

Renewable Energy in Ireland

2007 UPDATE



Renewable Energy in Ireland

2007 Update

Report prepared by
Fergal O' Leary, Martin Howley and Dr. Brian Ó Gallachóir

August 2007

Sustainable Energy Ireland (SEI)

Sustainable Energy Ireland was established as Ireland's national energy agency under the Sustainable Energy Act 2002. SEI's mission is to promote and assist the development of sustainable energy. This encompasses environmentally and economically sustainable production, supply and use of energy, in support of Government policy, across all sectors of the economy including public bodies, the business sector, local communities and individual consumers. Its remit relates mainly to improving energy efficiency, advancing the development and competitive deployment of renewable sources of energy and combined heat and power, and reducing the environmental impact of energy production and use, particularly in respect of greenhouse gas emissions.

SEI is charged with implementing significant aspects of government policy on sustainable energy and the climate change abatement, including:

- Assisting deployment of superior energy technologies in each sector as required;
- Raising awareness and providing information, advice and publicity on best practice;
- Stimulating research, development and demonstration;
- Stimulating preparation of necessary standards and codes;
- Publishing statistics and projections on sustainable energy and achievement of targets.

It is funded by the Government through the National Development Plan with programmes part financed by the European Union.

Energy Policy Statistical Support Unit (EPSSU)

SEI has a lead role in developing and maintaining comprehensive national and sectoral statistics for energy production, transformation and end use. This data is a vital input to meeting international reporting obligations, for advising policy makers and informing investment decisions. Based in Cork, EPSSU is SEI's specialist statistics team. Its core functions are to:

- Collect, process and publish energy statistics to support policy analysis and development in line with national needs and international obligations;
- Conduct statistical and economic analyses of energy services sectors and sustainable energy options;
- Contribute to the development and promulgation of appropriate sustainability indicators.

© Sustainable Energy Ireland

Reproduction of the contents is permissible provided the source is acknowledged.

Highlights

- In 1990 renewable energy was responsible for 1.9% of primary energy requirement for electricity (all from hydro power). By 2006, the share of renewables had increased to 4.5%, an increase of 287% in absolute terms (8.8% average annual growth).
- The 4.5% share in 2006 comprises wind (2.7%) and hydro (1.2%), with the remainder coming from landfill gas, biogas and biomass CHP.
- Electricity demand by final customers in Ireland grew by 118% (5% average annual growth) over the period 1990 to 2006.
- Final consumption of electricity increased by 6.4% in 2006.
- The total contribution from renewable energy to gross electrical consumption in 2006 was 8.6% (compared with 6.8% in 2005 and 4.9% in 1990).
- Wind and hydro energy in 2006, respectively, accounted for 5.6% (4.0% in 2005) and 2.5% (2.3% in 2005) of Ireland's gross electrical consumption while landfill gas was responsible for 0.38% (0.38% in 2005).
- Total electrical output from wind in 2006 was 1,622 GWh representing an increase of 46% on 2005.
- The total installed capacity of wind farms in Ireland (April 2007) was 782 MW_e an increase of 58% (288 MW_e) on the end of 2005.
- In 2006 electrical output from hydro was 724 GWh an increase of 3.9% on 1990.
- The electrical output from landfill gas in 2006 was 108 GWh, an increase of 2% on 2005.

Table of Contents

- 1 Introduction 4**
- 2 Context for Renewable Electricity Deployment..... 5**
- 3 Policy Developments..... 7**
 - 3.1 European Council Energy Action Plan.....7
 - 3.2 Energy White Paper –Delivering a Sustainable Energy Future for Ireland.....7
 - 3.3 National Climate Change Strategy 2007 - 2010 8
- 4 Renewable Energy Contribution to Ireland’s Electricity Requirements..... 9**
- 5 Individual Renewable Energy Sources 10**
 - 5.1 Wind.....10
 - 5.2 Hydro11
 - 5.3 Landfill Gas.....12
- Glossary of Terms 14**

1 Introduction

This report examines the contribution made by renewable energy to Ireland's electricity requirements for the period 1990 to 2006 with a particular focus on production data in 2006 and capacity data and relevant policy developments in 2005 to 2007. This update should be read in conjunction with a report published in August 2004 entitled, "*Renewable Energy in Ireland Trends and Issues 1990 – 2002*". This is the second in a planned series of updates and follows "*Renewable Energy in Ireland 2005 Update*".

This update focuses on electricity only. Updated information on other renewable energy used for heating and transport will be included in *Energy in Ireland 1990 to 2006*, due for publication in November following the finalising of the national energy balance.

