

Sustainability Committee

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Carbon reduction: Energy generation

This paper provides some background briefing for the next stage of the committee inquiry into carbon reduction and energy generation

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1. Introduction

Energy generation - the production of electricity, heat and fuels to provide services such as lighting and transport – is one of the biggest sources of carbon dioxide (CO₂) emissions in Wales. Achieving large reductions in Welsh CO₂ emissions requires increased energy efficiency measures and a shift towards generating electricity using methods that emit lower levels, such as renewables.

Policies at the EU, UK and Welsh levels have been formulated with the aim of reducing carbon emissions: a key European target is that 20 per cent of all energies are to be supplied by renewables by 2020¹; within this the target for the UK is 15 percent by 2020. At the UK level, the target is for 10 per cent of all UK energies to be supplied by renewables by 2010. The headline target in Wales is the annual production of 4 Terawatt hours (TWh) of renewable electricity by 2010, rising to 7 TWh in 2020².

2. CO₂ Emissions from energy

Electricity generation contributed around 33.7 per cent of the total Welsh carbon dioxide emissions in 2005, which is slightly higher than the UK proportion of 31.1 per cent. Emissions from electricity generation in Wales increased by 24.8 per cent compared with a fall of 15.6 per cent in UK emissions over the period 1990 to 2005³.

Wales is a net exporter of electricity, i.e. it produces more than it uses. In 2005 Wales exported 13 per cent of its electricity to England. This fell to 11.1 per cent in 2006⁴. The majority of generation capacity is in North Wales. There are no electricity grid transmission links between North and South Wales at the moment, energy is mainly exported from North Wales whilst South Wales is a net importer of electricity.

In 2006, 7.5 per cent of electricity generated was lost⁵ through transmission, distribution and theft. In 2005, this rate was 8 per cent, 19 per cent of which was lost through high voltage transmission systems, 76 per cent through distribution and 5 per cent through theft and meter fraud⁶.

One of the factors influencing Wales' high per capita emissions is the existence of carbon-intensive electricity generators. According to 2006 data for installations captured under the EU Emissions Trading Scheme (EUETS)⁷ Aberthaw and Connah's Quay power stations accounted for 42 per cent of the emissions by the top eleven participants of the scheme in Wales. Overall, electricity generation accounted for 56 per cent of the emissions by these top eleven participants.

¹ European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 20 by 2020: Europe's climate change opportunity*, 23 January 2008, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:EN:PDF>

² Welsh Assembly Government *Planning Policy Wales, Technical Advice Note 8: Planning for renewable energy* 2005, p.5, <http://new.wales.gov.uk/desh/publications/planning/technicaladvicenotes/tan8/tan8main1e.pdf?lang=en>

³ AEA Technology, *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2005*, August 2007, p14 http://www.airquality.co.uk/archive/reports/cat07/0709180907_DA_GHGI_report_2005.pdf

⁴ DBERR, *Energy trends December 2007*, p. 18, <http://www.berr.gov.uk/files/file43304.pdf>

⁵ DBERR *Energy Trends Marc 2008* p.16 <http://www.berr.gov.uk/files/file45397.pdf>

⁶ DBERR, *Digest of United Kingdom energy statistics 2006*, http://www.dtistats.net/energystats/dukes06_c5.pdf

⁷ The EU ETS captures the largest carbon dioxide emitters in Wales. A total of 61 installations in Wales are members of the EUETS.

Table 1: Top 11 CO₂ Emitters in the EUETS in Wales

Installation Name	Installation Type	CO ₂ Emissions (tonnes)	
		2005	2006
Aberthaw Power Station	Electricity generation	5,264,973	7,340,340
Port Talbot Steelworks	Industry	6,132,851	6,589,194
Connahs Quay Power Station	Electricity generation	3,434,321	3,158,476
Chevron Limited - Pembroke	Industry	2,320,641	2,251,765
Total Milford Haven Refinery	Industry	1,038,345	1,234,371
Baglan Bay Power Station	Electricity generation	1,104,318	1,142,501
Uskmouth Power Station	Electricity generation	993,930	866,926
Deeside Power Station	Electricity generation	978,825	640,379
Padeswood Works	Industry	300,016	623,006
Shotton Combined Heat and Power Station	Electricity generation	542,497	485,252
Barry Combined Heat and Power Station	Electricity generation	321,303	237,008
Totals		22,432,020	24,569,218

Source: Environment Agency Wales

3. The Welsh Energy Mix

The current energy mix in Wales consists primarily of fossil fuel and nuclear powered centralised generating stations. In 2006, 34,914 GWh of electricity were produced in Wales, compared with 398,326 GWh for the UK overall⁸.

