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SMART GRID IRELAND RESPONSE
TO UTILITY REGULATOR CONSULTATION
TRANSMISSION & DISTRIBUTION
PRICE CONTROL (RP6)

Introduction

Smart Grid Ireland welcomes the opportunity to respond to the Utility Regulators consultation on the Transmission & Distribution Price Control (RP6). Smart Grid Ireland (SGI) supports the Regulators vision to make a difference for consumers by listening, innovating and leading and providing an efficient revenue cap to enable NIE Networks to deliver quality outputs that customers need and want.

We also wholeheartedly support the commitment of the Regulator to best practice. The immediate challenge of managing to find the balance between representing the interests of the consumer in the short term and the need to provide the framework for securing a long term sustainable future development plan for the electricity grid network will indeed need a best in class approach to regulation

RP6 will require a level of balance between investment decisions and meeting expectations on the price consumers pay for their electricity. SGI supports the principle of affordable energy and look to the Utility Regulator for leadership in the development of a modernised grid for the benefit of Northern Ireland.

The Smart Grid Ireland response will provide a broad commentary on the reasons for a smart grid. It will also highlight that the “value to customers” is at the forefront of our consideration. Our response recognizes the evolution of the electricity market structure and the regulators need to operate within the regulatory framework of ensuring the provision of a secure, sustainable competitive, clean and efficient electrical energy supply for Northern Ireland’s current and emerging consumer, economic and social needs.

We believe that one of the challenges is to move the regulatory framework from a model by which regulators focus on managing utilities’ “cost of service” to a “value of service” philosophy. Our response draws from global best practices observed through our membership of the Global Smart Grid Federation comprising some 17 nations.

The transition to a low carbon society is outlined in the SET and in EU & DETINI energy policies to reform and reorganize towards a fully integrated EU internal smart energy union placing the consumer at the heart of the energy system. This will involve a paradigm change effect in N.I., as it will elsewhere.

The demand for low or non-carbon distributed electricity will increase significantly longer term with the growth of electric & hybrid transportation, the development of population housing stock, the diversity of energy supply and new industrial drivers such as Data Centre's and factory automation will change the game in how electrical energy is sold and delivered.

We recognize it is not the role of a regulator to select specific technology solutions to support the integration of variable renewable energy needs, there is nevertheless a need to consider how the regulatory regime should best support how to incentivise the investment in appropriate technologies that are relevant to the future proofing of the electricity grid network in NI. This comment is intended to get to the heart of a major dichotomy faced by all parties; namely how best to find an approach which allows NI to benefit from “learned experience in other jurisdictions while at the same time having evidential proof that these solutions will be capable of deployment (for value add benefit to consumer) in the NI grid.

We would view that the selection of appropriate grid integration measures to be an iterative process between NIE and the regulator, the choice of one measure will impact the pre-conditions for the next iteration. The regulator therefore needs to play a leadership role in assisting NIE through this transformation because of its far reaching impacts.

In appraising the extent of grid infrastructure modernization we recommend that the Regulator identifies those integration measures that are required to support:

- The integration of variable renewable energy, (VRE),
- The future needs of communities,
- Investment in economic growth and
- Improved services that underpins the transition process enabling smart cities.

CHALLENGES IN EXISTING ELECTRICITY GRIDS

Sometime century-old by design, existing grids face four main challenges globally:

Electricity demand is rising faster than any other final-energy source (2% per year until 2040), and intensifying around peak times because of the progressive shift in consumption from steady industrial baseload to variable household and commercial demand. As a result, networks are being both reinforced to increase existing capacity, and extended to reach larger customer bases;

Existing grid infrastructure is aging, because of very long return-on-investment cycles. In the U.S., the aging transmission network is causing a decline in power reliability. In some developing economies, such as India, theft and technical losses in inadequate distribution networks result in 20% of transmitted electricity being lost. The global financial impact of such grid issues is growing, as economies are ever-more reliant on electricity;

As wind and solar capacity increase, the penetration of Variable Renewable Energy (VRE) in some regions is reaching levels that are creating difficulties in the balancing of supply and demand at a reasonable cost;

Distributed Generation (DG) annual capacity addition is set to double in the next 10 years. Yet, in most cases so far, distributed capacity is either off-grid or merely connected to the grid, but not properly integrated into grid operation. As a result, bi-directional electricity flows and power-quality issues arise where the penetration of DG becomes critically high.

