Chapter 18
Ireland

1.0 Introduction

Wind energy's contribution to Ireland's electricity supply continues to rise (Figure 1). By December 2008, a total of 77 wind farms were connected, bringing the total installed capacity for wind to 1,002 MW or 13.7% of total installed capacity (1). Wind power displaced almost 1.28 million metric tonnes of CO_2 emissions and primary energy imports of 215,000 metric tonnes of oil equivalent to a nation that is more than 90% dependent on imported energy supplies. Wind farm connection rates have recovered to pre-2007 levels, with 207.7 MW connecting in 2008.

In 2008, wind generation produced approximately 2.3 TWh of electricity, increasing its share of electricity consumption from 6.8% in 2007 to approximately 8.7% in 2008 (2).

2.0 Progress Toward National Objectives

Ireland's target is to supply 15% of electricity demand from renewable sources by 2010. As large-scale hydroelectric development in Ireland is not a viable option, wind has contributed, and will continue to contribute, the vast majority of the additional renewable generation required (Figure 2). Added to other renewable generation stock, an estimated 1,350 MW of wind capacity is required to meet the target for 2010. At the end of 2006, 744 MW of wind capacity was connected. To meet the 2010 target from that point required the addition of 200 MW annually. In 2007, only 48.25

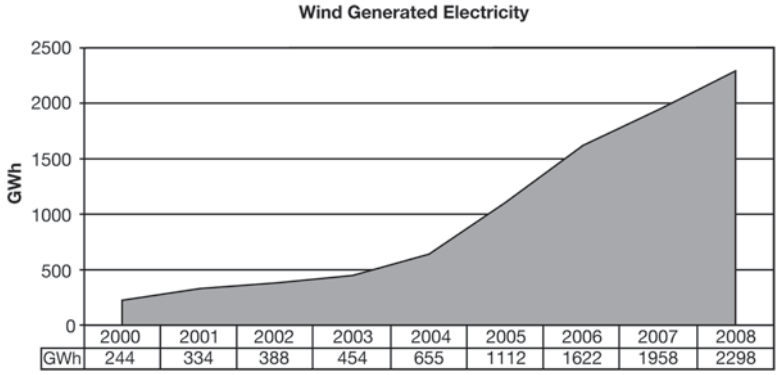

Figure 1 Wind-sourced electricity in Ireland, 2000–2008.
Source: EirGrid.

Table 1 Key Statistics 2008: Ireland	
Total installed wind generation	1,002 MW (MEC 986 MW*)
New wind generation installed	207.7 MW
Total electrical output from wind	2.298 TWh
Wind generation as % of national electric demand	8.7%
Target:	15% of electricity demand from renewables by 2010 40% of electricity demand from renewables by 2020
*maximum export capacity (MEC) see Section 2.0.	

MW were added and this was a setback in efforts to meet the target. In 2008, wind farm connection rates were more in line with 2005 and 2006. However, it appears that meeting the target will hinge on the capacity additions in 2009 and the first half of 2010. The system operators have target connection dates within this time frame for more than 600 MW of contracts. These dates have been subject to slippage in the past, but if 60% to 70% of those contracted wind farms are connected within the period, the target may be achieved. Contracted wind farms totaled 1,412.3 MW at the end of 2008 (1). These successful applicants were taken from the applicant queue via a group processing approach, which is discussed later in this report.

A key national objective for renewable energy was revised during 2008. As outlined in the 2007 Energy White Paper (3), Ireland had aimed to supply 33% of its electricity demand from renewable sources by 2020. This target has been increased to 40% (4), and the government has emphasized that the target is to be seen as a minimum rather than a ceiling. Using current emission factors for Ireland's fuel mix, a 33% penetration of renewable generation in 2020 would deliver a CO_2 saving alone of more than 7 million tonnes/yr. It can be seen from the figures for current connection applicants (11,000 MW) (5), sites contracted for connection (1,412.3 MW), and wind farms already connected (1,002 MW) that the wind industry is capable of providing the generation required as long as conducive conditions persist and the system operators have capacity to connect. Approximately 280 MW of new renewable capacity is required each year from 2009 to 2020 if the target is to be met. The peak connection rate to date was 231.85 MW in 2006, and the average connection rate over the past three years has been 162.6 MW. The capacity additions for each year since 2000 are shown in Figure 3.

Ireland's electricity regulator, the Commission for Energy Regulation, undertook a series of public consultations during 2008 that led to a direction to system operators as to how they should approach the connection of wind applicants in the next round of group processing (6). Those wishing to connect to the grid join an applicant queue once their application is "deemed

Figure 2 Kilgarvan, County Kerry 3-MW wind turbines. Courtesy of T. J. Hunter.

