



# ONSHORE WIND ENERGY FACTS

## FACTS INCLUDE

- ✓ WIND WORKS
- ✓ WIND IS NOT EXPENSIVE
- ✓ WIND CUTS CO<sub>2</sub> EMISSIONS
- ✓ WIND FARMS DO NOT HARM TOURISM OR PROPERTY PRICES
- ✓ PEOPLE SUPPORT SCOTLAND'S WIND ENERGY
- ✓ WIND IS A MAJOR CONTRIBUTOR TO THE ECONOMY
- ✓ ENVIRONMENTAL IMPACTS OF ONSHORE WIND ARE LIMITED AND MANAGED
- ✓ WIND FARMS ARE NOT NOISY

Renewable energy is now a mainstream part of our energy mix. Generating technologies like wind power, hydro and biomass, are already meeting the equivalent of a third of the electricity needs of all Scotland's homes and businesses. This is set to rise to over 50 per cent in the next few years once all the projects with planning consent and those under construction are in operation.

Onshore wind will make up the largest proportion of this generation. This is because Scotland is one of the windiest countries in Europe, and the technology is mature, attractive to investors and cheaper than alternatives that can be deployed at scale. This investment in onshore wind will in turn build revenue streams which will finance investment in grid upgrades, research and development (R&D) activity in the emerging technologies of offshore wind, wave and tidal power, and provide an accessible point of entry to Scotland's renewable energy supply chain.

The Scottish Government now has a target to meet the equivalent of 100 per cent of our electricity needs from renewables by 2020, and onshore wind will continue to play a significant role in meeting this target - both in terms of generating capacity, and in providing the finance to expand other renewable energy sectors.

With so much public interest in this new and growing sector, Scottish Renewables has produced this briefing paper to separate some common misconceptions from the facts about this incredibly important renewable technology.

## WIND WORKS

### Power output

In 2009, the latest year for which Department of Energy and Climate Change figures are available for Scotland, wind power generated 11 per cent of electricity consumed in Scotland.<sup>1</sup> Over the last two years our installed capacity of wind has reached 2.5 GW, meaning that the technology will meet around 16 per cent of our electricity demand in 2011.

Capacity or load factor is the ratio of actual energy produced in a given period, to the hypothetical maximum possible. Over a year, the output of a single turbine will vary greatly depending on wind speeds, however, a typical turbine is expected to generate approximately 20-40 per cent of the theoretical maximum output, known as its capacity factor. The average capacity factor for Scotland from 1998 - 2009 was 29.2 per cent.<sup>2</sup>

No technology works at 100 per cent capacity 100 per cent of the time. Load factors for other technologies are: 63 per cent for gas; 50 per cent for coal; 65 per cent for nuclear; and 35 per cent for hydro in 2009.<sup>3</sup>

### Variability

Wind output is variable according to wind speed. Turbines produce power over a wide range of wind speeds, cutting in at between 3 and 4 metres per second (m/s), producing their maximum output through to 25 m/s (equal to 55 miles per hour) when they typically shut down to protect the turbine from potential damage. In the UK, a wind turbine will produce useful power for 70-85 per cent of the year, equal to 6,000-7,500 hours per year.<sup>4</sup>

Wind is accurately forecast over the timeframes relevant to network operators and other market participants, and National Grid has stated that; "provided that the necessary flexible generation and other balancing service providers remain available, there is no immediate technical reason why a large portfolio of wind generation cannot be managed in balancing timescales."<sup>5</sup>

### Base load

The 'base load' is the minimum load experienced by an electric utility system over a given period of time. Base load capacity is generating equipment operated to serve loads 24-hours per day (eg. nuclear power plants).

## WIND IS NOT EXPENSIVE

### Costs

The independent energy regulator Ofgem reported in 2009 that the lowest cost scenario for the consumer is through greater investment in renewables as part of a mixed portfolio of energy. Conversely, increased reliance on imported gas and global competition for resources will result in the highest increase in consumer bills.<sup>6</sup>

However, wind is still a young technology and requires support to maintain investment. Given the significant costs associated with carbon and climate change and the volatile prices of imported fuels, the UK Government introduced the Renewables Obligation (RO). The RO requires electricity suppliers to source an increasing percentage of their electricity from renewable sources. Renewable Obligation Certificates (ROC's) are claimed for each megawatt hour of electricity produced, meaning subsidies are linked to levels of generation, not installed capacity and therefore, there are no incentives to invest in sites that will not produce electricity. The ROC payments are fixed by the electricity market as an incentive to encourage investment in low-carbon energy technologies, paid for by electricity supply companies which ultimately fund investment through consumer energy bills.