The report is structured as follows:

- Section 2 provides the context for renewable electricity deployment, examining recent energy trends in electricity generation.
- Section 3 explores the major policy developments relevant to renewable electricity at a national and European level.
- Section 4 analyses the total contribution made by renewable energy to meeting Ireland's demand for electricity.
- Finally, section 5 assesses recent trends for individual renewable electricity sources.

The national energy balance data presented in this report are the most up-to-date at the time of writing. The national energy balance is updated whenever more accurate information is known. To obtain the most up-to-date figures visit the statistics section of the SEI website³.

Feedback and comment on the report are welcome and should be addressed by post to the address on the rear cover or by email to "epssu@sei.ie".

¹ Available from www.sei.ie

² Ibid.

³ Ibid.

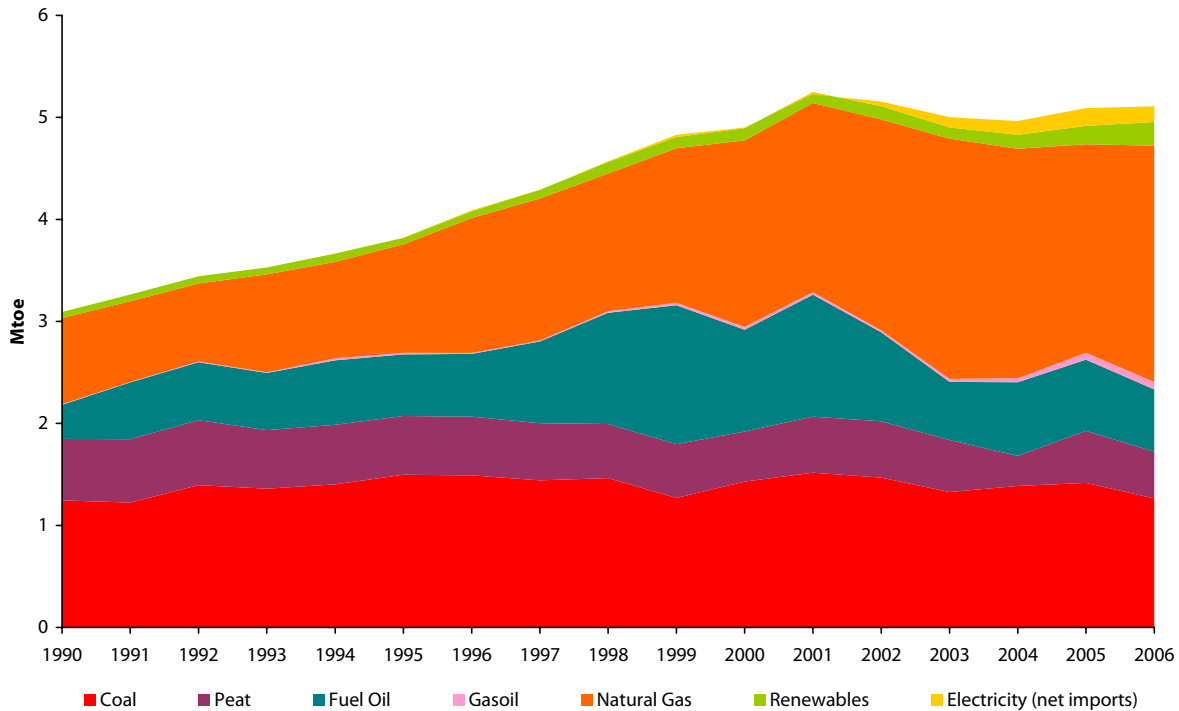
2 Context for Renewable Electricity Deployment

This section outlines the energy context within which renewable electricity trends are assessed. These trends are discussed in more detail for the period 1990 to 2005 in a separate SEI publication⁴.

Electricity demand⁵ by final customers in Ireland grew by 118% (5% average annual growth) over the period 1990 to 2006. Final consumption of electricity increased by 6.4% in 2006.

The primary fuels used to meet this demand are shown in Figure 1 and Table 1.

Figure 1 Primary Fuel Mix for Electricity Generation



Source: SEI

The primary fuel requirement for electricity generation grew by 65% (3.2% annual growth) from 3.1 million tonnes of oil equivalent (Mtoe) in 1990 to 5.1 Mtoe in 2006. Growth in 2006 was 0.7%. The increasing share of gas in the total is evident from Figure 1 and Table 1, in particular since 2001⁶. In 1990 gas was responsible for 27% of the total; this has risen to 45% in 2006. Over the same period usage of coal and peat declined from 40% and 20% respectively to 24% and 9%.

In 1990 renewable energy was responsible for 1.9% of primary energy requirement for electricity (all from hydro power). By 2006, the share of renewables had increased to 4.5%, an increase of 287% in absolute terms (8.8% annual growth). The 4.5% share comprises wind (2.7%) and hydro (1.2%), with the remainder coming from landfill gas, biogas and biomass CHP, see section 4.

