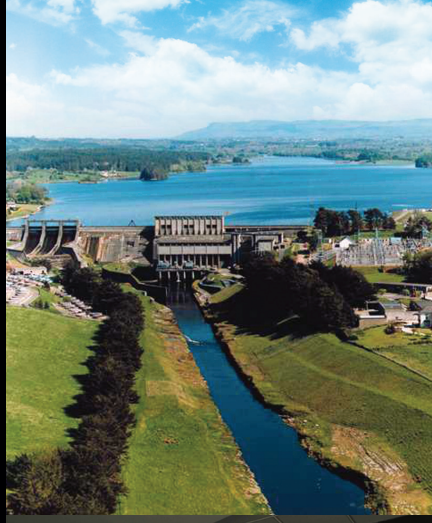
EirGrid Group

ANNUAL RENEWABLE REPORT 2011

Powering a Sustainable Future



EIRGRID

SONI System Operator for Northern Ireland

semo Single Electricity Market Operator

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Foreword

Over the coming years Ireland must tackle a range of social and economic challenges. Ensuring a secure, cost competitive and environmentally sustainable energy supply is essential. Our abundant renewable energy resource can play an important role in reducing our over-reliance on fossil fuel imports and reducing our energy-related carbon emissions. In my view, the best way to break our import dependency on fossil fuel based energy sources is to appropriately harness our own indigenous energy resources.

Developing and expanding the use of Ireland's renewable energy resource potential can moderate the impact of future international energy price increases. Earlier this year, the International Energy Agency acknowledged that the world had reached peak oil in 2006 and that the era of cheap oil is over. This statement was an important recognition that recent increases in international energy prices are not temporary, and that this trend is likely to continue over the coming years.

I am committed to ensuring that Ireland maximises benefits from our renewable energy potential and achieves our legally binding target laid down in the Renewable Energy Directive. Moving from around 15% of consumption in the electricity sector from renewable resources today to around 40% by 2020 represents a challenging transformation.
The development of the grid infrastructure and new grid management tools are critical in facilitating the significant expansion in wind generated electricity in the coming decade.

EirGrid is at the forefront of renewable integration and is working with all industry stakeholders to ensure the delivery of an electricity network that has the operational capability and infrastructural capacity to exploit the country's substantial renewable energy potential.

I welcome the release of EirGrid's Annual Renewable Report 2011. It is an authoritative overview of key developments in the renewable electricity sector in Ireland over the past twelve months, and offers a timely assessment of continued progress towards meeting our 2020 renewable energy target.

Pat Rabbitte, T.D.
Minister for Communications,
Energy and Natural Resources

Introduction

I am delighted to present the 2011 EirGrid Group Annual Renewable Report. This is the second such report designed to review developments in the renewable electricity sector in Ireland and Northern Ireland, and to highlight some of the main initiatives undertaken by EirGrid and SONI over the last twelve months.

Last year was another important year for the integration of renewable electricity in Ireland and Northern Ireland. Against a backdrop of continued economic difficulty, a combined 270 MW of wind generation was installed in Ireland (218 MW) and Northern Ireland (52 MW) since our last report in September 2010, bringing the total installed renewable generation on the island to 2262 MW. While it is acknowledged that the rate of yearly installed wind will need to increase in order to reach the approximately 5100 MW of wind generation that is needed to meet the 40% renewable electricity targets (North and South), a number of the building blocks for achieving the targets are now materialising.

Over the last twelve months, the European Union and the governments in Ireland and Northern Ireland have published a range of energy policy documents that has helped to further strengthen and clarify the future direction of renewable technologies in the electricity sector, while at the same time also signalling a high-level political intent to keep striving for more renewable generation in the years ahead.

In the last year, EirGrid and SONI have worked on identifying many of the operational challenges to managing high levels of variable renewable generation on the power systems of Ireland and Northern Ireland in 2020, and have initiated a three-year programme of work entitled Delivering a Secure, Sustainable Electricity System (DS3) to develop the appropriate solutions. The broad nature and strategic importance of this work means that any decisions taken will need input and engagement from all relevant industry stakeholders, and we are working to facilitate open communication and coordination at all stages of this process. The move towards increasing amounts of renewable generation on the power system will also require continuing work on our grid infrastructural programmes (GRID25, and RIDP), the Gate 3 grid connection process and additional technical analysis in the years ahead.

It is estimated that the level of installed wind generation in 2020 will be enough to meet around 37% of electricity demand across the island. In percentage terms, this is greater than any other synchronous region in Europe over this timeframe. While the majority of the 40% renewable electricity target will be met from wind generation, our work does not stop with wind. There is ongoing work to develop a better understanding of the potential for integrating other renewable sources, such as ocean energy technology, biomass and waste-to-energy plants.

In addition, we have also recently published the results of an offshore grid research study which examines the potential viability of offshore grids in the seas around Ireland, and we are continuing our active involvement involvement in the North Seas Countries Offshore Grid Initiative with nine other European countries.

In addition to the work undertaken by EirGrid and SONI, ongoing renewable research and analysis is continuing to take place in universities, energy research centres and government agencies all over the island. This work is fundamental to helping Ireland and Northern Ireland exploit the latent potential of the island's renewable energy resources. This transition has the potential to increase our energy security, reduce our CO_2 emissions and provide a range of economic benefits for the island, and EirGrid and SONI are proud to be at the heart of this change.

For further information on EirGrid and SONI's role and the various initiatives underway, I would encourage you to visit our website at **www.eirgrid.com**

Dermot Byrne
Chief Executive,
EirGrid

Executive Summary

Over the last twelve months, energy policy in Ireland and Northern Ireland has been under the microscope. The current economic situation has led to calls from some quarters for the governments to re-evaluate the level of investment in the energy sector and reconsider the current renewable electricity targets.

In June this year, the new Minister for Communications, Energy and Natural Resources, Pat Rabbitte, T.D., reaffirmed the Government's continued commitment to deliver on the necessary grid investment required to meet the 40% renewable electricity target. This announcement has helped to revive a secure investment environment for the renewable energy sector in Ireland, and provide clarity over the Government's planned response to the twin challenges of energy security and climate change.

In Northern Ireland, the assembly voted last year to approve an increase in the amount of electricity sourced from renewable sources to 40% by 2020 and published a road map for an overhaul of Northern Ireland's electricity infrastructure, including proposals to introduce smart grid technologies and enhance sustainability levels throughout the energy sector. The commitment to continue to increase the level of renewable generation was further enhanced by a recent announcement of Leasing Rounds for offshore wind and tidal stream projects in Northern Ireland which are scheduled to begin later this year.

It is widely recognised that Ireland and Northern Ireland have some of the best untapped renewable energy resources in the world and that the development of these resources will contribute simultaneously to achieving a secure, cost competitive and sustainable energy supply into the future – key policy objectives for both governments. Moreover, the recent confirmation that Ireland remains committed to meeting the 40% renewable electricity target and that Northern Ireland has adopted a similar target, augurs well for the future of renewable energy across the island. However, the achievement of these targets poses a series of challenges that still need to be overcome. EirGrid and SONI are helping to develop many of the necessary solutions to these challenges.

This report details progress in the renewable electricity sector over the last twelve months and for perspective, sets these developments in a broader international context. The structure of this report is as follows:

Section 1 - Renewable Energy in Context: this section offers a review of developments in the renewable electricity sector in the European Union (E.U.), Ireland, and Northern Ireland.

Section 2 - EirGrid and SONI in the Renewable Electricity Sector: this section presents an overview of EirGrid and SONI's work in meeting the renewable electricity targets[1]. It introduces the programme of work entitled Delivering a Secure, Sustainable Electricity System (DS3) and highlights the more general progress made during the last twelve months. This section also provides an overview of EirGrid and SONI's engagement with key stakeholders throughout the last year and highlights our regional and international involvement over the same period.

Section 3 - Research and Technological Developments: drawing together information and inputs on renewable energy developments from across Ireland and Northern Ireland, this section presents an update on a selection of emerging technology options and research in the renewable sector.

Section 4 - International Renewable Energy Developments: highlights some of the main international developments in the renewable energy space, focusing particularly on the E.U., U.S. and China.

Section 5 - Provides some brief concluding remarks.

1. The EirGrid Group comprises EirGrid TSO, SONI TSO and the Single Electricity Market Operator (SEMO). Hereafter, EirGrid will be used to refer to all elements of the Group.

1 RENEWABLE ENERGY IN CONTEXT

1. Renewable Energy in Context

The deployment of renewable generation in the electricity sector has increased rapidly in recent years. According to a 2011 International Panel on Climate Change (IPCC) report "of the approximately 300 GW of new electricity generating capacity added globally over the two-year period from 2008 to 2009, 140 GW came from [renewable] additions[2]." While the contribution of renewable energy to electricity generation varies by country and region, the trend is clear: more and more countries are working to decarbonise the power sector through the use of renewable sources.

By early 2011, it was estimated that over 118 countries had some type of target, measure or programme that supported renewable energy deployment[3]. Moreover, countries around the world are now legislating to facilitate the increased use of renewable generation on the power system through operational support measures such as priority dispatch[4]. For example, the 2009 E.U. Directive on renewable energy established a range of provisions to support the deployment of renewable generation in member states, including setting a binding target for each country and establishing a condition for each member state to develop a national action plan to achieve these targets. This renewable energy framework was further supported by a provision in the Directive that obliges Transmission System Operators (TSOs) in the E.U. to give renewable generation priority dispatch status, and a priority or a guaranteed connection to the grid. Ireland transposed the provisions of the E.U. renewable energy Directive into Irish law through Statutory Instrument (SI) 147 in March this year. Northern Ireland is currently progressing with meeting the requirements of this Directive.

Last year the European Union issued a number of important energy related communications, strategies and declarations that reaffirmed its position as one of the leading regions in the world for renewable energy deployment. Two important publications issued by the European Commission in November last year are worth noting: a Communication on Energy Infrastructure and Energy 2020 - a Strategy for Competitive, Sustainable and Secure Energy.

The Communication on Energy Infrastructure reinforced the urgent need to prepare the electricity grid for the integration of significant volumes of electricity produced from renewable sources. This Communication also discussed the need to tackle the challenge of connecting the offshore potential, mainly wind, foreseen in the seas around Northern Europe and developing an electricity network off and onshore. The Energy 2020 Strategy defines the energy priorities in Europe for the next decade and sets the actions to be taken in order to tackle the challenges of saving energy, achieving a market with competitive prices and secure supplies, and enhancing Europe's technological leadership.

In February 2011 a European Council meeting was held in Budapest entirely devoted to energy related issues. This meeting is a clear indication of the growing political importance of energy in a European context and issued a number of significant conclusions on Smart Grid development, the completion of the Internal Electricity Market (IEM) by 2014 and the introduction of an Energy Efficiency Directive. The proposal for an Energy Efficiency Directive was introduced in June 2011 and recommends specific energy efficiency measures to be binding on member states[5].

The European Commission has now started to look beyond the 2020 energy framework for Europe and in the second part of 2011 the commission will issue an Energy Roadmap out to 2050. This Roadmap will address the established objectives of E.U. energy policy – sustainability, energy security and competitiveness – and will focus on how energy security and competitiveness can be improved through a transition to a low-carbon energy system. The strategy will present different pathways to reach the overall objectives in the energy sector and will be set in the context of the European Council's target of an 80-95% reduction in E.U. greenhouse gas emissions below 1990 levels by 2050.

2. The IPCC *Special Report on Renewable Energy Sources and Climate Change Mitigation* is available at http://srren.ipcc-wg3.de/
3. The Renewable 2011 - Global Status Report (REN 2011). Available at http://www.ren21.net
4. Priority Dispatch is the process where certain generation plants are provided priority in the dispatch order. It is an instrument to try and achieve broad policy outcomes (e.g. increasing the share of renewable generation on the power system and/or maintaining a degree of indigenous non-competitive fuel sources on the power system) and is mandatory for renewable generation in E.U. law.
5. The proposal was issued on 22 June 2011 and is available to review at http://ec.europa.eu/energy/efficiency/eed/doc/2011_directive/com_2011_0370_en.pdf

1.1 RENEWABLES IN THE SINGLE ELECTRICITY MARKET (SEM)

The power system of Ireland and Northern Ireland is evolving. The integration of indigenous renewable generation on the power system is considered a means to achieving energy security, environmental sustainability and economic competitiveness, simultaneously. Supporting this transition are a range of government targets, policies and market incentives designed to provide the framework for the decarbonisation of the power system.