- In response to these challenges, investments in electricity grids are increasing by 4% a year globally, a growing share of which is directed towards smart-grid technologies (20% in 2014).
- Overall, the goal of a power grid is to co-optimize, for a given set of generation capacity and demand patterns:
 - Power reliability (frequency and extent of outages);
 - Power quality (voltage signal shape, frequency and phase angle); and
 - Power affordability for consumers

Extract: Schlumberger Energy Institute

N.I Smart Grid needs a modernised electricity network that monitors, protects and optimises the operation of its interconnected elements.

The notion of grid modernization may differ from country to country, depending on the smartness of the existing system. However, notwithstanding such differences, smart grids are generally characterized by the use of digital information and communications technologies to manage both the bi-directional flow of data between end-user and system operators and the bi-directional flow of power between centralised and decentralised generation. This integration of modern information and communications technologies into distribution utility operations is central to creating a modern grid

and just as these technologies have produced material benefits in other sectors, a smart grid can produce significant benefits in the power sector and for the consumer.

The challenge for the Regulator is how to manage the changing demands from consumers for more empowerment in their energy management. This is analogous to the increasing pressures from the digital age – we have seen it in the communications era and now these pressures will increase as a natural response to the increasing democratisation of information brought about by the digitisation of information

Diagrams 1.1 and 1.2 below introduce a widening of the traditional regulation approach to determining the investment profiling for the creation of a 21st century power grid.

The wider societal impacts of the interconnected nature of smart energy cannot be ignored and diagram 1.1 places the electricity grid within the holistic context of “energy “as part of a “smart system” . We would argue that energy, albeit a critical element, is still only one part of the wider development of smarter infrastructures that are underway throughout the developed world.

Dia:1.1



Diagram 1.2 illustrates the irresistible dynamic from the universal adoption of social media within global societies. So in facing up to the empowerment of consumers in the use of their energy it is essential that account is taken of the impact this will have on the investment support for the facilitation of this convergence of ICT and the grid as we know it. The smart grid deployment is the key enabler.

Dia:1.2



Another example of the positive cost benefit analysis from smart grid investment is evidenced by the research undertaken by the Electrical Power Research Institute (EPRI) in the US in 2011 which showed that national deployments of smart grid technologies could produce net economic benefits over the 20 year period (2010 through to 2030) of some \$1.3 trillion to \$2.0 trillion at an average benefit to cost ratio of between 2.8 to 1 and 6 to 1.

In the UK there are similar estimates of the positive cost benefits analysis from smart grid technology investments as shown in the separate reports published by Smart Grid Great Britain – “Smart Grid: a race worth winning” by Ernst and Young and “Great Britain: Unlocking the Potential of the Smart Grid” showing that expenditure will deliver significant economic benefits. These reports introduce another area of consideration because the benefits flow too many stakeholders in the economy and not just the consumer.

The opportunity for the regulator in the RP6 review is to address these challenges at minimal cost, optimize energy efficiency and asset utilization, improve power quality for the end user devices,

self-heal, resist physical and cyber attacks and enable new business solutions in a more open-access electricity market such as demand response and virtual power plants.

Beyond incremental changes in traditional grids, smart grids facilitate the expansion of independent micro-grids that are capable of “islanding” themselves from the main grid during power-system disruptions and blackouts. The modular nature of micro-grids may allow for their independence, interconnection and ultimately the construction of a new type of super-reliable grid infrastructure.

[The NI Electricity Regulator has an opportunity in RP6 to invest in smart grid technologies through making allowances for Research & Innovation \(R&I\) and competitiveness.](#)

By investing in R & I in line with the Strategic Energy Technology – plan (SET) which aims to accelerate the development and deployment of low-carbon technologies, NIE will be enabled to develop technological leadership in low carbon technologies and reduce energy consumption, empower consumers, create huge industrial opportunities and boost growth and jobs.

The transition to a smart grid requires the deployment of new power infrastructure, along with various kinds of devices, such as electronic sensors and computer systems, throughout the electricity network and their interconnection via high-speed communications networks using standardized protocols. It is essential that the “power internet” and the “internet of things” (IOT) are integrated.

One key outcome from intelligent network investment is that it enables consumers to contribute to grid management through the medium of intelligent end-user devices. Information Technology (ICT) can now create an environment where utility producers and consumers can interact. Consumers can now interact with the grid, track their electricity usage, and change their behaviour so electricity can be used more intelligently. Utility producers can automatically monitor electricity flows and adjust to changes in electricity supply and demand accordingly via demand response programs.