⁴ SEI, 2006. *Energy in Ireland – Trends, issues and indicators 1990 – 2005*. Available from www.sei.ie

⁵ Note that 2006 figures are provisional.

⁶ Between 2001 and 2003 electricity demand increased by 9.6% while the primary energy requirement for electricity decreased by 4.3% due largely to the introduction of two CCGT plants that raised the overall electricity generation efficiency.

Table 1 Growth Rates and Shares of Electricity Generation Fuel Mix

	Growth %	Average annual growth rates %					Shares %	
	1990 – '06	1990 – '06	1990 – '95	1995 – '00	2000 – '06	2006	1990	2006
Fossil Fuels (Total)	56.0	2.8	4.4	4.9	-0.2	-0.3	98.1	92.5
Coal	1.6	0.1	3.8	-0.9	-2.0	-10.7	40.3	24.7
Peat	-24.2	-1.7	-1.0	-3.1	-1.2	-10.4	19.5	8.9
Oil (Total)	103.1	4.5	12.9	10.7	-6.5	-10.5	11.0	13.5
Fuel oil	82.9	3.8	12.6	10.5	-7.9	-12.4	10.8	11.9
Gas oil	933.3	15.7	16.5	13.3	17.1	9.3	0.2	1.5
Gas	174.7	6.5	4.7	11.5	4.0	13.3	27.3	45.3
Renewables (Total)	287.1	8.8	0.9	13.4	12.0	29.1	1.9	4.5
Hydro	3.9	0.2	0.5	3.5	-2.6	14.7	1.9	1.2
Wind	-	-	-	72.4	37.1	45.9	0.0	2.7
Combustible Fuels (Total)	57.0	2.9	4.4	5.1	-0.2	-0.3	98.1	93.1
Electricity Imports	-	-	-	45.6	62.1	-13.0	0.0	3.0
Total	65.4	3.2	4.3	5.2	0.7	0.3	100.0	100.0

Source: SEI

3 Policy Developments

This section outlines the key renewable electricity policy changes and developments that have occurred since the publication of SEI's *Renewable Energy in Ireland – 2005 Update*.

3.1 European Council Energy Action Plan

The European Spring Council (conclusions published on March 9th 2007⁷) adopted a comprehensive Energy Action Plan based on the European Commission's Communication⁸ *"An Energy Policy for Europe"* that included ambitious targets for renewable energy (in addition to targets for energy efficiency and greenhouse gas emission reductions). The Council endorsed a binding target of a 20% share of renewable energies in overall EU energy consumption by 2020.

Regarding how this EU binding target will be distributed across the Member States and across the renewable energy sectors (electricity [RES-E], heating and cooling [RES-H] and transport⁹ [RES-T]), the Council requested that the Commission prepare a coherent framework (with Member States' full involvement) which could be established on the basis of a Commission proposal in 2007 for a new comprehensive directive on the use of all renewable energy sources.

While the Council did not specify individual sectoral targets to achieve the 20% renewable energy penetration (from less than 7% currently), The Commission's *Renewable Energy Road Map*¹⁰ suggests a route to deliver the overall target that comprises a 34% target for electricity from renewable sources (from 15% currently), 18% share of heating (from 9% currently) and cooling and 14% share of transport fuels, all by 2020.

3.2 Energy White Paper –Delivering a Sustainable Energy Future for Ireland

On the 12th March 2007, An Taoiseach Bertie Ahern TD and Noel Dempsey TD, Minister for Communications, Marine and Natural Resources launched the Government's Energy White Paper¹¹. The White Paper sets out the energy policy directions and targets for Ireland to 2020.

The following key targets with regard to renewable electricity were set:

- 15% of Ireland's gross electricity consumption from renewable sources to be achieved by 2010,
- 30% biomass co-firing at three State owned peat power generation stations to be achieved by 2015,
- 33% of Ireland's gross electricity from renewable sources to be achieved by 2020,
- 500 megawatt (MW) installed ocean energy capacity to be installed by 2020 and
- 400 MW CHP with particular emphasis on biomass fuelled CHP to be achieved by 2010 and 800 MW by 2020.

Also relevant from the White Paper are statements related to increased interconnection capacity and the Government made a commitment to deliver:

- a second North South electricity interconnector by 2011 which will more than double the existing cross border electricity transfer capacity to over 680 MW and
- an East-West electricity interconnector no later than 2012 which will provide 500 MW of capacity and which will remain in State ownership vested in EirGrid.

This increased interconnection should facilitate the increased deployment of renewable electricity generation.