Last year, the Northern Ireland Department of Enterprise, Trade and Investment (DETI) released a Strategic Energy Framework that outlined a commitment to achieving a 40% renewable electricity target by 2020[6]. This decision provides a level of strategic consistency across the island of Ireland in terms of the percentage target required from renewable generation sources over the next decade.

In order to facilitate the successful transition toward increasing amounts of renewable generation on the power system, EirGrid and SONI are working to develop appropriate enabling conditions. In early 2011, EirGrid and SONI completed a range of technical studies that identified the operational challenges to meeting the 40% renewable electricity targets in Ireland and Northern Ireland by 2020[7]. This technical research, combined with findings from the 2010 Facilitation of Renewables studies, has formed the basis of a new three-year programme of work designed to develop the appropriate solutions to operating increasing amounts of variable non-synchronous renewable generation on the power system over the coming years. Together with our ongoing work on Grid25 and the Gate 3 process, this operational research will support the efforts to put in place the building blocks toward meeting the renewable electricity targets by 2020.

The advent of significant volumes of conventional and renewable generation connecting to the power system is raising some important operational, regulatory and market questions for the renewable space across the island. The all-island regulatory consultation on the Principles of Dispatch and the Design of the Market Schedule (SEM-90-073) examined many of these important issues, including issues surrounding the efficiency of dispatch and the design of the market, to long-term investment signals associated with access rights.

The Regulatory Authorities (RAs') consultation examined twelve specific matters regarding the principles of dispatch and the design of the Market Schedule in the Trading and Settlement Code. As noted in the SEM Committee Decision Paper (SEM-11-062) in August, the range of issues covered in this consultation were complex and wide-ranging and have important implications for renewable generation in terms of TSO operational policy (i.e. priority dispatch) and market related issues, in particular regarding the treatment of Variable Price Takers in the Market Schedule[8]. Of the twelve specific matters under investigation, the SEM Committee took a decision on eleven of them. The one outstanding issue relates to the treatment if price taking generation in tie breaks in dispatch and the RAs have issued a subsequent consultation to deal with this question.

1.2 RENEWABLE POLICY & TARGETS: IRELAND

At the end of September 2011, Ireland had 1585 MW[9] of installed wind generation, 237 MW of hydro power and 46 MW of smaller renewable sources[10], enough renewable generation to contribute to 15% of overall electricity demand[11]. At particular time intervals, wind has produced enough power to meet 50% of electricity demand, and has even reached a high of 37% of total daily electricity demand. EirGrid and SONI are now managing instantaneous penetration levels of non-synchronous variable wind generation above 40% more often than ever before (see pages 25-26), putting us in a world-leading position for managing high levels of wind generation on a synchronous power system. It is important to note that due to low wind conditions, however, wind only provided 10% of system demand in 2010[12].

Government policies - including feed-in-tariffs and targets - have played a crucial role in accelerating the deployment of renewable electricity generation in Ireland. The current level of installed renewable generation is consistent with Ireland's interim renewable obligations set out in the 2007 Energy

6. See the Strategic Energy Framework for Northern Ireland at http://www.detini.gov.uk/strategic_energy_framework__sef_2010_-3.pdf
7. Ireland adopted a 40% renewable electricity target in October 2008. Northern Ireland announced their intention to aim for a 40% renewable electricity target in 2010.
8. More detailed information on the specifics of this decision can be found at: http://www.allislandproject.org/en/renewable_decision_documents.aspx?article=77d0b4de-341a-4f10-847f-df2dee9ae674&mode=author
9. Wind generation is split between the Transmission System Operator and Distribution System Operator (DSO). Wind figures on the Distribution System are provided to EirGrid from the DSO.
10. Small renewable sources include: renewable CHP, land fill gas, and biomass.
11. It is important to note that this is the percentage figure is not calculated using the E.U. Renewable Directive (2009/28/EC) calculation methodology which takes an average over the last 5 years.
12. Last year was a bad wind year. Capacity factor was down to 23.4% the lowest level since 2002.

2020 Renewable Electricity Targets across the EU

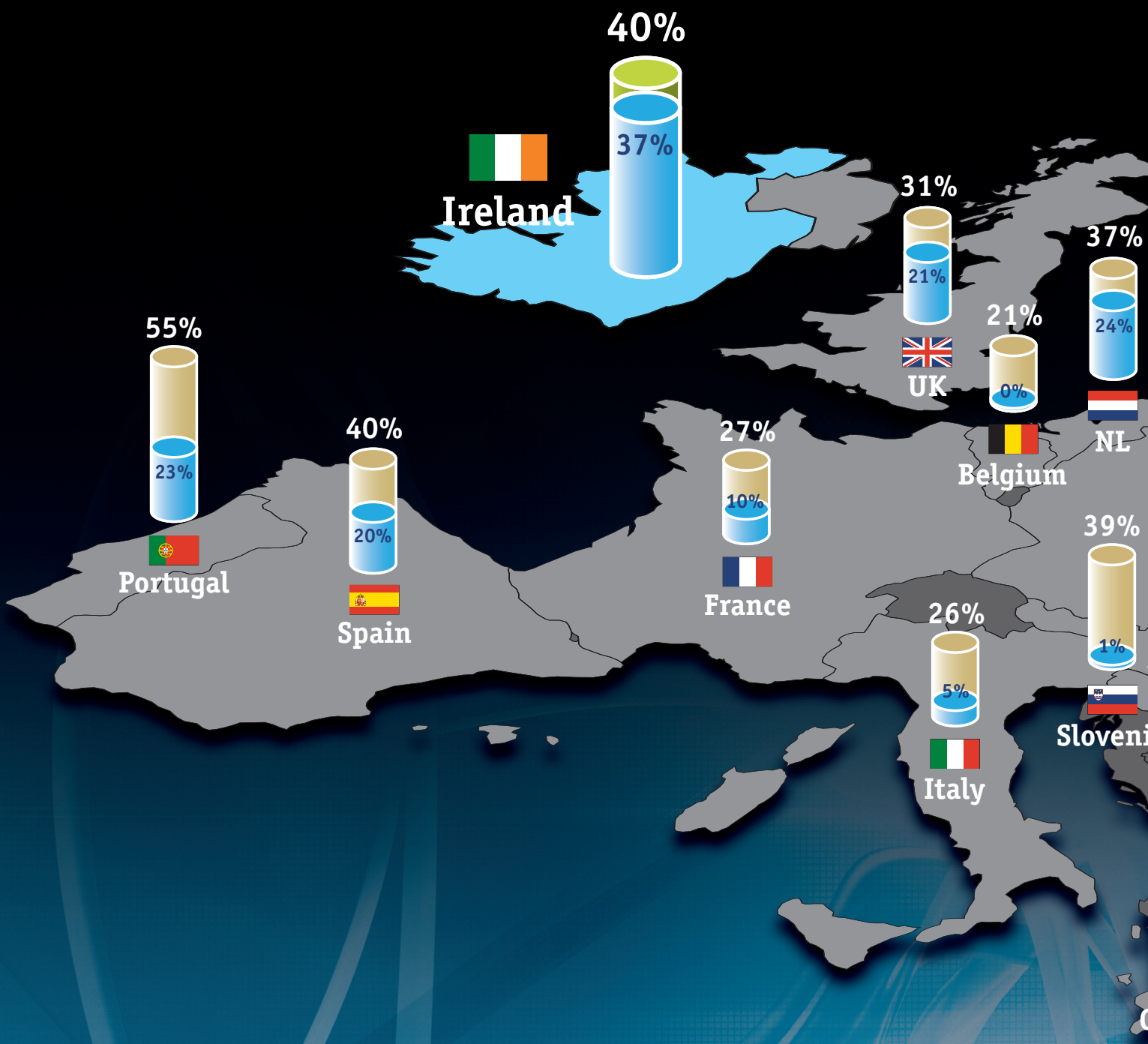
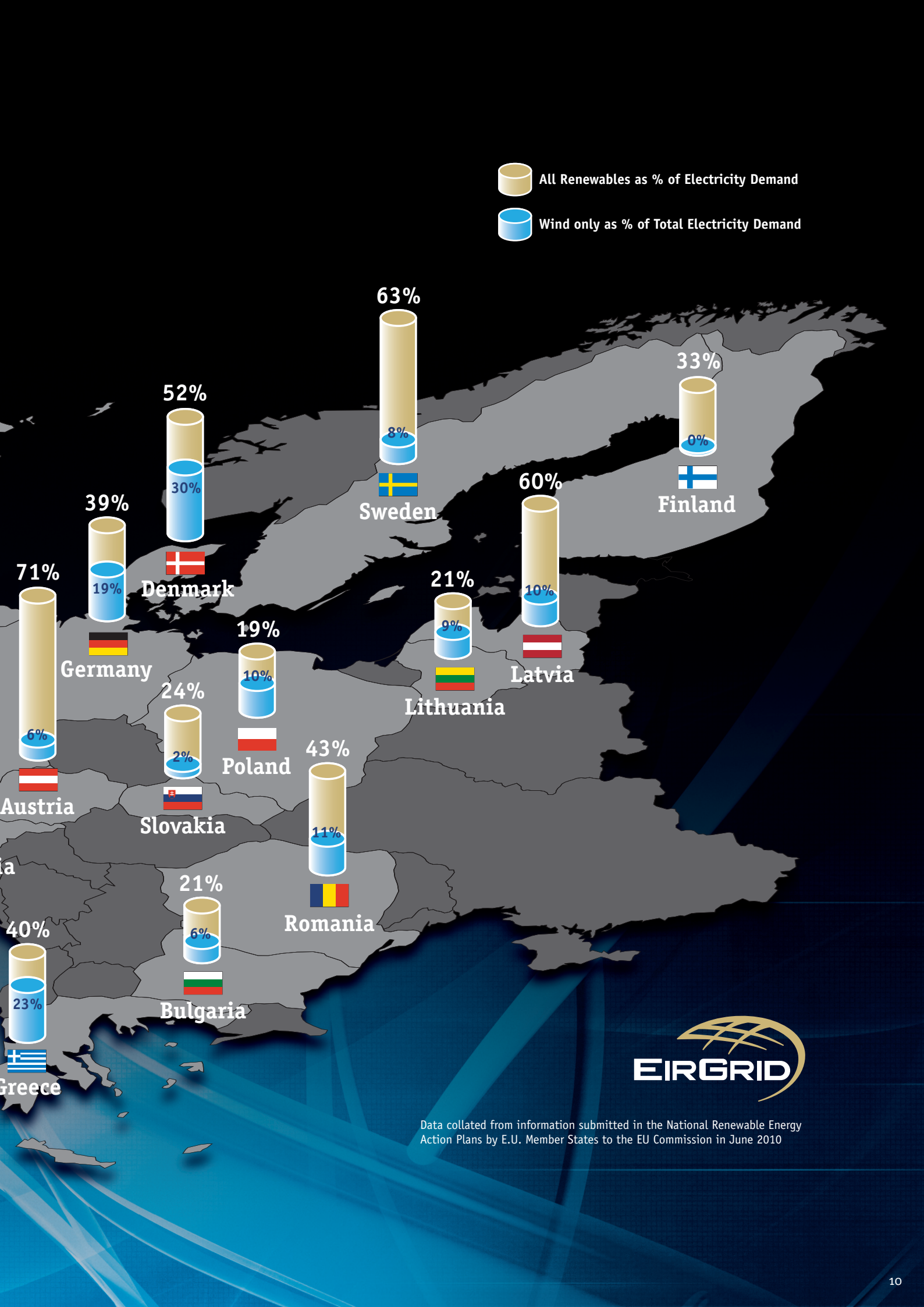


FIGURE 2: EU Wind and Renewable Percentages 2020



Data collated from information submitted in the National Renewable Energy Action Plans by E.U. Member States to the EU Commission in June 2010

White Paper *Delivering a Sustainable Future for Ireland,* and surpasses the country's E.U. obligations under the 2001 Renewable Directive (2001/77/EC) for 13.2% of the country's electricity consumption to be derived from renewable generation by 2010.

