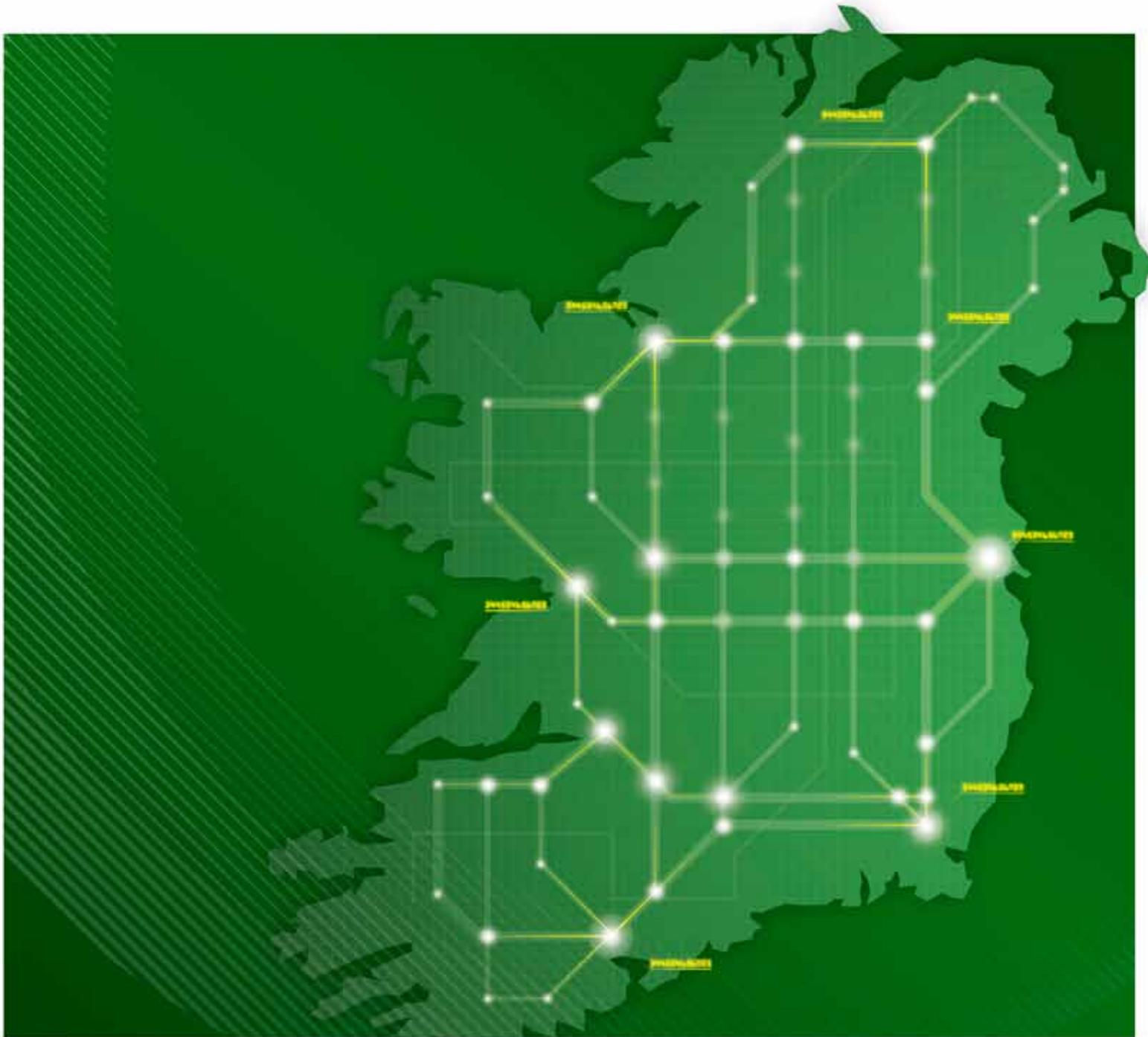


Ireland – Your Smart Grid Opportunity

Smart thinking, Smart infrastructure, Smart island





THE SMART GRID OPPORTUNITY

Sustainable. Efficient. Secure.

Three words that define the energy systems that will drive the development of economies and societies in the future. These systems will increasingly rely on electricity. Making them sustainable, efficient and secure will increasingly rely on Smart Grid.

Quite simply, the Smart Grid will fundamentally change how we generate, distribute and use electricity.

It will bring electricity systems into the 21st century and will have an impact far beyond that. Why? Because it will no longer be generated or distributed through a planned centralised system but through a system that is more responsive and more dynamic. And perhaps more importantly, Smart Grid will allow consumers to manage their consumption and cost while being less carbon intensive.

There is a consensus on the vision for Smart Grid; the path to productive development presents real opportunities. It will require a cohesive and committed alignment of policy makers, grid owners and operators; it will require the participation of research and ICT communities as well as the private sector.

And for those that lead the development, it will create exciting new research and enterprise opportunities.

Ireland has already begun to play a leading role in the development of the Smart Grid. Pivotal research is taking place, new skills are being developed; new technologies are being created; all of these things make Ireland the perfect test bed and places us far ahead in the Smart Grid journey.

And we'd like you to join us.

AN AMBITIOUS IRELAND NEEDS A SMART GRID

The Smart Grid will play a critical role in underpinning the energy needs of the revitalised Irish economy. It will lead to the creation of significant employment opportunities; it will amplify the capabilities of indigenous firms and multinational organisations; and it will generate new leading-edge products and services.

