

Ireland's Offshore Wind Power...

... see it ... experience it ... at Arklow.

• Project Overview

During 2004, the Arklow Offshore Wind Power Plant, the world's first offshore project to deploy giant wind turbines in excess of 3 megawatts, began using Ireland's clean, and abundant winds to fuel new electrical capacity for the area. Located about 10 kilometres off the coast of Arklow on the Arklow Bank, the project was co-developed by GE Energy and Airtricity, and built and owned by GE Energy. Under the terms of the Project's co-development agreement, Zeusford, a company owned 50% by Airtricity and EHN of Spain holds an option to purchase the project after certification, testing and demonstration is complete, approximately two years after first operation.

Currently operated by GE Energy as a demonstration platform for its new 3.6s MW offshore wind technology, the 25-megawatt project comprises 7 GE Energy 3.6-megawatt units – the largest wind turbines commercially installed at sea. The project represents Ireland's first offshore wind power project, and is expected to generate enough energy to serve the annual electricity needs of about 16,000 Irish households.

The 25MW Arklow Offshore Wind Park was introduced by Airtricity as Phase 1 of a much larger offshore project which it proposes to build over the coming years with the participation of EHN. The Arklow offshore wind park proposals have been made possible under a Foreshore Lease which was secured by Airtricity in January 2002 following completion of extensive environmental and geotechnical studies. Initially, GE Energy will operate the 25 MW facility as a test facility to learn more about the rigours of offshore wind power generation. This valuable knowledge and lessons learned will be applied to GE's future offshore wind energy technologies.

• Wind Energy

Wind energy has been the world's fastest growing energy source over the last decade, with an annual average growth rate of more than 31% over the past five years alone. On the island of Ireland, wind power installations currently contribute only 175 megawatts, out of which 138 megawatts are installed in the Republic of Ireland. Globally, installed wind capacity increased to over 40,000 megawatts during 2003. Today, Denmark and many regions of Germany and Spain now have between 10 and 25 percent of their electricity needs being served by wind energy. Forecasts for wind power continue to be favourable with more than 95,000 cumulative megawatts predicted worldwide by 2008.

***The Arklow Offshore Wind Park can be best viewed from Arklow's north and south public beaches.**





• Project Details

Project Capacity: 25 megawatts

Number of Wind Turbines: 7 GE 3.6s Offshore

Project Location: 10 km off the coast of Arklow on the Arklow Bank.

Grid Connection: The project connects to ESB Networks via a connection in the Arklow National Grid Substation. A submarine cable connects the wind park to shore. From shore, connection occurs via an underground cable. There are no overhead lines.

Assembly and Work Locations: Pre-assembly of some equipment took place at Rosslare port. Rosslare was selected due to its ability to accommodate large ship size as well as draft and space required for large cranes to be used for off-loading and reloading activities. Arklow's port is being utilised by GE as a base for the project's operations and maintenance activities, including boats, personnel, dispatch, and storage of smaller equipment.

• Project Developers: GE Energy, Airtricity and EHN

GE Energy: GE Energy is one of the world's leading suppliers of power generation and energy delivery technology, with 2003 revenues of nearly \$18.5 billion. With wind turbine design, manufacturing and/or assembly facilities in Germany, Spain and the United States, GE Energy is one of the world's leading wind power companies. For more information, visit the GE Energy website at www.gewindenergy.com.

Airtricity: Airtricity is a World Leading renewable energy company focused in the areas of wind farm development and green electricity supply. The company is currently developing wind farms in the Republic of Ireland, Northern Ireland, United States, England, and Scotland. For more information, visit the Airtricity website at www.airtricity.com.

EHN: Corporación Energía Hidroeléctrica de Navarra, S.A. (EHN) is a leading world group in renewable energies. Its core activity is the development, construction, exploitation, operation and maintenance of facilities that use these energy sources to produce electricity. For more information, visit the EHN website at www.ehn.es.

• Wind Turbine Supplier, Project Contractor, Owner, and O & M Provider:

GE Energy supplied the wind turbines, built, owns and operates the 25 MW Arklow project as a demonstration platform for its 3.6 MW wind turbine technology.

