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The Case for Wind Energy

Introduction

Ever since the start of the industrial revolution the UK has always been self sufficient in the resources of energy generation. Large coalfields in the Midlands, South Wales and Northern England, as well as the oil fields in the North Sea have greatly contributed to this. However, most coal mines have closed down now and oil and gas reserves are quickly running out meaning that the country will soon be highly dependant on foreign imports. This is not a favourable situation as there is and increased risk of power shortages if anything disrupts the supply lines, especially in the case of gas pipelines. Along with this carbon dioxide and other greenhouse gas emissions need to be decreased to help slow down the process of global warming. Therefore, the development of fossil fuel plants like coal, oil and gas will have to be slowed down. With the Kyoto protocol now in force the country will have to turn its attention to conserve energy more effectively and develop renewable technologies, this will also help make the country self sufficient.

Out of all the renewable sources of energy, wind energy is one of the most developed. Wind energy has been used for centuries in the UK, in the past it was used by windmills for grinding corn or pumping water. In the last few decades wind has been used to generate electricity. This can be done onshore or offshore. There is currently an installed capacity of 888.8 MW generated by 1186 turbines in the UK (BWEA, 2005). These turbines can generate 8PJ a year. Renewable energy has a 2.67% share of the UK's energy mix, under the renewable obligation this is to increase to 10% by 2010 (Restats, 2004). At present Wind energy is the third largest contributor to renewable energy supply in the UK, behind Hydro and biomass (DTI, 2005). It presently provides 0.3% of the total UKs energy supply. With the renewable obligation in force, wind energy will have a much greater role in providing energy in the UK in the future. This report will outline the benefits and drawbacks of using wind as a source of energy as well as the implications of expanding its role in the

energy mix. The report will finish by looking at possible projections of the development of wind energy over the next 40 years.

Benefits

Possibly the main benefit of wind energy is that it does not produce any emissions, therefore energy can be created cleanly without attributing to global warming. With the current number of wind turbines in the UK a saving of 2,010,000 tonnes of carbon dioxide has been made. As well as this the wind farms contribute to a 23,400 tonne reduction in sulphur dioxide and a 7,010 tonne reduction in nitrogen oxide emissions (BWEA, 2005). Scroby Sands offshore wind consists of 30 2 MW turbines, a wind farm of this size can prevent 75000 tonnes of greenhouse gases a year from being emitted (Powergen, 2003). So by building more and more wind farms even higher reductions in carbon dioxide emissions can be made. In the manufacture of a wind turbine a small amount of carbon dioxide will be released due to the fact that the energy used in manufacture is mainly derived from fossil fuels. Based on information from 128 95kW turbines in Denmark, it takes only 100 days to pay back the energy used in consumption (Windstats, 1990).

Wind Energy is a completely renewable resource of energy. There will always be wind to power the turbines. Therefore it can be highly exploited without the worry of the fuel running out. The UK has one of the best resources in Europe for wind generation. Offshore, the UK has the best potential wind resource in the world, and has been estimated to have over 33% of the total European potential offshore wind resource (BWEA, 2005).

Wind energy also has advantages to the economy. Wind farms are relatively cheap, according to Page (Page, 1994), a wind farm costs £425±100 for every square meter of rotor swept area. The British Wind Energy Association cost wind turbines at £750±100/kW onshore and 1100±100/kW offshore (BWEA, 2004). This makes onshore wind cheaper than nuclear and competitive with coal. However, the price of wind energy is rapidly falling so it could soon be much cheaper than coal and competitive with CCGT (BWEA, 2004). Wind energy can create employment in a

local area, currently 4000 people are employed in the wind energy industry (BWEA, 2004). Wind farms can bring money to local area through tourism, especially off-shore wind farms that have visitor centres which can attract large numbers of visitors. 30,000 people have visited the information centre for the new Scroby Sands offshore wind farm since May 2004 (DTI, 2005). The Renewable Obligation also makes it favourable for generator companies to build new wind farms as every supplier has to purchase a minimum amount of renewable energy.

Limitations

As with any source of power there are some limitations. Perhaps the most important of these limitations is the problem of intermittency. The wind doesn't always blow so some of the time wind turbines won't generate electricity. If wind energy was to be developed to an extreme, intermittency could pose a problem. It is thought that wind energy can supply about 10 -15% of the energy mix without causing problems. . However, the Country Guardian argue that if wind energy supplied 10% of UK's energy than it would cause power shortages on some days when the wind wasn't blowing unless there was a back-up power station running to counter this. Therefore they argue the need for wind turbines at all if they have to be supported by an additional power station (Country Guardian, 2000). The DTI argue that the fact that wind turbines are distributed evenly across the country it is very unlikely that the wind won't be blowing over the entire country and that all power stations require a coal or gas power station to back them up in case of outages, and that these back-up power stations don't need to be running at full power all the time(DTI, 2005).