The past twelve months have been an interesting time for the energy sector in Ireland. Against the backdrop of the country's economic slowdown, current energy policy in Ireland, including the 40% renewable electricity target, has been questioned in some quarters. In June this year, however, the new Minister put an end to speculation that renewable electricity target would be reduced by declaring the new Government's commitment to meeting the 40% target by 2020.

The new Energy Minister has recently announced that the 2007 Energy White Paper will be reviewed in the coming months and a revised 2012-2020 framework will be published early in 2012, taking account of the country's current economic situation. It is expected that this updated Energy White Paper will be informed by the outcome of the International Energy Agency's review of Ireland's energy policy, undertaken this year, and the first update of the National Renewable Energy Action Plan which is scheduled to be completed in December 2011.

Earlier this year, the DCENR issued a draft Offshore Renewable Energy Development Plan (OREDP) for public consultation. This plan outlined a number of possible scenarios for the development of Ireland's offshore wind and ocean (wave and tidal) energy out to 2030. The high deployment scenario envisioned 4500 MW of offshore wind generation and 1500 MW of ocean energy around the coast of Ireland. It is expected that this draft consultation document will be finalised over the coming months.

RENEWABLE ELECTRICITY ACROSS THE ISLAND 2010 TO 2020

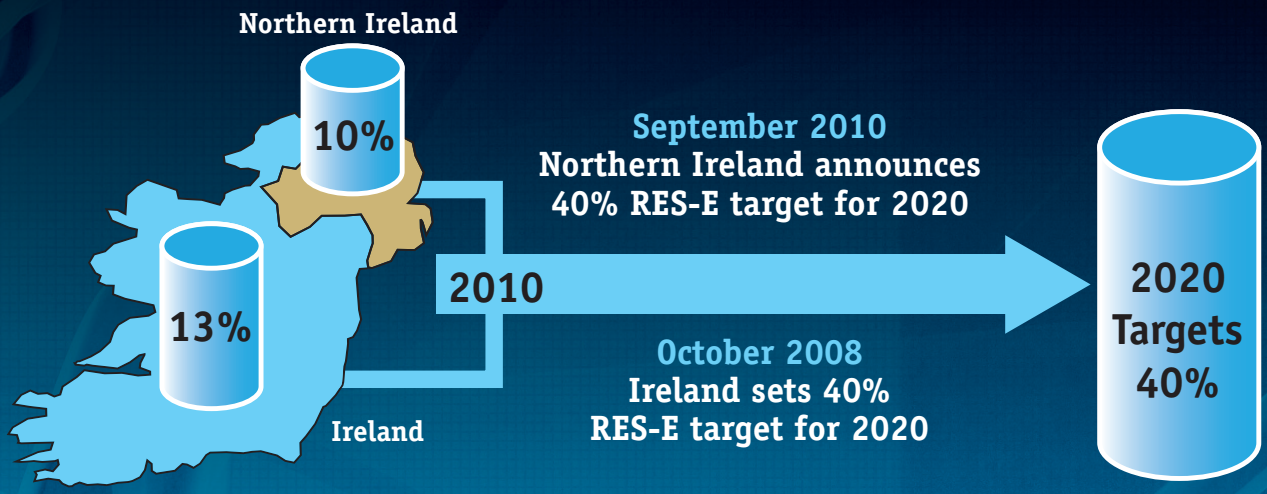


FIGURE 1: Consistent 2020 targets across the Island

1.3 RENEWABLE POLICY & TARGETS: NORTHERN IRELAND

In Northern Ireland there is currently 376 MW of wind generation connected to the power system and last year 10% of electricity demand was met by renewable energy sources, placing Northern Ireland is on a firm path towards meeting its interim 12% renewable electricity target by 2012.

The Northern Ireland Strategic Energy Framework (SEF) published in September 2010 set out four key energy goals: building competitive markets; ensuring security of supply; enhancing sustainability; and developing energy infrastructure. The SEF also set a 40% renewable electricity target to be reached by 2020. This target is consistent with the 40% renewable electricity target in Ireland and in the context of the all-island Single Electricity Market (SEM) is likely to help minimise the potential for market distortions between the two jurisdictions.

Over the last number of years, Northern Ireland has been focused on achieving its 2012 renewable electricity target that 12% of electricity consumption be met from indigenous renewable sources.

In an effort to ensure the development of a diverse renewable portfolio, 15% of this 12% renewable electricity target should be derived from non-wind sources. To meet the new 2020 renewable electricity target, it is expected that Northern Ireland will need to increase the installed level of wind generation on the power system to near 1000 MW. This development will pose significant infrastructural and operational challenges that SONI and Northern Ireland Electricity (NIE) are working to overcome. It is estimated that to facilitate this renewable target approximately £1 billion will need to be invested in the electricity network across Northern Ireland.

As part of this process, SONI, EirGrid and NIE have worked together to identify the network reinforcement requirements in the North West of the island of Ireland. This project, entitled the Renewable Integration and Development Project (RIDP)[13], aims to identify transmission reinforcement options and solutions for this region to accommodate the number of renewable generation projects proposing to connect in this North West region.

13. RIDP is the Renewable Integration Development Project which aims to identify possible transmission reinforcement options for the northwest of the island.

In March 2011, the Crown Estate announced a timetable for leasing offshore renewable energy projects in Northern Irish waters. The plan envisages the launch of two competitive tender rounds for offshore wind and tidal stream, beginning with an open call for expressions of interest later this year – it is anticipated that rights to develop offshore wind and tidal stream projects could be awarded early in 2012. Based on the findings of an earlier Strategic Environmental Assessment (SEA), it is estimated that at least 600 MW of offshore wind generation and 300 MW of tidal stream generating capacity could be deployed by 2020, without adverse effect on the environment.

In January this year, the Northern Ireland Renewable Industry Group (NIRIG) was established. This new lobby group represents the collective voices of the Irish Wind Energy Association (IWEA) and Renewable U.K. in Northern Ireland, and will bring added weight to the voice of the renewable industry in Northern Ireland[14].

ALL-ISLAND SYSTEM DEMAND AND WIND PENETRATION (9th & 10th May 2011)

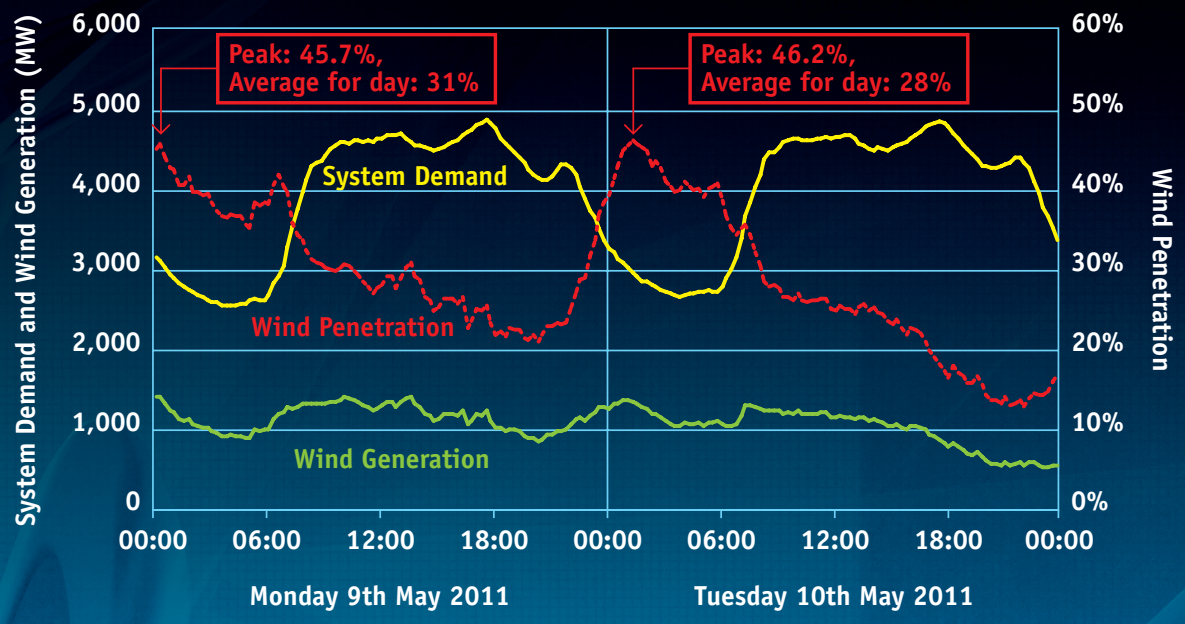


FIGURE 3: All-Island System Demand and Wind Penetration

14. There is more information on the NIRIG in Section 3.4.

1.4 DEVELOPMENTS IN THE U.K.

In recent months, the U.K. Government has consulted on its intention to introduce a number of measures to create an attractive investment environment for low carbon generation. Using a carbon intensity benchmark of 100gCO2/kWh by 2030, the combinations and variations of the following mechanisms were assessed:

- A Carbon Price Support (CPS) that will operate in conjunction with the existing E.U. Emissions Trading Scheme (E.U.-ETS) ensuring a floor price of £16/tonne CO2 by 2013, rising to £30/tonne by 2020 and £70/tonne by 2030.
- A Feed-in Tariff (FIT) with Contract for Difference (CfD) to support renewables in place of the existing Renewables Obligation (RO) scheme by 2017.
- An Emissions Performance Standard (EPS) to prohibit new plant build without appropriate carbon mitigation technologies such as Carbon Capture and Storage (CCS).
- A Targeted Capacity tender designed to reward plant for flexibility adhering to a defined security standard to support investment in units with necessary technical capabilities to support a decarbonised power system.

In July 2011, the U.K. Government published a White Paper on electricity market reform entitled: **'Planning Our Electricity Future: A White Paper for Secure Affordable and Low-Carbon Electricity'**. Importantly, the White Paper recognises the different structure of the Northern Ireland energy market, and is committed to working closely with the Northern Ireland Executive to monitor the interaction with the SEM. For example, the UK Government and the Northern Ireland Executive have agreed that because the SEM already uses a Capacity Payments Mechanism (CPM), the proposed Capacity Mechanism would apply across GB only. As a result the Northern Ireland Executive hope that any further reform decisions from the White Paper will take account of existing market arrangements in the SEM. The U.K. Government is planning to begin the legislative process on key elements of this White Paper in early 2012.

Impact of Wind Genera

The integration of increasing amounts of Wind on the electricity system is helping to reduce the amount of CO_2 emissions in the power sector.

Figure 3 shows the impact of wind on CO_2 emissions in the power sector in Ireland during a typical working week.

EirGrid, with the support of the Sustainable Energy Authority of Ireland, has developed a methodology for calculating CO_2 emissions from electricity generation in Ireland.