Ireland's high dependence on imported fossil fuels has significant consequences for the competitiveness of our economy. But we have excellent renewable resources primarily in wind and ocean energy for which the Irish Government has set ambitious energy targets:

RENEWABLE ELECTRICITY



40%

TRANSPORT ENERGY



10%

ENERGY EFFICIENCY



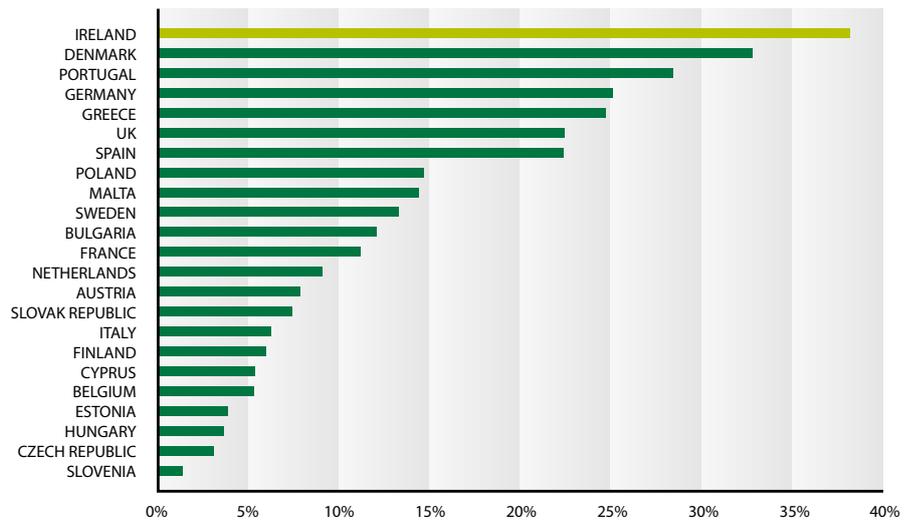
20%

- 40% of electricity to come from renewable sources by 2020 (the highest target in the EU for variable renewable electricity within a single electricity system)
- 10% of transport energy to be renewable and 10% of passenger vehicles to be electric by 2020
- 20% increase in energy efficiency by 2020
- Commitment to deploy Smart Meters on a national basis
- Funding of over €10 billion on grid and network development



A business-as-usual approach will not be sufficient to meet these goals: the Smart Grid system will. More integrated, with a more systems-based approach, the Smart Grid concept is simply the smart thinking that will allow Ireland to meet its ambitious energy targets by:

- Enabling greater use of renewable electricity
- Enabling consumers to control their energy consumption and costs
- Improving the performance and reliability of the electricity system
- Facilitating an efficient and sustainable electricity grid
- Promoting entrepreneurship and new business start-ups



Wind as a percentage of Total Electricity (2020 Target) – Select EU member states

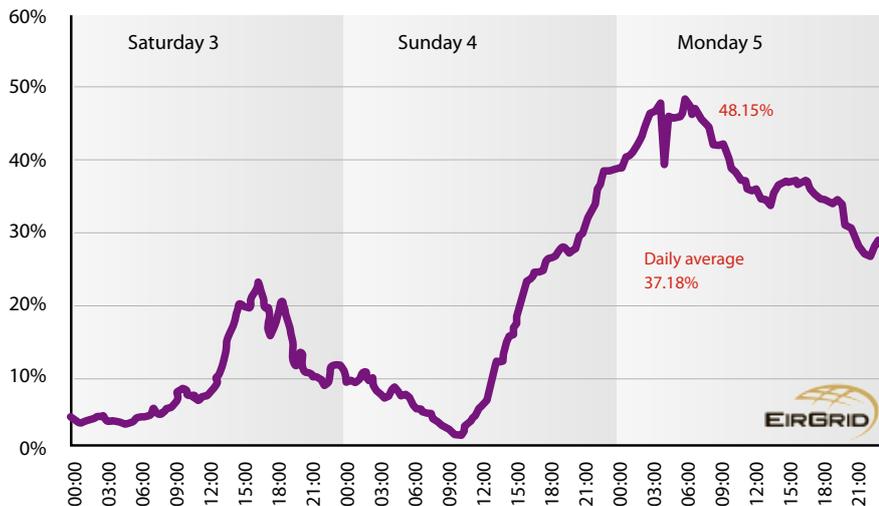
IRELAND DELIVERS SMART GRID INNOVATION

Ireland has unique characteristics; it is a natural test bed for the development and early deployment of the Smart Grid concept. In fact everything needed is in place, every advantage is ready to be exploited, and every one of the benefits below make Ireland the right place to start.

Small Advanced Electricity System

Ireland's electricity system is a relatively small isolated system with limited interconnection to other networks. The challenge of integrating up to 40% of substantially variable renewable electricity by 2020 is far in excess of that faced by any other system in the world.

To accomplish this, new operational strategies and market mechanisms will need to be developed and implemented along with the appropriate network investment. Achieving this will require the smartest of thinking and international talent.

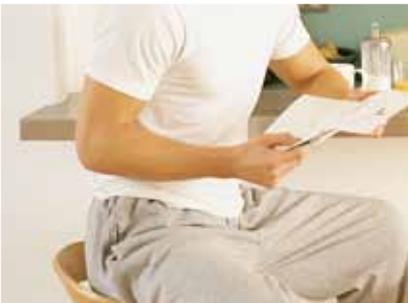


Wind Generation as a Percentage of System Demand
All Island Data (ROI and NI data) from Eirgrid and SONI

Single Electricity Market

Ireland has a single electricity market, one transmission system operator (EirGrid) and one distribution system operator (ESB Networks). The Commission for Energy Regulation (CER) in Ireland and the Northern Ireland Authority for Utility Regulation (NIAUR) employ an integrated approach to regulating the Single Electricity Market (SEM). EirGrid and ESB Networks also have direct licence obligations in Northern Ireland¹ for performing similar functions. Thus the Single Electricity Market has the same regulated industry participants in both Ireland and Northern Ireland. These factors significantly simplify the requirement for industry buy-in. They significantly increase the speed at which the rollout of new technologies can be achieved on the island and thus offer a shorter route to success.

