

---

# FIM Services Limited

---

## UK Renewable Energy A Growth Industry

---

December 2010

---

**FIM**

**FIM Services Limited**

Glebe Barn  
Great Barrington  
Burford  
Oxon  
OX18 4US

Tel: 01451 844655

Fax: 01451 844509

[fim@fimltd.co.uk](mailto:fim@fimltd.co.uk) [www.fimltd.co.uk](http://www.fimltd.co.uk)

## **RENEWABLE ENERGY – A GROWTH INDUSTRY**

Investors are focussing on the potential returns from generating power from renewable and/or sustainable sources. Interest is being driven by wide ranging support mechanisms that have been introduced by governments around the world. These are designed to encourage generation from renewable energy, combating global warming by reducing greenhouse gas emissions and to diversify energy supplies. This political drive is in turn being driven by increasing pressure from voters on climate change, energy security and the implications thereof.

### **POLITICAL DRIVE**

With growing emphasis being placed on climate change by many governments in the industrialised countries, even now in the USA where the government has to date lagged behind others, political pressure is now dictating that change will come about.

The Kyoto Protocol is an international voluntary agreement signed in 2005, which sets targets for industrialised countries to cut their greenhouse gas emissions. The industrialised nations who signed up to the treaty have a specific obligation to reduce emissions of greenhouse gases by an average of 5.2% below their 1990 levels by the first commitment period of 2008 to 2012.

Subsequently, the EU has committed to reduce emissions by 8% from their respective 1990 levels. The EU member states agreed to redistribute this target and as a result the UK's target is to cut its greenhouse gas emissions by 12.5%.

Further commitment periods were not legally adopted at the Copenhagen Summit in December 2009. However, the EU formerly confirmed its support for the Copenhagen Accord in January 2010 with a unilateral commitment to the reduction of the EU's overall emissions by 20% on 1990 levels by 2020 and a conditional offer to increase this cut to 30% provided an international agreement is reached committing other developed countries and more advanced developing nations to comparable reductions. The UK has passed legislation demanding a reduction in CO<sub>2</sub> emissions of at least 34% by 2020 and 80% by 2050.

### **CLIMATE CHANGE – THE ECONOMIC IMPORTANCE**

The Intergovernmental Panel on Climate Change (IPCC) in its Fourth Assessment Report issued in 2007 estimated that, as a direct result of human activity increases in greenhouse gases will raise average global temperature by between 1.8 and 4 degrees Celsius (°C) by 2100. This could lead to more extreme weather events, rising sea levels displacing 200 million people, disruptions in food supply particularly in Africa and an increase in malaria. Many of the world's species may also become extinct.

The main cause of global warming is considered to arise from the rapid increase in "greenhouse gas" emissions, mainly carbon dioxide (CO<sub>2</sub>) and methane, from agriculture, power generation and transport.

Naturally occurring greenhouse gases make up approximately 1% of the atmosphere and act as a glass roof around the earth, trapping heat and keeping the planet some 30°C warmer than it would be otherwise. If emissions continue to grow at current rates, the atmospheric levels of CO<sub>2</sub> are likely to double from pre-industrial levels during the 21st century, impacting on the global temperature.

The Stern Review, in its 2007 report to the UK Government on the economics of climate change, estimated that changes in weather patterns could reduce global GDP by 1%, whilst a 2°C rise in temperature would reduce GDP by 2% to 3%. It also estimated that if concerted action is taken to

stabilise emissions over the next 20 years GDP would reduce between 1% and 3% thereafter, the economic cost would be only 1% of global GDP.

## GREENHOUSE GAS EMISSIONS

Global greenhouse gas emissions were estimated in 2005 at 44 billion metric tonnes of CO<sub>2</sub> equivalent per annum. Since then emissions have increased and the concentration of greenhouse gas in the atmosphere reached a record high in 2009. The main component is CO<sub>2</sub> with one of the major sources being power generation from fossil fuels. The main contributors are the US, China and the EU. The United States, Germany and Canada have all managed to reduce their carbon-dioxide emissions between 2000 and 2008; China has more than doubled its emissions.

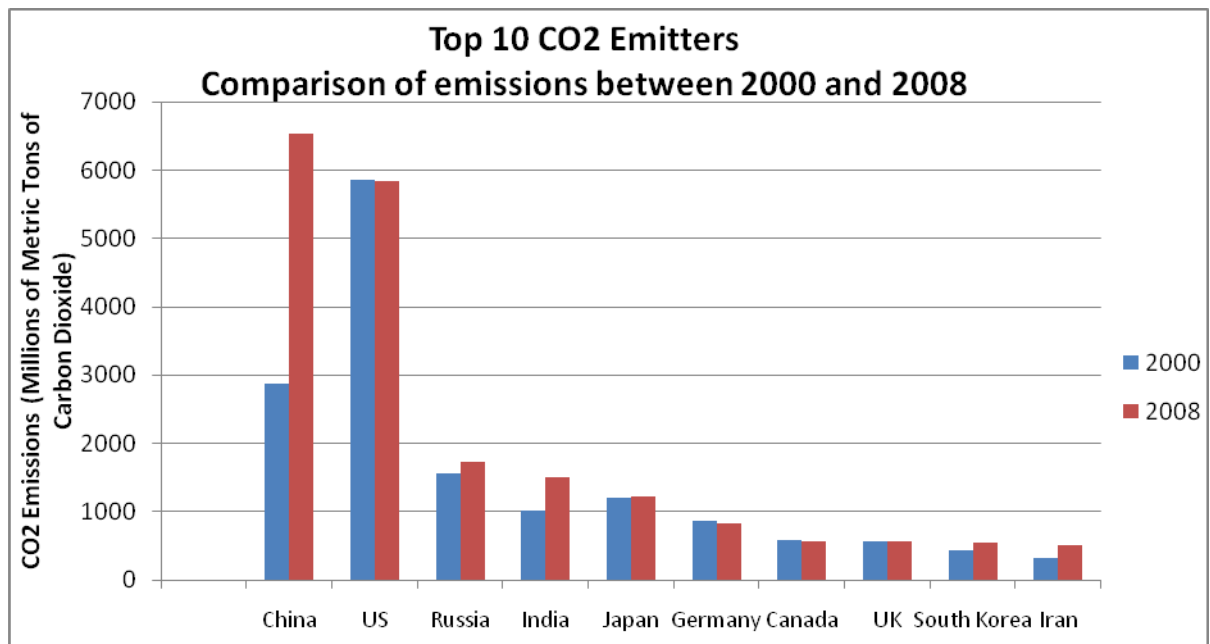


Figure 1: Source - US Energy Information Administration

When making comparisons between countries it is important to look at emissions per capita. The United States and Canada have the highest CO<sub>2</sub> emissions per capita and have both managed to reduce emissions per capita between 2000 and 2008.

Emissions per capita in developing countries are rising. The reductions made by industrialised nations do not counteract the rapidly rising emissions per capita of developing countries such as Russia, Iran, China and India. Industrialised nations need to continue to reduce emissions and develop new technologies which can then be utilised in less developed countries, on a global scale.

