn
0 have been refused

Application number	**Development description**	**Decision date**	**Location**	**Decision type**	**Domestic or non-domestic**	**Capacity**
09/0656/PA	Construction of new biomass boiler house and storage facilities.	14/12/2009	Pembrokeshire College, Haverfordwest	Conditionally Approved	Education supply	---

Table 5: Planning application for landfill gas in Pembrokeshire

1 application has been made
0 have been approved
0 are awaiting determination
0 have been withdrawn
1 has been refused

Application number	**Development description**	**Decision date**	**Location**	**Decision type**	**Dom/Non Dom**	**Capacity**
05/0654/PA	Change of use of part landfill to recycling of inert/demolition and construction	11/09/2006	Narberth	Refused	N/A	---

Summary of tables 1 to 5

Wind turbines in Pembrokeshire

40 applications have been made
25 have been approved
2 are awaiting determination
3 have been withdrawn
10 have been refused

Development	**Numbers**
Domestic	**8**
Domestic, grid connection	**4**
Non domestic, grid connection	**6**
Education supply	**3**
No information	**5**
N/A	**14**

Combined heat and power plants in Pembrokeshire

1 application has been made
1 has been approved

Development	**Numbers**
Non domestic, grid connection	**1**

Solar panels in Pembrokeshire

5 applications have been made
0 have been approved
1 is awaiting determination
1 has been withdrawn
3 have been refused

Development	**Numbers**
Domestic	**1**
Domestic, grid connection	**0**
Non domestic, grid connection	**0**
Education supply	**0**
No information	**0**
N/A	**4**

Bio-mass in Pembrokeshire

1 application has been made
1 has been approved

Development	Numbers
Education	1

Landfill gas in Pembrokeshire

1 application has been made
1 has been refused

Development	Numbers
N/A	1