Finally, there are a number of commitments to measures and supports in the White Paper that will impact on renewable electricity generation, namely to

- continue and extend the REFIT electricity support scheme to deliver the 2010 target including encompassing co-firing,

⁷ Available from http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/93135.pdf

⁸ Commission of the European Communities, 2007, An Energy Policy for Europe COM (2007) 1 Final. Available from http://ec.europa.eu/energy/energy_policy/doc/01_energy_policy_for_europe_en.pdf

⁹ The Council set a binding minimum biofuels target of 10% of all transport petrol and diesel to be achieved by all Member States by 2020.

¹⁰ Commission of the European Communities, 2007, Renewable Energy Road Map COM (2006) 848 Final. Available from http://ec.europa.eu/energy/energy_policy/doc/03_renewable_energy_roadmap_en.pdf

¹¹ The full text of the White Paper is available at <http://www.dcmnr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm>.

- support for research, development, commercialisation and technology transfer as well as grid connections and planning issues for offshore wind, ocean technologies and biomass,
- ensure the necessary transmission system planning and development in support of renewables by Eirgrid and SONI and the Regulators in the all-island framework ,
- set a target for biomass co-firing at Moneypoint coal power station,
- limit Ireland's relative dependence on natural gas to approx 50% by 2020,
- set an all-island target for renewables together with relevant NI Authorities and
- review the options for a consistent approach to supporting renewable energy in the all-island framework.

3.3 National Climate Change Strategy 2007 - 2010

The National Climate Change Strategy (NCCS) 2007 - 2012, published on the 2nd April 2007¹² follows on from the first national strategy, published in 2000 and reviewed in 2002. The Strategy details the measures by which Ireland will meet its Kyoto 2008 - 2012 commitment. It also outlines how the measures will position Ireland for the post 2012 period.

With regard to renewable electricity production the NCCS states that *"electricity generation from renewable sources provides the most effective way of reducing the contribution of power generation to Ireland's greenhouse gas emissions"*. It is forecast that an annual emissions savings of 1.47 million tonnes (Mt) of carbon dioxide (CO₂) will be achieved on foot of the Government's 15% target for 2010 and annual savings of 3.26 Mt with 33% renewable electricity by 2020.

¹² Available from <http://www.environ.ie/en/PublicationsDocuments/FileDownload,1861,en.pdf>.

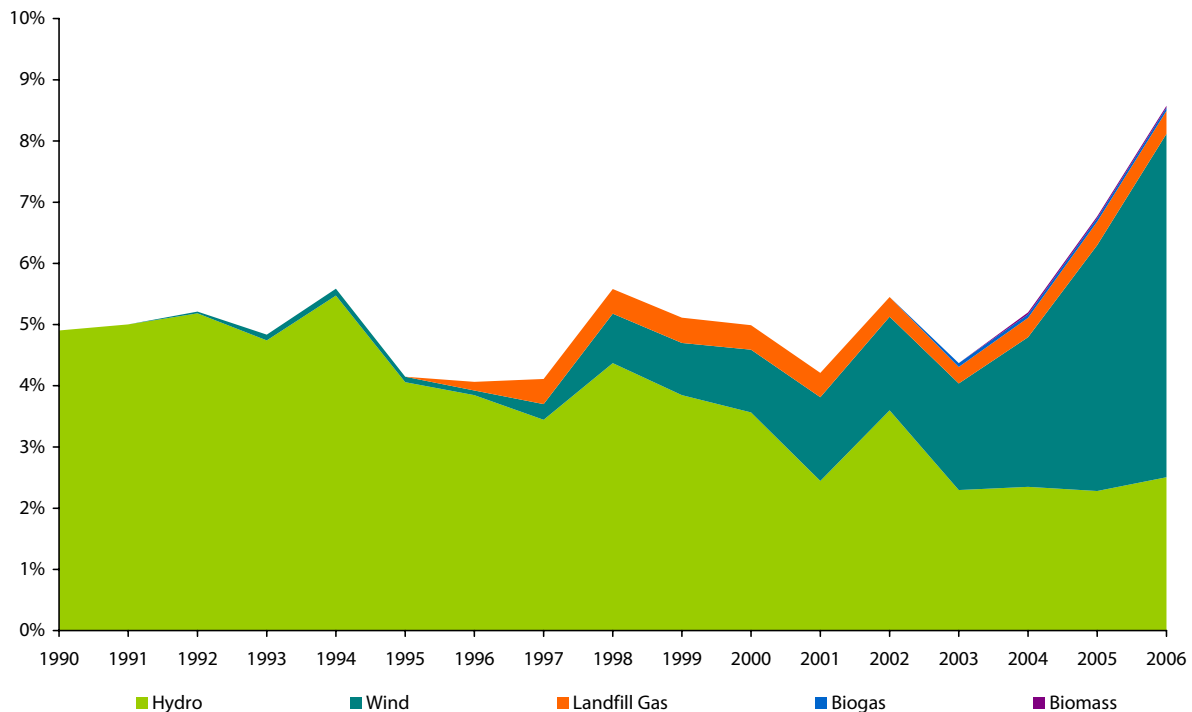
4 Renewable Energy Contribution to Ireland's Electricity Requirements

This section examines in detail the contribution made by renewable energy to Ireland's electricity supply. While section 2 focussed on the primary energy inputs to electricity generation, the analysis here is based on shares of electricity generated by fuel. Figure 2 graphs the electricity generated from renewable energy as a proportion of Ireland's gross electricity consumption¹³ in the period 1990 to 2006, showing the contribution from the individual renewable energy sources.

