Offshore Wind Energy

Wind Energy Fact Sheet 1

This Fact Sheet provides a brief description of offshore wind technology, its economics and the amount of energy that can potentially be exploited in the UK.

Why offshore?

The UK Government expects offshore wind energy, together with onshore wind energy, to be a major contributor to its target to generate 10% of UK electricity from renewable sources by 2010.

The UK's offshore wind resource is vast, with the potential to provide more than the UK's current demand for electricity. This makes offshore wind a very useful energy resource, readily capable of supplying a significant part of our total electricity needs and reducing emissions of greenhouse gases. Offshore wind speeds are higher than those onshore (typically up to 0.5m/s higher 10 km offshore) and also less turbulent. However, elevated inland sites can have higher wind speeds.

Due to the higher costs of installing each turbine offshore it is expected that, in general, the machines will be larger than their onshore counterparts (2MW and above). This is driven by economics, with larger machines more cost effective per unit of electricity generated. The larger turbines also experience higher wind speeds, because taller towers put the rotors into the stronger winds. In addition, onshore constraints such as planning, noise effects and visual impact are expected to be reduced offshore.

Other European countries such as The Netherlands, Germany, Denmark and Sweden are encouraging offshore projects (as well as onshore wind farms) as part of their environmental policies. Denmark is planning to provide 50% of its electricity from offshore wind by 2030.

How do we farm wind offshore?

Most of our experience of wind farm technology has come from onshore wind farms. Moving from onshore to offshore need not require major changes in the technology, other than the need to adapt the turbines to the marine environment. This will include the use of sealed nacelles to exclude the harsh environment offshore, different foundation/tower design to cope with wind/wave/current/tide/seabed interactions and the provision of special access platforms for maintenance.

Current trends in wind turbine development indicate that the size of offshore wind turbines will be 2MW or larger, compared with between 0.6MW and 1.5 MW for most modern onshore machines. Turbine manufacturers are already offering machines designed

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specifically for the offshore market. Using these larger machines improves the economics, since the foundation and installation costs do not increase proportionally with the size of the turbine.

The difficulty of reaching the wind turbines requires that they are designed to be controlled remotely, with high reliability and low maintenance. Planned visits generally happen only once a year.

Where can we put offshore wind farms?

Many issues need to be considered in the siting of offshore wind farms. The depth of the sea, the sea bed character and the local wind speed are all important, as is the proximity to potential electrical connection points. While it is technically possible to build farms in water depths over 30m and a long way offshore, it is very expensive, so it is likely that the first few offshore wind farms will be in much shallower depths and probably within 10km (5-6 miles) of the shore.

Currently, the most promising areas for offshore development are on the East and West Coasts of the UK. On the East Coast, an area from south of the Humber through Lincolnshire and Norfolk, then around East Anglia and down to the Thames Estuary, has greatest potential. On the West Coast, the area that has the best resources stretches from Blackpool down to North Wales. This does not mean that other sites will be ignored. Environmental factors will need to be considered at all potential sites; some of these factors will be similar to those onshore and some will be unique to the offshore environment.

In April 2001 the Crown Estate, which owns the UK Territorial Seabed, announced that 18 developers had pre-qualified to obtain a lease of seabed for the development of offshore wind farms. Each option is for 10km^2 of seabed accommodating a minimum generating capacity of 20MW and a maximum of 30 turbines. The developers have to gain all necessary statutory consents within 3 years in order to meet the terms of the lease. The prospective sites are spread around 13 areas. A map of the sites is available on the web at www.offshorewindfarms.co.uk/sites.html - contact details for the developers are on the same site.

How much wind energy is there?

The accessible offshore wind resource is estimated to be many times more than the UK electricity demand of about 300TWh per year. This estimate only takes into account water depth and not any of the other constraints.

However, certainly in the short to medium term, it is not practically possible to realise all of this resource. A more realistic figure is estimated to be 100TWh per year. This lower figure takes into account reasonable distances from the shore, water depth, type of seabed and the existing uses of the possible areas.

Water depth	Distance from shore (km)			**Totals**
[m]	0-10	10-20	20-30	
0-10	14.39	1.45	0.12	**15.95**
10-20	12.23	8.95	3.70	**24.88**
20-30	15.52	14.26	6.12	**35.89**
30-40	6.58	10.94	5.93	**23.45**
Totals	**48.73**	**35.59**	**15.86**	**100.18**

Estimated practicable offshore wind resource [TWh/y]

The national electricity network can absorb around 20% of the peak power demand from wind energy, without incurring extra operating costs. This corresponds to about 32TWh per year (see Fact Sheet 11 for more information). This means that the amount of wind energy that we can use from offshore sites may eventually be limited by the constraints of the current electricity network.

How much will offshore wind energy cost?

Offshore wind turbines will initially cost more than onshore machines. It has been estimated that offshore machines installed quite close to the shore (between 5km and 10km) and in shallow water (5-10m deep) might cost around £1000/kW installed. These costs are roughly 30% more than for onshore machines. However, costs are expected to decrease over time due to the use of larger machines in bigger wind farms and technology improvements.

References

New and Renewable Energy: Prospects in the UK for the 21st Century, Supporting Analyses, ETSU-R-122, ETSU for the DTI, March 1999

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