According to a report prepared for DEFRA, the Welsh Assembly Government, the Scottish Executive and the Northern Ireland Department of the Environment by AEA Technology in 2007⁹:

There is now only one nuclear power station in Wales whilst there has been a growth of Combined Cycle Gas Turbines stations (CCGTs) partly to replace the generating capacity from Trawsfynydd Nuclear Station, which closed in 1991. The increase in generation capacity in Wales comes from the opening of a 500 MW CCGT at Deeside in 1994, a 1,420 MW CCGT at Connahs Quay in 1996, a 250 MW CCGT at Barry in 1998, and a 575 MW CCGT at Baglan Bay in 2002. The remaining fossil fuel generation is from two conventional coal stations. One power station (oil-fired) at Pembroke has closed. The coal-fired station at Uskmouth closed and subsequently reopened as Fifoots after being upgraded and fitted with Flue Gas Desulphurisation. Aberthaw is the other conventional coal station.

⁸ DBERR, *Energy trends December 2007*, p. 19, <http://www.berr.gov.uk/files/file43304.pdf>

⁹ AEA Technology, *Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland: 1990-2005*, August 2007, p14 http://www.airquality.co.uk/archive/reports/cat07/0709180907_DA_GHGI_report_2005.pdf

Table 2: Percentage shares of electricity generation in Wales as at end 2006¹⁰

Generation method	Percentage share
Gas	40.3
Coal	25.8
Nuclear	20.1
Pumped Storage	7.6
Renewables	4.0
Other	2.2

Source: DBERR

Renewable electricity

Wales had an installed renewable electricity capacity of 543 megawatts (MW) of electricity generation in 2006¹¹. Most renewable sources are intermittent and, therefore, do not operate at their installed capacity - most operate at a percentage, which in the case of onshore wind is about 20 to 40 per cent of the installed capacity¹². By comparison, in 2006, nuclear power stations operated at a load factor of 69 per cent, combined cycle gas turbine stations at 54 per cent, and coal-fired stations at 66 per cent¹³.

The actual contribution of renewable resources to Wales's electricity production is 4 per cent (see Table 2). The 4 per cent figure accounted for 1,409 GWh, of which 275 GWh were hydropower, 867 GWh were wind and wave power, 182 GWh were landfill gas and 84GWh were other biofuels¹⁴ (see also Fig.1).

The majority of renewable electricity capacity installed in Wales is wind, followed by hydro (Fig 1). Solar photovoltaic accounts for a very small amount of generation but has grown rapidly since 2004. Based on the assumed capacity factors above, and assuming that no more renewables came online since the data were collected, the total output for renewables in 2007 was 1.787 TWh.

¹⁰ DBERR, *Energy trends*, December 2007, p. 20, <http://www.berr.gov.uk/files/file43304.pdf>

¹¹ DBERR, *Energy trends September 2007*, p16 <http://www.berr.gov.uk/files/file41460.pdf>

¹² Sustainable Development Commission. *Wind power in the UK: A guide to the key issues surrounding onshore wind power in the UK.* (May 2005) pp.17-18 http://www.sd-commission.org.uk/publications/downloads/Wind_Energy-NovRev2005.pdf

¹³ DBERR, *Digest of United Kingdom Energy Statistics 2007*, p. 136, <http://stats.berr.gov.uk/energystats/dukes07.pdf>

¹⁴ DBERR, *Energy trends*, December 2007, p. 20, <http://www.berr.gov.uk/files/file43304.pdf>

