SUSTAINABLE ENERGY IRELAND

Energy Policy Statistical Support Unit

Renewable Energy in Ireland

2008 REPORT – FOCUS ON WIND ENERGY AND BIOFUELS

Renewable Energy in Ireland

2008 Report – Focus on wind energy and biofuels.

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Sustainable Energy Ireland

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 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.

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Highlights

- Renewable primary energy grew by 12% in 2007. Growth in the period 1990 to 2007 was 182% (6.3% per annum on average).
- Renewable energy accounted for 2.9% of total primary energy requirement (TPER) in 2007.
- The estimated amount of CO_2 avoided due to renewable energy was 2.1 million tonnes in 2007. The emissions avoided from wind were most significant in 2007, 997 kt CO_2, followed by solid biomass 585 kt CO_2 and hydro 339 kt CO_2.

Progress Towards Targets

- In absolute terms, renewable energy doubled (from 224 ktoe to 443 ktoe) between 2003 and 2007 (19% annual average growth), due largely to the increasing contribution from wind energy.
- Ireland's target under the proposed EU Renewable Energy Directive for 2020 is for renewable sources to account for 16% of final energy consumption. The contribution from renewables was 3.3% in 2007.
- Over the period 1990 – 2005, renewable energy produced more thermal energy than electricity. In 2007, electricity from renewable energy was 29% higher than thermal renewable energy.

RES-E

- The share of electricity from renewable energy has nearly doubled between 1990 and 2007 from 4.9% to 9.4%. Most of this increase took place in the past seven years since 2000.
- The total electricity generated from renewable energy reached 2,758 GWh in 2007. To achieve the 15% RES-E target by 2010 will require 4,800 GWh according to forecasts in *Energy in Ireland 2007*.
- A 74% growth of electricity generation from renewable energy is required over the three year period 2008 – 2010 (or 20% average annual growth) to deliver the 15% target.

RES-H

- Renewable thermal energy grew from 108 ktoe to 184 ktoe between 1990 and 2007 and represented 3.4% of thermal energy use in 2007. Ireland's target is to achieve 5% renewables in thermal energy by 2010 and 12% by 2020.
- Renewable thermal energy production is dominated by biomass, in particular the use of waste wood to produce thermal energy in fibre board manufacture, joineries and wood processing plants and the use of tallow from rendering plants for thermal energy.
- The increasing activity in specific sub-sectors of industry has led to biomass increasing from 63 ktoe in 1990 to 152 ktoe in 2007, representing a growth of 141% (5.3% average annual growth).
- The introduction of the Greener Homes Scheme has reversed the overall declining trend in RES-H in households (45 ktoe in 1990 to 15 ktoe in 2003). In 2007, the use of renewable energy for heating in homes accounted for 24 ktoe and represented 13% of total renewable thermal energy usage in Ireland.
- It is estimated that 272 ktoe of renewable energy heat is required in 2010 to meet the renewable energy for thermal applications target. This compares with 185 ktoe in 2007, representing a 47% growth requirement in the three years 2008 – 2010.

RES-T

- There was a significant increase in the share of transport energy from renewables in 2007, albeit from a low base. In absolute terms, renewable energy in transport increased from 1 ktoe in 2005 to 3 ktoe in 2006 and 21 ktoe in 2007.
- Biofuels accounted for 0.5% of petrol and diesel sales in 2007, growing from 0.1% in 2006.

- The target for RES-T is 2% by 2008 and based on provisional energy forecasts for 2008, this corresponds to an approximate 90 ktoe requirement, growing from 21 ktoe in 2007, indicating the scale of the challenge.

Wind Energy

- Total electrical output from wind in 2007 was 1,958 gigawatt hours (GWh) representing an increase of 21% on 2006.
- Wind energy avoided almost 1 million tonnes of CO_2 emissions in 2007.
- There has been a slowdown in wind farm development in the past two years (177 MW installed between January 2007 and September 2008 compared with 405 MW over the two year period 2005 – 2006).
- The total installed capacity reached 915 MW by September 2008.
- To reach the 15% RES-E target by 2010 requires an additional 346 MW wind capacity to be added to the electricity network over the 14 month period October 2008 – December 2009 (in addition to a doubling of biomass electricity generating capacity).
- The peak recorded wind power output was 811 MW delivered on 19th October 2008.
- There is 892 MW of planned wind capacity with grid connection contracts and target connection dates between October 2008 and December 2012. Of this 476 MW is due to be connected before December 2009.

Biofuels

- Biodiesel, represented 76% of the 21 ktoe biofuel usage in 2007, followed by bioethanol (16%) and finally pure plant oil (8%).
- During 2007, there was 21% more biofuels produced indigenously than was imported, though this varies for each fuel.
- There was 73% more biodiesel produced indigenously than was imported in 2007.
- In the case of bioethanol, there was more than five times as much imported as was produced indigenously.
- In 2007, all the pure plant oil used for transport purposes here was produced in Ireland.

Table of Contents

Table of Figures

Table of Tables

1 Introduction

This report examines the contribution made by renewable energy to Ireland's energy requirements for the period 1990 to 2007 with a particular focus on production data in 2007 and capacity data and relevant policy developments in 2007 and, where available, 2008. This update should be read in conjunction with a report published in August 2004 entitled, *Renewable Energy in Ireland Trends and Issues 1990 – 2002*[1]. This is the third in a planned series of updates and follows *Renewable Energy in Ireland 2007 Update*[2].

This update focuses on primarily on wind energy and biofuels. These two renewable energy sources have demonstrated particularly interesting trends in the past two years. Also, they have been the main focus of policies and measures and are linked specifically to delivering targets. This is not to understate the importance of other renewable sources and the report does discuss progress towards all national and EU targets.

The report is structured as follows:

- Section 2 provides the context for renewable energy deployment, examining the recent trends in primary energy usage.
- Section 3 analyses the progress towards the various renewable energy targets.
- Section 4 assesses recent trends for two individual renewable sources, namely wind energy and biofuels.
- Section 5 estimates the extent of avoided carbon dioxide emissions arising from the use of renewables.
- Finally, section 6 summarises the policy measures which have been announced to increase renewable energy penetration.

The national energy balance data presented in this report are the most up-to-date at the time of writing (23rd September 2008). Balance data are updated whenever more accurate information is known. To obtain the most up-to-date balance figures visit the statistics publications section on Sustainable Energy Ireland's website. An energy data service is available at http://www.sei.ie/statistics, follow the links for Energy Statistics Databank. This service is hosted by the Central Statistics Office with data provided by SEI.

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.

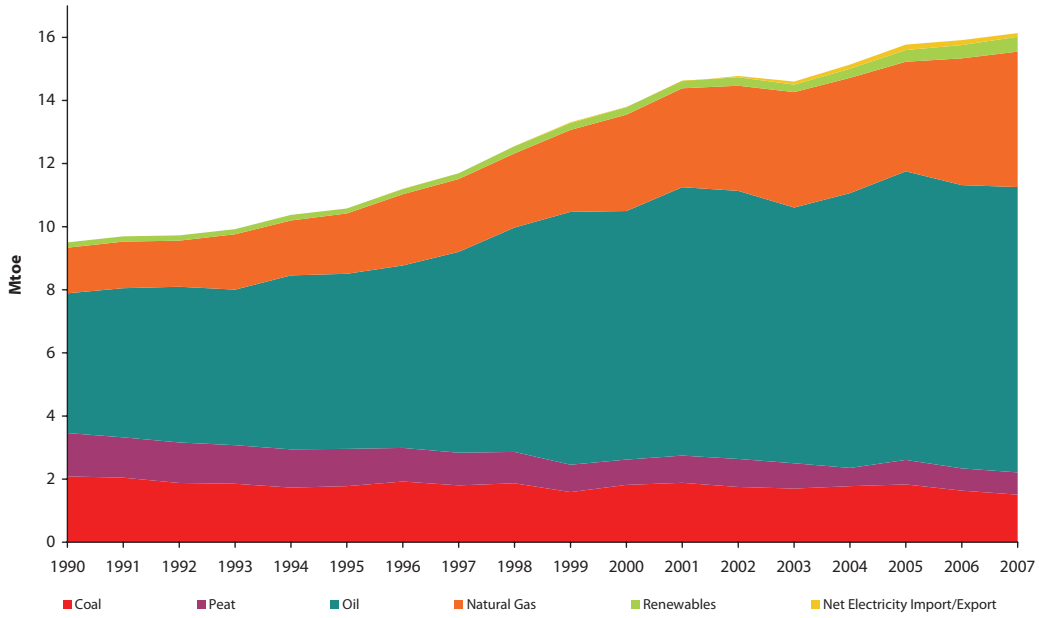
[1] Available from www.sei.ie
[2] Ibid.

2 Context for Renewable Energy Deployment

Ireland's overall energy supply is discussed in terms of changes to the total primary energy requirement (TPER), defined as the total amount of energy used within Ireland in any given year. This includes the energy requirements for the conversion of primary sources of energy into forms that are useful for the final consumer, for example electricity generation and oil refining. These conversion activities are not all directly related to the level of economic activity that drives energy use but are dependent to a large extent, as in the case of electricity, on the efficiency of the transformation process and the technologies involved.

Figure 1 illustrates the trend in energy supply over the period 1990 to 2007[3], emphasising changes in the fuel mix. Primary energy consumption in Ireland in 2007 was 16.1 million tonnes of oil equivalent (Mtoe).

Figure 1 Total Primary Energy Requirement 1990 to 2007



Source: SEI

Over the period 1990 – 2007 Ireland's total annual primary energy requirement grew in absolute terms by 70% (average annual growth rate of 3.2%). In 2007 Ireland's primary energy requirement increased by 1.4%. The individual fuel growth rates and shares are shown in Table 1.

[3] 2007 data are provisional at the time of publication.

Table 1 Growth Rates and Shares of TPER Fuels

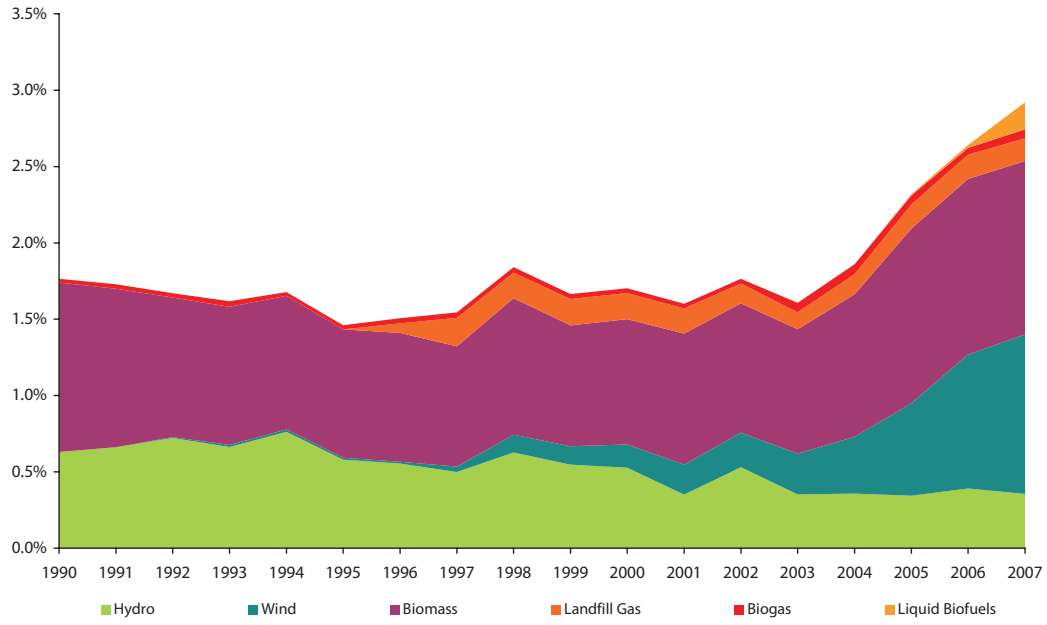
	Growth %	Average annual growth rates%					Shares %	
	1990 – '07	**1990 – '07**	**1990 – '95**	**1995 – '00**	**2000 – '05**	**2007**	**1990**	**2007**
Fossil Fuels (Total)	66.6	3.0	2.2	5.4	2.4	1.4	98.2	96.4
Coal	-27.7	-1.9	-3.1	0.4	0.2	-7.5	21.9	9.3
Peat	-49.1	-3.9	-3.0	-7.5	-0.7	-0.8	14.5	4.3
Oil	104.4	4.3	4.6	7.3	3.0	0.8	46.6	56.1
Natural Gas	196.8	6.6	5.8	9.8	2.6	6.8	15.2	26.6
Renewables (Total)	182.2	6.3	-1.6	8.7	9.3	12.3	1.8	2.9
Hydro	-4.4	-0.3	0.5	3.5	-5.7	-8.0	0.6	0.4
Wind	-	-	-	72.4	35.4	20.7	0.0	1.0
Electricity Imports	-	-	-	53.2	64.7	-21.0	0.0	0.8
Total	**69.8**	**3.2**	**2.2**	**5.5**	**2.7**	**1.4**		