While the share from hydro has declined, Figure 2 and Table 2 show how the electricity production contribution from wind energy and landfill gas has increased. There was also a small contribution from waste water biogas (0.06%) from 2003 and from biomass CHP (0.03%) since 2004. Wind and hydro energy in 2006, respectively, accounted for 5.6% (4.0% in 2005) and 2.5% (2.3% in 2005) of Ireland's gross electrical consumption while landfill gas was responsible for 0.38% (0.38% in 2005).

The total contribution from renewable energy to gross electrical consumption in 2006 was 8.6% (compared with 6.8% in 2005 and 4.9% in 1990).

Figure 2 Renewable Energy Contribution to Gross Electricity Consumption



Source: SEI and Eirgrid

Table 2 Renewable Electricity as Percentage of Gross Electricity Consumption

	1990	1995	2000	2001	2002	2003	2004	2005	2006
Renewables % of Gross Electricity	4.90	4.15	4.99	4.21	5.45	4.37	5.20	6.77	8.58
Hydro	4.90	4.06	3.56	2.44	3.60	2.30	2.35	2.28	2.51
Wind	-	0.09	1.03	1.37	1.53	1.74	2.44	4.02	5.61
Biomass	-	-	-	-	-	-	0.03	0.03	0.03
Landfill Gas	-	-	0.40	0.40	0.32	0.27	0.32	0.38	0.38
Biogas	-	-	-	-	-	0.06	0.06	0.06	0.06

Source: SEI and Eirgrid

¹³ Defined as total electricity generated plus net imports.

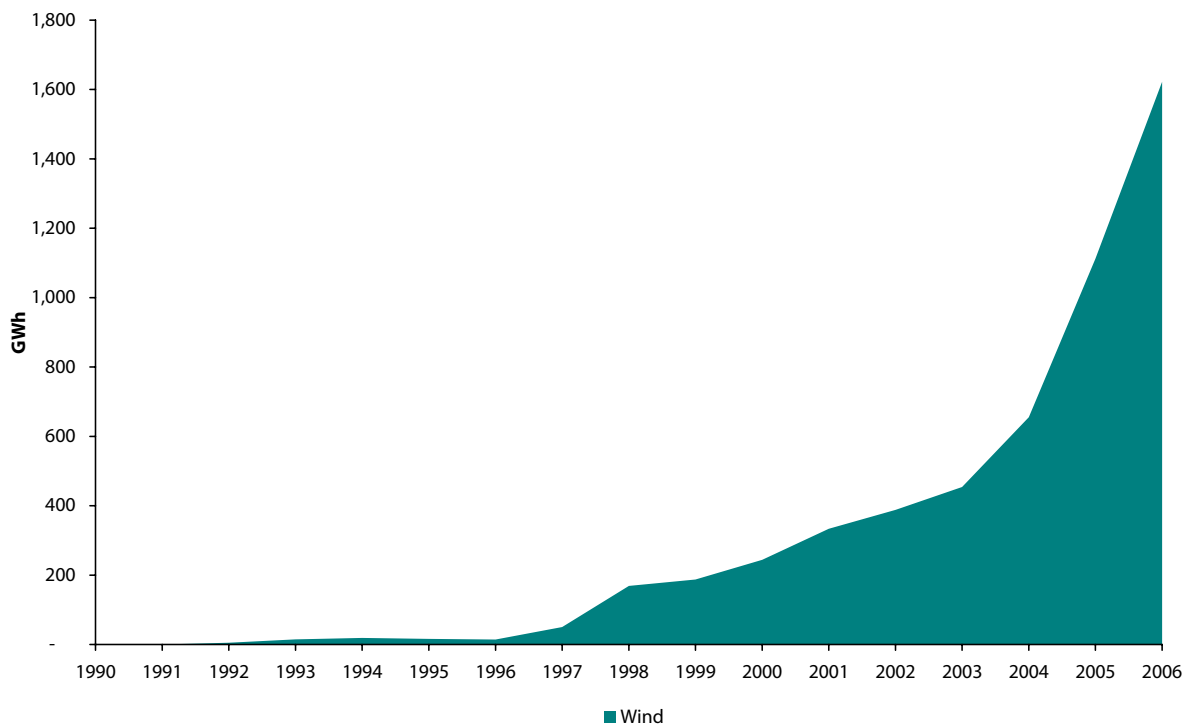
5 Individual Renewable Energy Sources

This section assesses recent trends for individual renewable electricity sources.