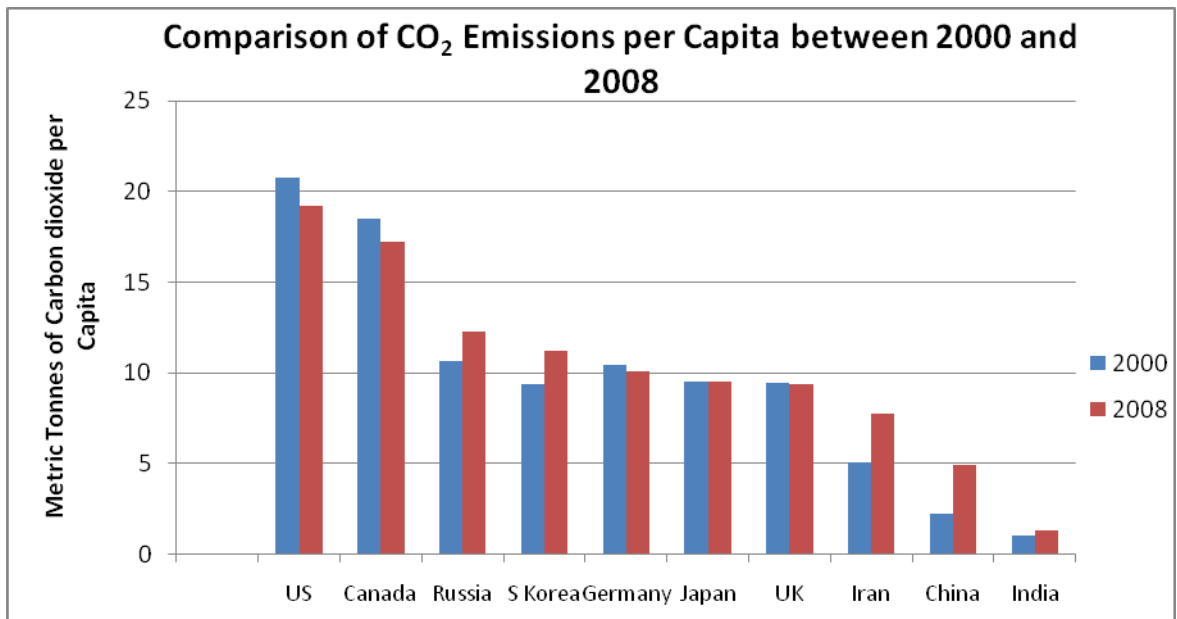


Figure 2: Source - US Energy Information Administration

Even if the industrialised nations meet the 2012 emission targets agreed in the Kyoto Protocol this will have a limited effect on global warming due to the increasing emissions in emerging economies. The Energy Information Administration (EIA) forecast that an additional 600 gigawatts of coal fired capacity will be built in China between 2006 and 2030. That equates to one 500 megawatts (MW) coal plant coming on line every week for 24 years.

International Energy Agency (IEA) figures show that China became the largest CO<sub>2</sub> emitter in the world in 2006. UN data shows that their total emission in 2008 was 6.5bn metric tonnes, only some 4.9 tonnes per capita ("tpc"), significantly below the UK at 9.4tpc and the USA at 19tpc. UK CO<sub>2</sub> emissions represent 2% of global emissions, with the major source being energy industries.

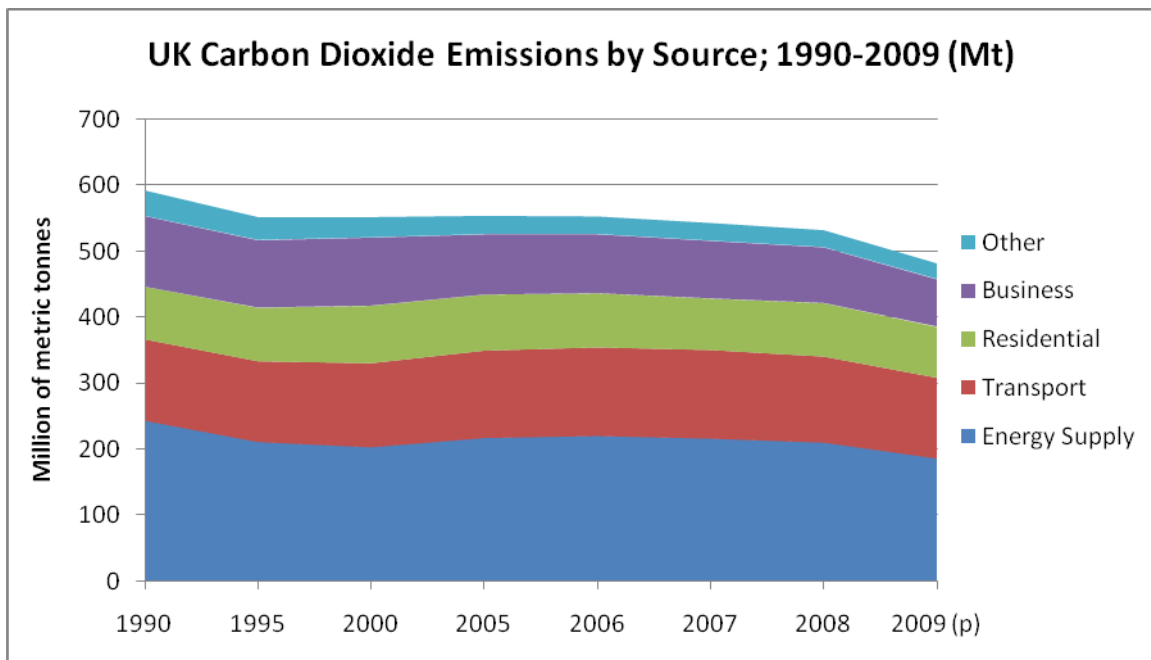


Figure 3: Source - DECC, 2009 estimates are provisional

## THE MECHANISM OF CHANGE

The requirement to subsidise renewable energy is to make it economic against established technologies, particularly those using fossil fuels.

There is a strong economic argument that if global warming is considered a serious threat to the environment, then the western world must invest in new technologies and therefore by definition be prepared to pay more for their energy needs. Investing in new technologies will rapidly improve their efficiency. The average cost of generating power from wind turbines has fallen by some 80% over the last 20 years.

The same is happening with solar power. On January 31, 2008, Sandia's National Solar Thermal Test Facility in New Mexico set a solar-to-grid system conversion efficiency record of 31.25% with their new Sterling solar dish system set. In the mid 1980s the solar-to-grid electricity efficiency was 10%.

It is expected that wave and tidal generating units will become more economic over the next five to ten years and will then contribute to the world's energy needs. The relative cost of generation per electricity unit (lifecycle costs including capital, fuel, operation and maintenance costs) in the UK is shown below:

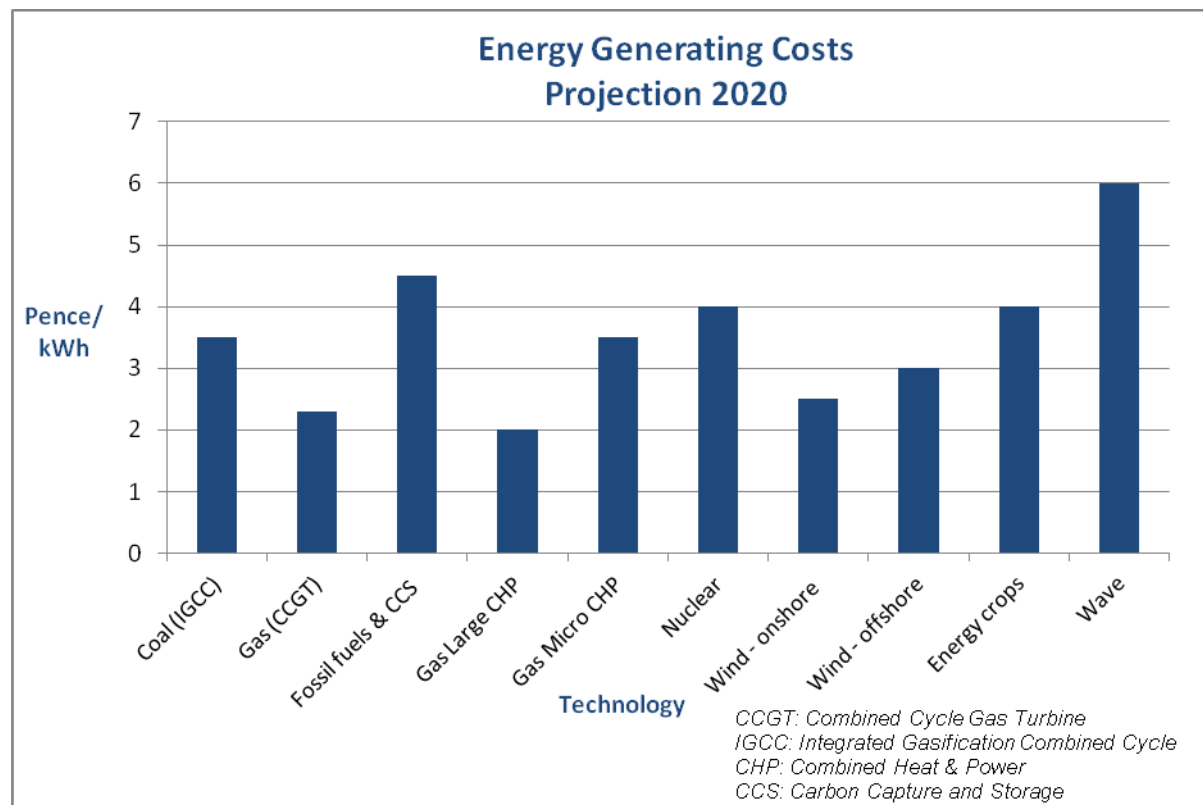


Figure 4: Source - Sustainable Development Commission

The developed nations need to invest in new technology including clean coal, renewables, carbon storage and other means of reducing emissions to both demonstrate to the emerging countries that these new technologies are economic and create new business opportunities.