Source: SEI

Renewable energy in total grew from 168 ktoe to 473 ktoe between 1990 and 2007, an increase of 182% (6.3% per annum on average) over the period. Its share in primary energy consumption increased from 2.7% in 2006 to 2.9% in 2007. The significant increase in overall TPER masks the fact that renewable energy has grown considerably in absolute terms since the mid 1990s. The increase in 2007 was 12%.

As shown in Figure 2, renewable energy has been contributing nearly 2% of Ireland's primary energy supply between 1990 and 2004. In 2004 the contribution stood at 1.9% and this has risen to 2.3% in 2005, 2.7% in 2006 and 2.9% in 2007.

Figure 2 Renewable Energy Contribution to TPER



Source: SEI

There are many different indicators spoken about in relation to the share of renewable in energy use and the figure of 2.9% renewable contribution to primary energy should not be confused with others that relate to specific targets or measures. This variety of indicators have come about to measure of progress against various measures and targets both national, EU and global. Care must be taken when assessing these targets to use the correct indicator. For instance, the indicative target for Ireland in the Renewable Energy Directive is a 13.2% share of gross electricity

consumption by 2010. The national target specified in the 2007 Government White Paper[4] is 15% by 2010 and 33% by 2020. In the Carbon Budget of October 2008 the 2020 target was extended from 33% to 40%. The proposed new EU Commission directive on the promotion of renewable energy has an indicative target of 16% of final consumption to come from renewable energy by 2020. These indicators are discussed as appropriate throughout the report.

2.1 Primary Energy Equivalent

The primary and final energy consumption for renewables such as wind and hydro are very similar. For most fuels this is not the case, due to the energy conversion losses associated with electricity generation. Depending on the efficiency of electricity generation, typically between 25% and 55% of the energy content of the fuel input into power plants is output in the form of electricity.

The primary energy of fossil fuels and combustible renewables is defined as the calorific content of the fuel, according to internationally agreed methodologies for presenting energy statistics[5]. For non-combustible renewable sources (wind and hydro) the primary energy is equated with the quantity of electricity generated. This follows the IEA principle that the primary energy should be the first energy form, downstream of the production process for which multiple energy uses are practical.

This allows for harmonised international comparisons, but it does not accurately represent how fossil fuels used for electricity generation are displaced by non-combustible renewable energy. This is because, in primary energy terms, the fuel input into a fossil fuel plant is currently equated with the electricity output from a non-combustible renewable energy plant, such as a wind farm or hydro-power plant. An alternative approach is to equate the primary energy of the renewable energy with the primary energy of the fuel that would have been required to produce the equivalent amount of electricity.

This is the principle behind the primary energy equivalent (PEE) based on the partial substitution method. It requires an assumption to be made about the efficiency of the fossil fuel based electricity generation being substituted by the non-combustible renewable generated electricity. The contribution from the renewable energy source is, under this approach, equated to the fossil fuel energy input that it displaces. The PEE for non-combustible renewable energy essentially represents the thermal fossil fuel energy avoided through the generation of renewable based electricity. By quantifying the fossil fuel displacement achieved by renewable energy, the environmental benefits and indeed the security of supply benefits may be quantified and used to inform policy decisions.

This raises a key question however – what electricity generation is being displaced by renewable energy generated electricity? In a previous report[6], the calculation of PEE was based on a theoretical displacement by each kWh from renewable energy of a kWh generated from the entire fossil fuel plant mix. This methodology used here draws on approaches that have been developed for use in baselining studies in credit based emissions trading systems[7].

Renewable energy plants are not generally displacing electricity from either 'must-run' plants (peat) or from baseload plants (coal fired station at Moneypoint and the combined cycle gas turbine (CCGT) plants. Calculating the PEE based on the remaining plant provides a more accurate estimate than using the entire plant mix and the approach is known as the *Operating Margin Approach*. There are clear limitations in this analysis but it does provide useful indicative results. The assumption underpinning this approach is that the renewable plant is displacing the last plants to be dispatched to meet electricity demand, i.e. the marginal oil and gas plant.

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[4] Dept. of Communications, Energy & Natural Resources (2007), *Energy White Paper 2007 - Delivering a Sustainable Energy Future for Ireland*, http://www.dcmnr.gov.ie/NR/rdonlyres/54C78A1E-4E96-4E28-A77A-3226220DF2FC/27356/EnergyWhitePaper12March2007.pdf.

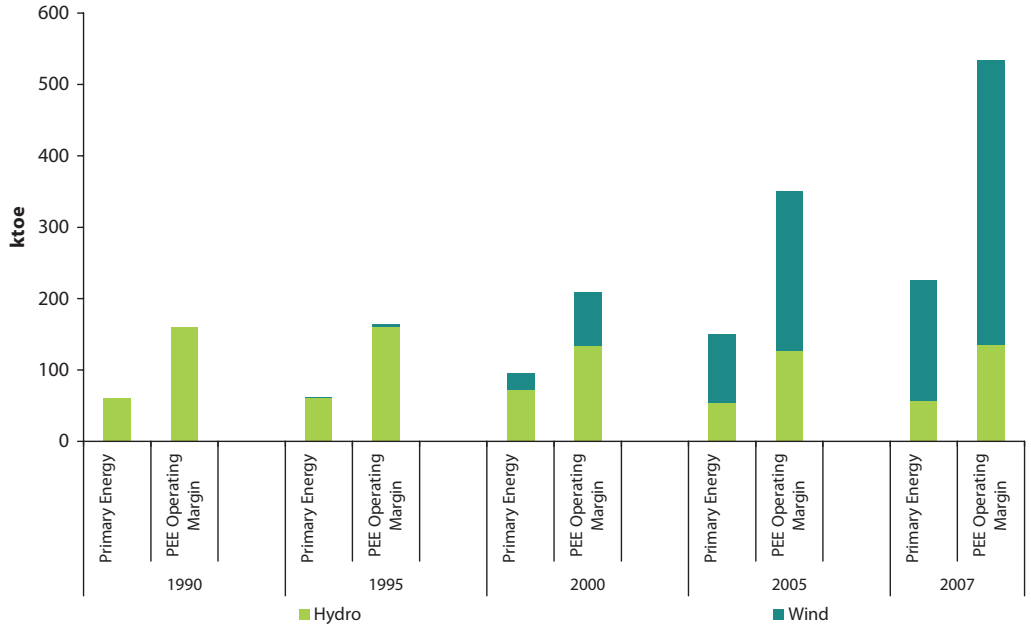
[5] International Energy Agency (2007), *Energy Balances of OECD Countries 2004 – 2005*. See www.iea.org for details.

[6] SEI (2004), *Renewable Energy in Ireland – Trends and Issues 1990 – 2002*, http://www.sei.ie/uploadedfiles/InfoCentre/RenewableEnergyinIreland19902002.pdf.

[7] Kartha S., Lazarus M. and Bosi M, 2004. *Baseline recommendations for greenhouse gas mitigation projects in the electric power sector.* Energy Policy *32,* 545-566. For further information on Ireland see Ó Gallachóir B. P., O'Leary F., Bazilian M., Howley M. & McKeogh E. J. *Comparing Primary Energy Attributed to Renewable Energy with Primary Energy Equivalent to Determine Carbon Abatement in a National Context* Journal of Environmental Science and Health Part A: Toxic /Hazardous Substances and Environmental Engineering, Vol.41, No. 5.

Based on this analysis the PEE (Operating Margin) for non-combustible renewable energy (wind and hydro) is compared with the primary energy values in Figure 3 at five yearly intervals since 1990 and also for 2007. The difference between the primary energy and PEE is particularly noticeable and also the increasing importance of wind. Focussing on the year 2007, the PEE was 136% larger than the renewable primary energy.

Figure 3 Primary Energy and Primary Energy Equivalent for Wind and Hydro

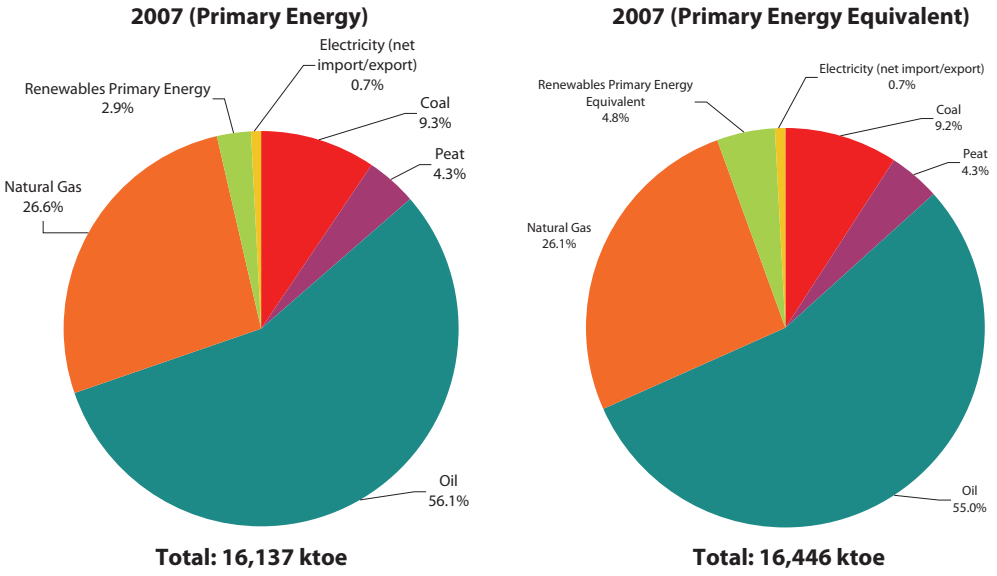


Source: SEI

The total PEE for renewable energy is then calculated by adding the primary energy for combustible renewable sources to the calculated PEE for non-combustible renewables. This provides a new measure of renewable energy's contribution to energy supply. The total PEE for renewable energy increased from 269 ktoe in 1990 to 782 ktoe in 2007, an increase of 181% (6.5% per annum on average). The increase in 2007 was 12%.