¹ Subject to regulatory approval.



ICT Infrastructure

With a proven and enviable record of working with and attracting large-scale multinationals such as IBM, Cisco, Ericsson and Google, Ireland's globally acknowledged capabilities combine with a policy focus and industry structure to bring the depth of skill required to rapidly develop and deploy new Smart Grid innovations.

Research Infrastructure with a Focus on Industry Partnership

Crucially, Ireland already has a strong research infrastructure; one that recognises the importance of partnering with key industry players and one that is more than capable of advancing the deployment of successful research projects.

For example, the UCD Electricity Research Centre, which has some 13 partners including system operators, generation companies, ICT technology manufacturers and government agencies, is leading the way in sustainable energy and Smart Grid research. Other research centres active in Ireland include EPRI, ITOBO, and Clarity.

Innovative Irish Smart Grid Companies

Irish firms have world-leading expertise relevant to Smart Grid in software development, energy services and network technologies. A growing number of innovative Irish companies are already applying that expertise to Smart Grid applications, established companies such as Glen Dimplex and enterprising start-up ventures such as FMC Tech, Wirelite, Enersol, Episensor and Coolpower.

IRELAND. A SMART PLACE TO DO BUSINESS

Compared to other countries, Ireland has the strongest imperative to speedily and successfully develop a Smarter Grid to deliver an energy future that is sustainable, efficient and secure. As a multicultural, multilingual and visibly energetic society Ireland is more than well placed to meet the challenge.

Ireland has a capacity for transformation at its very core. Having rapidly transitioned from an agricultural economy to a manufacturing economy and on to a smart economy, it did so based on twin pillars: innovation and entrepreneurship. Both these pillars continue to attract investment and to create a productive economy. As a result, our success is measured by Ireland's continuing ability to attract cutting-edge Foreign Direct Investment.

Lower Tax – Higher Return

Almost 1,000 overseas companies – including many of the highest performing world brands – have placed Ireland at the hub of their European networks. A tax rate of 12.5% applies to all corporate trading profits, and a 25% tax credit for Research Development and Innovation expenditure; this is in addition to the normal tax deduction for the expenditure.

This combination of winning factors ensures Ireland is extremely well placed as a centre for IP creation and exploitation.

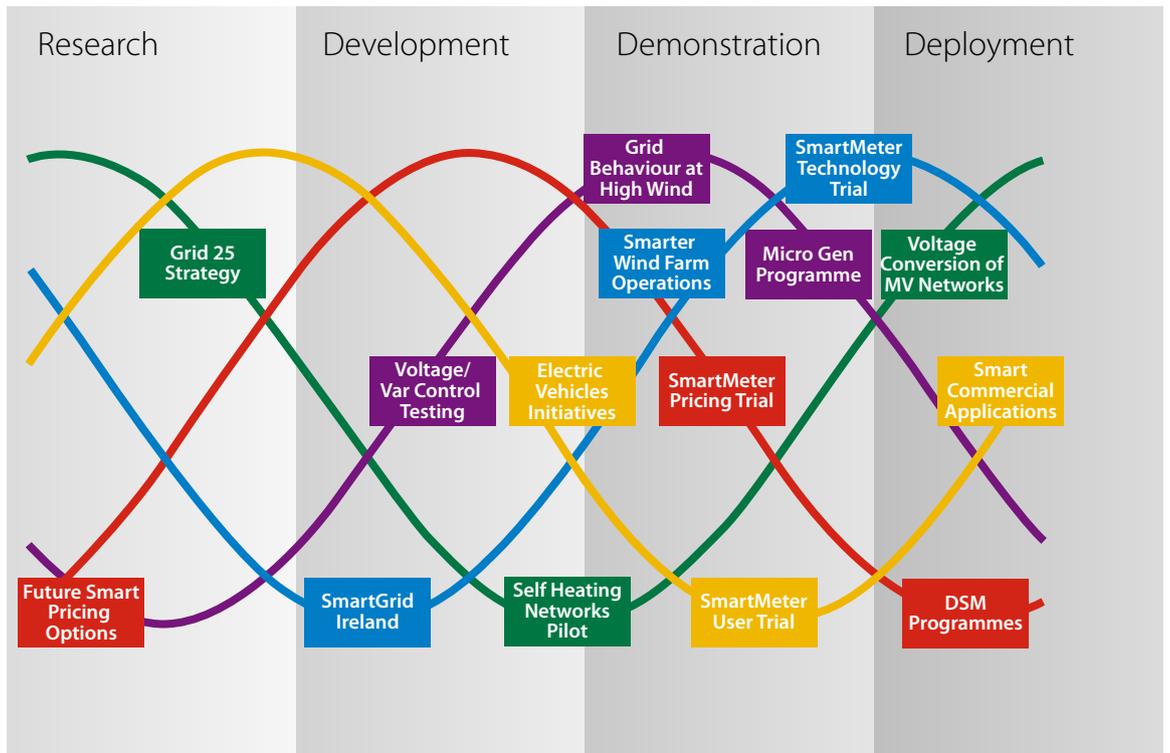
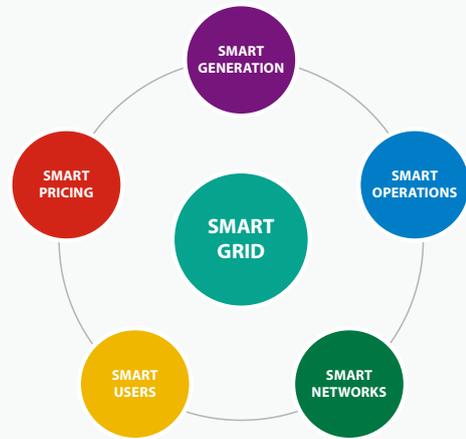
Irish people come with a remarkably high standard of education. According to the IMD World Competitiveness Report, we have one of the best educational systems in the world. Over 40% of people aged between 25 and 36 have benefited from 3rd level education. 60% of Irish graduates have degrees in engineering, science or business, and a significant number are proficient in more than one language. In short, Ireland doesn't just have human resources; we have exceptional human resources.

