

CRONALAGHT WIND FARM



In June 1997, an innovative wind energy power station was commissioned at Cronalaght in north-west Ireland. The power station comprises 5 wind turbines in a wind farm with a total installed capacity of 3MW, and produces enough electricity to supply 3,000 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 that significant operating experience under Irish conditions became available when the then Department of Energy established 13 projects around the country in a coordinated demonstration programme. Since then, many more projects have been commissioned, supported by government and European Union funds.

The site at Cronalaght, Gweedore, Co. Donegal, is situated in a remote region of Ireland (Fig. 1). It was identified as one of the most suitable sites in Ireland for wind generation in a Department of Energy/EU study in 1989. The prevailing winds come from the Atlantic Ocean, some 6 km away,

and the mean annual wind speed at the measurement height of 30 m is 9.8 m/s. The site has no amenity designation, and the nearest neighbour is 1.4 km distant. The local 38 kV electricity distribution network runs along the site boundary.

The wind farm was developed by Gineadoir Gaoithe Teoranta, an Irish company owned by local businessmen. Project financing was provided by ICC Bank (Ireland) and the project was grant-aided by the "THERMIE" programme of the European Commission.

The project has a number of innovative technical features which are intended to improve the penetration of wind energy in areas where electricity grid systems are weak, while preserving quality of supply.

TABLE 1. VESTAS V39-600 kW WIND TURBINE SPECIFICATION

Nominal output	600 kW
Rotor diameter	39 m
Number of blades	3
Hub height	40 m
Regulation	continuous pitch regulation
Cut-in wind speed	4 m/s
Cut-out wind speed	30 m/s



These relate to the turbines' generator design and regulation, and the monitoring and control system.

The selected turbines are 3-bladed, upwind, horizontal axis machines manufactured by Vestas A/S of Denmark, a world leader in wind turbines. There are 5 machines in the wind farm, each with a rated output of 600 kW. Their main technical features are summarised in Table 1. While the site is close to the local 38 kV distribution network, this part of the grid infrastructure is particularly "weak" in electrical terms. The site is some 49 km from the connection to the 110 kV national transmission grid system. The voltage profile for this 38 kV line is shown in Fig. 2.

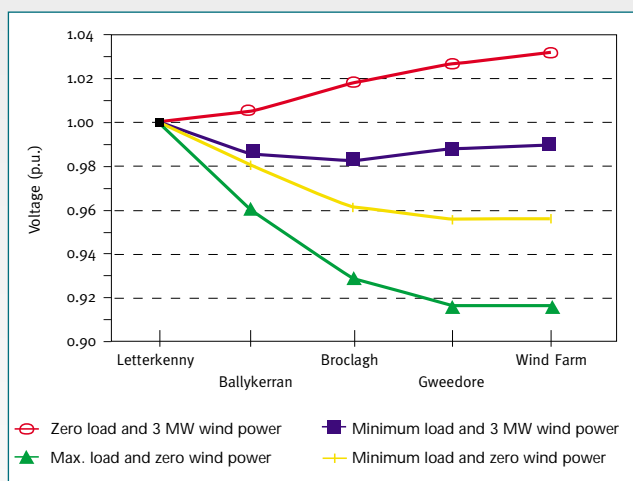
Initial system analysis indicated that the local grid would have to be reinforced in order to cope with the effects of connecting the wind farm. The cost of doing this would have made the project uneconomic to implement.

The project promoters responded to this problem by technical innovation. Vestas incorporated novel generator control and fast blade pitch regulation systems into the turbine design. In addition, a voltage control unit (VCU) was designed by Riso, a leading Danish research and development institution. The VCU was then developed and built by an Irish company PCAS (Process, Control & Automation Systems) Ltd. The VCU manages the output of the wind farm so that grid parameters could be maintained within normal limits under all operating conditions.

The system was inaugurated in June 1997, and generated approximately 11 GWh in its first year of operation, representing a capacity factor of 42.4%. The system availability was 96% over the period.



FIG 2. VOLTAGE PROFILE FOR 38KV LINE AT DIFFERENT LOAD CASES



The environmental benefits of the wind farm can be stated in terms of the environmental impacts avoided through not having to generate electricity from fossil fuels. The Cronalaght wind farm avoids the production of 80 tonnes of sulphur dioxide, 55 tonnes of nitrous oxides and 13,000 tonnes of carbon dioxide in a year.

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