Figure 4 compares the contribution of renewable energy to TPER using the traditional primary energy (PE) method and the primary energy equivalent (PEE) approach. Renewable energy accounted for 2.9% of TPER in 2007 (the first pie chart on Figure 4). Using the PEE approach it can be seen from the second pie chart in Figure 4 that the contribution to TPER is 4.8%.

Figure 4 Renewable Energy Share of TPER - Primary Energy and Primary Energy Equivalent 2007



Source: SEI

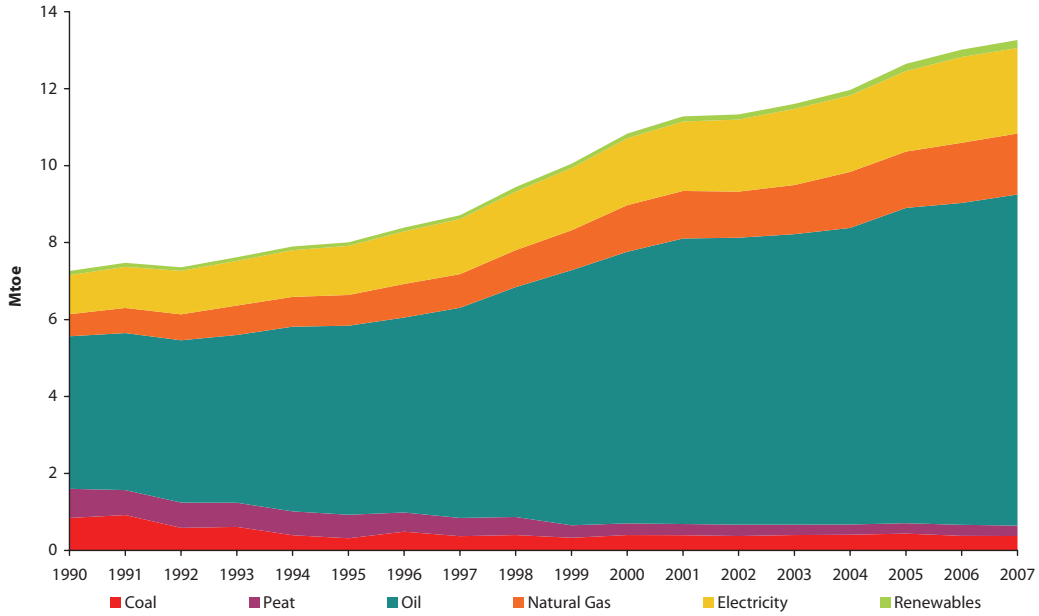
There are a number of limitations and caveats associated with this methodology. It ignores any plant used to meet the associated reserve requirements. These open cycle plants will typically have lower efficiency and generate increased CO_2 and NO_x emissions compared with CCGT and these emissions should be incorporated into the analysis. The purpose of presenting a simplified analysis here is to provide initial insights into the amount of fossil fuels that are displaced by renewables and the amount of emissions thereby avoided.

2.2 Energy Demand

Final energy demand is a measure of the energy that is delivered to energy end users in the economy to undertake activities as diverse as manufacturing, movement of people and goods, essential services and other day-to-day energy requirements of living. This is also known as Total Final Consumption (TFC) and is essentially total primary energy less the quantities of energy required to transform primary sources such as crude oil into forms suitable for end use consumers such as refined oils, electricity, patent fuels etc. (Transformation, processing or other losses entailed in delivery to final consumers are known as "energy overhead".)

Figure 5 shows the shift in the pattern of final energy demand by fuel over the period 1990 to 2007.

Figure 5 Total Final Consumption by Fuel



Source: SEI

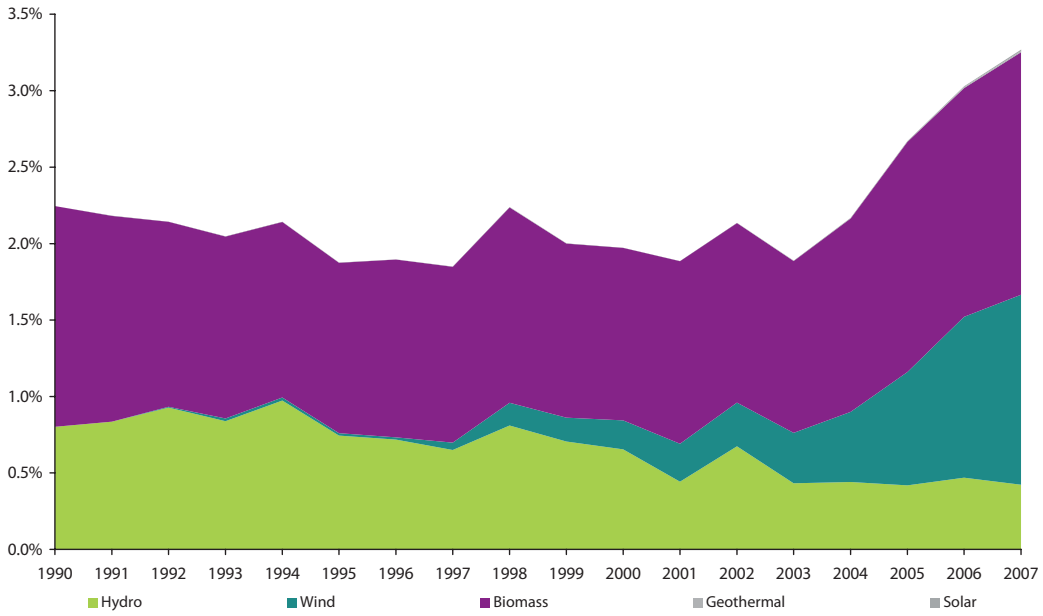
Ireland's TFC in 2007 was 13.3 Mtoe, an increase of 1.9% on 2006 and 83% above 1990 levels (representing an average growth rate of 3.7% per annum). Final consumption of renewable energy increased by 99% (4.1% per annum on average) from 1990 to 2007.

3 Progress Towards Targets

The European Commission proposed in January 2008 a new Directive[8] on the promotion of the use of energy from renewable sources. This proposed Directive contains targets for each EU member state. Ireland's target for 2020 is for renewable sources to account for 16% of final energy consumption. The definition of TFC in the Directive is slightly different TFC as conventionally defined in the energy balance. The Directive specifies final consumption of energy as the energy commodities delivered for energy purposes to manufacturing industry, transport, households, services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution. The renewable energy contribution includes electricity generation, transport energy and thermal energy generated by renewable sources.

Figure 6 shows the contribution of renewable energy to TFC according to the definition in the proposed Directive. The contribution in 1990 was 2.2% rising to 3.0% in 2006 and 3.3% in 2007. Figure 6 shows the contribution from the various sources of renewable energy. Biomass here consists largely of wood and wood waste as thermal energy, with smaller contributions from electricity generated from biomass and transport biofuels.

Figure 6 Renewable Energy (%) Contribution to TFC (Directive 2008)

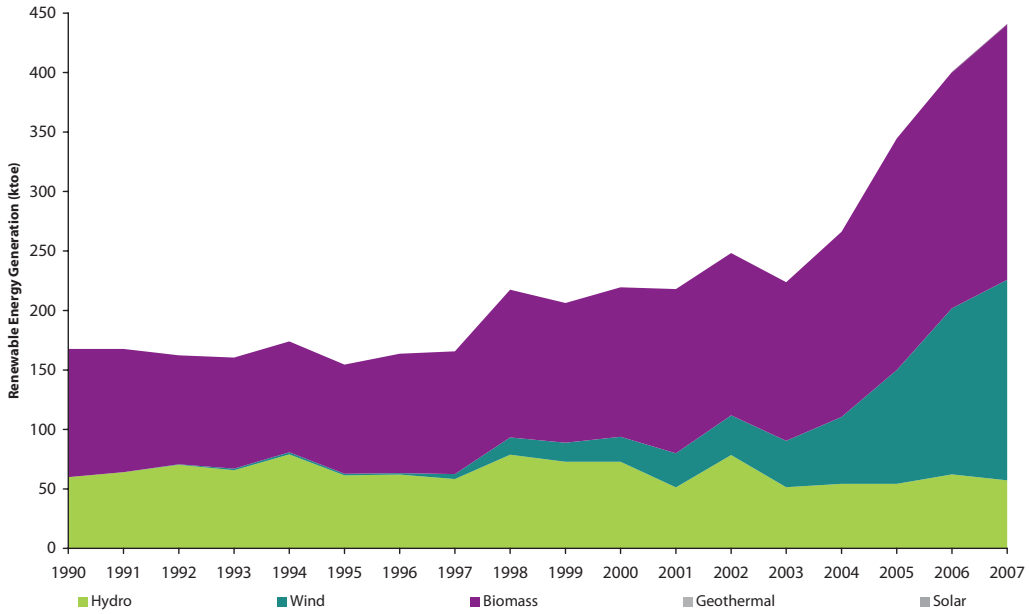


Source: SEI

Figure 7 shows the renewable energy contributions in absolute energy terms, to illustrate the growth in each source independently of TFC growth. The doubling of renewable energy (from 224 ktoe to 443 ktoe) between 2003 and 2007 (19% annual average growth) is striking, due largely to the increasing contribution from wind energy.

[8] The full text of the proposed Directive is available at http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf

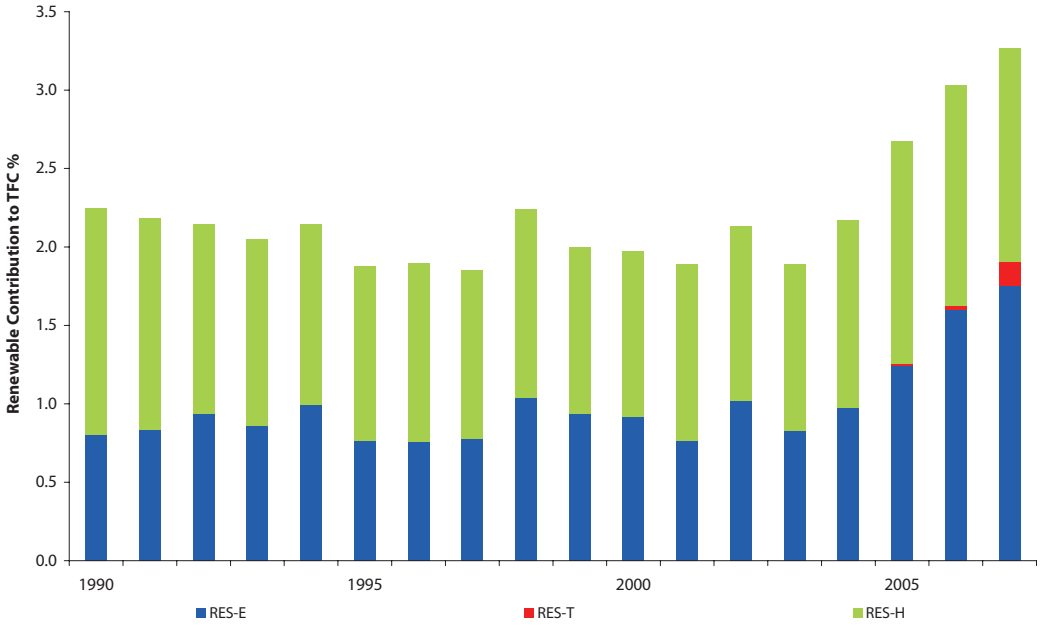
Figure 7 Renewable Energy (ktoe) Contribution to TFC (Directive 2008)



Source: SEI

Figure 8 shows the same information as presented in Figure 6 but here the renewable contributions are distinguished in terms of each energy mode, i.e. indicating separately the contribution in energy terms to electricity (RES-E), transport (RES-T) and thermal energy (RES-H).

