

BELLACORICK WIND FARM



Since 1992, Ireland's first commercial wind farm has been operating at Bellacorick. The wind farm comprises 21 wind turbines with a total installed capacity of 6.45 MW, and produces enough electricity to supply 4,500 households.

Ireland experiences Europe's highest wind speeds, and its topography and low population density make it an ideal location for electricity generation from wind power.

FIG 1. LOCATION

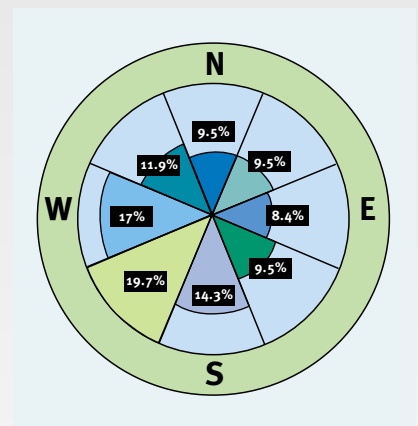


There have been wind power projects in Ireland involving single machines for many years, but it was not until 1981, when the then Department of Energy established 13 projects around the country in a coordinated demonstration programme, that significant operating experience under Irish conditions became available. Since then, many more projects have been established, supported by government and European Union funds.

The country's first commercial wind farm was established at Bellacorick in Co. Mayo in 1992 (Fig. 1). This area had long been identified as perhaps the best wind farm site in the country. All the key criteria for a successful wind farm project are satisfied at Bellacorick. The mean annual wind speed at the site at a measuring height of 30 m is 7.28 m/s. The prevailing wind direction is south-westerly, and the wind-rose diagram (Fig. 2) shows that for more than 50% of the time the wind blows from the west/south-west/south quadrant. Also, the wind regime is characterised by strong, steady winds. The ground is flat, with an open aspect to the prevailing winds, resulting in virtually no loss or turbulence due to topographical features. The land is remote, virtually uninhabited bogland used mainly for milled peat production, so no loss of amenity or high-value alternative land use is involved. A nearby

thermal power station is linked to the national grid, so delivery of the electricity generated by the project to consumers via the high-voltage transmission system could be achieved efficiently and at low cost (grid connection costs are often a limiting factor for wind power projects).

FIG 2. WIND-ROSE DIAGRAM



The wind farm is owned and operated by Renewable Energy Ireland, an Irish company whose majority shareholder is Bord na Mona (owner and developer of the peat bogs in the area). Elsamprojekt, a Danish power utility owned consultancy, has a minority interest. The project was grant-aided by the "Valoren" programme of the European Commission.



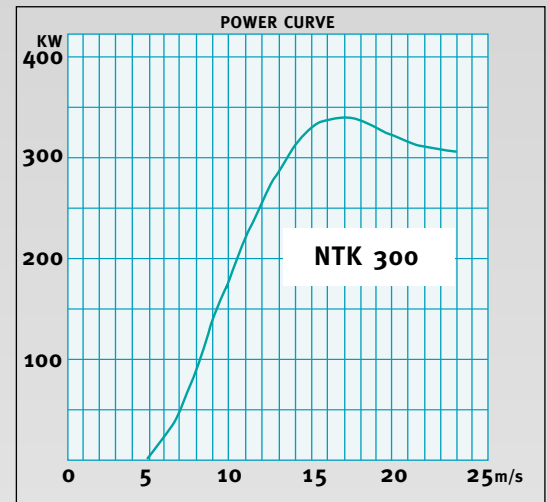
A key element in ensuring a successful wind farm project is choice of the wind turbine. The wind turbines specified were supplied by the NORDTANK Energy Group of Denmark (now part of NEG Micon), who have supplied more than 1,900 wind turbines world-wide.

The selected turbines are 3-bladed, upwind, horizontal axis machines. There are 21 wind turbines in the wind farm, and 20 of these are identical machines, each rated at 300 kW nominal output. Their main technical features are summarised in Table 1. One turbine is rated at 450 kW.

TABLE 1 NTK 300/31 Wind Turbine Specification

Nominal output	300 kW
Rotor diameter	31 m
Number of blades	3
Hub height	31 m
Blade material	fibreglass/polyester/carbon fibre/epoxy
Tower material	Steel
Regulation	Stall control
Braking systems	Hydraulic blade tip airbrake, disk brake on high-speed shaft
Yaw control	Active yaw system
Cut-in wind speed	5 m/s
Rated power at	13 m/s
Cut-out wind speed	25 m/s
The characteristic power v wind speed curve for this turbine is given in Fig. 3.	

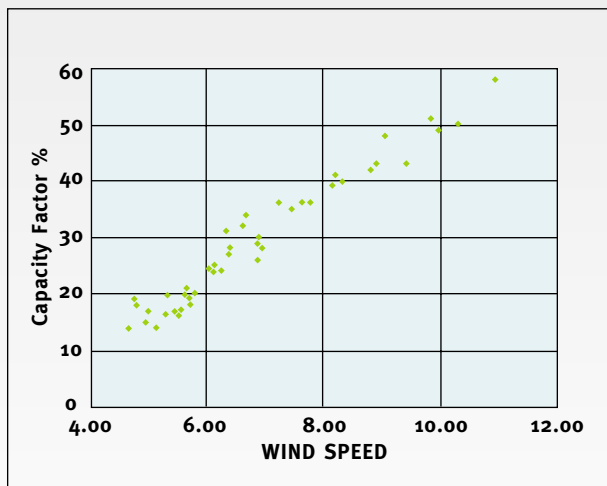
FIG 3. POWER V WIND SPEED CURVE



The turbines are located more than 6 rotor diameters apart in order to avoid interference effects. A sophisticated computer system monitors and controls the operation of each machine, and this can be accessed both at the local Bord na Mona plant and at NORDTANK headquarters in Denmark.

The wind farm generates about 17 GWh per annum on average. The output obviously varies with wind speed, and a plot of how the monthly mean wind speed has determined the capacity factor is shown in Fig. 4.

FIG 4. MONTHLY WIND SPEED VS CAPACITY FACTOR



The operational availability of the wind farm has been consistently high since it began operating commercially in October 1992. Table 2 summarises annual availability data.

The environmental benefits of the wind farm can be stated in terms of the environmental impacts avoided through not having to generate electricity from, say, coal. The Bellacorick wind farm avoids the production of 120 tonnes of sulphur dioxide, 85 tonnes of nitrous oxides and 20,000 tonnes of carbon dioxide in a year.

TABLE 2 OPERATIONAL AVAILABILITY

Year	Availability
1993	96.7%
1994	98.6%
1995	98.4%
1996	98.9%

This information sheet was produced in the framework of the OPET Network (Organisations for the Promotion of Energy Technology) which is supported by DGXIII under the Innovation Programme.



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