## UK RENEWABLE ENERGY TECHNOLOGIES

Renewable energy generation arises from a number of technologies including:

- Hydro:** Most large scale opportunities are already developed.
- Wind:** Onshore wind is the most developed and economic of the new technologies.  
Offshore wind is rapidly becoming more economic with improvements in turbine design.
- Solar:** The cost is still high in relation to traditional sources of generation, but rapid improvements in technology are beginning to see costs decline.
- Biomass:** The economics are heavily influenced by the cost of the feedstock, generally timber/timber residues or purpose grown short rotation coppice crops. An increase in subsidies in 2009 and a decision by the UK government in July 2010 to fully “grandfather” anaerobic digestion and energy- to-waste plants have generated significant investment interest.
- Waste to Energy:** New technologies in the form of pyrolysis, as opposed to traditional incineration, should lead to improvement in the economics, but this is still totally dependent on the quota fee paid by the waste producers to the plant operator.  
There will be significant investments in this area in the foreseeable future.

Currently the most economic of the renewable technologies, providing investors with good returns based on proven technology and with established mechanisms for raising project finance, are onshore wind, hydro-electric and biomass.

## WIND POWER – PROVEN TECHNOLOGY

Wind power has been growing at around 30% per annum over the last decade. It is now a major industry with an estimated installed capacity of 158 Gigawatts (1,000 megawatts (MW) or GW). At an assumed build cost of around £1.5 million per MW this represents a global investment of circa £237 billion.

Country	MW of Installed Capacity		Growth in Capacity 2008-09	Market share 2009
	2008	2009		
USA	25,237	35,159	39%	22.3%
Germany	23,903	25,777	8%	16.3%
China	12,104	25,104	107%	15.9%
Spain	16,689	19,149	15%	12.1%
India	9,655	10,926	13%	6.9%
Italy	3,736	4,850	30%	3.1%
France	3,404	4,492	32%	2.8%
UK	2,974	4,051	36%	2.6%
Portugal	2,862	3,535	24%	2.2%
Denmark	3,163	3,465	10%	2.2%
<b>Top ten total</b>	<b>103,727</b>	<b>136,508</b>	<b>32%</b>	<b>86.5%</b>
Rest of World	16,823	21,391	27%	13.5%
<b>World total</b>	<b>120,550</b>	<b>157,899</b>	<b>31%</b>	<b>100.0%</b>

Figure 5: Source - Global Wind Energy Council 2010

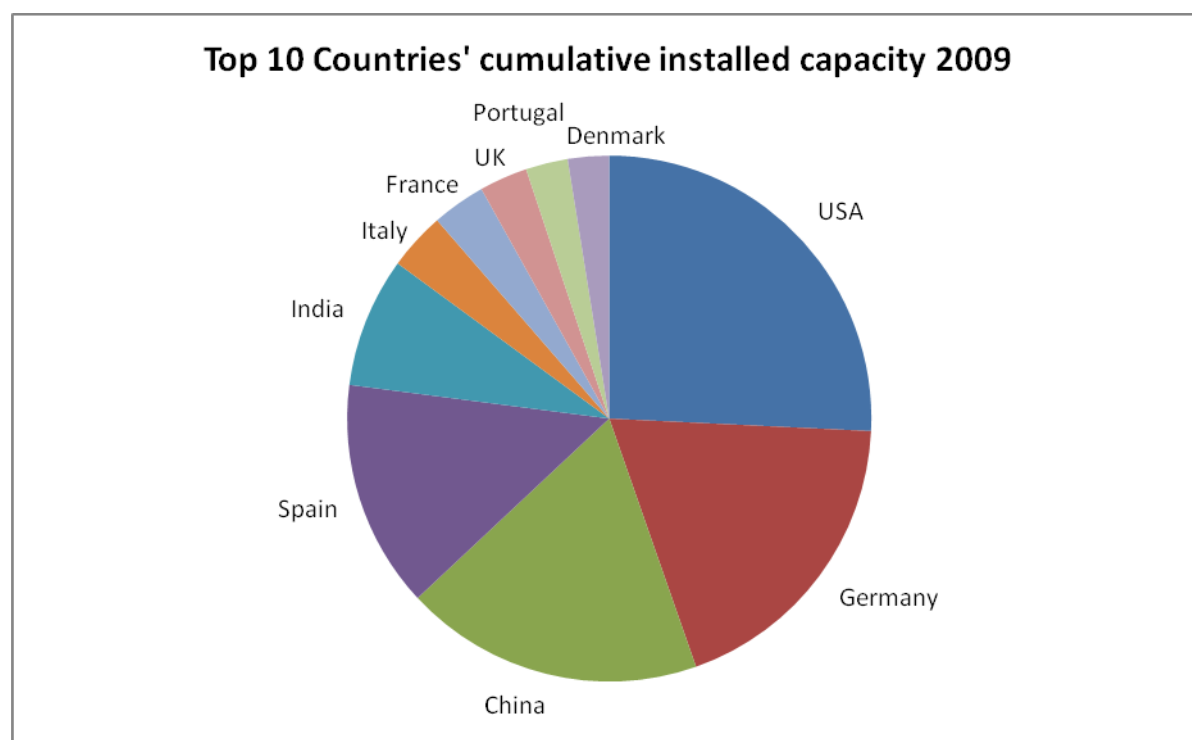


Figure 6: Source - Global Wind Energy Council 2010

The EU, which has been the major driver of the industry, aims to commission 230 GW of wind capacity between now and 2020. This could amount to 20% of Europe's electricity demand. US wind capacity grew by 10GW in 2009, up 40%. Taking into account all the commissions for new wind

turbines made globally, the world's wind power capacity is expected to reach 200GW by the end of 2010.

The UK is favoured in having one of the best wind resources in Europe. Load factors, reflected in plant utilisation, will be 30% to 35% in the uplands compared to 20% to 22% in the lowlands of Europe.

Total installed capacity in the UK is currently circa 3.7GW onshore and 1.3GW offshore.

In the UK, 1.8MW of onshore capacity on a reasonable site would produce over 4.7 million units of electricity a year, enough to supply over 1,000 households and save over 2,000 tonnes of CO<sub>2</sub> which would be emitted by the coal fired generation it replaces.

Modern turbines are quiet in operation. The design of the wind farm must comply with strict guidelines on noise levels relative to any nearby habitation.

Wind energy is one of the most efficient of the renewable energy technologies. The cost of wind energy varies according to many factors. The average cost for a new onshore wind farm in a good location in the UK is circa 3-4 pence per kWh, competitive with new coal (2.5-4.5 pence per kWh), especially if CCS is required, and lower than new nuclear (4-7 pence) if decommissioning costs are taken into account.

Growth continues to be rapid, with the emphasis fuelling a rapid improvement in technology with turbines increasing in both size and efficiency. Sway, a Norwegian company, will be building the first 10MW wind turbine in Oeygarden in 2011, capable of supplying 2,000 homes by itself. With a height of over 300m, this wind turbine improves efficiency by reducing the weight as well as the number of moving parts.