This information is presented on the EirGrid website in real time at:
CO_2 Emissions:
http://www.eirgrid.com/operations/systemperformancedata/co2emissions
CO_2 Intensity:
http://www.eirgrid.com/operations/systemperformancedata/co2intensity

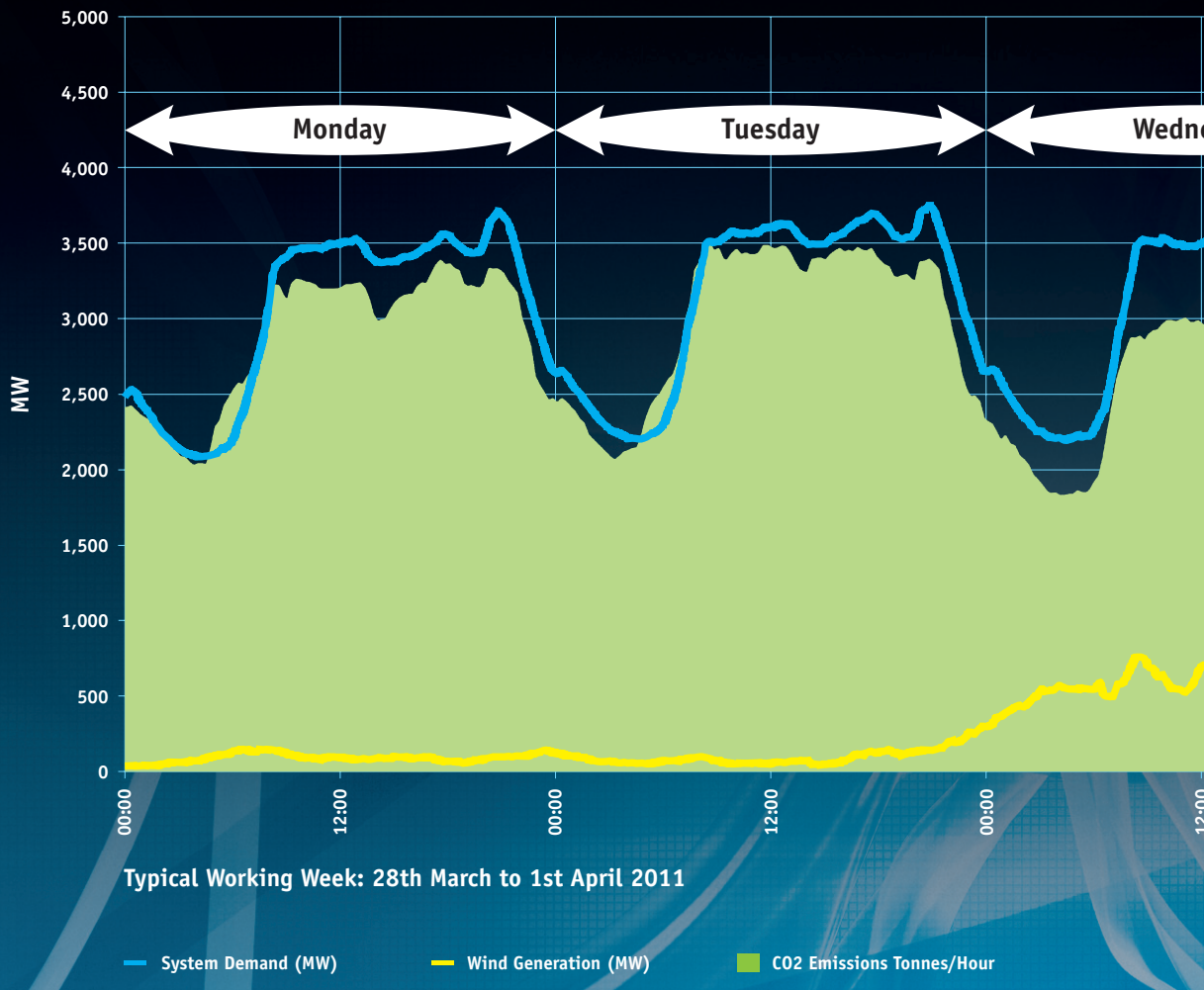


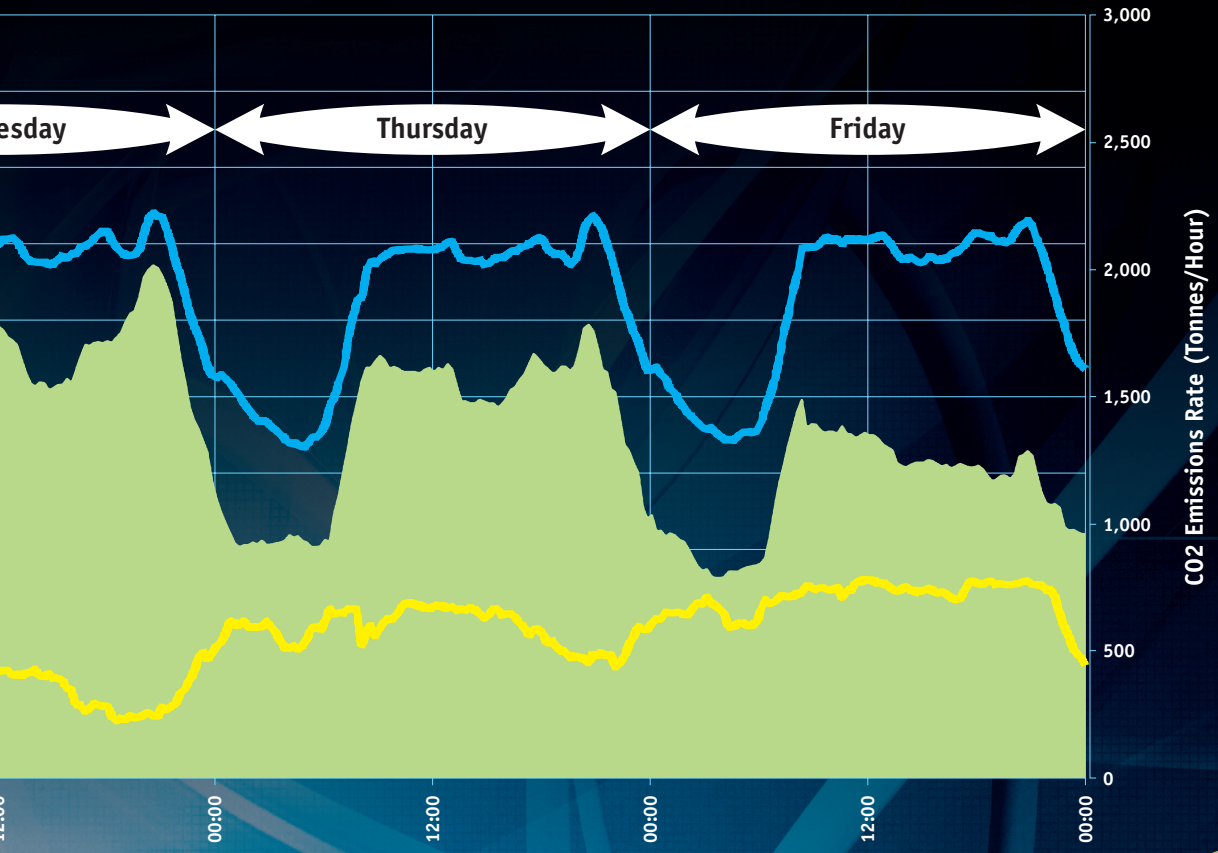
FIGURE 4: System Demand and Wind Generation in Ireland

ation on CO_2 Emissions

SmartGrid App

EirGrid's SmartGrid iPhone Application was named as Best Business Solutions Application at The Appy's Awards (these industry awards are for the best, the most useful and the most creative Apps developed in Ireland and their developers).

The iPhone application allows users to browse and graphically view key energy-related data in an easy and intuitive format. SmartGrid provides the user with a regularly updated view of system demand and CO_2 emissions. It is available for view or download.



2 EIRGRID AND SONI IN THE RENEWABLE ELECTRICITY SECTOR

2. EirGrid and SONI in the Renewable Electricity Sector

Over the next decade it is expected that approximately 5100 MW of wind generation will need to be installed across the island to meet the 40% renewable electricity targets. The impact of this level of variable renewable generation on the power system will materially impact on the way the electricity system is operated. There are five interrelated aspects of the work undertaken by EirGrid and SONI that contribute in different ways to the integration of increasing amount of renewables. These include: infrastructural development (Grid 25), the Gate 3 connection process, Smart Grid development, the DS3 work programme, and interconnection with neighbouring grids.

2.1 GRID DEVELOPMENT STRATEGIES

The physical location of renewable plant is often at different locations to existing conventional generation and to load centres. As a consequence, additional and upgraded grid infrastructure is required to provide access for distributed forms of renewable generation and to reinforce the system. In addition, developing system infrastructure will provide the means to integrate a greater quantity of renewable plant. Throughout the last year EirGrid made considerable progress in this regard.

Grid25 is EirGrid's strategy for the long term development of Ireland's transmission grid for a sustainable and competitive future. Grid25 will provide transmission capacity for increased electricity demand, new conventional generators and large amounts of renewable generation.

Since the Grid25 strategy was developed, significant progress has been made in optimising our investment plans, in identifying new technical solutions, in building new transmission circuits and in uprating existing circuits. There has been significant development of the transmission system in the past year, with more network put in place than has been built in the past 20 years. During the past year, 150 km of new transmission lines were completed, along with upgrades to 300 km of existing lines. Our Grid25 strategy is designed to ensure that all regions in Ireland will have access to reliable, high-quality power supplies, facilitating access to renewable energy resources.

Following the publication in 2010 of Northern Ireland's Strategic Energy Framework, NIE has commenced work on Network 25 – a grid development plan for the electricity network in Northern Ireland. According to the Northern Department of Enterprise, Trade and Investment (DETI), the "Network 25 plan will explore the need for future grid strengthening and will address grid requirements for all forms of generation[15]."

EirGrid and SONI are also working with NIE on the Renewables Integration Development Project (RIDP). RIDP will focus on potential transmission reinforcement options for the North West region, including a large portion of the North and West of Northern Ireland and County Donegal. Stage 3 of the 4 stage project is scheduled to be published in early 2012.

2.2 GATE 3: CONNECTION OFFER PROCESS

Through the Gate 3 Connection Offer Process – which involved issuing connection offers to generators for the connection of approximately 4000 MW of wind generation and 1500 MW of conventional generation - EirGrid managed and issued all of 94 connection offers on schedule. This is a major milestone for the industry and is a key step on the road towards meeting the 40% renewable electricity target.

The Gate 3 Offer Process is the third round of group processing for generation applications undertaken by EirGrid and ESB Networks. The project was set up on a formal footing between EirGrid and ESB Networks and a project governance structure and a detailed project plan was put in place. In addition, a Gate 3 Liaison Group involving the CER, EirGrid and ESB Networks, along with industry representatives, was established to assist in communication among key stakeholders on a monthly basis.

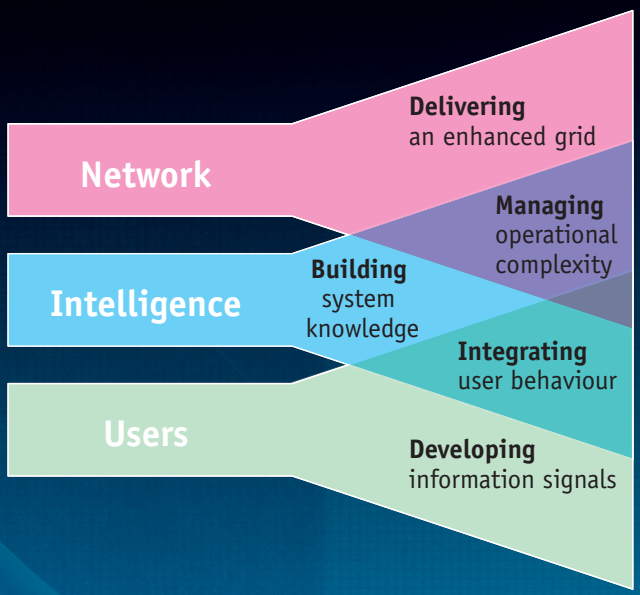
15. See the Draft Onshore Renewable Electricity Action Plan 2011-2020 recently released by DETI. Available at http://www.onshorerenewablesni.co.uk/

EirGrid is continuing to put in place arrangements for the next phases of Gate 3 including project delivery of accepted offers and offer modifications.

2.3 SMART GRIDS

Interest in the development of Smart Grids has increased considerably over the last number of years. In April this year, the International Energy Agency published a Smart Grid roadmap which declared that Smart Grids are "crucial for a secure, cost effective, clean energy future[16]." The E.U. Commission followed this roadmap later in April with a Communication on Smart Grid development. In conjunction with the relevant Smart Grid provisions in the Electricity Directive (2009/72/EC), this new Communication has put the development of Smart Grids at the top of the political agenda in Europe. Smart Grid development is considered to be a key enabler for a future low-carbon electricity system that facilitates demand-side efficiency, increases the share of renewable and distributed generation, and enables electrification of transport.

EirGrid and SONI have a central role in a Smart Grid environment for Ireland and Northern Ireland that will enhance power system reliability, promote jobs growth through enterprise opportunities and lower energy prices. In order for the Smart Grid to develop, Ireland and Northern Ireland must engender an environment that allows innovation and enterprise to flourish while being cognisant of the needs of the power system. The Distribution System Operator (DSO), the Sustainable Energy Authority of Ireland (SEAI), Governments, Smart Grid Ireland and the wider business community all have an important role to play in the Smart Grid space.



EirGrid and SONI will develop a SmartGrid that:

- Delivers benefits to customers
- Handles large amounts of renewable generation
- Facilitates informed demand side participation
- Utilises the network more efficiently
- Creates new enterprise opportunities
- Improves power system resilience

by

- **Delivering** an enhanced grid
- **Managing** the increasing operational complexity
- **Building** system knowledge
- **Integrating** the behaviours of Users
- **Developing** the right information and data signal

FIGURE 7: Smart Grid Adding intelligence and versatility for a better power system.