Fundamentally, clean forms of electricity generation currently cost more than polluting forms such as coal; that's why the UK government has published proposals to widen current incentives for wind and renewable technologies to other clean energies like carbon capture and storage and nuclear.

£1.1 billion was invested in ROCs in 2009/2010, compared to the £2bn annual investment by the taxpayer in nuclear decommissioning.<sup>7</sup>

### Constraint Payments

Some media reports have highlighted payments to wind generators not to produce electricity at times when the system cannot accommodate their output. In total, the wind farms were paid around £875,000, a fraction of the overall annual costs of balancing supply and demand, the total cost of which was £280m in 2010/11.<sup>8</sup>



“We believe that climate change represents the biggest long-term threat to birds and other wildlife, and views renewable energy technologies, including wind power, as an important part of the solution.”

RSPB SCOTLAND



## WIND POWER CUTS CO<sub>2</sub> EMISSIONS

### Atmospheric carbon

Wind power is a clean, renewable source of energy which produces no greenhouse gas emissions or waste products. The electricity from wind farms does not replace an equal amount of fossil fuel capacity; it replaces production. Every one megawatt hour (MWh) produced by a wind turbine potentially replaces one megawatt hour produced by another generator.

As nuclear plants currently provide the primary base load of electricity supply, wind generation is likely to displace coal and gas-fired plant. Coal generation is the primary load-following (marginal) plant. It is therefore reasonable to assume that wind power output will mainly displace coal, at least in the short to medium term. In the longer term, with greater reliance on gas-fired plants, significant wind penetration, and any increase in the price of gas relative to coal, could mean wind will begin to displace gas. This will depend heavily on the actual fuel mix in the future and the extent of demand management and storage options.

Annually, a typical 2.5MW turbine with a capacity factor of 30 per cent will generate 6570MWh, which is enough electricity for 1398 homes, and which displaces approximately 770 tonnes of CO<sub>2</sub> that would have been produced if that electricity had been generated by a fossil fuel plant.<sup>9</sup>

### Released carbon

During the construction of a wind farm, there is potential that carbon can be lost from any excavated peat and from the area affected by drainage. The carbon calculator tool developed by the Scottish Government provides a transparent and easy to follow method for estimating the time a wind farm will take to ‘pay back’ the carbon from its manufacture, transport and construction.<sup>10</sup>

## WIND FARMS DO NOT HARM TOURISM OR PROPERTY PRICES

### Tourism

There is no evidence to suggest that wind farms have a significant impact on Scotland’s tourism. Indeed, reports<sup>11</sup> concluded that any effect on tourism would be greatly outweighed by the economic benefits brought by the renewables industry to Scotland. Wind farms, however, can be tourist destinations in their own right. The visitor centre at Whitelee wind farm, opened in 2009, has attracted more than 120,000 visitors through its doors in its first year, with thousands more estimated to use the paths and cycle tracks through the site for recreation.<sup>12</sup>

### Property Prices

A 2007 report from the Royal Institute of Chartered Surveyors (RICS) and Oxford Brookes University<sup>13</sup> found no clear relationship between the proximity of wind farms and property prices. Indeed, the report highlighted the views of local estate agents that proximity to a wind farm was “simply not an issue”.

In 2006, research from the Edinburgh Solicitors’ Property Centre (ESPC), focusing on property sales near Crystal Rig wind farm in the Scottish Borders, found no evidence of a negative impact on the price of property in nearby areas.<sup>14</sup> The ESPC study found that prices in the town of Dunbar had risen from below to above the regional average over the previous four years, during which time the wind farm was built, and that since the wind farm began operating, property price inflation in Dunbar has continued to exceed that achieved across East Lothian.