## HYDRO-ELECTRIC POWER - LEADING RENEWABLE ENERGY TECHNOLOGY

### GLOBAL CAPACITY

Hydro-electric power is the best established renewable technology. Global hydro capacity of 887GW accounts for approximately 20% of the world's electricity production if pumped storage is included. Excluding pumped storage the figure falls to 6.9% of the world's electricity production, however this still amounts to over 65% of total renewable generation. Global hydro generation has grown at approximately 2% per annum between 2000 and 2008. Growth is forecast to increase at a rate of circa 4% per annum between 2008 and 2013 due primarily to significant investment in China and India.

<b>Global Installed Hydro Capacity including pumped storage (GW)</b>				
<b>Region</b>	<b>2009</b>		<b>Under Construction</b>	<b>Planned Hydro</b>
	<b>Installed</b>	<b>Market share</b>		
Asia	299	34%	121	175-278
Europe	246	28%	19	49-102
N & C America	167	19%	5	21-35
South America	139	16%	19	74-90
Africa	22	3%	8	25-98
Australasia/Oceania	14	2%	0	1-2
<b>World Total</b>	<b>887</b>	<b>100%</b>	<b>172</b>	<b>345-605</b>

Figure 7: Source - Hydropower & Dams, World Atlas 2009

Installed hydro capacity (excluding pumped storage) in the EU-27 is circa 106GW and circa 1.5GW in the UK.

### UK HYDRO-ELECTRIC

In the UK, most large scale opportunities, outside of pumped storage, have already been developed. However, there is substantial potential for small scale developments which, due to the introduction of Feed-In Tariffs (FITs) in April 2010, are now economic.

UK installed capacity (excluding pumped storage) is circa 1.5GW, comprised mainly of larger units of over 20MW capacity constructed many years ago. FIM expect that following the introduction of FITs, in April 2010, there will be significant growth in sub 5MW hydro installations which currently account for only 0.2GW or 14% of total installed UK hydro capacity.

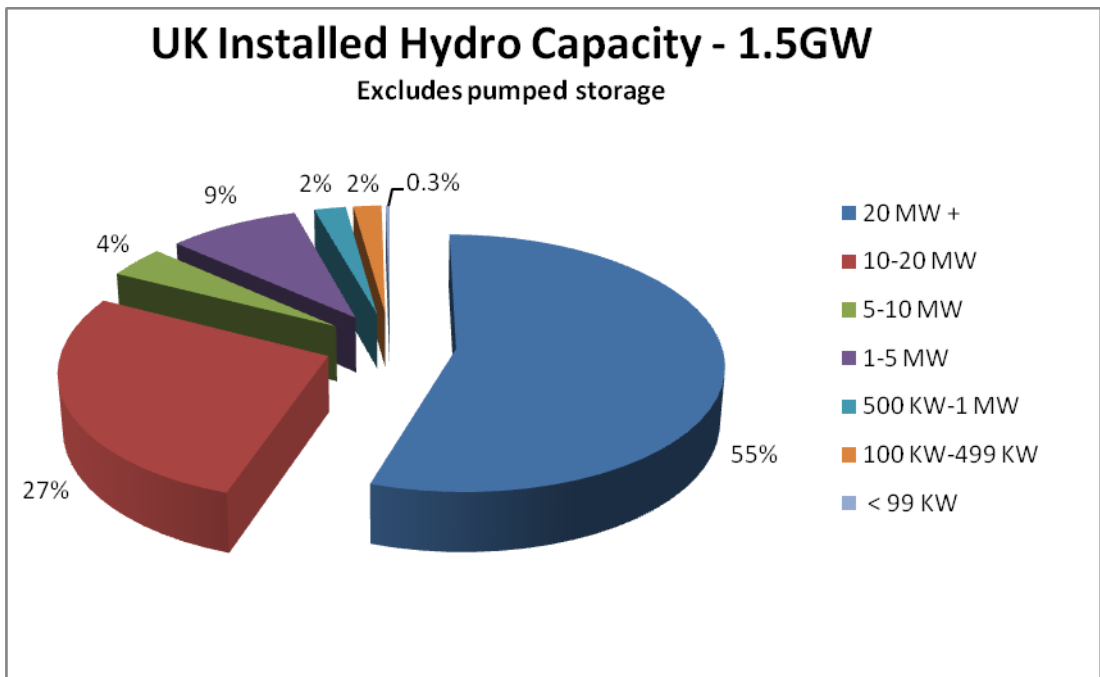


Figure 8: Source - British Hydro Association

In 2008 the Scottish government estimated that there remained 1.2GW of viable hydro resource over 7,043 small schemes; circa 170kW per site.

The technology of small scale hydro is simple, typically the schemes are run-of-river where the natural elevation “head” and flow rate “flow” of the river is used to generate electricity and minimal water storage or river barriers are required. Once constructed a typical run-of-river scheme could be expected to last for 50 years or more. Small scale hydro is also the most efficient renewable technology with efficiency factors typically between 70 and 90%.

The environmental benefits of small scale hydro are clear. Not only is hydro an efficient, durable and clean technology with no environmentally damaging by-products but the use of the natural flow of the river in run-of-river schemes avoids many of the environmental concerns associated with large scale pumped storage schemes.

A 1MW hydro scheme, with a typical capacity factor of 50%, on a reasonable site, could produce around 4.3GW of electricity a year. If household electricity consumption is estimated at 4.3MWh per year, the scheme could supply 1,000 households.

## BIOMASS

### GLOBAL CAPACITY

Global biomass electric power capacity has grown by 20% between 2006 and 2009, from 45GW to 54GW. The global distribution is set out below:

Installed Capacity 2009	2006 GW	2009 GW	2006 -2009 Growth	2009 Market Share
Developing Countries	22.0	24.0	9%	44%
EU-27 excluding Germany	7.7	12.0	56%	22%
United States	7.6	9.0	18%	17%
Germany	2.3	4.0	74%	7%
China	2.0	3.2	60%	6%
India	1.5	1.5	0%	3%
Rest of World	1.9	0.3	-84%	1%
<b>World Total</b>	<b>45.0</b>	<b>54.0</b>	<b>20%</b>	<b>100%</b>

Figure 9: Source - Renewables Global Status Report 2006 and 2010

The country with the largest existing biomass electric power capacity end 2009 was the US, followed by Brazil, Germany and then China.

### BIOMASS PLANTS IN THE UK

Three types of projects are being considered:

- Large (100MW plus) generating stations located in ports, which would burn imported feedstock. None are yet in operation. However, the largest biomass plant in the world (350MW) is planned to be completed in 2011 in Port Talbot, Wales.
- Medium sized (10 MW to 50 MW) plants, which burn domestically sourced feedstock. These are either in urban locations burning waste wood/materials or in rural locations burning lower grade clean timber or agricultural by-products/waste. In rural locations, they are often located adjacent to facilities processing timber or agricultural products to take advantage of the by-products/waste. Primary processing facilities may also be able to take advantage of the heat produced by generation. A number of plants have been built in the UK based on a range of feedstocks.
- Small plants, circa 5MW and less, often based around standardised generating stations. Some smaller plants have been built.

Most of the UK's operational biomass plants generate electricity only.

Plants operating in combined heat and power mode ("CHP") are significantly more efficient than those operating in electricity only mode. However, heat can only be distributed over relatively small distances and may require significant investment in infrastructure. Further, heat demand can be quite variable and the covenant of heat purchasers may be less secure.

Plants burning waste are significantly more expensive to build as they require additional investment to deal with potential pollutants in the feedstock to comply with the Waste Incineration Directive ("WID"). Clean timber is excluded from the WID. As a result, plants burning waste have a different economic profile, with the higher cost being offset by gate fees on feedstock that would otherwise go to landfill.

## BIOMASS HEAT AND ELECTRICITY GENERATION

FIM has been monitoring developments in biomass heat and electricity generation in the UK, with a focus on facilities which use domestically sourced clean timber as feedstock.

At its simplest level, development of these types of facility will increase demand for timber and timber processing residues:

- E.ON's operational Stevens Croft Facility at Lockerbie, located next to the James Jones & Sons Ltd and Forest Garden's sawmills, consumes some 500,000 tonnes/year of domestically sourced feedstock primarily in the form of chipped small round wood ("SRW") and sawmill residues. The total UK softwood timber harvest runs at circa 8.5 million tonnes per annum.