5.1 Wind

Figure 3 shows the electricity generated from wind energy and illustrates the rapid rise in electrical output since 1997 when the first of the wind farms supported by the AER programme came online. Total electrical output from wind in 2006 was 1,622 (gigawatt hours) (GWh) representing an increase of 46% on 2005. As stated in section 4 wind was responsible for 5.6% of gross electrical consumption in 2006 (4% in 2005).

Figure 3 Electricity Generated by Wind



Source: Eirgrid

Table 3 Renewable Electricity Production –Wind

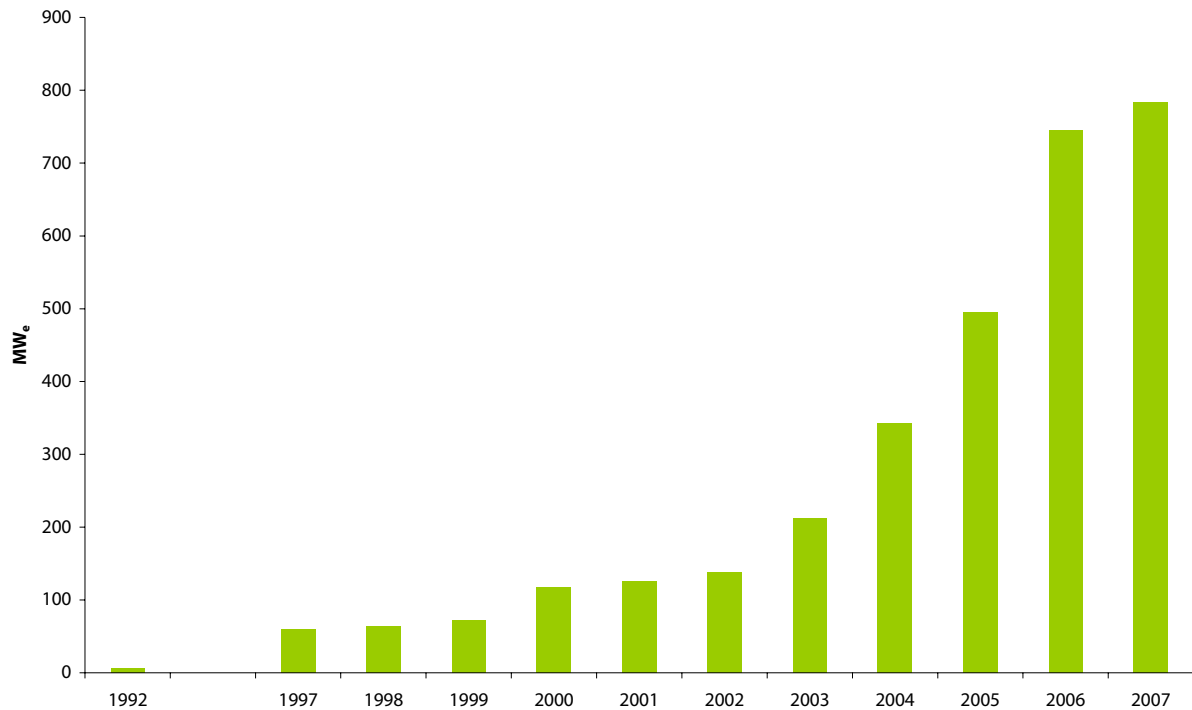
	1990	1995	2000	2001	2002	2003	2004	2005	2006
Wind (GWh)	0	16	244	334	388	454	655	1,112	1,622

Source: Eirgrid

The total installed capacity of wind farms in Ireland (April 2007) was 782 MW_e an increase of 58% (288 MW_e) on the end of 2005.

Figure 4 and Table 4 illustrate the evolution in installed wind capacity graphically from 1992 to April 2007. The recent surge in activity is very clear. In addition to that currently installed there is an additional 449 MW_e with signed connection offers from Eirgrid, all but 15 MW_e of which have target connection dates before July 2009. Finally, there are a further 1,301 MW_e of capacity being processed for grid connection under 'gate 2' and a further 2013 MW_e in applications.

Figure 4 Installed Capacity of Wind Projects



Source: Eirgrid

Table 4 Installed Capacity –Wind

	1990	1992	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Wind (MW_e)	0	6.5	59	64	72	117	125	138	212	343	495	746	782

Source: Eirgrid

5.2 Hydro

Table 5 and Figure 5 show the electricity generated from hydro since 1990 and emphasizes the large degree of variation from year to year associated, in part, with changing annual rainfall levels.