One of the most important environmental impacts from wind energy is visual intrusion. Wind Turbines are large structures and can be over 60m tall, therefore they can be very imposing on the landscape. However, the extent of how imposing or intrusive a wind turbine is is down to people's personal tastes. The Country Guardia support the view that wind farms are very intrusive and ones which are located near to National Parks spoil the aesthetic value of the National Park (Country Guardian,2000). The DTI argue that developers are told to locate wind farms away from areas of natural beauty and that where wind farms are currently located the majority of people don't find them that detrimental to the landscape (DTI, 2005)

There have been fears that turbines can be dangerous to birds in the form of the birds getting hit by the blades or towers or effects on migratory patterns. With careful planning of turbine sites this can be limited to a minimum. The wind turbines in Altamont Pass in California have on average killed 200-300 Redtail Hawks and 40-60 Golden Eagles each year, while it is estimated that 7000 migrating birds a year are killed at other wind turbine sites in Southern California.(California Energy Commission cited in Country Guardian, 2000). The DTI reports that wind farms have had no detrimental effect on birdlife in the UK (DTI, 2005). The RSPB believe the benefits of wind farms in reducing global warming far outweigh any detrimental effects on bird life, they believe climate change is more dangerous to birdlife (RSPB, 2003).

Noise is widely regarded as another environmental impact of wind energy. This consists of mechanical and aerodynamical noise. This is generally lower than most natural activities and the noise rapidly decreases as you move further form the wind turbine. However, in close proximity in rural remote areas noise could be a real problem, the country guardian claim that it can make some people ill (Country Guardian, 2000).

Other limitations include interference to television receptions, this can normally be put right by the wind developer placing signal boosters around the area (DTI, 2005). The other main limitation is the risk to safety from rotor failures. In extreme circumstances rotor blades can fail and cause devastating effects. In the winter of 1993 parts of a blade were thrown 400 m at a wind farm in Wales (Country Guardian, 2000). Therefore it is important that turbines are positioned away from roads and built up areas, causing planning constraints. However, the risk of rotor failures is very small as these occurrences are very rare and as technology increases as does safety.

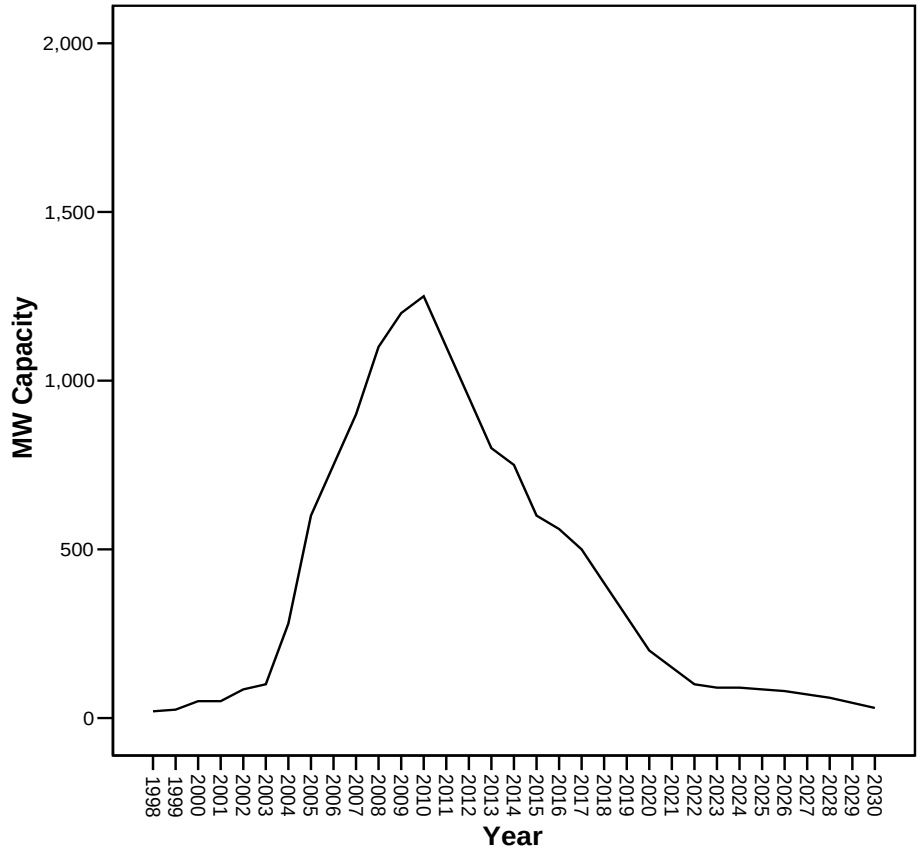
In some areas there is strong opposition to wind farms, the country guardian lists some 60 different opposition action groups. These groups can sometimes have high influence in planning procedures. Planning consent for wind farms has always been tough. Many wind farms in the past have been denied planning permission from local councils. Wind farms must be placed away from roads, wood land, communication

masts and built up areas, so there is limited space where they can be built. A large development programme in wind energy would definitely require a review of planning procedures.