Beyond this increase in demand for timber/processing residues, there may be opportunities for forest owners to enter into advantageous supply agreements with plant owners, as secured feedstock supply is typically a requirement for financing.

Further, as with wind farms and hydro generating stations, the renewable benefits offered to biomass plants may make investment in these facilities an interesting proposition, possibly in conjunction with supply of feedstock.

- Dedicated biomass plants producing electricity from regular biomass currently attract 1.5 ROCs/MWh;
- Dedicated biomass plants producing electricity from energy crops (Miscanthus, Salix or Populus) attract 2.0 ROCs/MWh; and
- Dedicated biomass CHP plants burning either regular biomass or energy crops receive 2.0 ROCs/MWh.

## WASTE TO ENERGY

Waste to Energy (WtE) is a form of energy recovery. Most WtE processes produce electricity directly through combustion, or produce a combustible fuel commodity, such as methane, methanol, ethanol or synthetic fuels. In this report clean, natural biological material such as miscanthus and sustainable wood cut offs are referred to as biomass whereas fuel used for WtE processes can be from a multitude of sources, including municipal solid waste, waste wood and animal carcasses.

This report does not go into detail about WtE because FIM do not view it as an investment opportunity with a good risk-return ratio. The initial investment into WtE plants can be expensive because of strict regulation on emissions and the need for advanced filter systems on the plant chimneys. Operational costs are also high due to the regulation on feedstock and the need to remove dangerous chemicals, metals and other harmful substances.

The landfill tax, introduced in 1996 to discourage use of landfill, is set at £48 per tonne in 2010/11 and will rise by £8 per tonne every year until 2014/15. Some developers and contractors are prepared to pay WtE plants a "gate fee" to remove and use their waste in order to avoid landfill tax. This can offset the initial costs of development. However, it is unlikely that these gate fees will remain in place and there is a risk that feedstock costs could increase. The uncertainty feedstock costs and regulation on feedstock makes WtE a riskier investment than other forms of renewable energy.

## UK RENEWABLE ENERGY - THE INVESTMENT OPPORTUNITY

The UK is a prime location to invest in renewables:

- The UK has one of the best wind resources in Europe and a liberalised electricity market, providing free market access and a high total price for electricity from renewable generation.
- Electricity demand is positively correlated with GDP. Once the recession has subsided, GDP is expected to move back to a long term compound annual growth rate (CAGR) of circa 2%. Renewable power generation experienced a CAGR in excess of 20% from 1996 to 2007, outperforming GDP, even through the dotcom bust.
- From 2006-2009, total electricity generation fell by an average of 5% per annum, while renewable electricity generation grew by an average of 13% per annum. So although electricity demand is positively correlated with GDP, over the last four years renewable energy has been uncorrelated. Because of its preferential status on the grid, renewable energy investments can be used as a hedge against GDP risk.
- Renewables provide a hedge against inflation. The UK Government provides committed support to renewable energy generators through the Feed-in-Tariffs (FITs) and Renewable Obligation Certificates (ROCs) which are index linked to inflation for the next 20 years. With RPI inflation recorded at 4.6% in October 2010 and inflation expectations rising, renewable power generation, especially wind, should prove to be an attractive asset class.
- Electricity supply from existing generators, such as coal and nuclear is forecast to decline as older plants which cannot meet emission targets or are outdated are decommissioned. This could lead to an increase in prices.
- Generation from renewables has historically fallen well short of targets set by the government, creating additional income for renewable generators. According to a report by the National Audit Office in June 2010, the UK produced only 2.3% of UK energy from renewable resources. The target for 2010 was 10%. The UK must now aim to achieve a target of 15% of all energy consumption from renewable sources by 2020.

### UK ELECTRICITY DEMAND AND SUPPLY

UK electricity demand is currently circa 322 terrawatt hours (TWh). Electricity demand increases in response to population growth and economic growth and fluctuates in the short term in response to business cycles and weather trends. Historically, GDP has been positively correlated with electricity demand. Demand grew steadily at an average annual rate of 4% from 1998 to 2004, fuelled by GDP growth. In 2005 demand peaked at 349TWh.

From 2005 to 2008 demand has steadily fallen at an average annual rate of 2%. The reasons behind this fall include mild winters in both 2006 and 2007, and a decrease in economic activity in 2008. Other factors include continued export of manufacturing to overseas locations and some progress in energy efficiency, particularly in industry.

In 2009 GDP contracted by 4.7%, which was the highest annual decline seen in the UK since 1946. The dip in industrial activity over the last few years contributed to the fall in electricity demand of 19TWh (a 6% decrease) from 2008 to 2009. The National Grid forecasts electricity demand to continue falling until 2015.

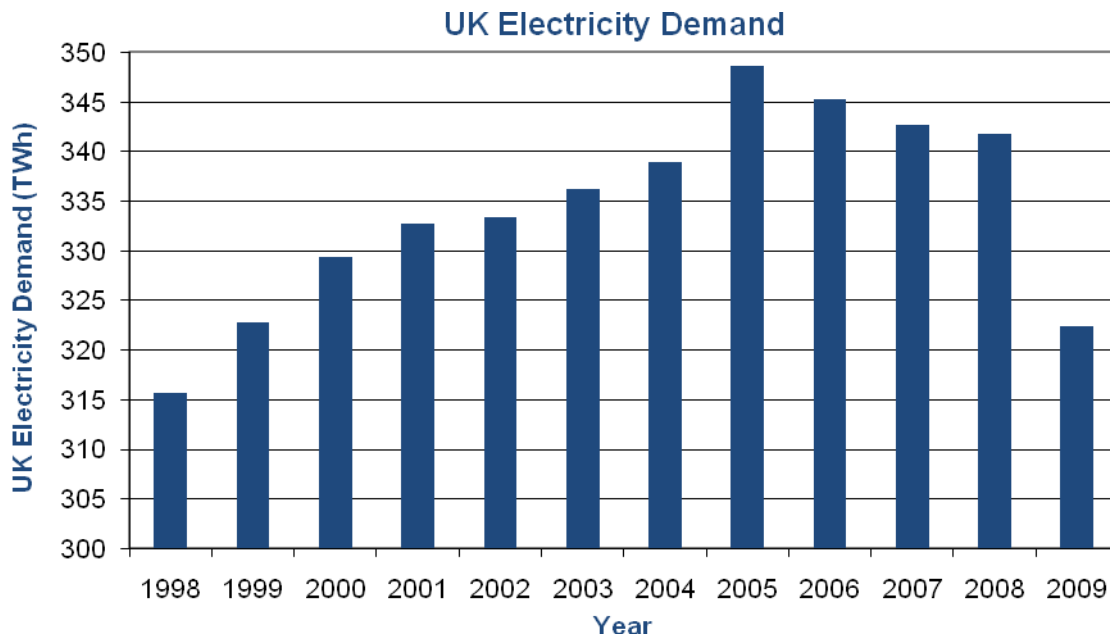


Figure 10: Source - Department for Business: Digest of UK Energy Statistics 2010

Current generation capacity is dominated by combined cycle gas turbine (CCGT) and coal stations, which represent 69% of the UK capacity.