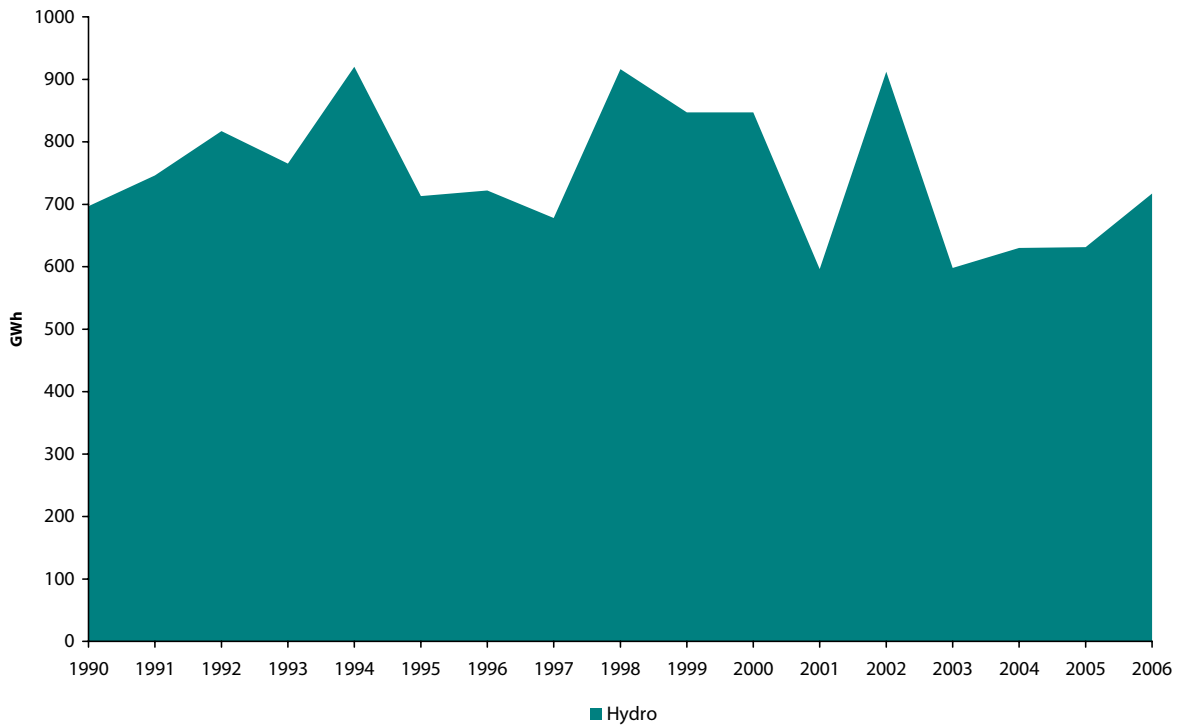
In 2006 electrical output from hydro was 724 GWh an increase of 3.9% on 1990. There was a 15% increase in output from hydro in 2006 compared with 2005. As stated in section 4 hydro was responsible for 2.5% of gross electrical consumption in 2006.

Table 5 Renewable Electricity Production –Hydro

	1990	1995	2000	2001	2002	2003	2004	2005	2006
Hydro (GWh)	697	713	847	596	912	598	630	631	724