Figure 8 Renewable Energy (%) Contribution to TFC by Mode



Source: SEI

The contributions to each mode are important because, in addition to the proposed EU Directive targets for renewable energy, Ireland has national targets for 2020 that are specified in the Government White Paper on Energy[9] for each individual mode of energy as follows

- RES-E 33% - electricity from renewable sources to contribute 33% to gross electricity consumption[10] by 2020 (increased to 40% in October 2008), with an interim target of 15% by 2010.
- RES-H 12% - 12% of thermal energy to come from renewable sources by 2020, with an interim target of 5% by 2010.
- RES-T 10% - renewable energy to account for 10% of petrol and diesel (i.e. non-kerosene) transport energy by 2020, with interim targets of 2% by 2008 and 5.75% (reduced to 3% proposed in October 2008) 2010.

The combined effect of these three modal targets, coupled with Ireland's energy efficiency targets are anticipated (according to forecasts published in Energy in Ireland 2007 report) to deliver a 16% renewable energy contribution to TFC[11], i.e. to deliver the proposed EU Directive target for Ireland. Table 2 tabulates progress towards the individual modal targets and to the overall TFC target for the period 1990 – 2007. Here the percentages in each row RES-E, RES-T and RES-H relates to the specific modal targets and the percentages in the final row relate to the overall target using the definition in the proposed EU RE Directive.

Table 2 Renewable Energy Progress to Targets[12]

% of each target	**1990**	**1995**	**2000**	**2005**	**2006**	**2007**			***2010***	***2020***
RES-E	4.9	4.1	5.0	6.8	8.6	9.4			*15*	*40(33)*
RES-T	0.0	0.0	0.0	0.0	0.1	0.5			*3 (5.75)*	*10*
RES-H	2.6	2.1	2.4	3.3	3.5	3.4			*5*	*12*
Directive (2008)	**2.2**	**1.9**	**2.0**	**2.7**	**3.0**	**3.3**				***16***

Source: SEI

The latter two columns show the targets for 2010 and 2020. This provides a sense of the scale of challenge to meet each target, and an indication of how significant progress to date is when placed within the context of these targets. In the case of RES-E, the share of electricity from renewable energy has nearly doubled between 1990 and 2007 from 4.9% to 9.4%, and increase of 4.5 percentage points over seventeen years. Most of this increase (4.4 percentage points) took place in the past seven years since 2000. Over the three year period 2008 – 2010, a further increase in share of 5.6 percentage points is required to meet the 2010 target of 15%.

In the case of RES-T the short term White Paper target is to achieve 5.75% of petrol and diesel transport energy from renewable energy by 2010. The Minister for Energy issued a consultation paper[13] on the introduction of a biofuels obligation scheme in October 2008 and proposed therein that the 2010 target be reduced from 5.75% to 3%. This proposed change arose due to growing concerns regarding the impacts of current biofuels development on food prices, food security and sensitive ecosystems coupled with the low greenhouse gas emissions benefits of some energy (and emissions) intensive biofuel production processes[14].

As shown in Table 2, there was a significant increase in the share of transport energy from biofuels in 2007 in particular, albeit from a low base. Biofuels accounted for 0.5% (in energy terms) of petrol and diesel sales in 2007, growing from 0.1% in 2006. There is a further short term national target of 2% by 2008 and the progress in 2007 demonstrates that while challenging, this may be achievable.

[9] The Irish White Paper on Energy can be downloaded from http://www.dcenr.gov.ie/NR/rdonlyres/54C78A1E-4E96-4E28-A77A-3226220DF2FC/27356/EnergyWhitePaper12March2007.pdf

[10] Gross electricity consumption = total electricity generated plus net imports.

[11] TFC (Directive) equals TFC (Energy Balance) – electricity demand plus gross electricity consumption

[12] Note: Individual target percentages are not additive.

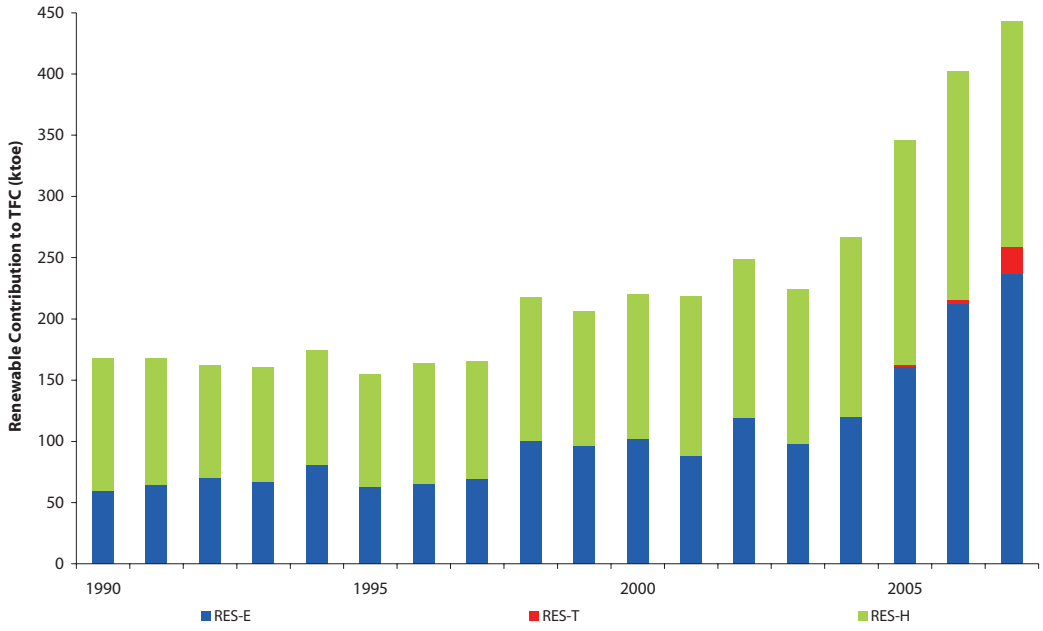
[13] DCENR 2008 *Public Consultation on the Biofuels Obligation Scheme September 2008.* Available from www.dcenr.ie

[14] See for example JD Murphy, N Power; How can we improve the energy balance of ethanol production from wheat?, Fuel, Volume 87, pp 1799 – 1806, 2008 or T Thamsiriroj, JD Murphy; Is it better to import palm oil from Thailand to produce biodiesel than to produce biodiesel from indigenous Irish rape seed? Applied Energy, doi:10.1016/j.apenergy.2008.07.010

Regarding RES-H, there was a decline in the contribution from renewable energy to thermal energy in the early 1990s, from 2.6% in 1990 to 2.1% in 1995. Between 2000 and 2007 RES-H grew from 2.0 % to 3.4%. This growth in renewable energy (dominated by biomass) that has occurred is mostly due to increased activity in the industrial sub-sectors where the biomass is mostly used (wood and food sectors). There has also been recent growth in renewable energy use in the residential and services sectors with the introduction of grant support schemes, but the increases here have to date been small in volume with respect to overall thermal renewable energy consumption. Against this backdrop, the short term target of achieving 5% renewable energy contribution to Ireland's thermal energy by 2010 is very challenging.

Figure 9 and Table 3 show the contribution of renewable energy to each energy mode, although presented here in absolute energy terms (ktoe) rather than as a percentage of the energy consumption for those modes. The growth in wind energy noted in Figure 7 is clearly visible here in the growth in RES-E, electricity generation from renewables.

Figure 9 Renewable Energy (ktoe) Contribution to TFC by Mode



Source: SEI

It is also interesting to compare the contributions from renewable energy to each of the energy modes or markets in Ireland, as shown in Table 3 and then to re-examine Table 2 from this perspective. Table 3 shows that renewable energy contributed 237 ktoe to Ireland in the form of electricity in 2007 and 184 ktoe in the form of thermal energy and 21 ktoe to transport energy. The contribution from renewable energy to electricity was thus 29% higher than renewable contribution to the thermal energy market and more than eleven times the contribution to the transport energy market. This contrasts significantly with the situation in 2005, when the renewable energy contribution to thermal energy was 23% higher than the renewable contribution to electricity.

Examining the data in this way provides a different perspective than focussing on the proportions of renewable energy in each energy market. According to Table 2, over the period 1990 – 2007, the renewable energy contribution to electricity has always been significantly higher than to the thermal energy market. Table 3 shows that renewable energy produced less electricity than thermal energy over the period 1990 – 2005. In 2007, electricity from renewable energy was 29% higher than thermal energy from Table 3, while Table 2 shows that the share of electricity from renewable energy was 176% higher than (or nearly three times) the share of thermal energy from renewable energy (i.e. 9.4% compared with 3.4%).

Table 3 Renewable Energy (ktoe) Contribution to TFC by Mode

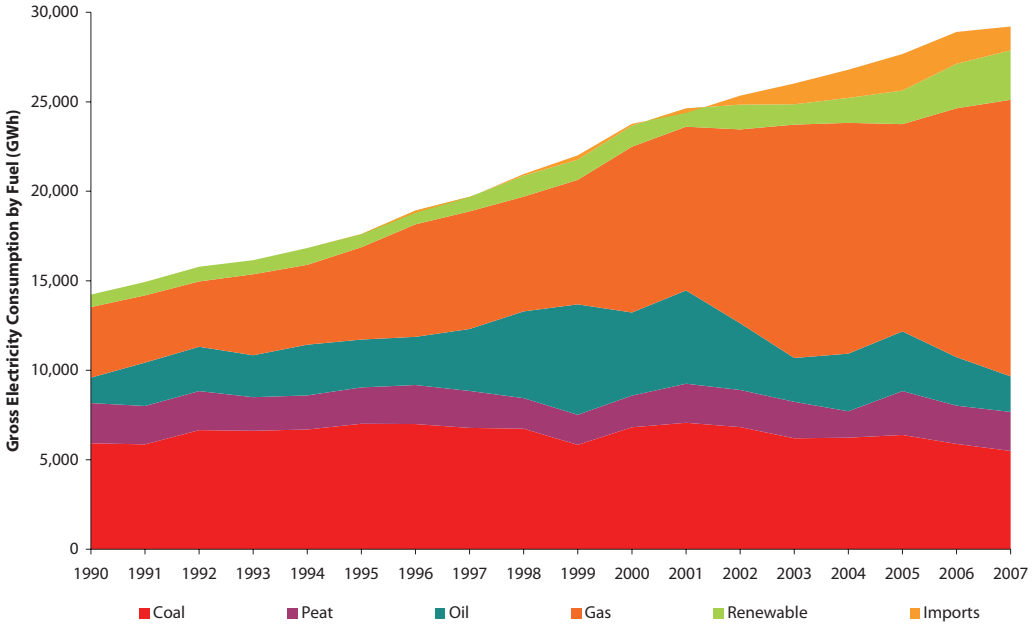
ktoe	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
RES-E	60	63	102	88	119	98	120	161	213	237
RES-T	0	0	0	0	0	0	0	1	3	21
RES-H	108	92	118	130	130	126	147	183	187	184

Source: SEI

3.1 RES-E

Figure 10 shows the growing trend in gross electricity consumption for Ireland over the period 1990 – 2007, illustrating the changing shares of each fuel / energy source. The doubling of gross electricity consumption over the period is striking, as is the growth in gas generated electricity. As shown in Table 4, the share of gas generation increased from 28% in 1990 to 53% in 2007. These changes provide a context against which the growth in RES-E can be assessed. The fact that renewable energy nearly doubled its share in the context of a doubling of overall gross electricity consumption points to the higher growth seen in Figure 9 (absolute growth) when compared with Figure 8 (percentage growth).