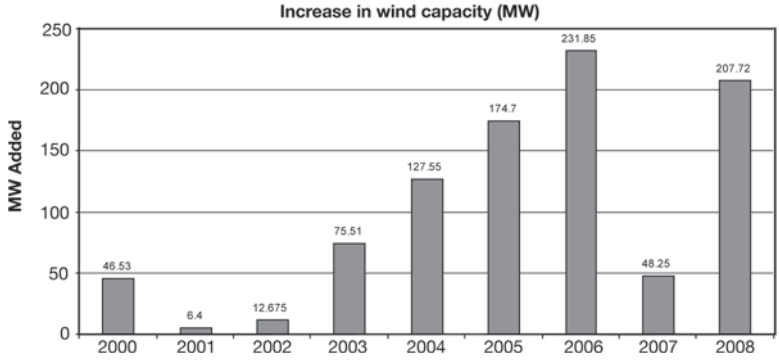

Figure 3 Annual increases in wind capacity 2000–2008. Source: EirGrid.

complete." The options considered for accepting applicants into Gate 3 included a date-order approach (as per Gate 1), a mixed date-order/optimization approach (as per Gate 2), or a new approach proposed by the system operators known as the Grid Development Strategy (GDS) (6). The GDS will result in the issuance of offers to an amount of applicants in the connection queue at gate closure.

The aim of the GDS approach is to plan and develop the grid to meet its anticipated demand and generation needs up to 2025 in a cost-effective, optimal, and efficient way by assessing the system over a longer term than has been used in the past. According to the Commission for Energy Regulation, "the GDS allows for the optimal connection of a very significant capacity of renewable generation in Ireland over the coming years, facilitating the achievement of the 40% Government renewable target through a long term and strategic programme of transmission development, to the benefit of renewable generators and end-customers."

During the next phase of the process up to 2011, 3,890 MW of renewable generation, including 3,877.5 MW of wind capacity, chosen by "deemed-complete" date order, will be offered. It is intended that this amount added to the grid by 2025 will provide the capacity needed to meet the 2020 targets, and it also takes into account some attrition of sites already holding connection offers. Where the local capacity of a node on the grid is less than the firm capacity required by a group of generators, firm access to the network will be rationed on the basis of date order of applications received. Sites within Gate 3 will have the option to increase their maximum export capacity (MEC) by 20% up to a cap of 4 MW to account for changes in technology over the time scales the connection process may take.

The entire list of wind connection applicants, including those in Gate 3, amounts to over 11,000 MW at year's end. To put this into context, Ireland's peak demand was not expected to rise above 5,000 MW during the 2008/2009 winter season.

In 2008, just 200 MW of interconnection existed between the Republic of Ireland and Northern Ireland. As a result, the Irish Republic's grid is relatively isolated. The East-West Interconnector project has progressed significantly in 2008 and is on course to be completed by 2012 (7). The East-West Interconnector will have a capacity of 500 MW and will be the first connection between the Republic of Ireland and Britain's transmission systems. It is hoped that the interconnector will assist in the deployment of high levels of wind generation and provide generators with access to a larger market. Marine surveys have been completed, the proposed route chosen, authorizations granted, and connection points determined. Final permissions are currently being sought at either end of the two high-voltage direct-current cables. In January 2009, the European Commission

announced a contribution of 100 million € toward the strategic infrastructure as part of its "Investing today for tomorrow's energy" economic development plan.

Another 350-MW high-voltage direct-current interconnector between Ireland and Britain is planned by Imera Power, a private asset-investment company that will build and operate the interconnector on a merchant basis.

3.0 Benefits to National Economy

3.1 Market characteristics

The design, development, construction, equipping and connection of wind farm facilities in Ireland is estimated at 300 million €/yr of economic activity over the past three years. Up to 80% of the outlay is spent on imported equipment, including the turbine and associated electrical equipment. Therefore, the value to the local and national economy could be estimated to be worth approximately 60 million €/yr. The value of civil and construction costs to the local economies is approximately 30 million €/yr.

Development of wind farms in Ireland has been undertaken by a wide range of individuals and organizations—from farmers and indigenous development companies to subsidiaries of semi-state bodies, utilities, and multinational developers. A landowner has the option of leasing land suitable for wind farm development without having to get personally involved in the development of the site. Typical costs for leasing such land are in the range of 6,000 €/MW installed.