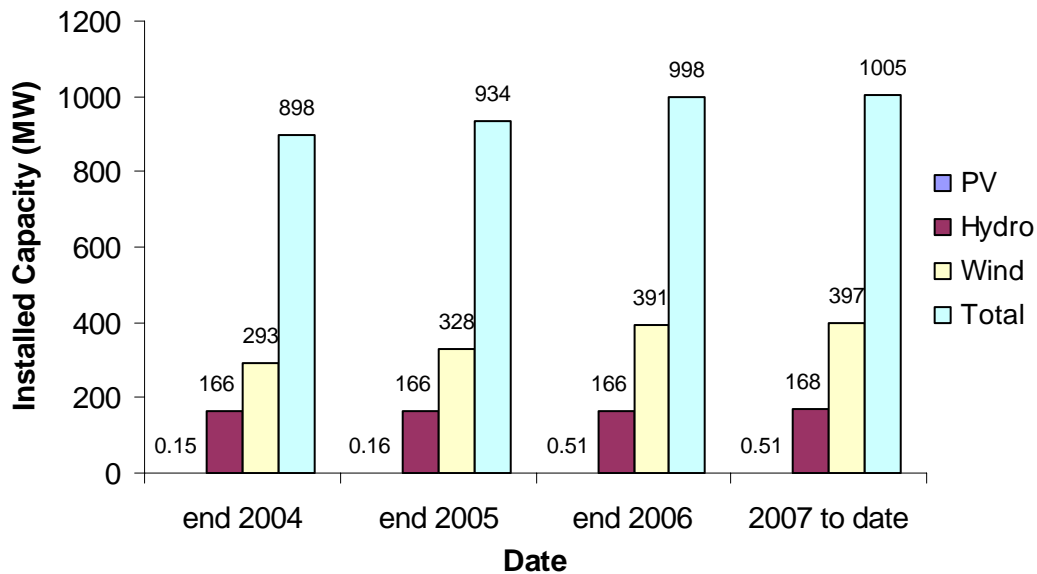


Figure 1: Growth in installed capacity electricity generation in Wales since the end of 2004.
Sources: Scottish Power Manweb and Western Power Distribution. (PV = Solar Photovoltaic)

Renewable heat

Due to the lack of a distribution network and the localised and generally small scale nature of heat generation, there are no Wales-specific data concerning the total consumption of renewable heat. The Renewable Energy Route Map for Wales highlights some of the larger biomass installations over 25 MW_{th}¹⁵ but there are a number of smaller generation devices, such as solar thermal for individual homes for which data are not available.

4. Government Policies

Welsh Assembly Government

The Welsh Assembly Government target for renewable energy is as follows¹⁶:

The Assembly Government has a target of 4TWh of electricity per annum to be produced by renewable energy by 2010 and 7TWh by 2020. In order to meet these targets the Assembly Government has concluded that 800MW of additional installed (nameplate) capacity is required from onshore wind sources and a further 200MW of installed capacity is required from off shore wind and other renewable technologies.

Figure 2 shows progress in meeting this target. This demonstrates that whilst the output from renewables is increasing, it is not currently at the rate necessary to reach the 2010 Welsh Assembly Government target.

¹⁵ Welsh Assembly Government, *Renewable Energy Route Map for Wales*. February 2008. p.11. Some of the sites are at the construction stage and are not yet operational.

¹⁶ Ibid.

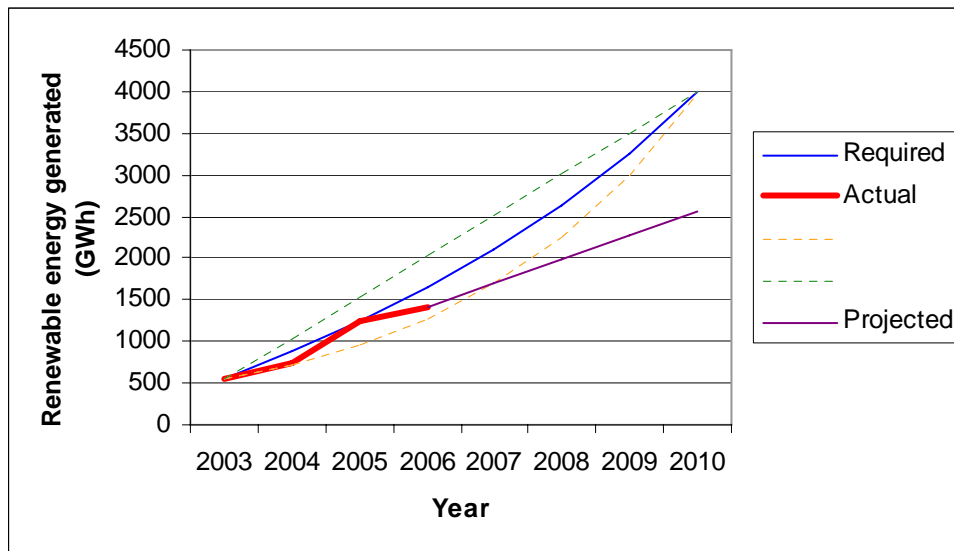


Figure 2: Progress in meeting the 4TWh target for renewable energy generation. The projection assumes that capacity will be added at the average rate from 2003-2006.