Figure 10 Gross Electricity Consumption by fuel source



Source: SEI

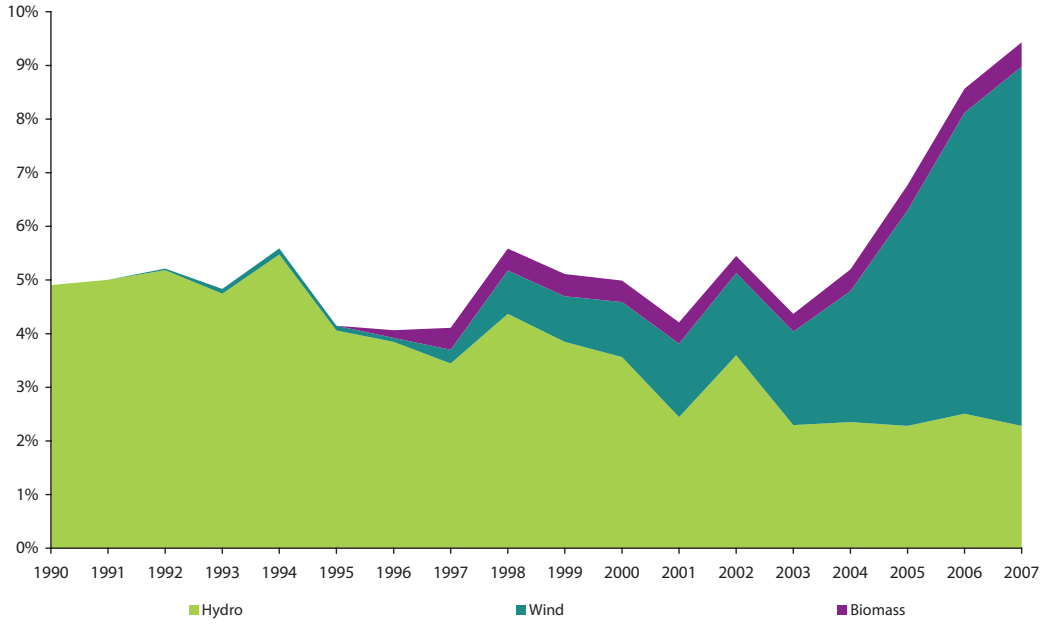
Table 4 Gross Electricity Consumption percentage by fuel source

% of Gross	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Coal	41.6	39.9	28.7	29.0	26.9	23.8	23.3	23.1	20.4	18.8
Peat	15.8	11.5	7.4	9.0	8.2	7.8	5.6	8.9	7.4	7.4
Oil	10.0	15.2	19.5	21.3	14.7	9.4	12.0	12.1	9.4	6.8
Gas	27.7	29.3	39.0	37.5	42.7	50.1	48.1	41.8	48.1	52.9
Renewable	4.9	4.1	5.0	4.2	5.4	4.4	5.2	6.8	8.6	9.4
Imports	0.0	-0.1	0.4	-1.0	2.0	4.5	5.9	7.4	6.2	4.6

Source: SEI

While the share from hydro has declined, Figure 11 and Table 5 show how the electricity production contribution from wind energy has grown. There was also a small contribution from waste water biogas (0.06%) from 2003 and from solid biomass CHP (0.05%) since 2004. Wind and hydro energy in 2007, respectively, accounted for 6.7% (5.6% in 2006) and 2.3% (2.5% in 2006) of Ireland's gross electrical consumption while landfill gas was responsible for 0.35% (0.38% in 2006).

Figure 11 Renewable Energy (%) Contribution to Gross Electricity Consumption by Source



Source: SEI and Eirgrid

Table 5 Renewable Electricity as Percentage of Gross Electricity Consumption

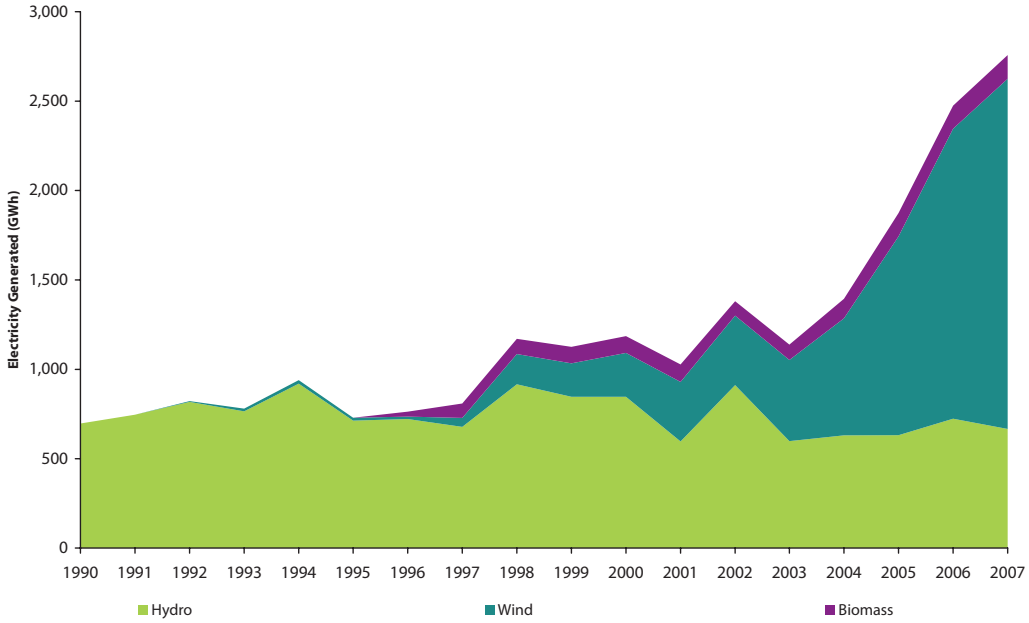
	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Renewables % of Gross Electricity	**4.90**	**4.15**	**4.99**	**4.21**	**5.45**	**4.37**	**5.20**	**6.77**	**8.56**	**9.43**
Hydro	4.90	4.06	3.56	2.44	3.60	2.30	2.35	2.28	2.51	2.28
Wind	-	0.09	1.03	1.37	1.53	1.74	2.44	4.02	5.61	6.70
Biomass	-	-	0.40	0.40	0.32	0.33	0.41	0.47	0.45	0.46

Source: SEI and Eirgrid

Figure 11 and Figure 12 show, in terms of percentage and GWh respectively, the contribution from each renewable energy source to the overall RES-E mix. Biomass here is a collective term comprising electricity generation from solid biomass, landfill gas and biogas, where landfill gas provides the most significant input. The four-fold increase in electricity generation from renewable energy that was tabulated in Table 5 is clearly visible in Figure 12, dominated by the growth in wind energy.

The total electricity generated from renewable energy reached 2,758 GWh in 2007. To achieve the 15% RES-E target by 2010 will require 4,800 GWh according to forecasts in *Energy in Ireland 2007*. The suggests a 74% growth of electricity generation from renewable energy is required over the three year period 2008 – 2010 (or 20% average annual growth) is required to deliver the 15% target.

Figure 12 Renewable Energy Contribution (GWh) to Gross Electricity Consumption by Source



Source: SEI and Eirgrid

The total installed electricity generating capacity of wind, hydro and biomass is shown in Table 6.

Table 6 Installed Electricity Generation Capacity -Renewables

MW_e	1990	2000	2001	2002	2003	2004	2005	2006	2007	2008[15]
Wind	-	117	125	138	212	343	495	746	783	915
Hydro	223	236	238	238	240	240	234	234	235	237
Biomass	-	12	12	12	12	17	18	25	27	30
Total	223	365	375	290	464	600	747	1005	1045	1182

Source: Eirgrid

EirGrid's *Winter Outlook 2008 – 2009 (Sept 2008)* puts the installed capacity of wind at 856 MW with an additional 150 – 200 MW expected to be connected by the end of 2008. More recent Eirgrid data (October 6th) indicate the total installed wind capacity reached 915 MW by September 1st 2008

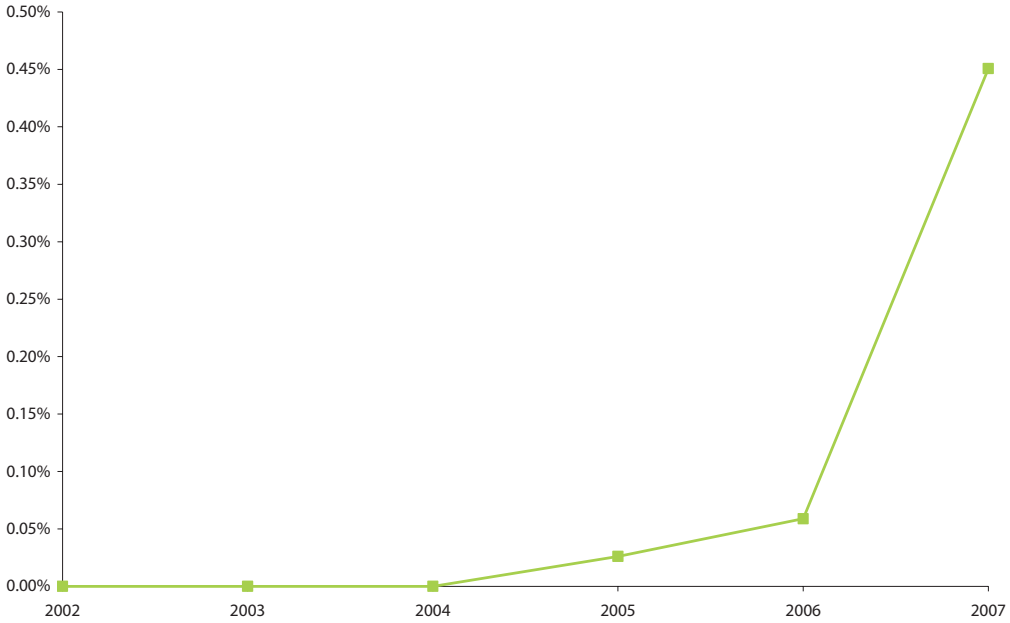
3.2 RES-T

Figure 13 illustrates the dramatic recent growth in renewable energy used for transport (biofuels), albeit from a low base. It shows the ratio of renewable energy used in Ireland as a share of petrol and diesel used in transport, in accordance with the definition in the EU Biofuels Directive 2003/30/EC. Petrol and diesel use in transport effectively represents road transport energy as kerosene used in aviation transport is excluded from the denominator but rail diesel used is also included.

It is evident from Figure 13 that the growth coincides with the introduction of tax relief support for biofuels, with slow growth from 2004 to 0.06% in 2006 followed by an increase to 0.45% in 2007.

[15] Eirgrid figures as of October 6 2008.

Figure 13 Renewable Energy as a Proportion of (Petrol and Diesel) Transport



Source: SEI

Table 7 shows the data behind Figure 13 and in absolute terms, biofuels increased from 1 ktoe in 2005 to 3 ktoe in 2006 and 21 ktoe in 2007. As mentioned the target for RES-T is 2% by 2008 and based on provisional energy forecasts for 2008, this corresponds to approx 90 ktoe, indicating the scale of the challenge.