16. See the International Energy Agency published a Smart Grid roadmap, available at: http://www.iea.org/papers/2011/smartgrids_roadmap.pdf

Despite all the discussion about Smart Grids, some confusion exists between the concepts of Smart Grids and Smart Metering, with many people using these terms interchangeably. Many elements of the Smart Grid are already in place on the Irish transmission system, including dynamic line rating, real-time stability analysis tools, and synchrophasor measurement devices. However, the Smart Grid needs to penetrate down to lower voltage levels in the distribution system, to homes and small businesses too. Smart Metering is a subset of Smart Grids and refers to modern advanced meters that monitor consumption by time of use. In addition, these meters can indicate the price of the energy to the consumer. Findings from the CER's Smart Meter Customer Behaviour Trials and Cost-Benefit Analysis published in May 2011* indicate that a national rollout of electricity smart metering and associated initiatives can assist consumers in being more efficient in their use of electricity. The findings also indicate that generally there is quantifiable net benefit to Ireland. The CER has subsequently published a consultation on the proposed national rollout of electricity and gas smart metering**.

The advanced technologies at the heart of the Smart Grid will bring about a number of benefits for electricity consumers, suppliers and network operators and will form a vital element in any future strategy designed to increase flexibility on the demand-side and increase control over new forms of renewable generation.

The development of Smart Grids in Ireland and Northern Ireland has gained considerable traction in recent years. In the next few years, EirGrid and SONI will seek further opportunities to exploit the benefits of new technologies, including additional demand-side participation, and increased levels of renewable generation, and will work with all relevant stakeholders in order to maximise the full potential of Smart Grids.

2.4 DELIVERING A SECURE, SUSTAINABLE ELECTRICITY SYSTEM

In June 2010, EirGrid and SONI published findings of the Facilitation of Renewables (FoR) suite of studies. This publication was an important step towards providing a more complete picture of the operational implications of managing high levels of variable renewable generation on the power system, and provided a foundation of knowledge to further refine our understanding of managing a power system in this new context. This was then followed with more in-depth analysis to identify specific actions from this work, which is outlined in the report "Ensuring a Secure, Reliable and Efficient Power System in a Changing Environment" available on the EirGrid website at http://www.EirGrid.com

The output from this additional research has led to the development of a three-year work programme called: "Delivering a Secure, Sustainable Electricity System" (DS3). The different aspects of this programme are fundamental to ensuring the continued security of supply on the island and are required to deliver on the 2020 renewable electricity targets. There are three major work areas within this programme; these are System Policies, System Tools and System Performance. The broad scope of this work necessitates the engagement of the Regulatory Authorities, relevant Government departments, Distribution System Operators and the wider industry. A key part of the programme includes active engagement with stakeholders. To that end, an Advisory Council consisting of representatives from across the electricity sector in Ireland and Northern Ireland has been established in order to provide input on the programme. The first meeting of this Advisory Council took place on the 24th October 2011. In addition, regular industry fora will be held to provide updates on the progress of the programme.

DS3: SYSTEM POLICIES

As the level of renewable generation increases over the next decade, EirGrid and SONI will have to update and develop new system operational policies to manage the increasing complexity associated with integrating large amounts of variable renewable generation. In particular, operational polices will need to be developed to support frequency control and voltage control. For example, our analysis of the current portfolio capability has shown that the levels of available primary operating reserve (reserve provided within 5 seconds) have fallen over time and will fall further as more non-synchronous generation is accommodated onto the system. This has implications in terms of frequency control of the power system that will require refinement to current system policies.

* CER/11/080 - http://www.cer.ie/GetAttachment.aspx?id=351e5725-abe4-4689-9282-a935fc39d8d7
** CER/11/191 - http://www.cer.ie/GetAttachment.aspx?id=8655ee89-9727-46f4-8889-03b3e0aa5863

DS3: SYSTEM TOOLS

Improved system operational tools will need to be developed and deployed as the operation of the power system becomes more complex with a rapidly changing plant portfolio. The aim of the tools is to provide the system operator with more accurate real-time information and also greater control and monitoring facilities. These tools include the ability to dispatch wind, to forecast wind output accurately and to assess the stability of the power system in real-time. Some of these tools are already in place in the control centres in Dublin and Belfast. Wind Security Assessment Tool, WSAT was installed in September 2010[17]. This tool assesses the instantaneous secure amount of wind generation on the power system based on voltage and transient stability analyses of transfers between wind and conventional power generation during both normal operation and any credible faults that may occur. At present, transfers are set to 250 MW to reflect the worst case wind power increase over a one hour period.

DS3: SYSTEM PERFORMANCE

System Performance refers to the performance of all plant connected to the power system. The Grid Code sets out the performance standards for this plant and enforcement of these standards is essential to ensure the capability of the portfolio[18].

The FoR studies identified deficiencies in system performance capability in terms of frequency and voltage control out to 2020 with more non-synchronous generation on the system. In terms of frequency control, the analysis has shown that the projected levels of synchronous inertia available in 2020 are less than the amount needed to meet system requirements. At high instantaneous variable renewable penetration levels, frequency control becomes more challenging due in part to the presence of Rate-of-Change-of-Frequency (RoCoF) protection relays shutting down wind turbines. Investigations are currently underway to either replace the RoCoF protection relays on the distribution networks by alternative protection schemes or increase the RoCoF thresholds.

In addition, enhanced sources of static and dynamic reactive power are needed on the system.

The controllability and availability of reactive power from wind farms is a key requirement for managing voltage performance securely. The first step in terms of this work area was to identify the shortfalls in the required system/ancillary services operational needs of the power system out to 2020. Much of the work was done early in 2011. The next stage will involve broad consultations on the structure, level and value of the system services required on the power system out to 2020.

2.5 EAST-WEST INTERCONNECTOR

The building of a 500 MW interconnector from Woodland in Ireland to Deeside in Wales (the East West Interconnector) is progressing as planned and it is expected to be operational in Q3 2012.

To put in place the business processes involved with cross-border trading, Unicorn Systems, is working with EirGrid and Moyle on the development of an Auction Management Platform (AMP) which will allow market participants to trade across both the East-West and Moyle interconnectors. The AMP will be a single platform for the island of Ireland and ensures that a single service provider (i.e. Unicorn) is providing the trading platforms for all interconnectors in the France-U.K.-Ireland regional area.

EirGrid held a Customer Workshop on the Access Rules that will apply to the East West Interconnector on 11 October 2010. The purpose of the workshop was to inform the industry of developments with the new interconnector and get stakeholder feedback. Another workshop is planned for November 2011 to

East-West Interconnector

17. The Wind Security Assessment Tool (WSAT) aids National Control Centre (NCC) staff in assessing the stability of the power system, particularly with high levels of wind generation. WSAT provides a real-time transient stability and voltage stability assessment of the current state of the power system.
18. Performance Monitoring ensures Grid Code compliance by carrying out daily Performance Monitoring of generation units connected to the power system. This process was introduced in 2010.

update the industry on developments. The formal consultation of the East West Interconnector Access Rules commenced on 18 February and closed on 18 March 2011. EirGrid received a number of responses on its draft Access Rules and has taken these fully into account in amending its rules where appropriate. As a requirement of the Congestion Management Guidelines[19], a significant amount of work has also been done to coordinate and harmonise the access rules across the France-U.K.-Ireland region. The Regulatory Authorities approved the East West Interconnector Access Rules on 7 October 2011. The rules were also approved by Ofgem on 3 October 2011.

Building work on the East West Interconnector is progressing well. Most of the underground cables onshore are now laid, and work has now commenced to lay cables under the sea bed of the Irish Sea. The cable laying work is expected to take approximately eight months to complete. The interconnector is currently on schedule to be completed and operational in late 2012.

Once the East West Interconnector is operational, Ireland and Northern Ireland (the Moyle Interconnector) will have a joint interconnector capacity of 1000 MW. This has the potential to provide additional capacity to the transmission system and it will facilitate the further penetration of renewables on the island.

2.6 ENGAGEMENT WITH STAKEHOLDERS

EirGrid and SONI are committed to engaging with all our customers and stakeholders through regular and open communications. In the last year, we hosted and sponsored a range of workshops, seminars, and conferences designed to fulfil this commitment.

The 2010 EirGrid Group Customer Conference, entitled 'Working together for a sustainable future' was held in Dundalk in November 2010[20]. The conference was attended by approximately 200 delegates from the electricity sector including large users of electricity, generators, power suppliers, and wind developers, and offered a useful and open forum to discuss a range of issues in the energy space. The keynote address was given by Daniel Dobbeni, CEO of Elia and President of ENTSO-E.

As part of our regular communication updates to industry players, EirGrid and SONI hosted a workshop in January 2011 to present our recent offshore research findings and the details of the programme for continuing the Facilitation of Renewables (FoR) Studies. In August 2011, EirGrid and SONI hosted a forum in Dundalk to launch the DS3 programme – the follow-on from the FoR Studies. Over 80 customers attended this forum. This is the first in a series of fora which will be held with the industry during the course of this programme.

In June 2011, EirGrid hosted a committee level meeting of ENTSO-E that focused entirely on renewable priorities. The event was attended by around 60 people from TSOs across Europe to discuss what the main priorities in the area of renewable generation integration should be for ENTSO-E over the coming years. Several risks to renewable integration were highlighted at the meeting including the need to ensure public acceptance, and the need for a pan-European regulatory framework to be developed.

In September 2011, EirGrid and SONI hosted a European Electricity Forum in Dundalk. The Forum was an initiative to engage with the industry, and present work being done by EirGrid, SONI and SEMO at a European level. This workshop highlighted developments by the System and Market Operators and included energy policy contributions by the Northern Ireland and Ireland Government departments.

Over the past twelve months, EirGrid sponsored a series of seminars on a broad range of energy topics in association with the Institute for International and European Affairs (IIEA). There have been three such events, which have involved speakers from the European Commission, ENTSO-E and the U.K. Department of Energy and Climate Change, the Sustainable Energy Authority of Ireland (SEAI) and covered a range of topics including: the North Seas Countries Offshore Grid Initiative; the Transition to a Low-Carbon Energy Future; and Smart Grids.

19. The Congestion Management Guidelines form part of the E.U. Third Energy Package. See Regulation No. 714/2009
20. The 2011 EirGrid Group Customer Conference was held in October 2011 as this report was going to print. For more information please see the EirGrid website: http://www.EirGrid.com

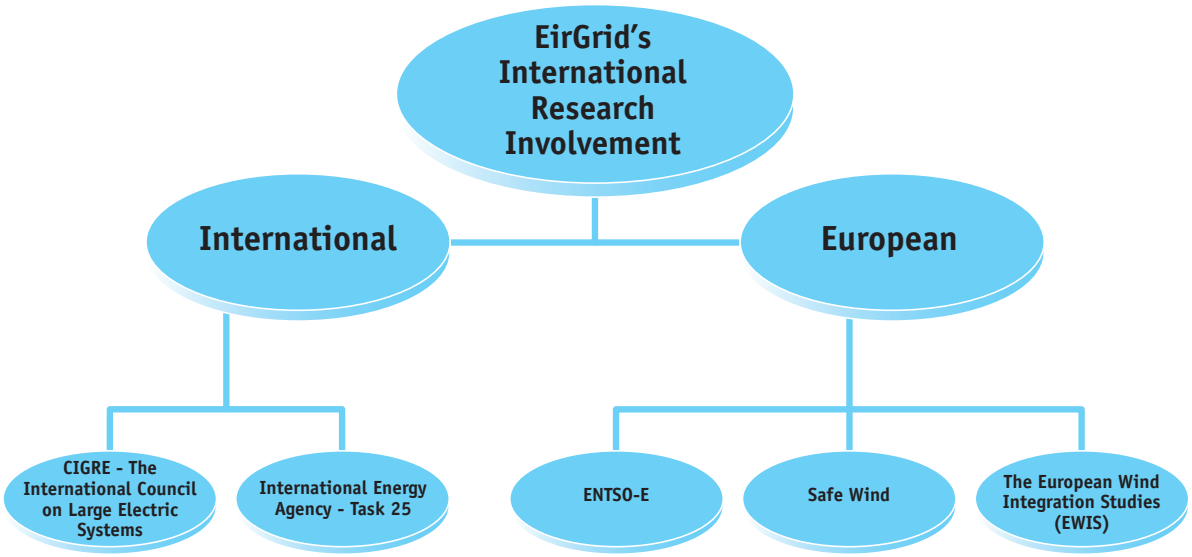
At the end of October this year, EirGrid and SONI held the first Advisory Council meeting of the DS3 programme. This Advisory Council was established to provide a forum to discuss views and concerns on those issues which impact on the successful implementation of the programme. The Council is comprised of experts from academia, industry and research centres across the Island.