• Technology

Manufacturer: GE Energy

Wind Turbine Type: GE 3.6s Offshore. GE's 3.6 MW wind turbine is the first commercially-available wind turbine over 3 MW specially designed for offshore use. The first commercial prototype 3.6-megawatt wind turbine was unveiled by GE during 2002. Installed on land in May/June of 2002 as a test bed, GE's 3.6 MW prototype began producing power for Spanish energy supplier Iberdrola in September 2002. For more information on the 3.6 MW wind turbine, visit the GE Energy website at www.gewindenergy.com

Rated output: 3.6 MW

Turbine Height: (at highest point): 124 metres (406 feet) to blade tip – taller than the Spire of Dublin

Turbine Hub Height: 73.5 metres (241 feet)

Turbine Weight: 290 tonnes (complete unit)

Foundation: The turbines are supported by a steel monopile foundation which is driven into the seabed by a hydraulic hammer. This equipment and process is also widely utilised for other similar applications, including installation of bridge piles and platforms for offshore oil and gas rigs. The monopile and associated transition piece provide cable access to the tower from the seabed as well as boat access to the actual tower and associated equipment.

Footprint: Each wind turbine utilises a footprint 5 metres (16 feet) in diameter; the wind turbines are spaced approximately 600 metres (1,970 feet) apart.

Tower: Tubular steel

Height: 70.5 metres (231 feet)

Weight: Approximately 160 tonnes

Diameter: 5 metres (16 feet) at the bottom; 3 metres (10 feet) at the top

Blade Length: 50.5 metres (165 feet)

Rotor Diameter: 104 metres (341 feet) – nearly the wingspan of two jumbo jets (A Boeing 747-400 has a wingspan of 64 metres, or 210 feet).

Revolutions per minute: 8.5 to 15 (one revolution every 4 - 7.5 seconds)

Swept Area: 8,495 square metres per turbine (91,439 square feet), or 4 times the sail area of a clipper ship. For example: the clipper ship Cutty Sark has 1,970 square metres (21,060 square feet) of sail area (see www.cuttysark.org.uk).

Construction Process:

The Arklow Offshore Wind Project's seven GE 3.6 MW wind turbines as well as equipment needed for construction of the plant, was staged at Rosslare Port and transported 30 miles by barge to the Arklow Bank for installation. The Arklow Bank is a sandbank that is about 15 miles long and half a mile wide (13.5 nautical miles long and an average of 1 nautical mile wide), located just off the coast of Arklow in County Wicklow. The towers for the Arklow project are made of corrosion-resistant steel. These structures consist of several sections. The bottom sections, known as monopiles (weighing 280 tonnes), were hammered into the sand bank to emerge a few metres above the water level. Next, transition pieces were mounted on the monopiles which secure

the first tower section and provide a platform for boat access to the units. Then tubular steel towers in two sections were installed. Finally each unit's "nacelle", which houses the turbine's generator, gearbox and other key components was lifted into place. To complete the erection, each turbine's giant rotor was hoisted into place by a 1200 ton crane. The last turbine erection was completed only nine weeks after beginning the first foundation. The power generated by the wind turbines is fed to a switching station in Arklow harbour through an undersea cable. Power is then transported from the switching station to the local ESB substation where it is placed onto the local electricity grid.

• Project Benefits

Increased energy independence: Incorporating wind electricity into Ireland's energy mix increases the country's fuel diversity, reducing dependence on foreign fuel imports and their fluctuating costs. It also enhances the country's energy security by allowing production of electricity through Ireland's clean, green and abundant natural energy source...the wind.

Stable energy costs: The project's fuel, the wind, is free. Therefore, project costs can be estimated and will not fluctuate or escalate over the project's life due to increases in fuel cost.

Increased local tourism: Over the past decade, wind project site areas have enjoyed increased local tourism due to growing worldwide interest in wind energy. The Arklow project is also encouraging tourism in the local area.

Households Served: The 25 MW Arklow Bank Wind Park is expected to annually provide enough renewable electricity to serve about 16,000 average Irish households*.

*Figures provided by Airtricity