Table 7 Biofuels Growth in ktoe and as a Proportion of Petrol and Diesel

ktoe	2002	2003	2004	2005	2006	2007
Petrol	1,689	1,687	1,732	1,820	1,884	1,983
Diesel	1,956	2,018	2,176	2,329	2,509	2,776
Biofuels (ktoe)	0.00	0.00	0.00	1.08	2.59	21.45
Petrol plus Diesel	3,645	3,705	3,907	4,149	4,394	4,759
Biofuel Penetration	0.00%	0.00%	0.00%	0.03%	0.06%	0.45%

Source: SEI

3.3 RES-H

Renewable energy contributing to Ireland's thermal energy requirements is dominated by biomass, in particular the use of waste wood to produce thermal energy in fibre board manufacture, joineries and wood processing plants and the use of tallow from rendering plants for thermal energy. As shown in Table 8, the increasing activity in these sub-sectors of industry has led to biomass increasing from 63 ktoe in 1990 to 152 ktoe in 2007, representing a growth of 141% (5.3% average annual growth). In addition there is a small contribution included in this data from biogas generated by anaerobic digestion of food processing waste products.

Table 8 Trends in Renewable Thermal Energy by Sector

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
RES-H Sectoral Split (ktoe)	**108**	**92**	**117**	**130**	**130**	**126**	**146**	**183**	**186**	**185**
Industry*	**63**	**62**	**100**	**113**	**113**	**108**	**129**	**163**	**164**	**152**
Food, beverages and tobacco	2	3	4	4	4	44	45	54	58	59
Wood and wood products	61	59	96	109	109	64	84	109	106	93
Residential	**45**	**30**	**17**	**16**	**16**	**15**	**15**	**17**	**18**	**24**
Commercial/Public Services	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**3**	**5**	**8**

Source: SEI

There are two notable trends behind the trend in renewable energy use in the residential sector that is also shown in Table 8. This sector's use of renewable energy is also dominated by solid biomass (wood), although also includes recently added geothermal energy and solar thermal energy. Since 1990, there has been a decrease in traditional biomass (logs) in open fires that has declined in line with the general decline of solid fuel open fires. As shown in Table 8, biomass usage decreased from 45 ktoe in 1990 to 15 ktoe in 2003, a drop of 66% (or 4.6% per annum reduction). In contrast with this is the more recent increasing trend of 'new biomass' in homes, i.e. the use of wood pellets and wood chips as the penetration of biomass boilers and stoves increases, supported under the Greener Homes Scheme[16], augmented by installations of solar energy and heat pump heating systems. The result of this has been to reverse the overall declining trend in RES-H in households. Between 2004 and 2007, renewable energy use in homes increased from 15 ktoe to 24 ktoe, a growth of 61% (or 17% per annum). In 2007, the use of renewable energy for heating in homes represented 13% of total renewable energy thermal energy usage in Ireland.

The recent growth in RES-H in the residential sector has also been observed in the services sector, also supported by an SEI grant scheme, the Renewable energy Heat Deployment (ReHeat) scheme. Since 2003, there has been a consistent 2 – 3 ktoe of biogas production from anaerobic waste water treatment in the public services sector. This has been augmented from 5 ktoe in 2006 to 8 ktoe in 2007 by solid biomass heating systems in the commercial services sector and to a lesser extent heat pump and solar thermal systems.

According to the Baseline Energy Forecasts published in Energy in Ireland 2007 Report, the thermal energy demand for Ireland will reach 5,442 ktoe in 2010. This suggests that 272 ktoe of renewable energy heat is required in 2010 compared with 185 ktoe in 2007, representing a 47% growth in the three years 2008 – 2010, a significant challenge against the context of the recent progress highlighted in Table 8.

[16] Greener Homes is a capital grant support scheme administered by SEI for home renewable energy heating systems. See www.sei.ie/greenerhomes for details.

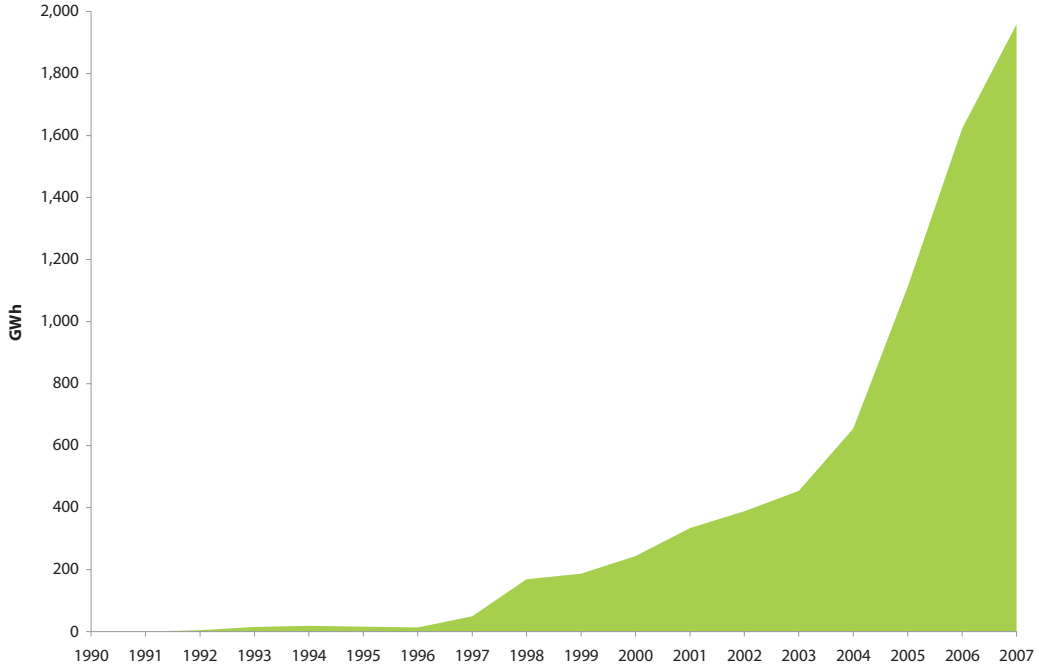
4 Individual Renewable Energy Sources

This section focuses on individual renewable sources that have shown particularly interesting trends in the past two years, namely wind energy and biofuels. The other reason for focussing on these two sources is that they have been the main focus of policies and measures linked to specific targets. The Renewable energy Feed in Tariff (REFIT 2006) programme[17] was designed to deliver sufficient installed wind power capacity to augment existing renewable electricity generating plant in order to meet the 2010 15% RES-E target. Similarly the Biofuels Mineral Oil Tax Relief (MOTR) Scheme (I and II)[18] were designed to stimulate biofuels penetration to deliver 2% of transport energy from petrol and diesel by 2008.

4.1 Wind

Figure 14 and Table 9 show 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 Alternative Energy Requirement (AER) programme came online. Total electrical output from wind in 2007 was 1,958 gigawatt hours (GWh) representing an increase of 21% on 2006. As stated in section 2 wind was responsible for 6.7% of gross electrical consumption in 2007 (5.6% in 2006).

Figure 14 Electricity Generated by Wind



Source: Eirgrid

Table 9 Renewable Electricity Production –Wind

	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Wind (GWh)	0	16	244	334	388	454	655	1,112	1,622	1,958

Source: Eirgrid

Figure 15 traces the evolution in installed wind capacity from 2000 to 2008 (the first wind farms came on line in 1992). It shows the annual incremental capacity added and the trend in total wind capacity on the Irish transmission and distribution networks. The surge in wind farm construction activity in the period 2003 – 2006 is very clear and

[17] For more information on the REFIT 2006 programme see
http://www.dcenr.gov.ie/NR/rdonlyres/E260E316-B65A-4FDC-92F0-9F623BA18B55/0/REFITtermsandconditions.doc
[18] For more information on the MOTR scheme see
http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/Biofuels+Scheme+II/

resulted in Ireland (the All-Island network) reaching the highest level of wind power penetration in the world[19]. While total installed wind capacity in Ireland is low compared with Germany, Spain and Denmark, wind power penetration is higher in the Irish system than in either the British, UCTE or NORDEL synchronous power systems.

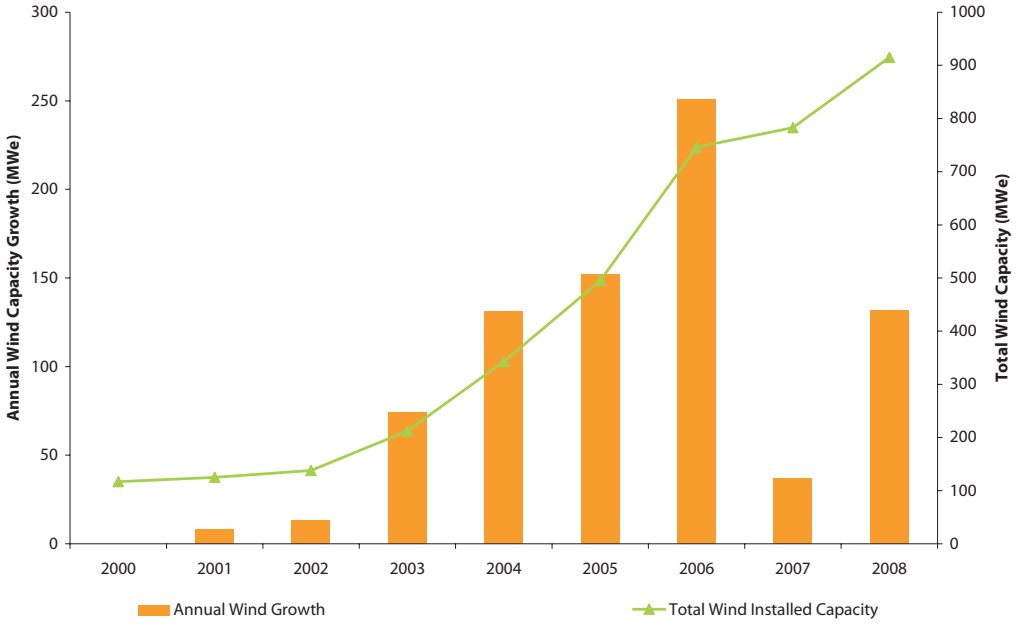
It is also clear that there has been a significant slowdown in wind farm development in the past two years (177 MW installed between January 2007 and September 2008 compared with 405 MW over the two year period 2005 – 2006). The total installed capacity reached 915 MW by September 2008. The peak recorded wind power output[20] was 811 MW delivered on 19th October 2008.

In order to reach the 15% RES-E target by 2010, it was estimated that 1,261 MW of installed wind capacity was required (in addition to 61 MW biomass, representing a doubling of biomass capacity)[21]. To deliver 15% of RES-E during 2010, this installed capacity is required by the end of 2009. This requires an additional 346 MW wind capacity to be added to the electricity network over the 14 month period October 2008 – December 2009. To achieve the 15% RES-E target thus requires an immediate significant acceleration in wind farm deployment.

In addition to the 915 MW currently installed there are a number of wind farms with grid connection contracts and target connection dates. Wind farms with an additional combined capacity of 149 MW have target connection dates during 2008 and there is a further 327 MW with grid connection target dates during 2009. While the requirement is an additional 346 MW installed capacity between October 2008 and December 2009, there are 476 MW with grid connection contracts and target connection dates in that 14 month period.

There are a further 212 MW contracted wind capacity with target connection dates during 2010 and a further 204 MW between 2010 and 2012. Thus between October 2008 and December 2012, there are 892 MW in grid connection contracts and target connection dates before the end of 2012 in addition to the 915 MW currently installed.