Source: DBERR

Other targets are highlighted below:

- The Welsh Assembly Government has set out a commitment to sustainable energy production which will include the drawing up of an Energy Strategy that will cover 'diversified renewable energy generation and biomass'¹⁷.
- The *Environment Strategy for Wales* includes a commitment to 'renewable and low carbon energy generation'¹⁸.
- An aim to encourage 800 MW of new on-shore wind electricity development by 2010¹⁹.
- The *Renewable Energy Route Map* sets out the Welsh Assembly Government's intention to increase renewable energy, and estimates that up to 33 TWh of electricity could be generated in Wales by 2025 with a saving of more than 14 million tonnes of CO₂²⁰.
- Support for renewables through the planning system through Technical Advice Note 8 which includes the designation of areas for onshore wind development and advice to local authorities to adopt policies to encourage the use of renewable energy²¹.
- The *Microgeneration Action Plan for Wales* contains the following targets²²:
 - To install 20,000 microgeneration heating units by 2012, with of the order of 100,000 by 2020,
 - To install 10,000 micro-electricity units by 2012, rising to numbers in the order of 200,000 by 2020, and
 - To have in place 50 combined heat and power and/or district heating systems by 2020.

¹⁷ Welsh Assembly Government *One Wales: A Progressive Agenda for the Government of Wales*, 27 June 2007.

¹⁸ Welsh Assembly Government, *Environment Strategy for Wales*, May 2006. [Link to Strategy](#)

¹⁹ Welsh Assembly Government, *Energy Wales: Route Map to a Clean, Low-Carbon and More Competitive Energy Future for Wales*, June 2005. <http://new.wales.gov.uk/docrepos/40382/4038231141/40382112412/energyroutemape.pdf?lang=en>

²⁰ Welsh Assembly Government, *Renewable Energy Route Map for Wales*, February 2008.

²¹ Welsh Assembly Government, *Planning Policy Wales Technical Advice Note 8: Planning for Renewable Energy*, July 2005.

²² Welsh Assembly Government, *Microgeneration Action Plan for Wales*, March 2007.

<http://new.wales.gov.uk/docrepos/40382/4038231141/40382112413/plane.pdf?lang=en>

UK Government

The majority of UK Government's policies are contained in the Energy White Paper²³ and supporting documents:

- Ten per cent of the UK electricity demand to be supplied through renewables by 2010.
- A strengthening of the Renewables Obligation up to 20 per cent. Additionally the RO scheme will be banded so that a mixture of renewable technologies are supported, not merely the least expensive²⁴.
- Planning reforms to reduce obstacles to renewables²⁵.
- The continuation of the Low Carbon Buildings Programme with an extra £50 million announced in 2006 to provide grants to householders and organisations to install microgeneration technologies²⁶.
- Removal of current barriers to the connection of microgeneration installations to the National Grid (working with Ofgem and National Grid UK).
- Increased public sector involvement with the private sector to increase research and development of low carbon technologies²⁷
- Combined Heat and Power (CHP) installations are to be exempted from the climate change levy and reformed planning guidance will increase the consideration given to CHP in new planning applications²⁸.
- The establishment of the Energies Technologies Institute to be 50:50 funded between the public and private sector with £600 million²⁹. Full operation was announced on 17 December 2007³⁰.

In addition, the UK Government's White Paper on Nuclear Power states³¹:

"The Government believes new nuclear power stations should have a role to play in this country's future energy mix alongside other lowcarbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate this".

Europe

- A binding target of a 20 per cent share of renewable energies of overall EU consumption by 2020³².
- To cut greenhouse gases by at least 20 per cent by 2020 and by 30 per cent in the context of a comprehensive international agreement³³.

²³ The Stationery Office, *Energy White Paper: Our Energy Challenge – Creating a Low Carbon Economy*, (February 2003).

²⁴ The Stationery Office, *The Energy Bill*, January 2008. <http://www.publications.parliament.uk/pa/cm200708/cmbills/053/2008053.pdf>

²⁵ *The Planning Bill*, Bill 71 2007-08

²⁶ HM Government, *Climate Change the UK Programme*, March 2006
<http://www.defra.gov.uk/environment/climatechange/uk/ukccp/pdf/ukccp06-all.pdf>

²⁷ The Stationery Office, *Meeting the Energy Challenge – A White Paper on Energy*, May 2007. pp. 216-234.
<http://www.berr.gov.uk/files/file39387.pdf>

²⁸ *ibid.* p. 13.