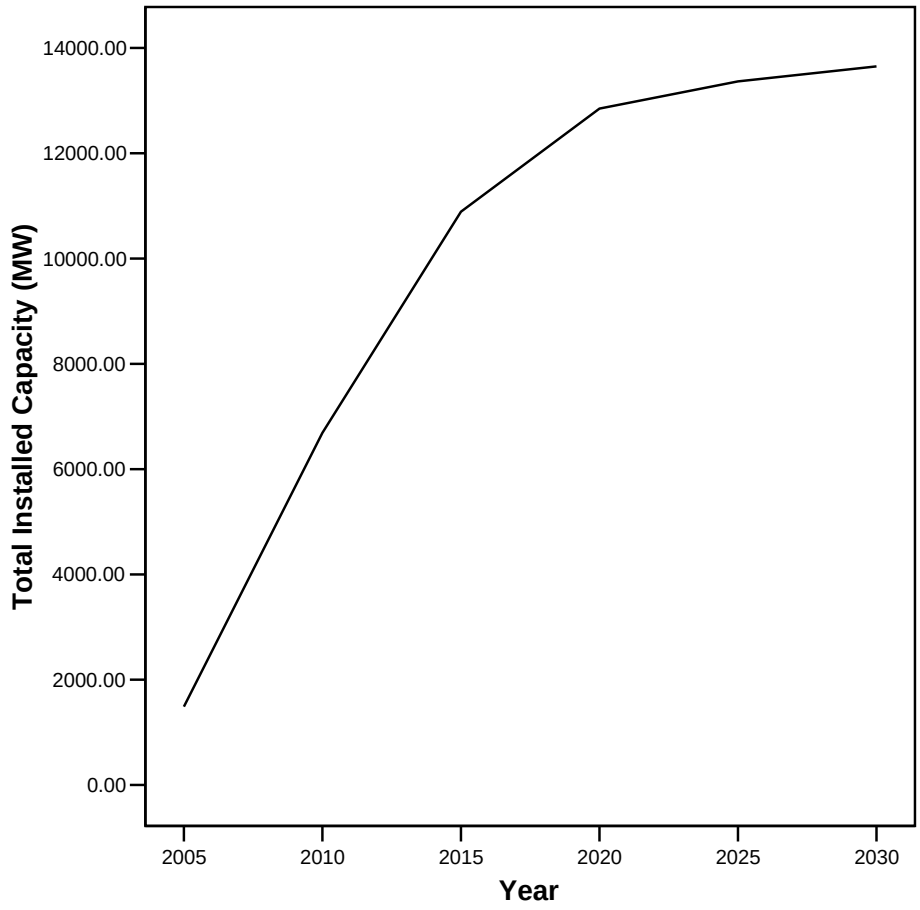
Projections

The UK currently has an installed capacity of 888.8 MW (BWEA, 2005). The BWEA project that by 2010 there will be an installed capacity of 8000MW (BWEA, 2004). This will involve the construction of 4000 2 MW wind turbines, which means 800 turbines a year, (over 2 a day), which is much more than the currently yearly rate. About 280 MW were installed in 2004 (BWEA, 2004). Therefore this projection is not feasible.

There are a number of scenarios for the development of wind energy over the next 25 years. The most feasible is to increase installation capacity per year rapidly until about 2010 and then to decrease the installation capacity rate per year after. This is shown in the graph below.



If installation rates follow this scenario then the capacity of wind energy will increase as the graph shows below



The table bellows shows the capacity and generation per year for the next 30 years

Year	Capacity MW	Generation PJ
2010	6688.8	63.3
2015	10888.8	103.0
2020	12848.8	121.6
2025	13363.8	126.4
2030	13646.8	129.1

By 2030 there would be the equivalent of 6823.4 2MW turbines operating
If total UK capacity is of 100,000MW then wind could provide 13.6% of total capacity. This could produce a saving of nearly 31 million tonnes of carbon dioxide.

However these projections are dependant on technology not advancing. With advancements in wind technology there may not be the need for so many turbines.

Conclusions

There is no reason why wind energy cannot be exploited to a much higher level than it has been at present. These projections despite the limitations of wind energy are realistically achievable. With wind energy supplying 13% of the UK's energy supply CO_2 emissions could be greatly reduced. Therefore there is an important need to develop this industry further.

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