Combining advanced metering infrastructure with smart appliances makes dynamic demand-response programs possible. These can contribute to system flexibility (in addition to peaking power plants or electricity storage) to compensate for fluctuations in VRE output or to flatten out aggregated peak loads. Bi-directional smart meters enable net metering and vehicle-to-grid programs that incentivize

individual customers to become local suppliers of power and storage capacity.

In addition, automated meter readings reduce the operating costs of distribution-system operators and provide greater visibility into pilferage.

Another principal aim of smart-grid technology is to enhance the physical capacity of the network. These new technologies could be especially effective in connecting remote offshore wind farms to distribution grids or interconnecting asynchronous grids. In some cases investment in new technology and innovation will help to delay expenditure in high cost asset replacement.

It would also be possible to adjust dynamically the maximum admissible power throughput of transmission lines by installing special temperature sensors along them. This would allow the deferral of expensive and sometimes-controversial grid-extension plans.

Consumer, Economic and Social Benefits of Investment in Research & Innovation and selective deployment of Smart Grid technologies within RP6.

ECONOMICS AND ENVIRONMENTAL BENEFITS

Although impacts are difficult to quantify in a consultation response document such as this, a smart-grid roll-out is believed to provide net economic and environmental benefits in all regions where studies have been undertaken.

For U.S. society as a whole, the direct and indirect benefits of a full roll-out outweigh their costs by a factor of between 2.7 and 6. Restricting the scope to electricity-grid stakeholders, the direct benefits/cost factor is between 2 and 4 in OECD countries, and 3 and 4.5 in China.

However, if smart-grid investments are mostly borne by the system operators, the benefits are spread among many groups: producers, T&D operators, customers, and the public at large, as a result of environmental benefits.

Although environmental sustainability is not the primary driver of smart-grid adoption, smart grids contribute to limiting greenhouse gases emission both directly (through energy savings) and indirectly (by encouraging the development of electric vehicles and

renewables). Overall, smart grids could contribute to 4% of cumulated CO₂-emissions reduction efforts until 2030 in the lowest cost pathway towards limiting to 2°C any rise in the average global atmospheric temperature.

SOCIAL ACCEPTANCE AND CYBERSECURITY

Social acceptance of smart grids is a prerequisite for active consumer participation in grid management. Clarity in relation to data privacy, sharing and protection will be essential in securing consumer acceptance and grid security. Cybersecurity must be developed to protect technology, processes and people from deliberate attacks and accidents.

Research Findings - extract from SBC Energy Institute 2015 – deployment of Smart Grids.

PRIVATE INVESTMENTS

The smart-grid market is sizeable: investment amounted to \$44 billion in 2014, with \$16 billion in digital-energy technologies alone.

Government support kick-started investment in 2009, resulting in a flurry of investment. Since 2011, growth rates have stabilized, and investment has focused on smart meters and distribution automation.

In the next five years, a forecast annual investment growth rate of 5% (10% in digital-energy) will be fuelled by the roll-out of smart meters: 100 million were installed in 2014, and the global penetration rate is due to increase from 22% to 40% in 2020.

Solid funding from venture capital and private equity highlight the emergence of smart grids as an essential area of clean technology.

Major smart-grid companies are located in the U.S. and Europe.

PUBLIC INITIATIVES

The U.S kick-started smart-grid investments in 2009 with \$4.5 billion of public-funding commitments.

In Europe, €3 billion of public funds have been allocated since 2006 to help companies invest in smart-grid projects.

Smart-grid initiatives continue to expand globally, with increasing momentum all around the world.

RD&D LANDSCAPE

The number of smart-grid patents filed increased by 17% a year between 2000 and 2010.

Most smart-grid technologies are in the demonstration and deployment stages, further highlighting the dynamism of this growing sector

Conclusion

Having outlined Smart Grid Ireland's insights and the strategic direction we observe in other countries, the regulator and NIE should consider these and decide on the balance of investment and value to the customer in the longer term.

NB: NIE & ESB Group (Both SGI Members) have abstained from any input to this response as it was felt on their part that it would be inappropriate to be directly involved in this response

Smart Grid Ireland is a not for profit, all-island advocacy network, whose mission is to facilitate the delivery of a secure, affordable and sustainable energy infrastructure, positioning Ireland at the forefront of global smart grid development, to create long-term economic wealth and employment for the people of Ireland

Note: Any queries to this submission should be addressed to bob.barbour@smartgridireland.org. or by contacting the SGI secretariat Lorraine Branagh at +44 (0)2890 737950.