Figure 15 Installed Wind Generating Capacity 2000 - 2008[22]



Source: Eirgrid

[19] Measured as the ratio between installed wind generation capacity and overall generating capacity for a synchronous power system. For more detail see Ó Gallachóir B. P., Gardner P., Snodin H. & McKeogh E. J.*Wind Energy and System Security - The Grid Connection Moratorium in Ireland.* International Journal of Energy Technology and Policy (IJETP) **5** 633 – 647

[20] Wind power is published as 15 minute average data on http://www.eirgrid.com/eirgridportal/DesktopDefault.aspx?tabid=Wind%20Generation%20Curve&TreeLinkModID=1451&TreeLinkItemID=247

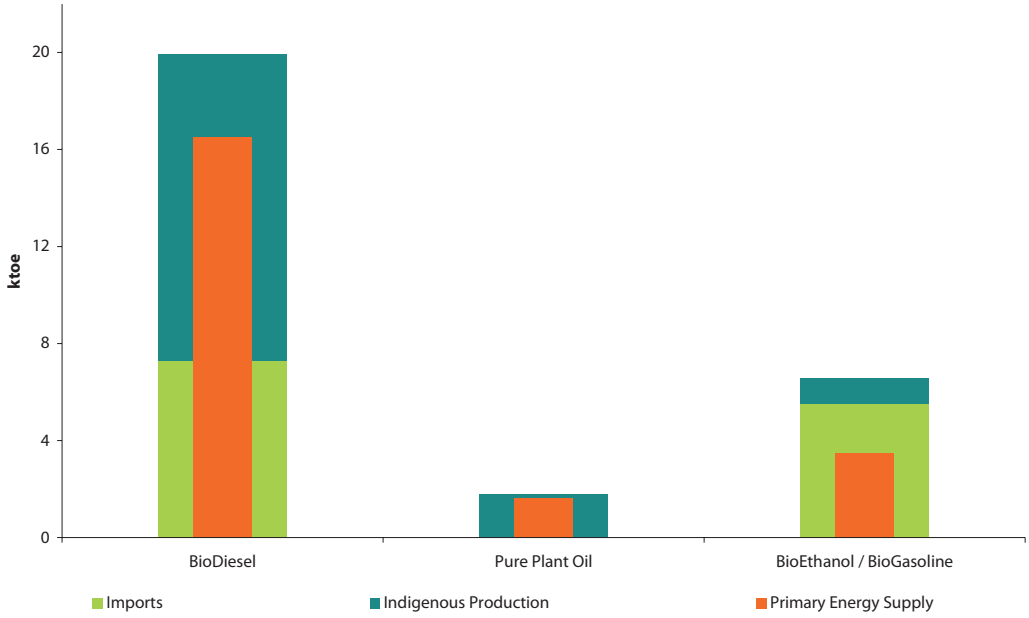
[21] SEI 2007 *Energy in Ireland*

[22] 2008 data

4.2 Biofuels

Figure 16 shows the contribution of different biofuels to Ireland's transport energy supply in 2007. The graph distinguishes between the amount of biofuels produced and imported (the thicker bars) and the amount used (the thinner bar) in 2007. The dominant fuel is biodiesel, representing 76% of biofuel usage in 2007, followed by bioethanol (16%) and finally pure plant oil (8%). It is also apparent from Figure 16 that during 2007, there were 21% more biofuels produced indigenously than were imported. However for individual biofuels this varies and in the case of bioethanol, imports represent more than five times the amount produced in Ireland.

Figure 16 Biofuels Production, Imports and Usage 2007



Source: SEI

In the case of bioethanol, there were more than five times as much imported as was produced indigenously. There was 73% more biodiesel produced indigenously than was imported in 2007 and pure plant oil used for transport purposes here was all produced in Ireland.

5 CO_2 Displacement

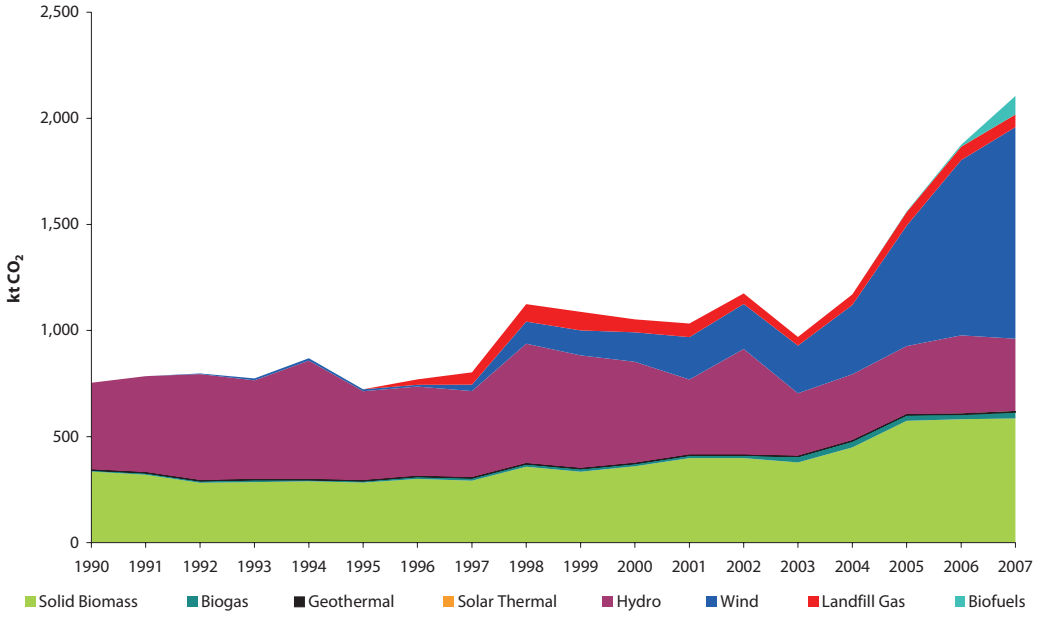
One of the benefits of determining the PEE associated with non-combustible renewables (see section 2.1) is that it can be used to calculate the amount of CO_2 avoided through the use of renewable energy. The caveats associated with the results for primary energy equivalent apply equally to the calculated CO_2 avoided.

Figure 17 shows the trend in avoided CO_2 emissions from renewable energy for the period 1990 – 2007. It is assumed the electricity from renewables (wind, hydro, landfill gas and the electricity portion of waste water biogas) avoids the amount of CO_2 produced by the weighted average electricity production from the same marginal plant considered in section 2 i.e. oil and single cycle gas plant.

It is further assumed that the thermal energy from renewable energy (solid biomass, biogas, geothermal and solar and the thermal portion of waste water biogas) displaces thermal energy from oil fired boilers. The CO_2 avoided from thermal renewable energy is equated with the CO_2 emissions that would have arisen from this oil consumption.

The avoided CO_2 emissions associated with biofuels usage in transport assumes 100% displacement of emissions from conventional fuels. The emissions from biofuels production are accounted for in this analysis in accordance with the UNFCCC reporting guidelines[23]. Thus the CO_2 avoided from bioethanol in transport is equated with CO_2 emissions that would have arisen from petrol consumption and CO_2 avoided from biodiesel and pure plant oil is equated with diesel consumption.

Figure 17 Avoided CO_2 from Renewable Energy 1990 to 2007



Source: SEI

Based on this methodology the estimated amount of CO_2 avoided from renewable energy increased by 179% (6.2% per annum on average) over the period 1990 to 2007 reaching 2,106 kt CO_2 in 2007, illustrated in Figure 17. The emissions avoided from wind were most significant in 2007, 997 kt CO_2, followed by solid biomass 585 kt CO_2 and hydro 339 kt CO_2.

[23] Emissions from fossil fuels used in the production of biofuels in Ireland are captured separately in the transformation section of the energy balance.

6 Going Forward

As seen in section 2 over the period 1990 to 2007 the total primary energy requirement (TPER) for Ireland increased by 70% (3.2% per annum on average) while renewable energy increased by 182% (6.3% per annum). Even so the share of renewables in TPER was only 2.9% in 2007 (1.8% in 1990). There is clearly further scope for renewable energy to contribute to Ireland's increasing demand for energy and there is a clear motive for policy makers to put in place programmes and measures to increase this share.

6.1 Targets and Measures

Since publication of the previous report in August 2007, the main policy development has been the proposed EU Directive on renewables as mentioned in section 3.

On 10 January 2007 the European Commission adopted an energy and climate change package, calling on the Council and European Parliament to approve the following targets

- an independent EU commitment to achieve a reduction of at least 20% in the emission of greenhouse gases by 2020 compared to 1990 levels and the objective of a 30% reduction by 2020, subject to the conclusion of a comprehensive international climate change agreement;
- a mandatory EU target of 20% renewable energy by 2020 including a 10% biofuels target.

The response relating to renewable energy was a *Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources*[24]. Each member state was given an individual target with the total for the EU being a 20% share of renewable in total final energy usage. The targets reflect the current situation. Ireland's target is 16% by 2020 (3.3% in 2007) whereas the Sweden has a target of 49% (39.8% in 2005).

6.1.1 Bioenergy Action Plan

In March 2007, the Bioenergy Action Plan for Ireland[25] was published. The Action Plan followed the work of a Ministerial Task Force in which several government departments were represented as well as the Office of Public Works. The departments included were:

- the Department of Communications, Energy and Natural Resources;
- the Department of Transport;
- the Department of Education and Science;
- the Department of Agriculture and Food;
- the Department of the Environment, Heritage and Local Government;
- the Department of Finance.

The Plan contains 50 action items. Actions include:

- Through the Energy RTDI Strategy under the auspices of the Research Council as well as SEI's R&D programmes to increase support for research projects across the bioenergy sector.
- Fund research in collaboration with DCENR & SEI to identify and select plant varieties and crop production and management systems that are most suited to biofuel production in the Irish context.
- Use of biomass CHP in future major public site developments.
- Expand existing programme of biomass heating in schools, starting with 8 additional schools in Summer 2007 with a view to broadening this on a significantly wider scale on a national basis.

[24] The full text of the Directive is available from http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/80&format=HTML&aged=1&language=EN&guiLanguage=en

[25] DCENR (2007), *Bioenergy Action Plan, http:*//www.dcenr.gov.ie/NR/rdonlyres/4FFF6234-26CA-46B5-878A-AA04A7288DA4/0/FinalBioenergyReport.pdf

- CIE transport companies mandated to move as soon as possible towards a 5% blend in all their existing diesel fleet.
- Promote the use of biofuels at up to 5% blends in Local Authority fleets and when purchasing new fossil fuel vehicles ensure that they are capable of taking much higher biofuel blends, in the range of 30% and higher.
- The 50% VRT relief for Hybrid Vehicles has been extended to flexible fuel vehicles in Budget 2006 and to electric cars in Budget 2007.

6.1.2 Wood Biomass Harvesting Machinery Scheme

The Department of Agriculture and Food has introduced a scheme[26] of supports to grant to assist the development of the supply chain required to process and supply wood biomass to end-users.

6.1.3 BioEnergy Scheme for Willow and Miscanthus

The Department of Agriculture and Food also introduced a BioEnergy Scheme (BES)[27] providing establishment grants to encourage the growing of willow and miscanthus for the production of biomass suitable for use as a renewable source of energy.

6.1.4 Renewable Energy Feed-in-Tariff for Electricity Generation

The renewable energy feed in tariff (REFIT)[28] scheme has been extended to include Offshore Wind, Ocean Energy and Combined Heat and Power (CHP). This is to help meet the national target specified in the recent Government White Paper of 15% of all electricity to come from renewable energy sources by 2010 and 33% by 2020. The support levels are linked to the consumer price index. A summary of the scheme is shown in Table 10.

Table 10 REFIT Scheme support levels

REFIT Reference Prices	c/kWh	Announced
Wind <5 MW	5.9	01/05/2006
Wind >5 MW	5.7	01/05/2006
Hydro <5 MW	7.2	01/05/2006
Biomass LFG	7	01/05/2006
Other Biomass	7.2	01/05/2006
Biomass CHP	12	24/01/2008
Anaerobic CHP	12	24/01/2008
Offshore Wind	14	08/02/2008
Wave	22	15/01/2008

Source: SEI Renewable Energy Information Office.