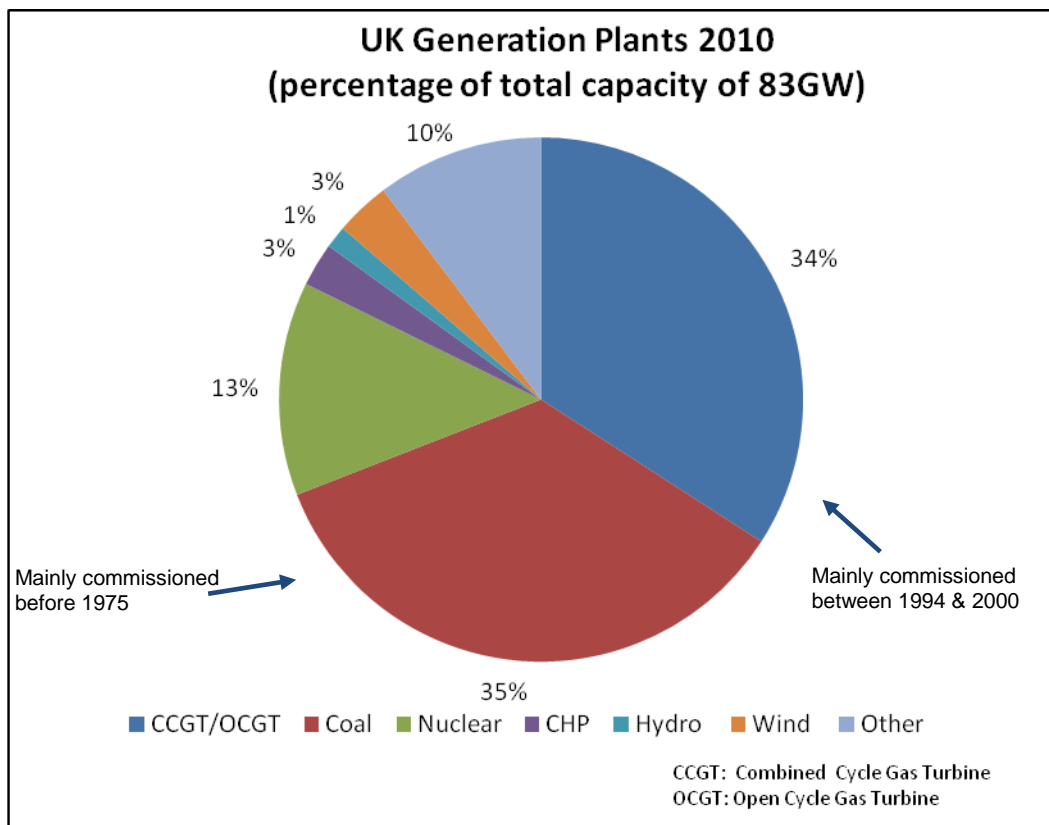


Figure 11: Source - NGT Seven Year Statement 2010

## FORECAST IN CHANGES TO GENERATING CAPACITY MIX

- Growth in generating capacity to 2016 is forecast to be driven by CCGT and wind power.
- CCGT/OCGT generating capacity is forecast to grow by 55% between 2010 and 2016.
- Wind energy capacity is forecast to grow by over 410%.

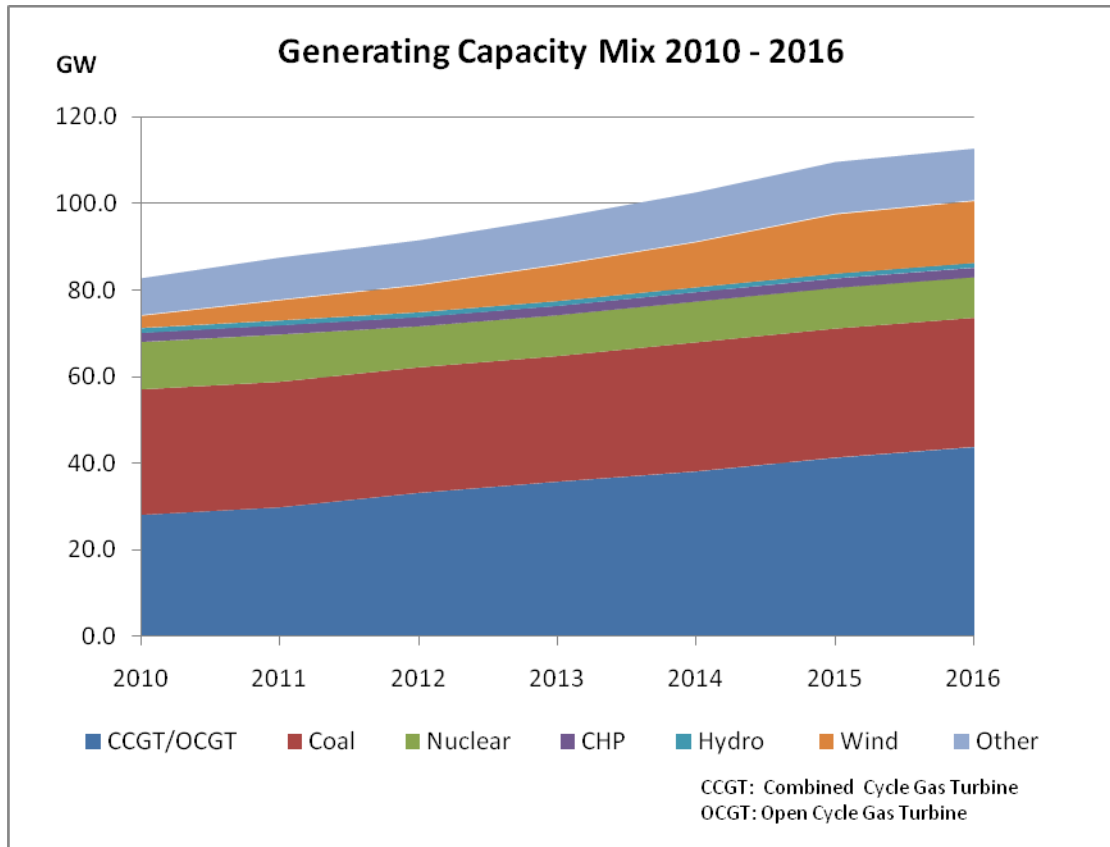


Figure 12: Source - NGT Seven Year Statement 2010

## UK RENEWABLES GENERATION

In 2009, total output from all renewable generators amounted to 21.1 TWh which represented 6.7% of total electricity supply. The main contributors of renewable electricity were onshore wind (36%), landfill gas (24%) and hydro (12%).

Between 2008 and 2009, renewable energy production increased by 3.4 TWh or 19%, with 65% of the increase coming from wind energy.