Ireland: Encouraging Business – Promoting Growth

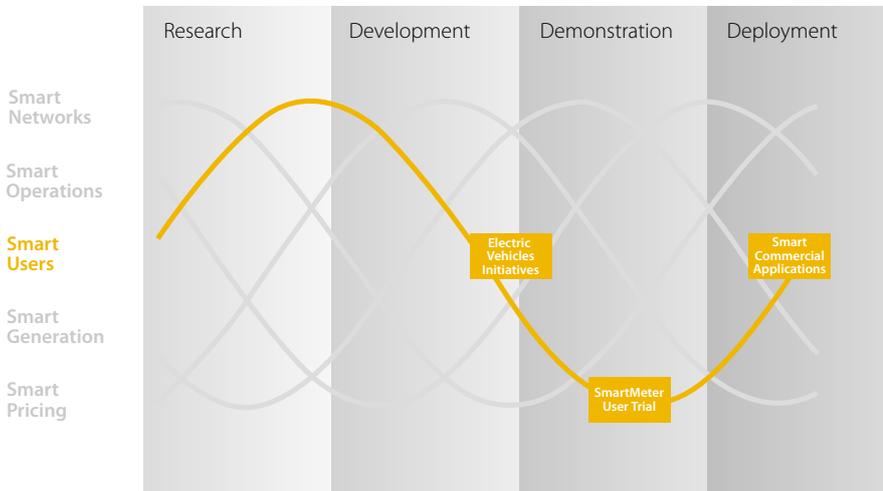
Irish Government policy is determinedly and positively pro-business. We welcome smart new business into a smart new economy. Ireland's Smart Economy is founded on an exemplary research, innovation and commercialisation ecosystem. It is already making Ireland the leading innovation and commercialisation hub in Europe. The Smart Economy is also a 'Green Economy', where addressing environmental challenges and creating high-tech employment opportunities go hand in hand.

SMART GRID ACTIVITIES IN IRELAND

Right now Ireland is vigorously pursuing Smart Grid development. Consumers are being given new impetus; businesses are being given energy-management solutions, and R & D is advancing at an accelerated pace. The following pages highlight some of the significant projects completed or underway. All of these developments confirm not just the potential of Smart Grid, but the on-the-ground reality of an idea whose time has come.



SMART USERS



Smart Grid is exciting. It will provide a platform for real consumer participation. In fact consumer participation will not only become a possibility with the Smart Grid but also a necessity to maximise the benefits. This will fundamentally and positively change how consumers think about and use electricity.

We all know that behavioural change can be slow. SEAI has completed a comprehensive Demand Side Management (DSM) study showing that strong effective stimulation programmes will be needed to mobilise consumers to smarten up their energy behaviour. This research underpins the significant work that is currently underway to facilitate smart energy users.

Smart Meter User Trial

The CER in association with ESB Networks, SEAI and Bord Gais Energy are conducting a national trial of Smart Meters. From early 2009 6,500 electricity users (both residential and commercial) began using Smart Meters. In 2010 a number of stimuli were introduced to the participants, including various time of use prices, and new smart bills containing detailed consumption and cost information. A sample group will also be receiving In Home Displays (IHDs) and a small proportion of all participants will have 'Smart Web' access.

This is one of the largest and most comprehensive trials of its kind in the world to date. The trial is also reviewing Smart Meter prepayment options with the objective of agreeing a smart metering prepayment market model.



National Smart Meter Plan



Electric Vehicle Initiatives

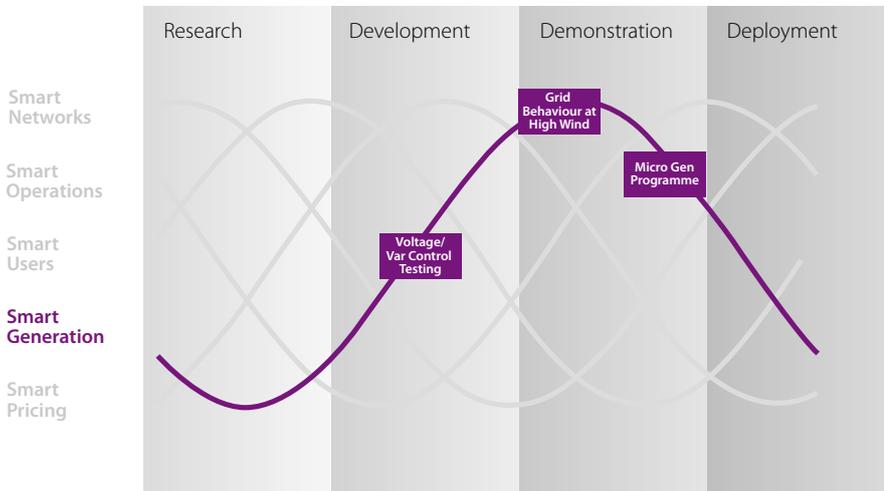
Electric Vehicles (EVs) will play a key role in Ireland's smart behaviour framework. A grant scheme has been launched to accelerate EV deployment. From 2011, car buyers can get a grant of up to €5,000 for the purchase of an EV. New EVs will also be exempt from vehicle registration tax for the first three years. The scheme aims to get 6,000 EVs on the road by 2012. ESB Networks in conjunction with EPRI and UCD are carrying out a detailed study on the level of electricity charging that can be accommodated on existing low voltage networks. 1,500 publicly accessible charging stations and 2,000 domestic charging points will be installed in Ireland by the end of 2011. ESB Networks are trialling smart home charging system for EVs in advance of this.