Because the equipment is imported, the associated operation and maintenance (O&M) costs are with international suppliers. Therefore a large portion of the O&M expenditure, which is estimated to be 1.5% to 3% of the capital costs of a project, goes to equipment suppliers and manufacturers abroad. Current total capital costs are in the range of 1.7 million €/MW installed for wind developments in the 10-MW range. Five manufacturers' turbines were installed during 2008; the market share of each (in terms of each) is shown in Figure 5.

A major development in the wind sector came during 2008 when Scottish and Southern Energy plc completed the acquisition of Airtricity Holdings Ltd, valued at the time at 1,455 million €. Airtricity has wind farm projects in Ireland, China, Europe, and the United States. Scottish and Southern Energy plc is the second-largest

Figure 4 Wind farming near Dunmanway in West Cork. Courtesy of Zane R. Llewellyn.

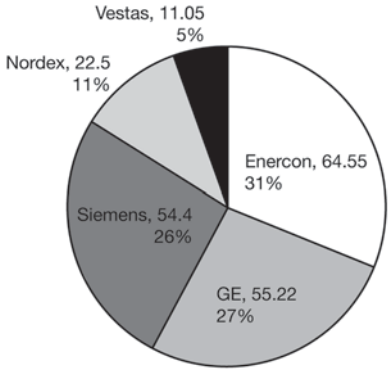

Figure 5 Turbines connected in 2008 (manufacturer, MW, %).

generator and supplier in neighboring United Kingdom, with operations in a range of other utilities and services.

3.2 Industrial development and operational experience

Although a burgeoning ocean energy industry is developing in Ireland, the country has no manufacturing industry of large-scale wind turbines. There is, however, a developing micro-scale turbine manufacturing industry, with a handful of companies developing their own units and masts. In addition, several companies are involved in manufacturing key mechanical and electrical components for both micro-scale and large-scale turbines and generators.

In 2007, the average size of a large-scale wind turbine grew to 1.9 MW; however, in 2008 the average size fell to 1.65 MW. During 2008, 128 turbines were installed in 12 wind farms, including extensions to two existing wind farms.

3.3 Economic details

Turbine costs currently range between 1.1 million € and 1.4 million €/MW, depending on the size of the turbine and the project. The trend in costs continues to be upward. A typical cost for connection would be in the range of 150,000 € to 300,000 €/MW. With the global economy facing recession, the demand for materials and hence costs are expected to be reduced. Figure 6 shows how typical project costs can be apportioned in Ireland.

Current support mechanisms for renewable generation take the form of a Renewable Energy Feed-In Tariff (REFIT). REFIT is a public service obligation–backed power purchase agreement (8). Section 4.0 will provide details of the mechanism.

The single electricity market (SEM) has been live for more than a year. Northern Ireland and the Republic of Ireland trade almost all of their electricity through a gross pool operated by the SEM operator; a portion of electricity is still traded bilaterally with licensed suppliers outside of the pool. Generators with installed capacity of less than 10 MW can trade bilaterally if they choose, thus avoiding administrative burdens associated with market participation. All generators above the 10 MW minimum must trade in the mandatory pool, either directly or via an intermediary.

The SEM Committee continues to consult on the treatment of wind and other intermittent generation in the SEM (9). Membership of the SEM Committee includes both regulatory authorities and external members from Spain. The aim of the consultation is to promote discussion in a market of increasing wind penetration

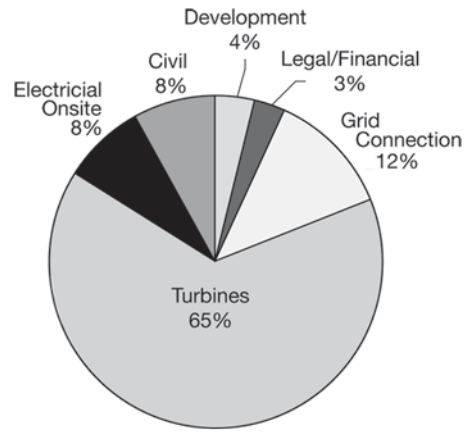

Figure 6 Breakdown of capital costs. Source: IWEA.

with the goal of dealing with issues in a timely manner. Issues such as the process to secure economic dispatch, firm access, the calculation of the average system marginal price, constraint compensation, and capacity payments will be further developed in 2009 following several meetings held in February.