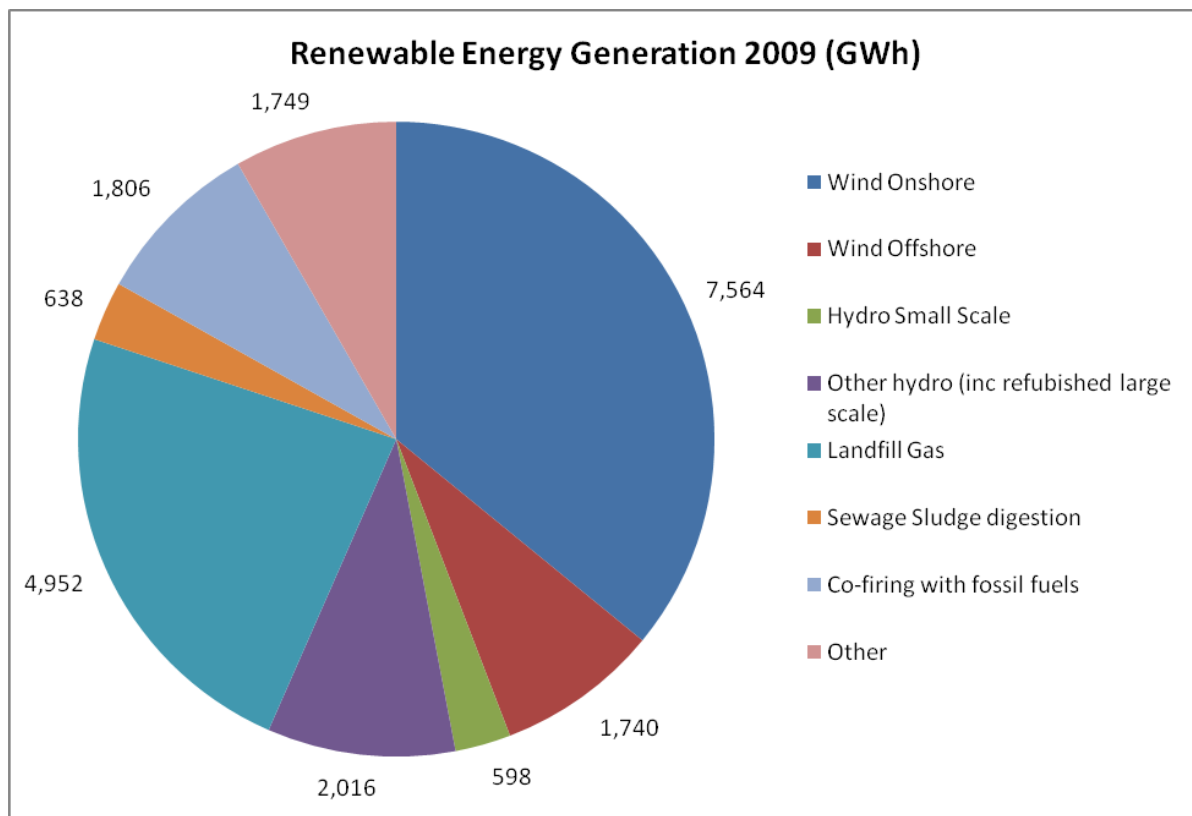


Figure 13: Source - DECC Digest of UK Energy Statistics 2010

### Investment Opportunities:

- Landfill is largely at full production. Government legislation through the land fill tax discourages further landfill sites, so there will only be nominal additional output from this source.
- Wave and tidal generation are still in the development phase.
- Large-scale hydro has largely been developed. Small scale additions are envisaged. There are investment opportunities in small schemes, predominantly in Scotland.
- Medium-scale biomass, which use domestic organic matter, will give good opportunities for forest owners to set up contracts to supply agricultural waste and wood cut offs. There will be investment opportunities into biomass due to the green benefits from ROCs.
- The main source of increased production in the foreseeable future is forecast to be wind power (both onshore and offshore). Wind is a mature and proven technology which can expand to help meet the UK's target of supplying 15% of renewable energy in 2020.

## UK RENEWABLE ENERGY LEGISLATIVE FRAMEWORK

The UK Government introduced legislation in 2002 under the Renewable Obligation Order 2002 (Renewable Order or RO) to encourage the use of renewable energy in order to help reduce carbon emissions and diversify sources of supply. The RO imposes on all electricity suppliers in the UK an obligation to source a set, and rising, proportion of their electricity from renewable generation.

The impact of the RO is to provide a fixed sum, indexed-linked, for renewable power generated in the form of a Renewable Obligation Certificate (ROC) and to impose a penalty on those electricity suppliers who fail to meet the targets set by the legislation.

At the time of the legislation the target was to supply 10.4% of the UK's electricity from renewables by 2010/2011. In 2004 this target was increased to 15.4% by 2015/2016.

From 1 April 2009, the obligation changed from a percentage of a supplier's sales to an obligation to present a number of ROCs per MWh of a supplier's sales. The introduction of a banded RO breaks the existing direct link between the level of the Obligation and the actual amount of renewable energy required to meet it.

The central objective of the Renewables Order is to comply with the UK's commitment under the Kyoto Agreement to reduce greenhouse gas emissions by 12.5% below 1990 levels by 2008 to 2012. Europe has set a binding target for 20% of the EU's total energy supply to come from renewables by 2020.

The Government revisions to the RO in April 2009 and 2010 included a review of the ROC mechanism and confirmed the Government's intentions:

- To retain the Retail Price Index (RPI)/RO buyout price link, providing existing and new renewable generators with an index linked fixed element of income for 20 years from the start of operation.
- If the number of renewable energy generators in the industry increases, the number of ROCs that are presented in total may increase. If the number of certificates issued was to remain the same, the buyout fund would decrease in value. To prevent entry into the industry having the effect of lowering the buy-out premium, the government has increased the headroom for the number of ROCs issued to 8% for the period ending 31<sup>st</sup> March 2011 and 10% thereafter.
- To introduce banding for different technologies, to be reviewed every four years, with the first review in 2013. "Grandfathering" is intended to ensure that projects continue to receive as a minimum the number of ROCs appropriate at the date of commissioning of each plant throughout the life of the legislation.
- Onshore wind continues to receive 1 ROC/MWh. Offshore wind, direct biomass combustion and less commercial technologies such as solar and marine will receive up to 2 ROCs/MWh.

The Government's Renewable Energy Strategy published on 15 July 2009 included announcements on expanding and extending the RO to enable it to deliver close to 30% renewable electricity or more by 2020.

As from April 2010 the RO was extended to allow small scale renewable generators to elect to receive Feed-in Tariffs (FITs) for their electricity. FITs will provide small scale generators with substantially higher output prices than provisionally available under the RO structure (see page 22).

## RENEWABLE OBLIGATION TARGETS

The legislative framework was initially set to run until 2027. However, the RO (Amendment) Order 2010 stipulates that the RO will be extended to 2037, providing additional comfort to renewable energy developers and investors.

The actual level of renewable supply continues to fall well short of the RO set targets. The shortfall in 2009/2010 was 29%.

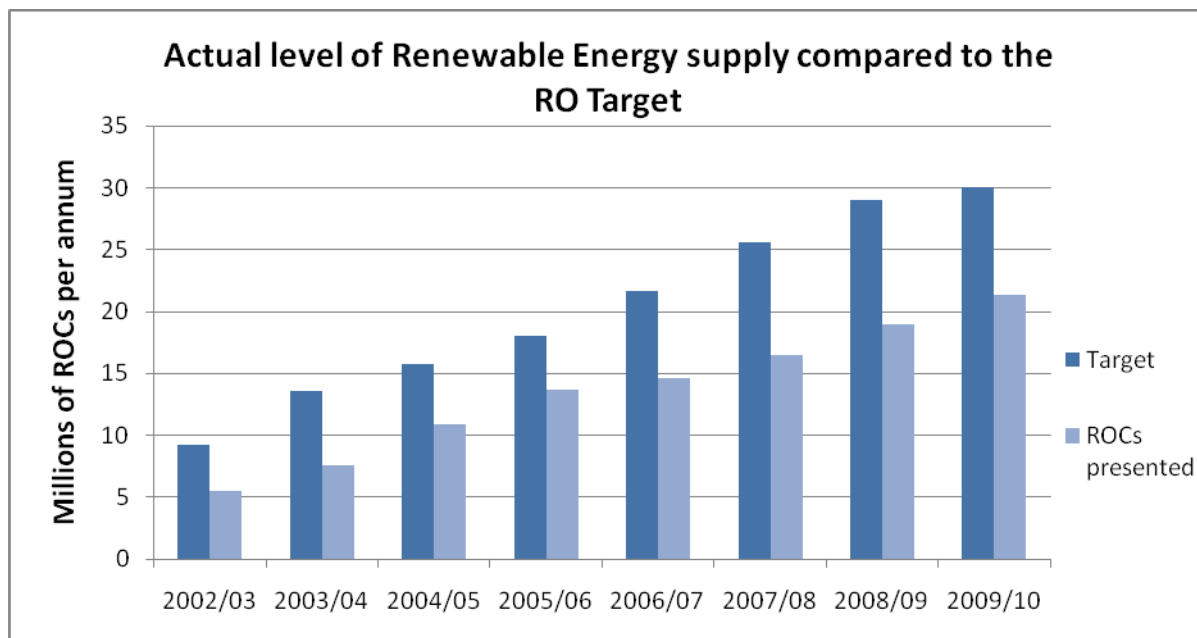


Figure 14: Source - Ofgem, DECC

Obligation Period	RENEWABLES OBLIGATION	
	Number of ROCs per MWh of electricity supplied in Great Britain	As revised by headroom provision
2010/2011	0.104	0.111
2011/2012	0.114	0.124
2012/2013	0.124	
2013/2014	0.134	
2014/2015	0.144	
2015/2016	0.154	

Figure 15: Source - Ofgem

Total electricity demand in 2009 was 322TWh. The OFGEM Annual Report 2009/10 (CP7) states that 21.3m ROCs were presented in 2009. The RO fixed target for 2015/16 is currently 0.154 ROCs per MWh of supply. If it is assumed that total electricity supply remains constant, at 322TWh, in order for the UK to comply with the 2015/16 target, 49.6 million ROCs need to be produced. To put things in perspective, this represents an increase of 133% over current levels of ROCs.