Smart Commercial Applications

Many Irish companies are developing applications to enable smart behaviour. Wirelite provide an intelligent wireless energy management solution for HVAC, refrigeration, and heating in retail groups and food processing businesses and are incorporating price responsive demand shifting capabilities in their product. Episensor specialise in wireless communication capabilities for end consumers and utilities. Cylon has been providing smart building control systems since 1985 and is becoming one of the largest independent manufacturers of building controls in Europe. Glen Dimplex is developing many of their domestic heating products to interact with smart control systems.

Other Smart User projects include SEAI's Sustainable Energy Zone project in Dundalk which is demonstrating a range of customer-behaviour technologies along with a comprehensive programme of efficiency upgrades and renewable technology demonstrations. Another focus of ESB Networks, Glen Dimplex and others is in the electrification of heat where loads with significant thermal inertia, such as space and storage heating, could be used as part of a DSM system dynamically matching load to wind.

SMART GENERATION



Smart Grid is geared to maximise the generation of sustainable low carbon electricity. It will also enable consumers to generate their own low carbon electricity using micro generation technologies and be paid to export it back to the grid.

The level of variable renewable generation required to meet Ireland's 2020 targets presents a unique challenge not yet faced by any other country in the world. Thus Ireland will have to face and solve many technical issues first. But a great deal of smart thinking in generation activity is already taking place.

In 2008, DCENR and SEAI, with Northern Ireland counterparts and transmission system operators and regulators of the Republic and Northern Ireland, completed the detailed All-Island Grid Study to assess the ability of the Irish electricity system to absorb large amounts of renewable energy. Other research projects have followed on from this.

Grid Behaviour at High Wind Penetration

Eirgrid has completed a study to examine the potential impact of high instantaneous shares of wind power within the entire island's electricity system. This study is one of the first to significantly model grid behaviour at very high levels of wind penetration. Crucially the research shows that with a combined installed capacity of just over 6,000 MW, Ireland and Northern Ireland can reach the 40% target. However it will at times be necessary to curtail wind farm output in order to maintain the appropriate system inertia to operate a secure power system.

This study is the basis of a clarified and improved performance requirement across a range of generation services that will be at the core of Smart Generation for existing and future generators. The controllability of all wind farms is a key requirement as are the standards of voltage performance from all generators. With one of the most demanding voltage standards in the world, Ireland is showing that high performance can be delivered and that this has tangible benefits to operating a system with high penetration of renewables.



Voltage/Var Control Testing

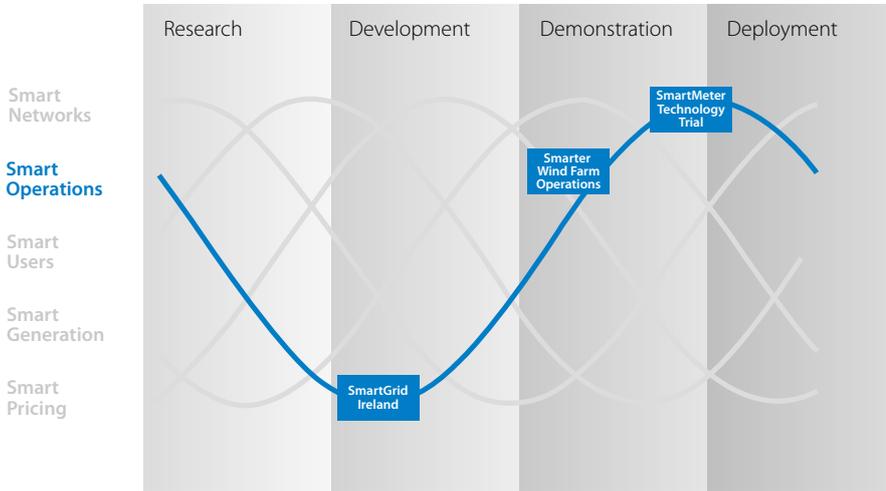
The control of reactive power both in steady state and dynamic performance is important to the secure and efficient operation of the power system. Distribution connected generation complicates this, and over half of the potential windfarm connections in Ireland will be to the distribution system. EirGrid and ESB Networks have undertaken significant work in the planning and operation of the future power system. ESB Networks in conjunction with the EPRI and UCD are currently testing voltage/var control options. Two large 38kV connected wind generators are connected to a dedicated 110/38kV transformer bulk supply point. The scenarios of constant voltage, constant power factor and interactive settings will be modelled to optimise the operation modes for reactive power control while maintaining the voltage rise standards.

Micro Generation Programme

SEAI is carrying out a Micro Generation Pilot Field Trial which will provide intensive field data on the performance of micro generators such as small scale wind, photovoltaic, hydro and combined heat and power. Some of the monitored installations are using the Coolpower EMMA controller device to optimise power exports to match network requirements. An interim export tariff for micro-generation was introduced by ESB Networks/Customer Supply in 2009 and this will be superseded by a longer term government mandated support. Also an "Inform and Fit" connection policy has been introduced by ESB Networks to reduce the length of time and complexity of the connection process.