## PEOPLE SUPPORT SCOTLAND'S WIND ENERGY

Scottish Renewables commissioned YouGov to carry out a poll in 2010 which found more than three-quarters of all Scots support the development of onshore wind farms.<sup>15</sup> Of those surveyed 78 per cent agreed that 'wind farms are necessary so that we can produce renewable energy to help us meet current and future energy needs in Scotland' - up from the 73 per cent support for this statement five years ago.

The YouGov poll also revealed that over half (52 per cent) of Scots disagree that wind farms are an 'ugly and a blot on the landscape', with a 6 per cent decline in those agreeing with this statement since 2005 (28 per cent in 2005 compared to 22 per cent in 2010).

In the latest Scottish Environmental Attitudes and Behaviours Study from Ipsos MORI, it found almost half of Scots (48 per cent) agreed Scotland's energy should only come from renewable sources, not from nuclear power stations or coal and gas. The same survey found 30 per cent of Scots would be happy to pay more for their electricity if they knew it was produced in a more environmentally responsible way.



**“Ofgem reported in 2009 that the lowest cost scenario for the consumer is through greater investment in renewables as part of a mixed portfolio of energy.”**

**OFGEM**

## WIND IS A MAJOR CONTRIBUTOR TO THE ECONOMY

Of the 10,800 direct full time jobs in wind and marine energy in the UK, the majority (56 per cent) are associated with large-scale onshore wind and 7 per cent of the overall workforce is employed in small-scale wind.<sup>16</sup>

Figures for Scotland are harder to come by, but Scottish Renewables is working with SCDI, PwC and the Fraser of Allander Institute to assess the economic impact of investment in wind power and other renewable technologies. Scotland is home to SSE, the UK's biggest onshore wind operator and investor, and Scottish Power, part of Iberdrola, the world's biggest wind operator and investor.

There are also many successful Scottish companies already operating in the onshore wind supply chain at home and abroad, including:

**RJ Mcleod**

**Sgurr Energy**

**Natural Power Consultants**

**Dawson Energy**

**West Coast Heavy Haulage**

Onshore wind has been essential in developing technologies and techniques that can be applied offshore, an area where Scotland becoming known for significant expertise and potential. In March 2011 Doosan Power Systems announced plans to locate a research centre in Renfrew employing up to 200<sup>17</sup> people. They also want to build a manufacturing plant in Scotland, creating up to 500 direct jobs and 1,000 supply-side jobs. In December 2010 Mitsubishi revealed their plans to invest £100million into a renewables research centre in Edinburgh which will create 200 jobs.<sup>18</sup>

Onshore wind also supports local economies with community benefit payments invested in local facilities.

## ENVIRONMENTAL IMPACTS OF ONSHORE WIND ARE LIMITED AND MANAGED

### Environment

The interaction between wind farms, wild life and natural habitats is highly site specific. Wildlife and habitat impacts are mitigated through careful project location, design measures and appropriate construction techniques and are submitted as an Environmental Statement (ES) with the planning application.

In Scotland we have a robust planning system with planning guidelines in place that ensure that only wind farms in the right place, with acceptable impacts, are given planning permission. The planning system is there to balance the need for renewable energy development in order to cut carbon emissions with the need to conserve special sites, species and landscapes, with more than 40 per cent of all sites entering planning being refused by local planning authorities.<sup>19</sup> Planning authorities take account of the Environmental Statement when making decisions. Wind farm developers and operators are in some cases required as part of their planning consent to undertake ongoing monitoring on site and to mitigate impacts where necessary.

Onshore wind farms cover a small area of the country, currently around 0.8 per cent of Scotland's land mass.<sup>20</sup>

Environmental organisation such as Friends of the Earth Scotland, WWF Scotland and RSPB Scotland all support greater deployment of wind, the latter stating that, "We believe that climate change represents the biggest long-term threat to birds and other wildlife, and views renewable energy technologies, including wind power, as an important part of the solution."<sup>21</sup>

## WIND FARMS ARE NOT NOISY

**Virtually everything with moving parts will make some sound, and wind turbines are no exception.**

The highest contributor to the total sound made by a turbine is the aerodynamic noise, which is produced by the flow of air over the blades. Measurements of environmental noise are usually made in decibels, dB(A). It is perfectly possible to stand underneath a turbine and have a normal conversation without raised voices. Below is a table of comparisons of every day noise levels in comparison.<sup>22</sup>