## UK RENEWABLE ENERGY OUTPUT PRICING

Larger scale renewable generators receive a premium for their production, in addition to the value of electricity generated, made up of three elements:

- Renewable Obligation Certificates (ROCs) providing a fixed, indexed linked, payment.
- ROC Recycle Buyout Fund Premium (Buyout Fund Premium) providing an additional variable income dependent on the total production of renewable energy against the set government targets.
- Levy Exempt Certificates (LECs) providing an additional index linked supplement.

This results in total output pricing which is currently high in relation to many other jurisdictions, assisting in providing investors with competitive returns.

**Smaller scale renewable generators can elect to receive a Feed-in Tariff (FIT), introduced in April 2010 (see page 22).**

### Renewable Obligation Certificates (ROCs)

Generators of renewable electricity receive a ROC for between 0.5 and 4 MWh of production depending on the type of renewable energy generation.

ROCs are tradeable. They had a set value under the RO of £30 per MWh in 2002 indexed against the annual RPI for the previous year, thus providing renewable generators with a fixed income.

ROC VALUES	
Year	£ per MWh
2008/09	35.76
2009/10	37.19
2010/11	36.99
2011/12	37.91
2012/13	38.86
2013/14	39.83
2014/15	40.83
2015/16	41.85

Figure 16: Source – Ofgem annual reports and RO Buy-out price Mutualisation and Ceiling

Note: ROC values post 2010/11 are assumed to grow at the same rate as RPI of 2.5% per annum.

### ROC Recycle Buyout Fund (Buyout Fund Premium)

Those suppliers failing to meet the set supply targets, either by generating sufficient ROCs themselves or by buying ROCs in the market, pay a penalty into the penalty pool known as the ROC

Recycle Buyout Fund. The buyout fund is paid out to generators producing renewable electricity in proportion to the ROCs issued to them against all ROCs issued.

The greater the shortfall in ROCs issued below the set target, the greater the value of the Buyout Fund premium paid. Should the target number of ROCs be achieved there would be no Buyout Fund premium. As a result the premium provides renewable generators with additional but variable income.

The planning system is clogged by applications. A swift build to meet the government's targets appears unlikely. The capacity constructed will be governed by offshore wind farms. These continue to be difficult to finance as a result of the costs involved. A medium build forecast seems at least likely. On this basis the Buyout Fund Premium should continue to have significant value over the medium term, although this would change if the speed of commissioning new renewable generation increases or the government changes the definition of "renewable".

Furthermore the Recycle Buyout Fund is protected through the use of headroom provisions. The Renewable Obligation Order 2009 (as amended by RO (amendment) Order 2010) states that the size of the Obligation will be set as the higher of a fixed target and DECCs forecast of ROCs supplied in that year, uplifted for headroom. The fixed target in the year ended 31 March 2012 is 0.114 ROCs per MWh of electricity supplied in Great Britain rising to 0.154 ROCs per MWh for the year ended 31 March 2016.

For the year 2009/10, the combined value of the ROC and Buyout Fund Premium above amounted to £52.36 per MWh, calculated as to:

<b>1. ROC Buyout Fund premium 2009/2010</b>	
RO Requirement	30,101,092
ROCs submitted	21,337,205
Shortfall	<u>8,763,887</u>
Buyout cost / ROC	£37.19
Buyout Pool (Distributed)	£323,668,318
Buyout premium	£15.17

Figure 17: Source - Ofgem Information Note (7 October 2010 and update 22 November 2010)

<b>2. ROC Value 2008/2009</b>	
ROC Value	37.19
+	
Buyout Fund Premium	<u>15.17</u>
<b>Total</b>	<b><u>£52.36</u> /MWh</b>

Figure 18: Source - Ofgem Information Note (7 October 2010 and update 22 November 2010)

## LEVY EXEMPT CERTIFICATES (LECS)

LECs are a small additional income. They arise under the Climate Change Levy introduced in April 2001. The levy is raised on the producers of CO<sub>2</sub> emissions. Renewable generation is exempt and qualifies for LECs. The 2010/11 value of a LEC is £4.70/MWh, indexed in line with RPI.

## TOTAL OUTPUT PRICING

The overall price paid for electricity from renewable sources is made up of three elements. It is important for investors to understand the relative weighting of each source as this impacts on the risk profile of developing projects in the UK.

<b>3.</b>	<b>Approximate Current Value £/MWh</b>	<b>Approximate Current %</b>
Brown 2010/2011	41.00	44%
Green supplements		
Fixed, indexed (ROCs) (2010/11)	36.99	40%
Variable (RBF premium 2010/11*)	<u>9.93</u> 46.92	<u>11%</u> 51%
LECs (2010/11)	4.70	5%
<b>Indicative Total Renewable Energy Price</b>	<u><u>£92.62</u></u>	<u><u>100%</u></u>
* FIM estimate		

Figure 19: Source – Ofgem and FIM Renewable Energy Pricing Paper

The off-takers apply a discount to each element. The discount varies from party to party and on each particular element. In general those providing longer term power purchase agreements tend to apply a higher discount, providing an opportunity to achieve higher net returns on the spot market by selling output on a short term contract.

## SALE OF OUTPUT

The investor has two options to sell renewable electricity generated under the ROC mechanism. The merchant route currently provides a significantly higher total sale price than the lower risk Power Purchase Agreement (PPA) route, currently providing the optimum route for those seeking to maximise their return from a project through enhanced cash flow in the early years.

### A. Merchant

Spot market sale, generally on a one or maximum two year contract with an approved supplier.

The generator receives the output values less handling/marketing costs.

Higher risk/higher reward in the short term.

The risk is in future prices or the ability to lock into a PPA in two or more years and the terms thereof.

### B. Power Purchase Agreement

Take out a PPA with an approved supplier, generally A rated, for 8 to 14 years. The term of the PPA can match the bank debt repayment schedule. The value is generally a percentage of each component of the output value, depending on the level of risk accepted by the purchaser in the form of a guaranteed floor price below which the value will not fall. The lower the floor price the higher the percentage generally offered. The discounts are greater than on short term off-take contracts.

## FEED-IN TARIFFS (FITs)

As from 1 April 2010 small scale renewable generators can elect to receive FITs for their electricity. This creates exciting opportunities for investors.

FITs will provide small scale generators with very substantially higher output prices than previously available under the RO structure.

Two tariffs are available:

**Generation tariff:** payable at specified rates depending on generating capacity and technology over a specified timespan.

**Export tariff:** set at £30/MWh for all electricity generated. Generators can elect to receive the export tariff or alternatively sell their output on the open market. At the current time open market prices are circa £45/MWh.

Both tariffs are index linked from April 2010. The mechanism is subject to legislation set out in Feed-in-Tariffs (Specified Maximum Capacity and Function) Order 2010.

FIM see the main benefits to investors being in small scale wind farms in the range of 100kW to 1.5MW and hydro electric schemes in the range of 100kW to 2MW, which could be constructed using project finance.

Larger scale schemes will tend to favour the established RO structure. Small schemes do not justify project finance and are only likely to be of value to owner/occupiers generating electricity for their own use.

	<b>Generation Tariff Rate (p/kWh)</b>	<b>Tariff lifetime (years)</b>
Hydro 100kW – 2MW	11.0	20
Wind 500kW – 1.5MW	9.4	20
100kW – 500kW	18.8	20

Figure 20: Source – DECC Feed-in Tariffs, Table of Tariffs Size

Combined with the export tariff this will give index linked income for 20 years of:

Hydro 100kW – 2MW	£140/MWh
Wind 500kW-1.5MW	£124/MWh
Wind 100kW – 500kW	£220/MWh

Figure 21: Source – DECC Feed-in Tariffs, FIT licence modifications, p22 FIT payment Rate Table

This creates substantial returns to investors from a low risk technology with set index linked income.

Details on FITs are available on:

[www.decc.gov.uk/en/content/cms/consultations/elec\\_financial/elec\\_financial.aspx](http://www.decc.gov.uk/en/content/cms/consultations/elec_financial/elec_financial.aspx) and  
[http://www.decc.gov.uk/en/content/cms/what\\_we\\_do/uk\\_supply/energy\\_mix/renewable/feedin\\_tariff/fits\\_grant/fits\\_grant.aspx](http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/feedin_tariff/fits_grant/fits_grant.aspx)