Other generation-focussed projects are now being undertaken by world leading developers currently in Ireland. Companies such as WaveBob, Openhydro, and Marine Current Turbines are investigating tidal and wave technologies in conjunction with SEAI's Ocean Energy Development Unit, which supports developers of wave energy devices through concept validation, model design optimisation, testing and deployment. EirGrid and ESB Networks are conducting an innovative windfarm project involving windfarms powering an electrical motor connected through a synchronous alternator to examine the benefits of synchronous versus non-synchronous generation. The objective of lowering the average carbon intensity in the future generation mix is the subject of a comprehensive study conducted by EirGrid. Quite simply, the entire arena is in a progressive state of advancement.

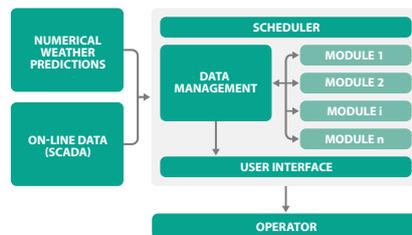
SMART OPERATIONS



The operation and control of electricity generation and the network assets is a critical element of any country's electricity system. As the Smart Grid evolves, this role is becoming ever more complex with increasing variable renewables, changing demand behaviour and growing demands for electricity from new technologies such as electric vehicles. Smart operational strategies will be required to manage these challenges. In Ireland a great deal of research has already been carried out to explore how electricity operations can become smarter.

Smarter Wind Farm Operations

Eirgrid is working on the deployment of a Wind Security Assessment Tool (WSAT) in the National Control Centre to help grid controllers manage the increasing levels of wind generation in real-time. Eirgrid is also a key partner in the EU project to develop a next generation wind resource forecasting system called Anemos. A key part of Anemos is the use of high-resolution meteorological forecasts. Anemos software is currently being trialled in Ireland.



Anemos Project



Smart Meter Technology Trial

Up to two million electricity smart meters providing interval consumption data may be installed in Irish homes. This will be a significant communications and ICT systems challenge. To prepare for this ESB Networks is currently carrying out a national trial to establish the maturity and performance level of different communications technologies in the Irish environment. A distribution line carrier (DLC) trial is taking place using approx. 1,100 Sagem meters. A radio frequency (RF) 2.4 GHz trial is also underway using approx. 2,300 Trilliant/Iskraemeco meters and systems. Other technology options are also being investigated.



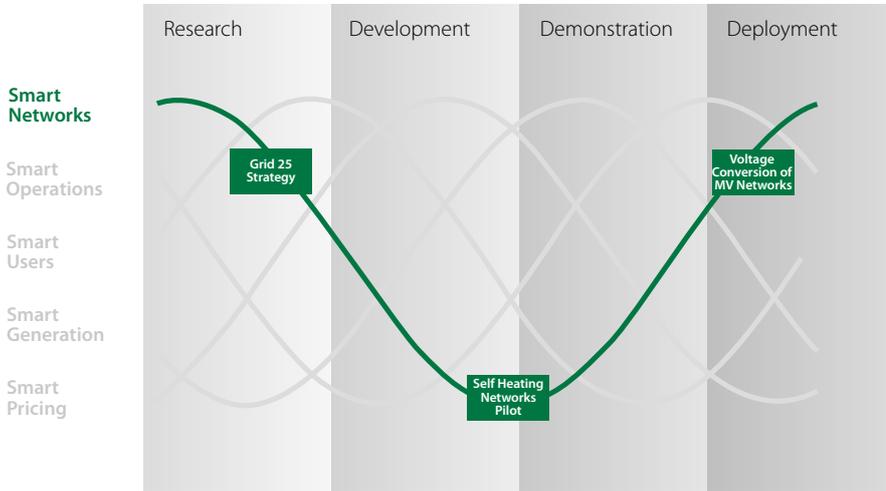
Smart Grid Ireland

Smart Grid Ireland (SGI) is an industry-led group seeking to collectively exploit the benefits and opportunities in the Smart Grid sector. It is an All Island network with members from both Northern Ireland and the Republic of Ireland. SGI is currently working on a scoping study to define the significant elements of a Smart Zone which will focus on Grid optimisation, renewable integration, DSM and communications / IT applications.

Other operationally focused research projects include the Department of Communications, Energy and Natural Resources (DCENR) follow-on to the All Island Grid Study which considered the impact of Demand Side Management measures on the renewable energy focussed Irish system, as well as the SEAI Aran Islands demonstration project which will examine the potential to use a local wind and ocean driven system to supply the majority of the community's electricity, heat and transport needs.

In Ireland a great deal of research has already been carried out to explore how electricity operations can become smarter.

SMART NETWORKS

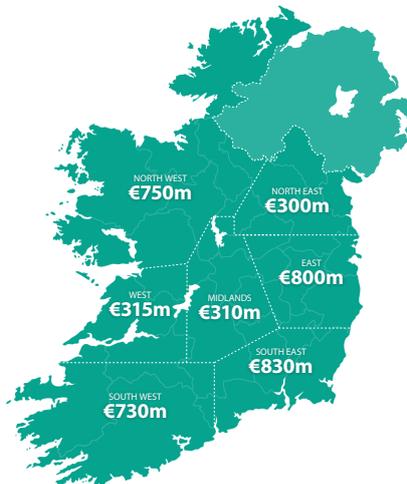


Smart Networks will be the enabler of the Smart Grid. Ireland’s electricity network is currently ranked as one of the most advanced systems worldwide; however it will have to become smarter and more adaptable to deliver on the coming challenges.

The All Island Grid Study included a comprehensive initial study on the extent and cost of the network reinforcements that will be needed to accommodate the renewable energy target. A great deal of network upgrade activity is already underway and significant investment has been allocated to it. There is also considerable research and demonstration in Ireland of new technologies with the potential to improve the existing capabilities of the network and make it a Smart Network.