Source	Indicative noise level dB(A)
Truck at 30mph at 100m	65
Busy general office	60
Car at 40mph at 100m	55
Wind development at 350m	35-45

- 1 DECC Energy Trends <http://www.decc.gov.uk/en/content/cms/statistics/publications/trends/trends.aspx>
- 2 DECC Historical Regional Statistics [https://restats.decc.gov.uk/cms/historic-regional-statistics/#load\\_factors](https://restats.decc.gov.uk/cms/historic-regional-statistics/#load_factors)
- 3 Digest of UK energy statistics 2010, Table 5.10
- 4 Wind Power in the UK. 2005 A guide to the key issues surrounding onshore wind power development in the UK - Sustainable Development Commission [http://www.sd-commission.org.uk/data/files/publications/Wind\\_Energy-NovRev2005.pdf](http://www.sd-commission.org.uk/data/files/publications/Wind_Energy-NovRev2005.pdf)
- 5 National Grid: GB Seven Year Statement 2009 Chapter 4 [http://www.nationalgrid.com/uk/sys\\_09/default.asp?action=mnchE\\_6.htm&Node=SYS&Snode=E\\_6&Exp=Y](http://www.nationalgrid.com/uk/sys_09/default.asp?action=mnchE_6.htm&Node=SYS&Snode=E_6&Exp=Y)
- 6 Ofgem: Project Discovery. See <http://www.ofgem.gov.uk/markets/whlmkts/discovery/Documents/1/Project%20Discovery%20Presentation%20-%20Jan%20Marlee%2016th%20March%202010.pdf>
- 7 Nuclear Decommissioning Authority Annual Report 2010-11
- 8 Correspondence from National Grid
- 9 Renewable UK Calculations for Wind Energy Statistics <http://www.bwea.com/edu/calcs.html>
- 10 Calculating carbon savings from wind farms on Scottish peat lands – A new approach <http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17852-1/CSavings>
- 11 The Economic Impacts of Wind Farms on Scottish Tourism, 2008 Scottish Government <http://www.scotland.gov.uk/Resource/Doc/214905/0057315.pdf>
- 12 [http://www.whiteleewindfarm.co.uk/news/more\\_12000\\_visitors\\_blow\\_in\\_whitelee\\_windfarm](http://www.whiteleewindfarm.co.uk/news/more_12000_visitors_blow_in_whitelee_windfarm)
- 13 What is the impact of wind farms on house prices? Oxford Brookes University 2007 FiBRE <http://www.st-andrews.ac.uk/media/RICS%20Property%20report.pdf>
- 14 Impact of wind farms on residential property prices – Crystal Rig Case Study 2006 ESPC
- 15 <http://www.scottishrenewables.com/news/more-three-quarters-all-scots-support-growth-wind/>
- 16 Renewable UK Report - Working for a Green Britain: Employment and Skills in the UK Wind & Marine Industries (February 2011) - [http://www.bwea.com/pdf/publications/Working\\_for\\_Green\\_Britain.pdf](http://www.bwea.com/pdf/publications/Working_for_Green_Britain.pdf)
- 17 Doosan Power Systems Press Release 22 March 2011 [http://www.doosanpowersystems.com/live/dynamic/pressreleases.asp?article\\_id={349C3A04-B5A3-4A54-BDF8-A14C053CE696}&id=29](http://www.doosanpowersystems.com/live/dynamic/pressreleases.asp?article_id={349C3A04-B5A3-4A54-BDF8-A14C053CE696}&id=29)
- 18 Scottish Government Press Release 3 December 2010 <http://www.scotland.gov.uk/News/Releases/2010/12/03100354>
- 19 RenewableUK State of the industry report 2010 [http://www.bwea.com/pdf/publications/SOI-Oct\\_2010\\_report.pdf](http://www.bwea.com/pdf/publications/SOI-Oct_2010_report.pdf)
- 20 Correspondence from SNH
- 21 RSPB: Wind Farms – Bird Sensitivity Map <http://www.rspb.org.uk/ourwork/policy/windfarms/map.aspx>
- 22 Information taken from The Scottish Office, Environment Department, Planning Advice Note, PAN 45, Annex A: Wind Power, A.27. Renewable Energy Technologies, August 1994