4.0 National Incentive Programs

REFIT is the form of support mechanism employed in Ireland, initially with the aim of meeting the 2010 targets for renewable energy (10). The indirect beneficiaries of this form of state aid are the renewable generators. Electricity suppliers receive payments accruing under REFIT in return for entering into 15-year power purchase agreements with approved generators. Different levels of REFIT exist for different renewable technologies to reflect the variation in their setup costs and to promote diversity in the generation portfolio. For wind generation, the values of the REFIT reference prices originally announced in 2006 were 57 €/MWh and 59 €/MWh for large-scale and small-scale wind, respectively. This value is inflated annually by the Consumer Price Index, which at present is low. At January 2009, the value of REFIT for large-scale wind was approximately 64 €/MWh. The average wholesale price of electricity for 2009 was forecasted to be between 90 €/MWh and 110 €/MWh; however, this is likely to reduce as gas prices fall (11).

Should suppliers become exposed to higher than average prices by contracting with REFIT-backed generators, they are compensated through the PSO for the opportunity cost occurring. Suppliers also receive 15% of the large-scale wind reference price on top of the energy payment. This 15% payment was originally designed to cover balancing costs ("top-up" and "spill") in the old market and has been carried forward into the single electricity market.

Early in 2008, the Department of Communications, Energy, and Natural Resources announced a REFIT specific to offshore wind at 140 €/MWh. The increased discrete tariff for offshore wind is designed to reflect the additional costs associated with offshore wind development and aims to stimulate activity in the area. Despite the fact that Ireland is an island, offshore development has been limited to date, with 97.5% of installed capacity onshore. Hundreds of megawatts of offshore wind capacity has been licensed, but progress toward construction is not yet evident. However, Gate 3 includes 785 MW of offshore connection applicants. The department responsible for foreshore leases has decided to temporarily postpone the assessment of further applicants until it has reviewed the process.

At the opposite end of the scale, a micro-generation field trial is planned for 2009 and 2010 (12). The study will offer a financial incentive for host sites to get involved. A proposal by the largest electricity supplier to buy exported electricity from domestic sites was welcomed as progress, although the industry would like to see a tariff or support mechanism that would provide a driver for technology adoption. The 90 €/MWh offering will be reviewed annually and is an interim tariff prior to the outcome of the micro-generation pilot study and smart-metering trials.

An indirect incentive for the deployment of micro-generation is provided by the Energy Performance in Buildings Directive being implemented in Ireland under the Building Energy Ratings scheme. Irish building regulations require that new dwellings have a portion of their energy demands met by renewable sources on-site. The designer has a choice between sourcing this energy through either renewable thermal or renewable electrical means (4 kWh/m2/yr electrical or 10 kWh/m2/yr thermal). The contribution of a wind turbine can be included in the Building Energy Ratings scheme once its performance over a year has been verified.

Sustainable Energy Ireland also administers a Low Carbon Homes Programme

which is in place to incentivize further efficiency in the design of dwellings (12). The program provides financial assistance for developments (5–15 dwellings) that offer a 70% improvement in energy efficiency when compared to 2005 building regulations. The program requires at least 10 kWh/m2/yr of electricity to be generated on-site for self supply or export. One-off demonstration buildings are considered if it can be shown that the design can be duplicated. Funding of 40%, up to a maximum of 15,000 €, is available per unit, and all scales of renewable electricity generation are eligible costs.

5.0 R, D&D Activities

Several key studies were published during 2008. January saw the publication of the All-Island Grid Study, which has since been of interest to industry participants all over the world and has provided a platform for further research in Ireland (13). A summary was provided in the 2007 IEA Wind Annual Report. The conclusions of the study were a key factor in the decision by government to increase to 40% Ireland's 2020 renewable electricity target.

5.1 Impact of high levels of wind penetration on the SEM

Following on from the technical grid study the regulators undertook a study to assess the possible impacts of high penetrations of wind on the SEM in 2020 (14). The study examines the impact of the five generation portfolios from the All-Island Grid Study on the unconstrained system marginal price and on the capacity payments to generators. Generators receive capacity payments proportional to their capacity and availability. The cost/benefit analysis was limited to analyzing the additional cost of the added renewable capacity and the displaced costs for carbon fuel and conventional plant. The study also analyzed the effect high wind penetration might have on the profitability of existing and new conventional generators. It should be noted that, among other limitations, network costs were not included in the study.

At a high level, the study resulted in the following findings:

- Wholesale market prices are significantly lower for all but one portfolio of high wind penetration
- As expected, economic benefits are sensitive to fuel and carbon prices
- A mixed portfolio of plant including combined-cycle gas turbine, open-cycle gas turbine, and wind provides a greater carbon reduction
- Incentives may be required for all forms of new generation into the future
- The SEM design appears to be robust, but continued review will be required to facilitate the changes expected in the next decade.

It is worth noting that the modeling was carried out during a period of historically high oil and gas prices. Since then, prices have dropped to a level comparable with the low-price-fuel scenario, rather than those used in the central scenario.