EirGrid hosts a meeting of ENTSO-E in Dublin in June 2011

2.7 REGIONAL AND INTERNATIONAL INVOLVEMENT

EirGrid has been active in a range of international research projects and regional organisations during the last few years. The main research projects EirGrid are or have been involved with include Anemos Plus, SafeWind, the International Energy Agency Task 25 on wind energy, the European Wind Integration Studies (EWIS) and CIGRE (the International Council on Large Electric Systems). These projects offer a platform to engage with international stakeholders and share international best practice in the renewable energy space.

As active members of ENTSO-E, EirGrid and SONI are involved in a number of important European Working Groups (WG) and Committees that cover areas of strategic importance to the power system in Ireland, Northern Ireland and Europe. For example, the North-West Europe (NWE) regional group in ENTSO-E is acting as a pilot project to develop a single solution for day-ahead and intraday markets across the NWE region based on the European Target Model. Two NWE Monitoring Groups for day-ahead and intraday have been established to ensure the solution for harmonising cross-border trading arrangements in NWE can be applied to other regions once they are ready. EirGrid is active in both of these groups providing a unique insight into the proposed developments on day-ahead and intraday trading in the European Target Model that will ultimately have a direct impact on the integration of renewable generation and the shape of the future internal electricity market in Europe.



IRELAND & NORTHERN IRELAND ENTER

EirGrid & SONI's on-going work to deliver the network infrastructural requirements and develop the appropriate power system operational tools has put **Ireland & Northern Ireland on course to achieving the renewable electricity targets by 2020.**

2009

Month	Day	Duration Above 40% (hrs)	Max* Renewables % Achieved on the Day
Jan	••• No Occurrences •••		
Feb			
Mar			
Apr			
May			
Jun			
Jul			
Aug	23	2:00	41.6%
	26	4:30	45.7%
Sep	8	5:45	44.5%
Oct	3	3:15	41.3%
	25	7:15	43.3%
	30	4:30	44.7%
Nov	2	0:30	41.2%
	3	3:00	44.8%
	5	2:30	43.6%
	19	4:45	43.8%
	21	6:15	50.0%
	22	9:45	52.9%
	24	3:30	45.2%
	25	6:00	48.8%
Dec	6	1:45	43.0%
	29	0:45	40.3%

2009 Total: 66 hours

2010

Month	Day	Duration Above 40% (hrs)	Max* Renewables % Achieved on the Day
Jan	••• No Occurrences •••		
Feb			
Mar	18	1:15	40.7%
Apr	22	1:30	42.8%
May	••• No Occurrences •••		
Jun	••• No Occurrences •••		
Jul	1	5:30	46.0%
	4	7:00	48.8%
Aug	••• No Occurrences •••		
Sep	13	1:15	40.6%
	14	3:15	42.7%
Oct	••• No Occurrences •••		
Nov	2	3:45	42.4%
	9	1:30	44.5%
	10	0:15	40.7%
	11	3:45	44.5%
	12	4:15	46.1%
	18	1:45	43.1%
Dec	26	5:45	46.0%

2010 Total: 55 hours

YEAR ON YEAR INCREASE IN RENEWABLES PENETRATION

The tables above list all the days since 2009 when instantaneous penetration of renewables reached 40% or more on the ROI system.

Duration: Shows the number of hours where renewables reached 40% or higher of total electricity demand during the day in question (Hours not necessarily consecutive).

Max renewables %: Shows the highest instantaneous renewable penetration % achieved on the day in question.

*Max penetration of renewables (wind and hydro) on ROI system at any time on the relevant day.
Duration periods are indicative and approximated to the nearest 15 minute period.

A NEW ERA OF RENEWABLE ELECTRICITY

As a percentage of overall system demand, **Ireland & Northern Ireland have already achieved world-leading** levels of wind penetration on the electricity system and are managing **up to and beyond 40%** of instantaneous wind generation with increasing regularity.

2011

Month	Day	Duration Above 40% (hrs)	Max* Renewables % Achieved on the Day
Jan	14	0:30	40.2%
	15	9:15	48.1%
	16	6:30	49.8%
Feb	2	6:15	48.3%
	4	0:15	40.1%
	7	0:15	41.0%
	12	0:30	40.2%
	15	3:15	46.2%
	20	7:15	48.9%
	24	5:30	47.3%
	25	6:30	49.9%
Mar	9	0:30	40.1%
	10	5:45	45.1%
	31	3:15	43.7%
Apr	1	6:15	49.9%
	4	6:00	48.2%
	5	5:45	48.4%
	6	2:15	42.7%
	13	5:45	45.9%
May	8	16:45	48.4%
	9	5:45	48.5%
	10	6:00	51.6%
	16	0:15	40.1%
	21	0:15	41.4%
	22	4:00	44.2%
	23	2:30	47.5%
	25	2:00	45.6%
	26	4:30	48.8%
	28	1:30	41.6%
	29	3:45	45.5%
Jun	1	1:45	42.1%
	12	0:45	40.6%
Jul	16	0:30	43.4%
	17	14:30	46.4%
	18	0:45	41.7%
	19	0:45	41.5%
Aug	10	1:15	41.8%
Sept	5	2:00	48.9%
	6	8:00	52.2%
	7	5:30	45.5%
	9	0:45	46.3%
	10	18:00	50.7%
	11	17:30	51.9%
	12	7:45	52.1%
	13	4:00	45.0%
	18	1:45	46.1%
	21	0:15	40.4%
	25	2:45	45.4%
	27	3:30	46.4%
	28	7:00	44.8%
	29	2:00	46.4%
	30	1:45	41.7%
Oct	4	0:15	42.9%
	5	7:45	50.9%
	6	5:30	46.5%
	7	4:00	43.8%
	9	9:00	47.7%
	10	3:00	48.5%
	11	2:15	43.0%
	16	1:00	45.9%
	17	2:30	47.4%
	18	4:15	46.8%
	21	8:45	48.9%
	22	7:45	52.0%
	23	4:15	50.6%
	24	1:15	46.2%

2011 Total: 293 hours
2011 to date

3 RESEARCH AND TECHNOLOGICAL DEVELOPMENTS

3. Research and Technological Developments

The decarbonisation of the electricity power system is firmly underway in Ireland and Northern Ireland. Driven and shaped by ambitious renewable electricity targets, legislation promoting the integration of renewable generation and a range of financial support measures, the renewable technological research sector has expanded in recent years. The level of Government involvement in the sector has engendered a vibrant renewable research, demonstration and business sector to emerge across the island. This section details a selection of some main research endeavours and emerging technologies throughout the island.

3.1 SUSTAINABLE ELECTRICAL ENERGY SYSTEMS

The Sustainable Electrical Energy Systems (SEES) Cluster (a cooperative venture between academic institutions and companies across the island) is tackling fundamental applied research and demonstration challenges to underpin the emergence of future integrated, smart and sustainable electrical energy systems. The challenges addressed include the integration and optimisation of very high, variable renewable penetrations (40% energy and above), the development of an active, smarter electricity network enabled by the deployment of information and communication technologies, facilitation of customer and utility demand management, and electrification of segments of the heat and transport markets. The research programme addresses key issues that underpin the successful transformation of the sustainable electrical energy system:

- Flexibility to complement renewables while maintaining reliability
- Optimisation and control of dispersed generation and demand-side resources
- New loads and storage, and their characteristics
- Stochastic processes and optimisation
- Electricity market and policy issues
- ICT to enable the smart, flexible power system

The Cluster brings together participants in the Irish electricity industry (including EirGrid, ESB, Bord Gáis, Bord na Móna, Commission for Energy Regulation, Cylon, Gaelectric, SSE Renewables, Viridian and Wavebob) and key international partners (including ABB, Alstom, EPRI, GE Energy, Glen Dimplex, NREL, NTR, UTRC, UWIG) and Information and Communication Technology companies (including Eircom, Ericsson, IBM, Intel and Skyware Global) around a group of leading researchers in the areas

of electrical engineering, mechanical engineering, electronic engineering, geology, energy economics, applied mathematics and dynamics & control. Demonstration activity, involving all academic partners and the 25 industry partners forms the keystone of the project, involving all aspects of power system operation, planning and markets, with the Irish power system itself being the testbed platform.

The academic institutions which form the core of the Cluster are University College Dublin (UCD), Economic and Social Research Institute (ESRI), Trinity College Dublin (TCD), University of Limerick (UL) and National University of Ireland Maynooth (NUIM). The Cluster is led by Prof. Mark O'Malley, who is also the director of the Electricity Research Centre (ERC).

3.2 OCEAN ENERGY DEVELOPMENT UNIT

In 2009, an Ocean Energy Development Unit was established in the Sustainable Energy Authority of Ireland (SEAI) to coordinate Ireland's potential in the development of ocean energy technologies. It is widely recognised that Ireland possesses some of the best offshore wind and wave resources in Europe, and that provided the technologies are developed to capture the energy in these resources, and the transmission capacity and trading mechanisms are put in place to bring electricity to market at a competitive price, then Ireland is facing an opportunity with real potential to contribute to economic recovery.

Across Europe, and globally, the pace of activity in all of the sectors comprising the marine renewable 'jigsaw' is accelerating:

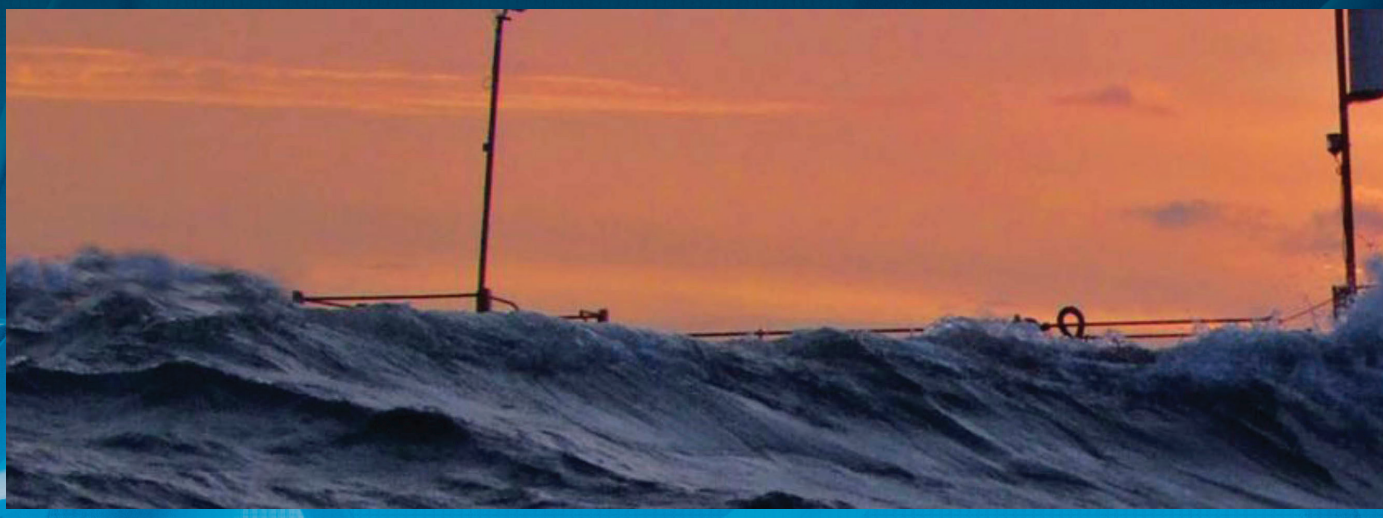
- Conventional offshore wind developments are being rolled out in a number of European sea areas, with novel electricity collection and transmission systems.
- Research, development and demonstration of floating offshore wind technologies, which open up the prospect of harnessing stronger and less constrained wind resources in deeper water, is accelerating.
- Prototype technologies to capture near and offshore wave energy and tidal flow are being deployed at a growing number of test and demonstration facilities in Europe and effective consortia of industrial technology and utility enterprises are emerging.
- Initiatives to scope and design the novel offshore grid infrastructure required are gathering momentum, notably the North Seas Countries Offshore Grid Initiative, the Isles project and the Friends of the SuperGrid.