Grid 25 Strategy

EirGrid’s Grid 25 strategy proposes to deliver a world class grid infrastructure for Ireland while striking a balance between costs, reliability and environmental impact. With an investment of €4 billion, the grid capacity will be doubled by 2025. Grid 25 also aims to enable the different regions in Ireland to develop their potential in attracting new high tech industry and to accommodate population growth.



Self Healing Networks Pilot

ESB Networks is piloting Self Healing Networks technology. Existing network switches are being allowed to act autonomously in the event of a fault, so that supply is restored to the affected parts of the network from multiple sources and the actual faulty circuit is isolated. In this way supply can be automatically restored to the vast majority of customers without delay or intervention by the central control centre.



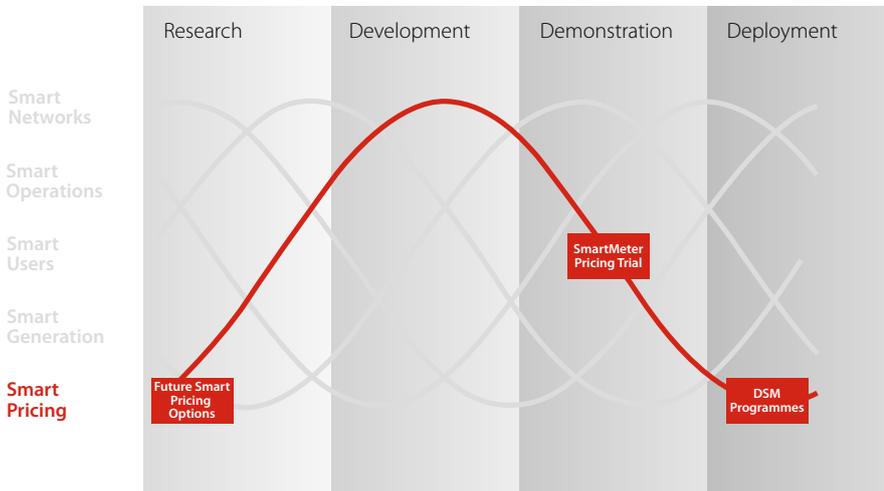
Voltage Conversion of Medium Voltage Networks

ESB Networks is currently converting the existing 10kV network to 20kV with a view to having all rural networks operating at 20kV by 2025. Extensive SCADA controlled distribution automations systems have also been installed. To further improve continuity ESB Networks is now trialling the use of MV Arc Suppression Coils coupled with a sophisticated control system in conjunction with an innovative Irish company, Enersol. This is a groundbreaking project as the application of Arc Suppression in MV systems, containing substantial amounts of Single Phase MV, has previously been considered impractical by other utilities.

ESB Networks has a comprehensive programme of other Smart Network research and demonstration projects including High Temperature Low Sag conductor network upgrade programme, Voltage Rise Management studies, Capacitor Banks Installation, Investigation of Conservative Voltage Reduction (CVRs) Embedded Generation, Storage and Dynamic Network Sectionalising and Energy Efficient Distribution Transformers (Amorphous Core and Hexaform Three Phase transformers). Eirgrid has completed an Electricity Storage Study and is also a key partner in the Offshore Transmission Electricity Grid Research with Irish Scottish Links on Energy (ISLES) project. There are also some innovative Irish companies developing products to enable smart interaction between generation and networks. For example, FMC Tech has developed a new technology called Crystal System to monitor electricity distribution and transmission networks.

A great deal of network upgrade activity is already underway and significant investment has been allocated to it.

SMART PRICING



Smart pricing will make the value and cost of energy use transparent to consumers, and allow them to see when cost exceeds value.

Ireland already has a Single Electricity Market (SEM) for the trading of wholesale electricity; this allows for a degree of demand responsiveness and substantial investment in the generation portfolio in Ireland and Northern Ireland. The SEM has already delivered important benefits, and a number of significant work streams and industry consultations are underway to leverage even further benefits in the areas energy pricing structures, capacity and ancillary services. In addition, the trading arrangements with interconnected systems are being improved; this allows for more responsive trading that better reflects the needs of consumers. Current Smart Pricing projects are:

Smart Meter Time of Use Pricing Trial

A key part of the Smart Metering trial is the testing of time of use tariffs and behavioural stimuli. Customer behaviour data on standard flat prices was initially collected for over 6 months. Since Jan 2010, four groups were placed on time of day pricing with various levels of peak and off-peak pricing. A control group is also included. The selection and design of the sampling is nationally representative and will ensure that a 2% change in overall usage and peak time usage can be detected

Using information gathered via the different trials conducted as part of the Smart Metering Project Phase 1 and from other sources, an analysis will be developed to ascertain the costs and benefits that would be involved in a full national roll-out of Smart Metering in Ireland.



DSM Retail Programmes

Irish industrial consumers already have access to several DSM retail programmes. Eirgrid currently operates a Winter Peak Demand Reduction Scheme which incentivises businesses to reduce electricity consumption during the peak hours of 5-7pm in winter. Eirgrid also run Powersave which encourage large and medium sized customers to reduce their electricity demand on days when total system demand is close to available supply and Short Term Active Response (STAR) whereby electricity consumers are contracted to make their load available for short term interruptions.

Future Smart Pricing Options

The CER and NIAUR are currently carrying out a public consultation on their vision for demand side participation for the single electricity market. The consultation paper identifies a range of measures that could have a beneficial impact in the Irish market including two smart pricing options; visible day ahead pricing for the industrial and commercial sectors and smart metering that allows for advanced displays and time of use tariffs.