5.2 Grid25

EirGrid, Ireland's transmission system operator, has published its strategy for the development of the grid up to 2025 (15). The study aims to identify how, on a national and regional level, the grid will need to be developed to accommodate projected demand growth and the move toward a high proportion of renewables. EirGrid estimates that the transmission system's capacity will have to double by 2025, and such an expansion is likely to cost in the region of 4 billion €. The potential of the existing grid to be upgraded will be maximized to minimize the construction of new lines, and no new 220-kV lines will be built. EirGrid will design the transmission network around 400-kV rather than 220-kV lines to minimize the footprint and length of new lines (a 400-kV circuit typically has the same

capacity as three 220-kV circuits). The network will also have 110-kV lines.

Following on from Grid25, the transmission system operator has begun more detailed studies to identify specific reinforcement needs and their environmental, economic, and system impacts.

6.0 The Next Term

Ireland intends to take part in the new IEA Wind Task 28 (The Social Acceptance of Wind Energy Projects: Winning Hearts and Minds) and will contribute research beneficial to the international wind community. IEA Wind Task 25 (Design and Operation of Power Systems with Large Amounts of Wind Power) has been extended, and Ireland will continue its involvement.

While output from wind increases, provisional figures show that the capacity factor for the wind portfolio may have dropped just below 30% during 2008 (2). The reasons behind this apparent fall warrant further study (wind resource, site selection, turbine availability, etc.).

Several R, D&D projects will take place during 2009 and beyond. These—along with a national smart metering pilot, further work on Gate 3, and a review of the connection process for smaller generators greater than 11 kW—will assist the deployment of wind at all scales.

6.1 Micro-generation field trials

There is growing interest in the area of micro-generation from all sectors of the community for both economic and ecological reasons. Interest is expected to increase further, now that the largest electricity supplier intends to offer 0.09 €/kWh to its domestic customers for exported electricity.

The major wind R, D&D activity expected in 2009 will be at the smaller scales and will be undertaken by Sustainable Energy Ireland. Financial support to meet 40% of the start-up and short-term-maintenance costs will be available in approximately 50 trial locations with an overall budget for the study of 2 million € (12). Sustainable Energy Ireland will fund data monitoring at all of the sites for the 18-month duration of the study. The monitoring will assess the performance of the technologies and inform future decisions on possible incentives, tariffs, or deployment programs.

To protect customers and prescribe best practices in the pilot study, turbine suppliers and manufacturers applying for inclusion in the pilot study will be required to supply equipment that conforms to the appropriate European standards (EN 61400-2/11/12), as will the associated inverters (EN50438). Installers will be required to undergo wind theory and practical manufacturer training. A robust site assessment and feasibility study will have to accompany an application. Best practices are prescribed in an effort to ensure high-quality and safe installations in a fledgling sector sensitive to the impact of bad customer experiences on future growth.

6.2 Smart network for island communities

Several offshore islands in Ireland support communities. Energy is provided by imports from the mainland or, in some cases, from distributed diesel generators. Wind has been used on the islands as far back as the 1980s and is still being harnessed on several islands on a small scale. The offshore islands have some of the best wind resources in Europe, and it is hoped that this, along with ocean energy, could be employed to increase the economic and environmental sustainability of island life by supplying the communities with reduced-cost electricity for power, heat, and transport. The Department of Community, Rural and Gaeltacht Affairs and Sustainable Energy Ireland have commissioned an economic and technical feasibility study focused on the Aran Islands with the possibility for duplication in other communities. The study will also assess the costs and benefits of storage technologies, both for transport end use and heating, thus improving security of supply of energy and reducing the need for conventional reserve.

6.3 Autoproduction

Autoproducers are generators with on-site generation installed with the aim of displacing imported electricity at retail rates. Wind autoproduction, large and small scale, will grow over the coming years as heavy energy users look for options to make their operations more competitive and sustainable. As autoproduction adds generation capacity downstream of the meter, it can be easier to facilitate than adding the same capacity directly to a congested grid, although grid access for the full capacity of the generator may be sought.

To date, autoproduction has been mainly employed through CHP generation. Following on from the success of the 850-kW turbine installed on campus in Dundalk Institute of Technology, some industrial customers are exploring their options. A number of energy services companies offer a risk-free model to industrial customers that have a suitable site. These companies take on all the risk in planning, designing, procuring, installing, and operating the megawatt-scale turbines. They then offer to the energy user on-site a tariff for the power produced that is guaranteed to be a percentage below the retail rate for the period of the long-term contract. With competitiveness becoming increasingly difficult for industry in Ireland, this arrangement is likely to be attractive to high energy users with suitable sites.

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