²⁹ Department of Trade and Industry, *Energy Technologies Institute Prospectus*, September 2006.
http://www.energytechnologies.co.uk/assets/files/ETI_Prospectus.pdf,

³⁰ Energies Technologies Institute website <http://www.energytechnologies.co.uk/>

³¹ Department for Business, Enterprise and Regulatory Reform *Meeting the Energy Challenge: A white paper on nuclear power* January 2008 <http://www.berr.gov.uk/files/file43006.pdf>

³² European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 20 20 by 2020: Europe's climate change opportunity*, 23 January 2008, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0030:FIN:EN:PDF>

³³ *ibid.* p. 5.

- Increased support for renewable technology development through the Directive on Electricity Production from Renewable Energy Sources³⁴.

5. Devolved responsibilities

Legislative Competence

Energy does not appear as a separate field in Schedule 5 of the *Government of Wales Act 2006*. The following are all UK Government reserved matters:

- oil and gas (apart from pollution);
- the generation (>50MW), transmission and supply of electricity (apart from pollution);
- energy conservation (apart from the encouragement of energy efficiency otherwise than by prohibition or regulation).

Electricity Consents

Planning application consents for all applications under 50MW rests with local authorities in Wales. At present, responsibility for consenting to power stations with a generating capacity of greater than 50 MW in Wales and England rests with the Secretary of State for Business, Enterprise and Regulatory Reform under the provisions of Section 36 of the *Electricity Act 1989*. The Welsh Assembly Government is a formal consultee in the consents process but has no statutory role in the final decision.

The *UK Planning Bill*³⁵ proposed a reform of planning for nationally significant infrastructure projects, including energy projects above 50 MW and major gas infrastructure projects in Wales and England. An independent Infrastructure Planning Commission will make decisions on nationally significant infrastructure projects.

The threshold for consents for installations offshore differs, in that the Welsh Assembly Government can only consent to developments under 1 MW. Some changes have also been proposed under the *Draft Marine and Coastal Access Bill*³⁶, including the creation of a Marine Management Organisation which would have a lead role in consenting applications in Welsh offshore waters between 1 – 100 MW. Table 3 outlines the current and proposed consents powers.

³⁴ European Commission, *Directive 2001/77/EC of The European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market*, (September 2001) http://eur-lex.europa.eu/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf

³⁵ UK Planning Bill <http://services.parliament.uk/bills/2007-08/planning.html>

³⁶ Draft Marine Bill <http://www.defra.gov.uk/marine/legislation/index.htm>

Table 3: Proposed Consent Bodies for Electricity Installations

Installation size	Current consent body	Proposed consent body
Nationally Significant Infrastructure	Secretary of State for Business, Enterprise and Regulatory Reform	Infrastructure Planning Commission
> 50 MW onshore	Secretary of State for Business, Enterprise and Regulatory Reform	Infrastructure Planning Commission
< 50 MW onshore	Local Authorities	Local Authorities
> 100 MW offshore	Secretary of State for Business, Enterprise and Regulatory Reform	Infrastructure Planning Commission
1 - 100 MW offshore	Secretary of State for Business, Enterprise and Regulatory Reform & Welsh Assembly Government	Marine Management Organisation & Welsh Assembly Government
< 1 MW offshore	Welsh Assembly Government	Welsh Assembly Government

Infrastructure Planning Commission: proposed by the UK Planning Bill

Marine Management Organisation: proposed by the Draft Marine and Coastal Access Bill

For offshore installations, the Welsh Assembly Government's role is in providing licences under the *Food and Environmental Protection Act 1985* and the *Coast Protection Act 1949*

The Minister for Environment, Sustainability and Housing has indicated on several occasions that it is the position of the Welsh Assembly Government that responsibility for determining applications for generating stations greater than 50MW onshore and up to 100MW offshore³⁷ should come to Wales.

³⁷ Sustainability Committee, 4 June 2008, p20 <http://www.assemblywales.org/bus-home/bus-committees/bus-committees-third1/bus-committees-third-sc-home/bus-committees-third-sc-agendas/sc20080604qv.pdf?langoption=3&ttl=SC%283%29-12-08%20%3A%20Transcript%20%28PDF%2C%20187kb%29>