The Smart Grid will facilitate smart, dynamic pricing and distributed consumer demand-response.

SMART ACADEMIC INFRASTRUCTURE

There are many research and development challenges that need to be addressed in order to fully realise the potential of Smart Generation, Smart Operations, Smart Networks, Smart Users and Smart Pricing.

Thankfully, Ireland already has a smart academic research infrastructure in place, one that actively partners with industry to produce accurate, relevant research. The Irish sustainable energy research community can meet the research challenges ahead and allow Ireland to innovate and lead the world in the grid integration of renewable energy and other aspects of the Smart Grid. A robust framework for energy research has already been developed by The Irish government and this will bring further advances in all relevant areas.

Electricity Research Centre (ERC)

The ERC is one of Ireland's most innovative and progressive research groups. This collaboration between academia and major Irish and international electricity industry partners is unique. The group tackles the fundamental and applied research questions underpinning the development of a sustainable electrical energy system and builds human capacity in this crucial sector.

The ERC is based on a core group of engineering excellence in UCD and energy economics in Trinity College Dublin (TCD). There are strong collaborative links with

other research groups in Ireland, UK, Europe and the USA. There are currently four research groups within the ERC – Systems (led by Prof Mark O'Malley (UCD)), Operations led by Dr Damian Flynn (UCD), Networks (led by Dr Andrew Keane (UCD) and Economics (led by Dr Eleanor Denny (TCD)). The ERC is funded by industry members, an SFI Charles Parsons energy research award and other sources, including SFI Principal Investigator, Stokes, TIDA and Research Frontiers Programmes, the European Commission, IRCSET and Teagasc.



ITOBO - Energy Efficient Buildings Research

Funded by Science Foundation Ireland, Information and Communication Technology for Sustainable and Optimised Building Operation (ITOBO) brings together both academic and industry partners to work in the development of embedded systems for the energy efficient operation of buildings. The main research areas include hardware design, wireless systems integration and network protocol development and constraint-based decision support. ITOBO's academic partners are University College Cork, Cork Institute of Technology, Tyndall National Institute of Technology and NUI Galway. The industry partners are Intel Ireland, ARUP, Cylon Controls Ltd., Spokesoft Ltd. and HSG Technischer Service GmbH.





Charles Parsons Award Scheme – Science and Engineering of Sustainable Energy

There are seven awards under the Charles Parsons Initiative focussed on world class research, education and training in the science and engineering of sustainable energy. Funded by the Irish government, the Charles Parsons Awards have allocated €20 million to various research projects over the period to 2013, including projects in the Smart Grid area.



CLARITY - Energy Aware Hardware Research

CLARITY is a partnership between University College Dublin, Dublin City University and Tyndall National Institute Cork. The technology developed by CLARITY aims to empower the citizen by taming the information overload problem currently facing individuals and helping to ensure that everyone has access to the right information at the right time. One of the key research areas is Configurable and Energy-Aware Hardware. CLARITY has many industry partners including IBM, Episensor, Disney Research and Fairview Analytics.



United Technologies Research Centre (Ireland)

UTRC has established its European research base on the grounds of the Tyndall National Institute, University College Cork, at an investment worth €15m, supported by IDA Ireland. UTRC is the research wing of United Technologies Corp, (UTC) – a global provider of high technology products and services to the building systems and aerospace industries. The objective of the Irish research centre, UTRC-I, is to accelerate technologies addressing renewable energy, energy efficiency, and integrated energy systems as well as security systems. Activities will also include the demonstration of emerging technologies from individual buildings to district wide applications. A key factor in UTRC's choice of location was to identify global clusters of expertise to complement its corporate research centres based in the US and China. Ireland fulfilled this criterion.





International Energy Research Centre

The establishment of the International Energy Research Centre (IERC) was announced early in 2010. Up to 50 new jobs will be created supported by an investment of €20 million by the Irish government. The IERC's goal is to assemble key companies in the integrated energy systems research field, both national and international, who will direct research to develop integrated sustainable energy systems. The IERC will be hosted at the Tyndall National Institute in Cork.

There are many other academic organisations with the potential to become key participants in Smart Grid research in the future. These include:

Mathematics Applications Consortium for Science and Industry (MACSI) [University of Limerick]	Extensive data analysis capability
Irish Software Engineering Research Centre (LERO) [University of Limerick]	Research on software development
Federated, Autonomic Management of End-to-end communication services (FAME) strategic research cluster [Waterford Institute of Technology]	Researching information networks
NUI Maynooth	EV recharging protocols, ocean energy research and seabed sensors
UCD Department of Engineering	Specific research projects on heat pumps and refrigeration and power system security
Solar Energy Conversion Cluster (UCD)	Developing new materials that mimic the steps involved in natural photosynthesis
Energy Efficiency Competence Centre (I2E2)	Focussing on compressed air and HVAC systems research
Hydraulics and Maritime Research Centre (HMRC)	Centre of excellence for ocean renewables and coastal engineering
Digital Enterprise Research Institute (DERI)	Internationally recognised institute in semantic web research

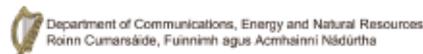
CONTACT US

Ireland has put in place a solid foundation for further Smart Grid developments. Recognising the need for a strategic approach to further work, a smart grid road map working group has been established to identify and address critical needs in relation to the development of the Smart Grid in Ireland. Working group members include the Department of Communications, Energy and Natural Resources, the transmission system operator, the distribution system operator, the energy regulator, the national energy authority, and the two national development agencies.



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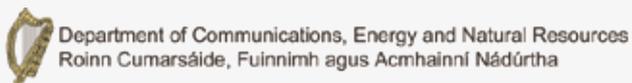
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