Source: Eirgrid

Figure 5 Electricity Generated by Hydro

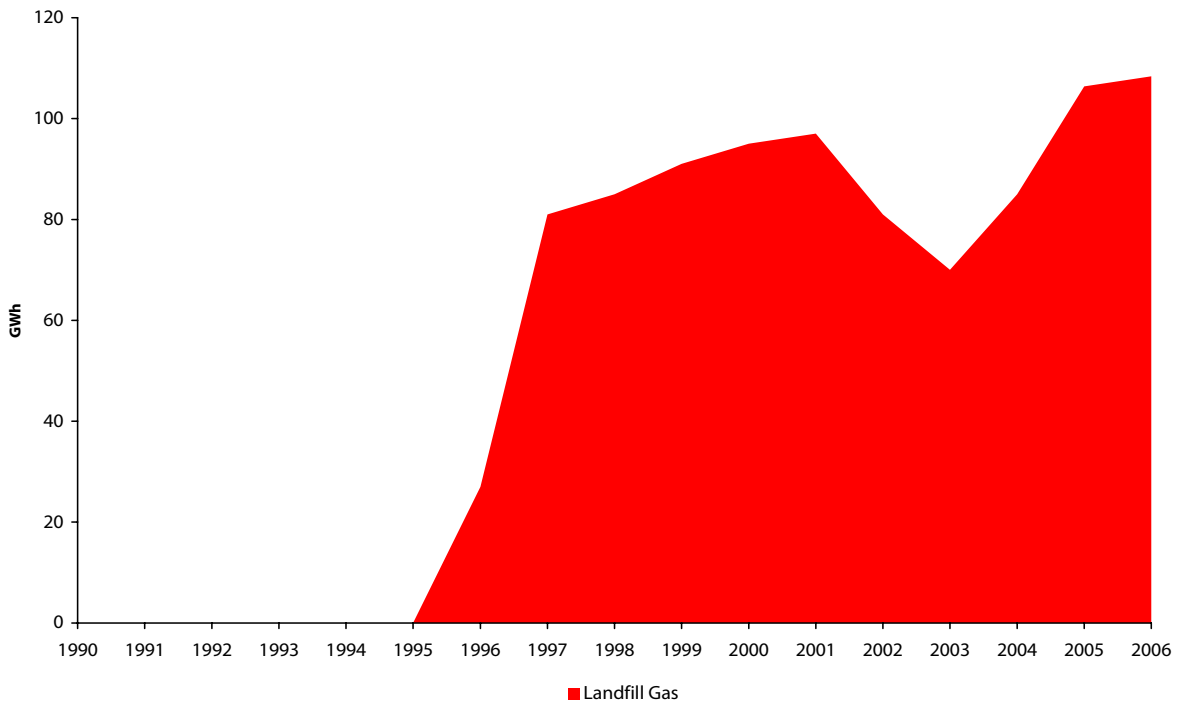


Source: Eirgrid

5.3 Landfill Gas

In Ireland there are currently 12 landfill gas electricity generating units¹⁴ operating with a combined installed capacity of 29.5 MW_e. The first landfill gas sites were installed in 1995. The electrical output from landfill gas is presented Figure 6 and Table 6 for the period 1996 to 2004.

Figure 6 Landfill Gas Electricity Production



Source: Eirgrid

¹⁴ Note that there may be more than one unit at a site.

Table 6 Renewable Electricity Production –Landfill Gas

	1996	2000	2001	2002	2003	2004	2005	2006
Landfill Gas (GWh)	27	95	97	81	70	85	106	108

The electrical output from landfill gas in 2006 was 108 GWh, an increase of 2% on 2005.

Source: Eirgrid

Glossary of Terms

Biogas:

A gas composed principally of methane and carbon dioxide produced by anaerobic digestion of biomass, comprising: Sewage sludge gas, produced from the anaerobic fermentation of sewage sludge and Other biogas, such as biogas produced from the anaerobic fermentation of animal slurries and of wastes in abattoirs, breweries and other agro-food industries.

Combined Heat & Power Plants:

Combined heat and power (CHP) refers to plants which are designed to produce both heat and electricity. CHP plants may be autoproducer (generating for own use only) or third party ownership selling electricity and heat on-site as well as exporting electricity to the grid.

Gross Electrical Consumption

Gross electricity production is measured at the terminals of all alternator sets in a station; it therefore includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station. The difference between gross and net production is amount of own use of electricity in the generation plants.

Hydro-Power:

Potential and kinetic energy of water converted into electricity in hydroelectric plants. Pumped storage is treated separately in the national energy balance.

Landfill Gas:

A gas composed principally of methane and carbon dioxide produced by anaerobic digestion landfill wastes.

Solid Biomass:

Covers organic, non-fossil material of biological origin which may be used as fuel for heat production or electricity generation. It comprises: Charcoal: covers the solid residue of the destructive distillation and pyrolysis of wood and other vegetal material and Wood, wood wastes, other solid wastes: Covers purpose-grown energy crops (poplar, willow etc.), a multitude of woody materials generated by an industrial process (wood/paper industry in particular) or provided directly by forestry and agriculture (firewood, wood chips, bark, sawdust, shavings, chips, black liquor etc.) as well as wastes such as tallow, straw, rice husks, nut shells, poultry litter, crushed grape dregs etc. Combustion is the preferred technology for these solid wastes. The quantity of fuel used is reported on a net calorific value basis.

Wind Energy:

Kinetic energy of wind exploited for electricity generation in wind turbines.



**Sustainable Energy Ireland
Energy Policy Statistical Support Unit**
Building 220
Cork Airport Business Park
Co. Cork
Ireland

T. +353 21 4547050 | epssu@sei.ie
F. +353 21 4547059 | www.sei.ie

Sustainable Energy Ireland
Glasnevin
Dublin 9
Ireland

T. +353 1 8369080 | info@sei.ie
F. +353 1 8372848 | www.sei.ie



*Sustainable Energy Ireland is funded by the Irish Government
under the National Development Plan 2007-2013 with
programmes part financed by the European Union*