With all this work ongoing, the critical issue for Ireland is to determine the correct national investment strategy that will help release this potential and contribute to the economy.
A programme, initiated by SEAI's Ocean Energy Development Unit in 2009, has already delivered some significant progress:

- Ireland is recognised as one of the 'early movers' in developing the technology required to capitalise on its resource, with Irish companies like Wavebob, Ocean Energy and Open Hydro.
- Key elements of the marine renewable energy supply chain, including utility project developers, engineering consultants, academic research institutions and a wide range of companies are mobilising and effective industry and regional organisations are developing.
- Ireland is developing world-class research and test facilities such as the 1/4 scale Wave Energy Test Site and SmartBay Ireland – the national facility for marine ICT- in Galway Bay, the Atlantic Marine Energy Test Site (AMETS) off Belmullet, Co Mayo, and the upgraded wave tank facilities of the Hydraulic and Maritime Research Centre (HMRC) that will be housed in Cork's Maritime and Energy Research Campus and Commercial Cluster (MERC) initiative, which is being funded through the Programme for Research in Third-Level Institutions (PRTLI).
- The development process for the national wave test site project (AMETS) has, from an early stage, involved collaborations with significant industry players. This is to share the risks, the costs and the learning process in what is a 'frontier' activity.
- The Department of Environment, Communities and Local Government (DECLG) has taken responsibility for foreshore consenting and is progressing plans to provide a modern consenting system. And an Offshore Renewable Energy Development Plan (OREDP), and accompanying Strategic Environmental Assessment (SEA) of the off-shore marine renewable energy resource - wave, wind and tidal - is currently being finalised.
- EirGrid are developing world-class capabilities in the design and modelling of offshore grid infrastructure.

While good progress has been made in the early stages of the National Ocean Energy Strategy, according to SEAI measures that may help to realise the marine renewable energy opportunity include:

- Expansion of the scope of the initial Ocean Energy Strategy to include all marine energy resources and to fully embrace the associated enterprise opportunities.
- Establishment of the national co-ordination mechanisms proposed, in order to implement the wider Offshore Renewable Energy Development Plan (OREDP):
- The implementation of enabling legislation and the announcement of a marine leasing round.
- Enhanced planning around grid issues - reinforcement, offshore grid, interconnection, and mechanisms for the export of electricity.



SEAI's studies postulate a cumulative economic benefit up to €12 billion by 2030 and up to €120 billion by 2050 from electricity generated, emissions reductions, security of supply, regional development and knowledge created in the marine renewable sector, with potential employment of several tens of thousands[21]. This prospect provides a strong incentive to add further momentum to this work, even in these difficult times.

3.3 DEMAND-SIDE MANAGEMENT

With increasing amounts of variable renewable generation expected on the power system over the coming decade, operating the electricity system will become more complex. One way of helping to manage this complexity is to create more flexibility on the demand side which can assist with system balancing, and the provision of system support services such as ramping and reserve. By increasing flexibility in electricity consumption through the introduction of more demand-side measures, it will provide the system operators with more options for managing the variability of renewable energy sources.

Over the past number of years, demand side participation experience has been developed by customers through demand side schemes run by the Transmission System Operator (TSO) such as the Winter Peak Demand Reduction Scheme (WPDRS). Many parties are now interested in developing Demand Side Units within SEM. Over the coming years, it is expected that this will be a growth area within SEM. Activation Energy Ltd is a good example of progress in this area[22]. Activation Energy Ltd is developing a service to facilitate energy users who have flexible loads to provide "Demand Response" to SEM. Activation Energy Ltd aims to register a Demand Side Unit in SEM in late 2011. In Northern Ireland, iPower is a company who own and operate an Aggregated Generation Unit (AGU). This AGU is an accumulation of over 60 member generators connected to the Distribution system. Each member generator has the ability to reduce the load at each site and also export power up to an agreed Maximum Export Capacity (MEC). In the SEM the AGU is treated similar to other generators who bid into the market. Demand Side Units will result in users who have the ability to reduce their demand when requested by responding to dispatch signals from the Control Centres. Dispatch instructions are likely to come at times when there is a tight capacity margin or when dispatching a Demand Side Unit on the system can offer a viable alternative to the dispatch of conventional thermal plant.

21. See Economic Study for Ocean Energy Development in Ireland (a report to SEAI, June 2010). Available on the Internet at: http://www.seai.ie/Renewables/Ocean_Energy/Ocean_Energy_Information_Research/Ocean_Energy_Publications/SQW_Economics_Study.pdf
22. Activation Energy Ltd are in the process of applying to SEMO for registration in the market.

3.4 NORTHERN IRELAND RENEWABLE INDUSTRY GROUP

The Northern Ireland Renewable Industry Group (NIRIG) was formally launched at an inaugural conference held in Belfast in January 2011. NIRIG is a joint collaboration between the Irish Wind Energy Association (IWEA) and Renewable U.K., the largest renewable representation bodies in Ireland and the U.K. respectively. NIRIG represents the views of the large scale renewable energy industry in Northern Ireland, providing a conduit for knowledge exchange, policy development support and consensus on best practice between all stakeholders in renewable energy.

According to Gary Connolly, chairman of NIRIG, it "is both an exciting and challenging time to be involved in renewables in Northern Ireland." The adoption of a 40% renewable electricity target by the Northern Ireland Assembly has provided an increased level of certainty for the renewable industry in Northern Ireland and Government departments and industry players are now working closely together to achieve this target. In addition, the forthcoming offshore leasing round by the Crown Estate provides real opportunities for the first time in offshore wind and marine generation off the coast of Northern Ireland. Seagen at Strangford has already demonstrated the viability of marine generation in particular and has been pivotal in kick starting a vibrant and growing supply chain sector in Northern Ireland.

Despite the many positive developments in the renewable space, there are also many challenges that lie ahead. One of the most important of these is the construction of new grid infrastructure. For Gary Connolly, the role of political and community leaders will be important in this process, "Infrastructure development is contentious and it is important that the general public is involved in the process so that the importance and benefits of such development is clearly understood and any concerns can be addressed."

A second major challenge to renewable development in Northern Ireland and across the world, is the impact of the ongoing financial turmoil. The deployment of renewable generation is capital intensive and the members of NIRIG are finding that financial institutions are seeking ever-increasing assurances that their investment is secure and profitable.

There are many factors that impact investor confidence in the renewable sector. These can include the rules for dispatch of renewable generation, the timescales for connection and the current market structure and the support mechanisms on offer. According to NIRIG, while the Northern Ireland Renewable Obligation has proven to be an effective policy, reform of the electricity market in Great Britain would indicate that reform in Northern Ireland is also likely. However, careful analysis will be required to ensure that any new market support mechanism will facilitate the delivery of the targets by 2020 in the context of the Single Electricity Market and wider European market integration.

3.5 OFF-SHORE NETWORK RESEARCH

In May 2011, EirGrid published a pioneering study entitled "Offshore Grid Study - Analysis of the Appropriate Architecture of an Irish Offshore Network"*. This study is an example of our commitment to inform policy debates on strategic energy issues and it offers policymakers a robust technical foundation from which to make future decisions. There were a number of important findings from this study that are worth noting:

- A well designed offshore grid to cater for offshore generation could minimise the need for combined onshore and offshore reinforcement and would facilitate the development of more interconnector capacity between Ireland and Great Britain, and potentially France.

- Integrated planning of the offshore network optimises the development needed to connect offshore generation and interconnection. This provides the opportunity to limit the overall length of network for interconnection between national networks. This is particularly relevant to the connections between Britain and Ireland (historically only between two onshore points). Future Celtic Sea generation would also offer optimisation opportunities with interconnection between Ireland and France.

- The overall cost of offshore generation connection would be minimised by the development of "Meshed' or interlinked networks.

- Offshore networks will make use of 'smart' devices to enhance flexibility and minimise the scale of the offshore network.

EirGrid is also a central participant in the North Seas Countries Offshore Grid Initiative and is working with other European countries to examine ways to develop a North Seas infrastructure that can deliver greater interconnection between the markets and facilitate the development of offshore wind in the region[23].

23. North Seas Countries Offshore Grid Initiative is a political agreement between nine European countries - Ireland, Germany, United Kingdom, France, Denmark, Sweden, the Netherlands, Belgium, Luxembourg and Norway.

* http://www.eirgrid.com/media/EirGrid%20Offshore%20Grid%20Study.pdf

4 INTERNATIONAL RENEWABLE ENERGY DEVELOPMENTS

4. International Renewable Energy Developments

A recent report from the Intergovernmental Panel on Climate Change (IPCC) on Renewable Energy Sources and Climate Change Mitigation has predicted that 77% of the world's energy could come from renewable sources by 2050. Governments around the world are setting renewable energy targets and are putting in place a range of financial and technical support mechanisms to make this happen. For many Governments this development is a means to reduce their energy dependence on fossil fuel imports, fulfil climate change obligations and reduce the price of energy for all end-users – simultaneously.

4.1 THE EUROPEAN UNION

In the last decade, energy policy in Europe has reached the top of the political agenda. At the heart of E.U. energy policy is an array of mechanisms and measures that aim to address the issues of energy security, climate change and economic competitiveness. The deployment of large-scale renewable generation is considered central to limiting E.U. energy imports in the future, which today currently stand at 50% of total energy. Without these concrete efforts it is predicted that this import dependency could increase to 70% in the coming decades[24]. This is a development that would impact on E.U. climate change obligations, cost competitiveness and security of supply – simultaneously.

Last year was a good year for the deployment of renewable generation (Wind, Concentrated Solar Power, Solar PV, Biomass, Hydro and Geothermal) in the E.U.; indeed, 22.6 GW of new renewable generation was installed throughout the year - more than ever before. The deployment of wind generation in the E.U. last year reached 9.3 GW of additional capacity. Although this was down 10% on the 2009 figure of 10.3 GW, it still represented a significant level of deployment. Total installed wind generation in the E.U. has now reached 84 GW, a 12.2% growth on the total in 2009, and wind contributed approximately 5.3% of overall E.U. electricity consumption last year. Ocean energy (Wave and Tidal) offers the potential for energy security and carbon emissions reduction but is unlikely to make a significant short-term contribution before 2020 due to its early stage of development. A significant amount of research, development and demonstration is taking place in Europe through a number of ocean energy research institutes, including the European Marine Energy Centre in Scotland.

Europe dominated the global market for the deployment of new Photovoltaic (PV) installations last year, at about 12 GW. The total PV capacity connected in Europe has now reached almost 28 GW. This increase in the level of installed PV generation stands in contrast to the market for wind deployment, which shrank last year. The main reason cited for this is that solar panels prices halved since 2007 creating a benign market for project finance and the attractive financial support schemes provided by governments. 2010 was the first year that Europe deployed more PV than wind.