It was announced in the Carbon Budget of October 2008 that the 2020 target of gross electricity consumption to come from renewable energy was to be extended from 33% to 40%

6.1.5 Planning Permission Exemptions for Renewable Energy Technologies

Planning exemptions for Micro-Generation renewable energy technologies have also been introduced for both domestic[29] and other buildings[30]. The exemptions apply to wind turbines, solar panels, heat pumps and biomass subject to certain conditions in each case.

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[26] Dept. of Agriculture and Food (2007) , *Wood Biomass Harvesting Machinery Scheme*
http://www.agriculture.gov.ie/forestry/woodbiomasscheme/biomassscheme.pdf
[27] Dept. of Agriculture and Food (2007) , *BioEnergy Scheme for Willow and Miscanthus*
http://www.agriculture.gov.ie/schemes/bioenergy/bioenergy.xlm
[28] For more information on the REFIT 2006 programme see
http://www.dcenr.gov.ie/NR/rdonlyres/E260E316-B65A-4FDC-92F0-9F623BA18B55/0/REFITtermsandconditions.doc
[29] Statutory Instrument No.83 of 2007
[30] Statutory Instrument No.235 of 2008

6.1.6 Small and Micro Scale Electricity Generation Programme

In April 2008 a new small and micro scale electricity generation programme[31] was announced. The programme will assess technical, financial and regulatory issues surrounding the deployment of small and micro generation technologies in Ireland. It will also include a detailed review of feed in tariffs and potential supports for small and micro scale generation and the definition of quality standards for products and installers as well as a pilot trial of monitored installations.

6.1.7 Renewable Heat Deployment Programme (ReHeat)

In order to facilitate meeting the national target specified in the Government White Paper of 5% of all heat to come from renewable energy sources by 2010 and 12% by 2020 a Renewable Heat (ReHeat) Deployment Programme[32] was launched in March 2007. The programme provides assistance for the deployment of renewable heating systems in industrial, commercial, public and community premises in Ireland. The heating systems covered by this grant scheme are boilers fuelled by wood chip or wood pellets, solar thermal systems and heat pumps.

6.1.8 Greener Homes Scheme Phase II

Phase II of the Greener Homes Scheme[33] was launched on 1st October 2007. The intention of the Greener Homes scheme is to stimulate consumer investment in renewable heating solutions and to develop the market for renewable technologies and fuels, thereby reducing CO_2 emissions in the domestic sector. Phase II includes a range of new objectives including heightened product standards and improved training standards across the industry.

6.1.9 Biofuels Obligation Scheme

A public consultation paper on the Biofuels Obligation Scheme[34] was launched in September 2008. The obligation will apply to fuel companies, placing no burden on the taxpayer. It will be a key component in achieving the EU target of 10% penetration of renewable energy in transport by 2020. The consultation document proposes a target of 4% by volume of transport fuel by 2010, equating to 3% by energy. It attaches an important condition; the biofuels must come from sustainable sources.

6.2 Forecasts

In order to inform policy formulation SEI/EPSSU, in conjunction with ESRI, produced[35] forecasts which examine energy usage in 2020. Two sets of forecasts were prepared. The first, the *Baseline* forecast is not anticipated to represent a realistic outcome, but is useful in presenting a base case against which other forecasts may be compared. The second, the *White Paper* forecast, builds on the *Baseline* forecast, with additional assumptions introduced to incorporate the targets contained in the *Energy White Paper*, and the National Energy Efficiency Action Plan (NEEAP).

Figure 18 presents the forecast of the renewable energy contribution to TFC (according to the definitions in the proposed Directive) indicating separately the contribution to electricity (RES-E), transport (RES-T) and thermal energy (RES-H). The scale of the graph is set deliberately to indicate the distance to the 16% target.

The graph shows that the proposed EU Directive target for Ireland is met in 2020 within the *White Paper forecasts*. It is important to note that the energy efficiency savings are also contained within these forecasts. Given the renewable energy targets are expressed as percentages of energy consumption, any decrease in energy savings, or increase in energy demand due to other factors, will increase the amount of renewable energy production required to meet the renewable energy targets.

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[31] Small and micro scale electricity generation programme is a grant support scheme administered by SEI. See http://www.sei.ie/index.asp?locID=1305&docID=-1 for details.

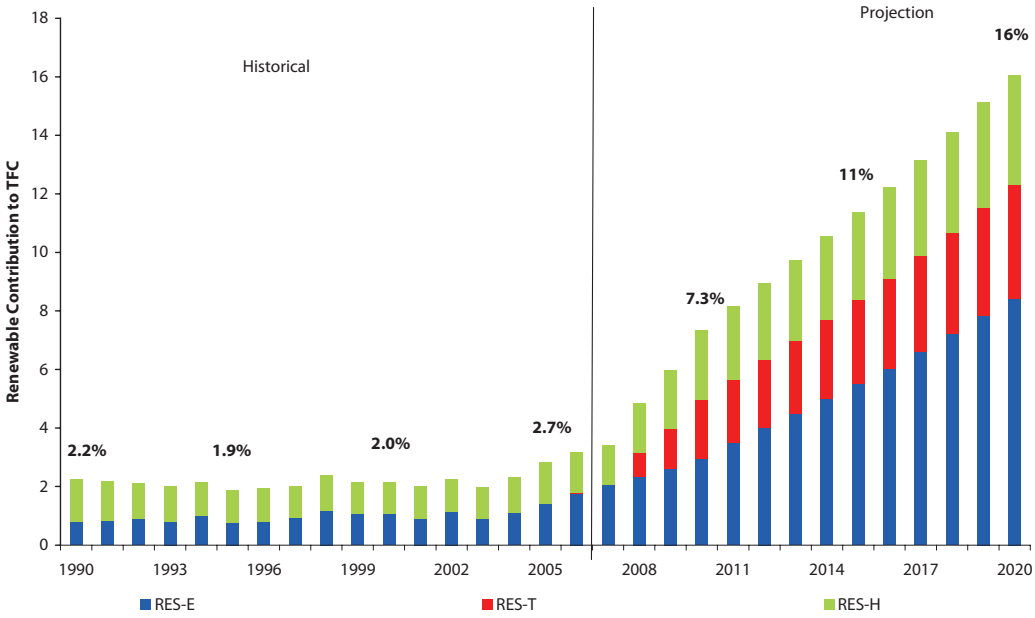
[32] Renewable Heat (ReHeat) Deployment Programme is a grant support scheme administered by SEI. See http://www.sei.ie/index.asp?locID=1114&docID=-1 for details.

[33] Greener Homes is a capital grant support scheme administered by SEI for home renewable energy heating systems. See www.sei.ie/greenerhomes for details.

[34] DCENR 2008 *Public Consultation on the Biofuels Obligation Scheme September 2008.* Available from www.dcenr.ie

[35] These forecasts were originally published in *Energy in Ireland 1990 -2006*. Available from www.sei.ie/statistics

Figure 18 Renewable Energy Contribution to TFC (White Paper)



Source: SEI

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.

Carbon Dioxide (CO_2): A compound of carbon and oxygen formed when carbon is burned. Carbon dioxide is one of the main greenhouse gases. Units used in this report are *t* CO_2 – tonnes of CO_2, *kt* CO_2 – kilo-tonnes of CO_2 (10^3 tonnes) and *Mt* CO_2 – mega-tonnes of CO_2 (10^6 tonnes).

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.

kilowatt hour (kWh): The conventional unit of energy that electricity is measured and charged for commercially. Related units are megawatt hour (MWh) and gigawatt hour (GWh) which are one thousand and one million kWh's respectively.

RES-E, RES-H & RES-T: Renewable energy sources in electricity, heat and transport respectively.

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.

Tonne of Oil Equivalent (toe): This is a conventional standardized unit of energy and is defined on the basis of a tonne of oil having a net calorific value of 41686 kJ/kg.

Total Final Consumption (TFC): This is the energy used by the final consuming sectors of industry, transport, residential, agriculture and tertiary. It excludes the energy sector such as electricity generation and oil refining etc.

Total Primary Energy Requirement (TPER): This is the total requirement for all uses of energy, including energy used to transform one energy form to another (eg burning fossil fuel to generate electricity) and energy used by the final consumer.

Wind Energy: Kinetic energy of wind exploited for electricity generation in wind turbines.

References

Dept. of Agriculture & Food (2007), *BioEnergy Scheme for Willow and Miscanthus,* http://www.agriculture.gov.ie/schemes/bioenergy/bioenergy.xlm

Dept. of Agriculture & Food (2007), *Wood Biomass Harvesting Machinery Scheme,* http://www.agriculture.gov.ie/forestry/woodbiomasscheme/biomassscheme.pdf

Dept. of Communications, Energy & Natural Resources (2007), *Bioenergy Action Plan, http*://www.dcenr.gov.ie/NR/rdonlyres/4FFF6234-26CA-46B5-878A-AA04A7288DA4/0/FinalBioenergyReport.pdf.

Dept. of Communications, Energy & Natural Resources (2007), *Energy White Paper 2007 - Delivering a Sustainable Energy Future for Ireland*, http://www.dcmnr.gov.ie/NR/rdonlyres/54C78A1E-4E96-4E28-A77A-3226220DF2FC/27356/EnergyWhitePaper12March2007.pdf.

Dept. of Communications, Energy & Natural Resources (2008), *Public Consultation on the Biofuels Obligation Scheme September 2008.* Available from www.dcenr.ie

Eirgrid (Sept. 2008), *Winter Outlook 2008 – 2009*, http://www.eirgrid.com/EirgridPortal/uploads/Announcements/Winter%20Outlook%20150808%20Final.pdf.

European Commission (January 2008), *DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the promotion of the use of energy from renewable sources*, http://ec.europa.eu/energy/climate_actions/doc/2008_res_directive_en.pdf.

International Energy Agency (2007), *Energy Balances of OECD Countries 2004 – 2005.* See www.iea.org for details.

Kartha S., Lazarus M. and Bosi M, (2004), *Baseline recommendations for greenhouse gas mitigation projects in the electric power sector.* Energy Policy *32,* 545-566.

Murphy JD, Power N 2008 How can we improve the energy balance of ethanol production from wheat?, Fuel, Volume 87, pp 1799 – 1806.

Ó Gallachóir B. P., Gardner P., Snodin H. & McKeogh E. J. 2007 *Wind Energy and System Security - The Grid Connection Moratorium in Ireland.* International Journal of Energy Technology and Policy (IJETP) **5** 633 – 647

Ó Gallachóir B. P., O'Leary F., Bazilian M., Howley M. & McKeogh E. J. 2007 *Comparing Primary Energy Attributed to Renewable Energy with Primary Energy Equivalent to Determine Carbon Abatement in a National Context* Journal of Environmental Science and Health Part A: Toxic /Hazardous Substances and Environmental Engineering, Vol.41, No. 5

Sustainable Energy Ireland (2007), *Energy in Ireland 1990 – 2006 (2007 Report)*, http://www.sei.ie/statistics

SEI (2004), *Renewable Energy in Ireland – Trends and Issues 1990 – 2002*, http://www.sei.ie/uploadedfiles/InfoCentre/RenewableEnergyinIreland19902002.pdf.

Thamsiriroj T, Murphy JD; 2008 Is it better to import palm oil from Thailand to produce biodiesel than to produce biodiesel from indigenous Irish rape seed? Applied Energy, doi:10.1016/j.apenergy.2008.07.010

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