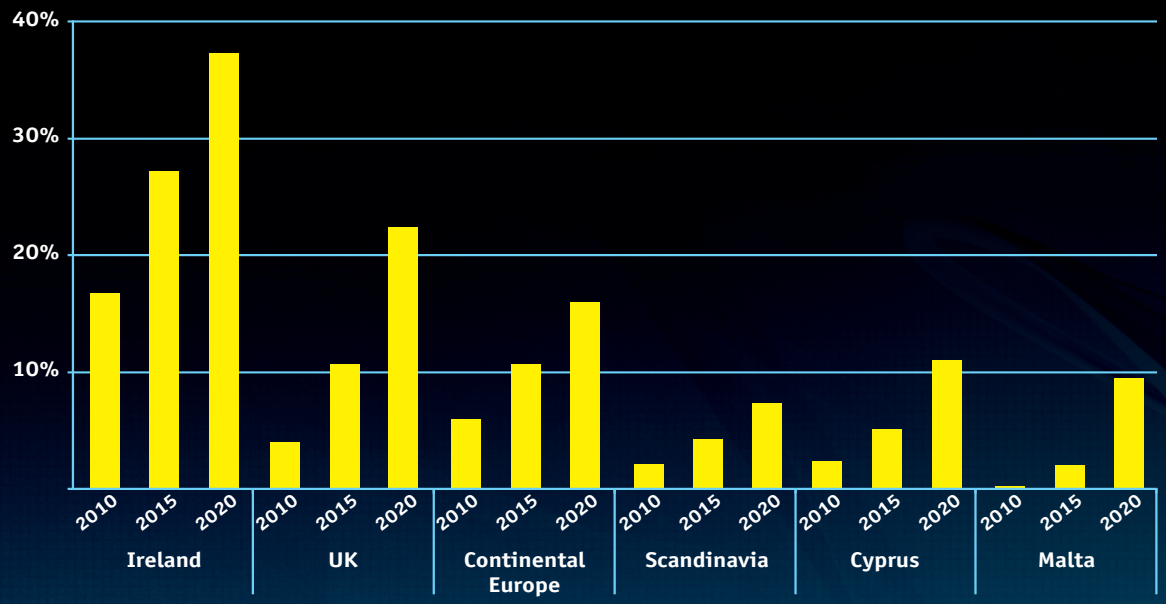
4.2 THE NATIONAL RENEWABLE ENERGY ACTION PLANS (NREAP)

The 2009 E.U. Renewable Energy Directive set out to address the renewable integration challenge through binding renewable energy targets for each member state. However, the Directive did more than this. Article 4 of the Renewable Energy Directive required that member states submit a National Renewable Energy Action Plan (NREAP) that details how each member state expects to reach its legally binding 2020 target for the share of renewable energy in its domestic gross final energy consumption. This plan, which was to be prepared in accordance with a template published by the E.U. Commission, required member states to set out the sectoral targets, the technology mix they expect to use, the trajectory to 2020 and the measures and reforms they will undertake to overcome the barriers to developing renewable generation. All 27 NREAPs were published in January 2011.

24. Umbach F. Global energy security and the implications for the E.U. Energy Policy. 2010; 38:1229-1240.

A summary of the NREAPs submitted to the E.U. Commission indicates that the E.U. will achieve its 20% aggregate renewable energy target by 2020. According to the information provided, 15 member states say they will exceed their targets, ten consider they will meet their targets, and only two expect not to meet their target domestically. Consequently, aggregating the NREAPs, the E.U. is expected to exceed its 2020 20% target by 0.7%. The NREAP estimates that the final share of energy consumption from renewable generation in the electricity sector will be 31% in 2020. The fact that 60% of greenhouse gas emissions in the E.U. come from the energy sector, means that this shift will contribute significantly towards meeting the 20% E.U. greenhouse gas emission reduction target by 2020.

PENETRATION OF NON-SYNCHRONOUS RENEWABLES IN EACH EUROPEAN SYNCHRONOUS SYSTEM 2010 – 2020



Data collated from information submitted in the national Renewable Energy Action Plan by EU Member States to the EU Commission in June 2010.

4.3 UNITED STATES OF AMERICA

The renewable energy space in the U.S. has proven to be dynamic and rapidly evolving over the last few years. Renewable energy in the U.S. almost tripled between 2000 and 2008 and today accounts for around 11% of installed generation capacity. This translates into approximately 125 GW of renewable generation in the U.S. in 2010. The American Clean Energy and Security Act of 2009 (ACES), is the primary legal catalyst for this transition towards more renewable electricity. ACES requires electric utilities to supply an increasing percentage (6% in 2012; 9.5% in 2014; 13% in 2016; 16.5% in 2018; and 20% in 2020) of the total amount of electricity produced from renewable sources. The electricity sector is responsible for about one third of all U.S. greenhouse gas emissions and 40% of total carbon dioxide emissions, thus these renewable targets will help reduce America's total emissions.

In March 2011 President Obama set an ambitious goal that 80% of America's electricity will come from clean technologies such as "renewable... along with

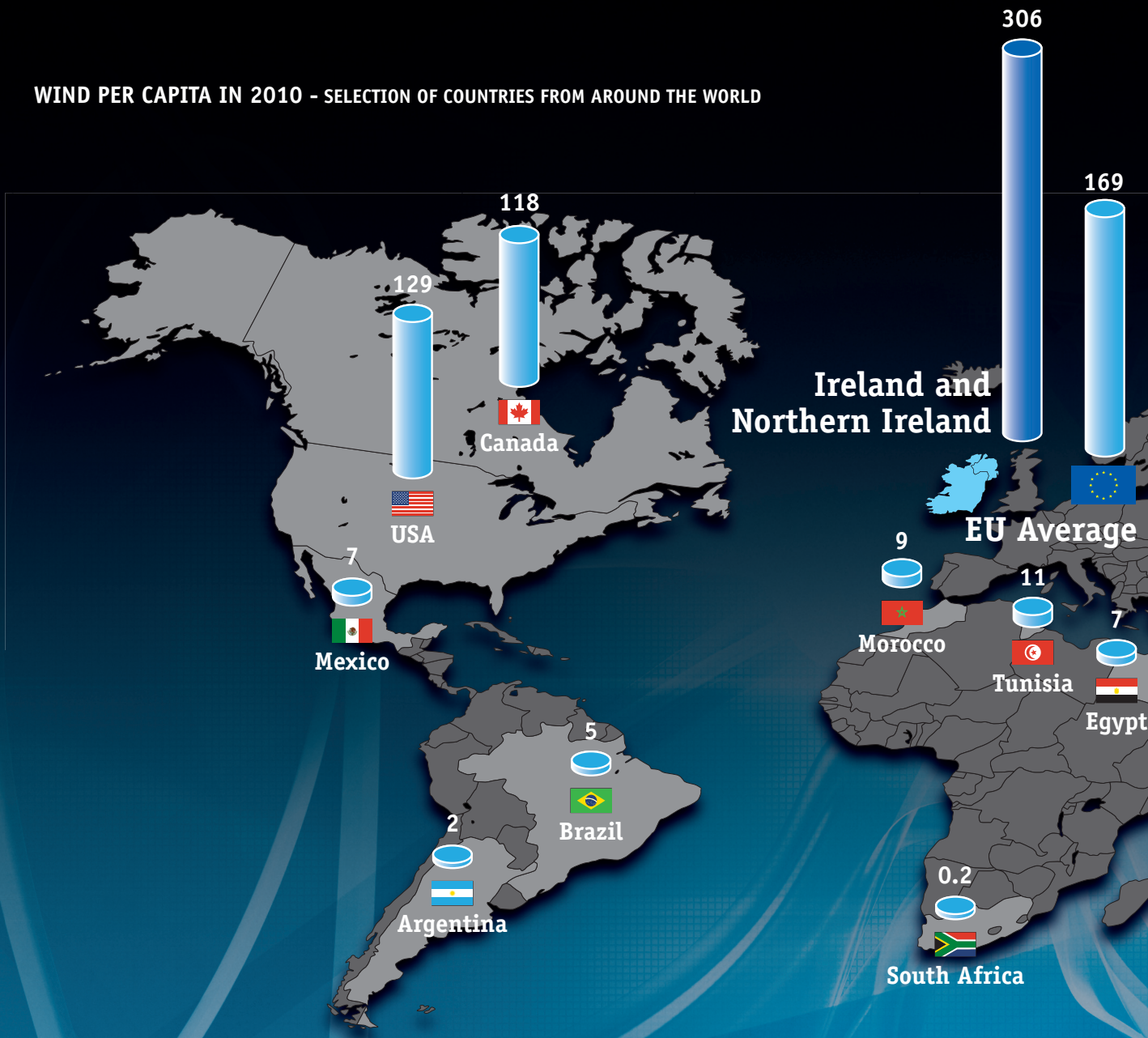


FIGURE 9: Wind per Million of the population in 2010 in a selection of countries from around the world

natural gas, clean coal and nuclear power." Although the President provided no specific percentage for renewable generation, it is likely to make up a significant proportion of this. Indeed, according to the U.S. Energy Information Agency 2011 Energy Outlook, renewable electricity generation, excluding hydropower, is expected to account for nearly one-quarter of the growth in electricity generation from 2009 to 2035.

Throughout last year the U.S. installed an additional 5.1 GW of wind generation, bringing the total level of installed wind to near 40 GW. This puts the U.S. second globally in terms of installed wind capacity, lagging slightly behind China at 42.3 GW. Solar PV grew fast during 2010 and the U.S. experienced an annual growth rate of almost 100% that led to an increase from 1.2 GW in 2009 to 2.4 GW of installed capacity at the end of 2010.

The U.S. Department of Energy funds research, development, and deployment projects to advance the use and adoption of clean, renewable energy technologies and continued this funding last year

for nascent generation technologies such as ocean energy. In fact, between 2005 and 2010, the U.S. has spent almost 5 billion dollars on renewable energy RD&D. This research funding has produced a number of useful technical studies on integrating renewable generation such as the 2009 North American Electric Reliability Corporation (NERC) report on Integrating Variable Generation. This NERC study provides America with a robust roadmap for grid planning and operations changes needed for America's future electric generation portfolio[25].

4.4 CHINA

In March this year, the Chinese Government launched a series of economic initiatives collectively called the 12th Five-Year Plan (2011-2015). This plan seeks to create more sustainable growth across China and proposes to substantially increase the amount of renewable energy generated in the country by 2015.

There are several aspects to the plan that cut across the Chinese economy as a whole. In the energy sector, there are several notable highlights: The State Grid Transmission Company is to be charged with the development of the Smart Grid and the growth of a massive market for smart grid equipment. The proportion of non-fossil fuels in primary energy consumption should reach 11.4% over the five years to 2015. Installed wind generation capacity, which at the end of 2010 stood at 44.7 GW[26], is scheduled to reach 130 GW by 2015. Offshore wind generation is expected to expand to 5GW in 2015 and 30GW by 2020. The National Energy Administration has estimated that installed solar power capacity will reach 10 GW in 2015. Biomass, nuclear energy and the development of electric vehicles are also expected to develop fast over the next five years. Overall, China hopes to derive 15% of its power generation from cleaner energy sources by 2020.

4.5 GLOBAL DEVELOPMENTS

In 2010, Europe, North America and China once again dominated the world market for renewable generation technologies. However, progress was made in Asia, Africa, and Latin America last year too.

Asia experienced good growth in renewable energy in 2010, largely led by China, but also due to robust growth rates in India. India's wind capacity increased by 10.7% last year and reached an installed capacity of 13,000 MW at the end of the year. In Africa, total installed wind capacity reached 906 MW in 2010 with most growth experienced in Egypt, Morocco and South Africa. Interestingly, South Africa introduced a feed-in tariff for renewable generation last year and is expected to install around 700 MW over the next two years. Total installed wind generation in Latin America reached 2000 MW in 2010. This represented a growth rate of 30.8%, a remarkable achievement against the backdrop of the global economic recession.

25. The NERC study is available on the Internet at: http://archive.awea.org/newsroom/releases/releases/NERC_study_16Apr09.html
26. World Wind Energy Report 2010 – available at www.wwindea.org

5. Concluding Remarks

The aim of this report was to provide an overview of the wide array of renewable activity in the electricity sector across the island of Ireland and place these developments in a broader regional and international context.

As the report shows, renewable energy is a significant and growing percentage of the overall generation portfolio mix on the island. At the end of September 2011, there is 1868 MW of renewable generation connected to the electricity network in Ireland and 394 MW connected in Northern Ireland.

Developing a robust electrical power system across the island that has the infrastructural capacity, technological capability and operational tools to facilitate the development of the island's renewable energy potential is fundamental to reaching the 40% renewable electricity targets – North and South. EirGrid and SONI are fully focused on ensuring that all aspects of delivering the 40% target - Grid25, the East-West Interconnector, Smart Grids, the Gate 3 process and DS3 - are in place to secure the island's future energy and sustainability needs.

While EirGrid and SONI will continue to work towards increasing the amount of renewable energy on the system, a wide array of renewable research and development activity is also taking place all over the island. This report reviewed a selection of this activity ranging from the Belmullet Wave Energy Test Site to the academic research in the Sustainable Electrical Energy Systems (SEES) Cluster.

EirGrid and SONI are fully cognisant that fulfilling the ambitious renewable electricity targets across the island will only be met with the full engagement and support of all stakeholders in the electricity sector and the wider public and we look forward to enhancing our cooperative work with all stakeholders in the energy sector in the coming years.

EirGrid and SONI would like to thank SEAI, the Electricity Research Centre in UCD, Activation Energy Ltd, and the Northern Ireland Renewable Industry Group who contributed material for this report.

Notes

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