

British-Irish Council Energy Ministerial Meeting

British-Irish Council Summit, Manchester 2019

MAKING THE TRANSITION TO A SMARTER ENERGY SYSTEM

British-Irish Council (BIC) Energy Ministers noted at their meeting in Edinburgh in June 2018 that by sharing information and experiences, the BIC Energy work sector continued to bring important benefits and opportunities for its members. They agreed several potential areas for collaboration, many of which related to smart solutions for helping to enable the transition to low carbon energy.

Following the meeting, Member Administrations jointly decided to cooperate in particular on smart energy systems, as this theme incorporates a large number of the issues that Ministers had identified as being of interest. This paper seeks to inform discussions on smart energy systems.

Ministers are invited to:

- **note the work sector's engagement on this topic;**
- **discuss what approaches are most effective in realising the transition to smart energy systems and what barriers need to be overcome;**
- **consider how smart energy systems can be promoted at a local and community level;**
- **discuss priorities for research and innovation funding; and**
- **agree that this paper and the attached annex be published on the Council's website and made available for interested stakeholders.**

**BIC Energy Work Sector
June 2019**

Making the transition to a smarter energy system

1. Introduction

1.1. *The role of smart energy systems*

The energy systems in our islands are undergoing fundamental change as we progress along the path to decarbonisation. We are increasingly relying on intermittent renewable generation, whose output rises and falls with changes in weather. Energy systems are also becoming increasingly decentralised, with more homes and businesses generating and storing power. The need for decarbonisation will also substantially increase the proportion of electric vehicles on our roads and new approaches to heating buildings. We are starting to develop coordinated solutions across these sectors, which will help us to minimise costs and maximise benefits.

Making the transition to a smarter energy system will enable us to respond to these changes in the most cost-effective way, while unlocking important benefits for consumers and local communities. **A smart energy system is one that increases the flexibility of generation, supply and demand of energy in a coordinated and intelligent manner. It builds upon innovative new technologies and applications, such as smart meters, electric vehicles and new demand side response and storage technologies.** New business models and digitisation also play a vital role by enabling us to match supply and demand more efficiently, supporting the integration of intermittent renewables.

1.2. *Wider benefits of smart systems*

Smart systems bring significant public benefits, such as lower carbon emissions, reduced energy bills and cleaner air, in addition to giving consumers greater control over their energy usage and bills. Research indicates that **a smarter and more flexible energy system could bring £17-40 billion of savings in England, Wales and Scotland by 2050** – savings accrued from avoiding or deferring network reinforcements and new generation, reducing curtailment of low carbon generation, and better operation of the system. Similar savings can be achieved across these islands.

Smart energy solutions and expertise also have **significant export potential** as countries across the world strive to meet international carbon reduction obligations. Leadership in this area will enable us to harness this potential, **boosting economic growth and job creation at home.**

By sharing our experience of smart energy systems across BIC Member Administrations, we can make the most of these opportunities, supporting each other to develop and deploy smart technologies and solutions. This paper provides a starting point for this dialogue. It explores policy approaches to enabling this transition, the facilitation of key technologies, smart energy at a local scale, and funding for innovation. It then proposes a series of outputs and areas of collaboration that BIC Member Administrations can continue to work on.¹

2. Policy approaches to enabling smart energy systems

Internationally, a variety of policy reforms have been pursued to enable smarter energy systems. These range from top-down approaches such as targets for the deployment of certain technologies, to market-led initiatives focused on fostering fair competition among

¹ Although the paper is primarily concerned with the smartening of the electricity system, as this is an area in which important progress has been made in recent years, some consideration is also given to smart solutions across different sectors, such as transport and heat.

smart solutions and other technologies in the energy system. At the level of central government, BIC Member Administrations have tended to favour market-led initiatives to deliver smart and flexible energy solutions.

For example, the UK Government's Smart Systems and Flexibility Plan, published jointly with the UK's energy regulator (Ofgem) in 2017, sets out a vision for upgrading market and regulatory frameworks to support the transition to a smarter energy system. It includes 29 actions (with another nine added in 2018) for the Government, Ofgem and industry to take forward for unlocking the potential of smart technologies, such as electricity storage and demand response, by:

- removing regulatory and policy barriers;
- enabling smarter homes and businesses; and
- ensuring that markets are accessible to smart technologies.

Ireland's DS3 Programme ('Delivering a Secure, Sustainable Electricity System'), led by the system operator EirGrid (and the System Operator for Northern Ireland (SONI), as part of the all-island electricity market), seeks to sustain energy security while increasing the amount of renewable generation in the Irish electricity system to reach a long-term target of 75%. Through close collaboration with regulators, policy makers, network companies and other market participants, the programme will ensure that the market for system services rewards generators for providing electricity in a flexible and smart way, enabling the grid to react better to fluctuations in supply and demand.

The Welsh Government set out an initial approach in a Local Energy policy statement in 2014 that established the Smart Living programme to develop a range of demonstrator projects. Wales is now piloting a regional approach to local energy planning.

The Scottish Government has highlighted the importance of smarter local energy systems in its Vision for Scotland's Electricity and Gas Networks. The document sets out its view on the approaches and actions needed to ensure that this vital infrastructure is operated, regulated, supported and developed in a way that supports and enables the decarbonisation of the whole energy system.

The Isle of Man, following an extensive study in collaboration with a major network company, is developing smart and innovative solutions to reduce electricity network losses in supplying domestic and large commercial customers and thereby reducing carbon emissions.

We are also starting to consider the need for smarter approaches to energy across different sectors. For example, the UK Government's £102.5 million 'Prospering from the Energy Revolution' challenge fund will support four projects demonstrating local energy solutions for decarbonisation across the power, heat and transport sectors in England, Scotland and Wales. Similarly, Ireland's €500 million Climate Action Fund, announced in 2018, will allocate €77 million to seven innovative and smart 'pathfinder' projects to support decarbonisation across various sectors.

3. Facilitation of key technologies

At the heart of the transition to a smarter energy system is the emergence of a variety of new infrastructures and technologies that allow us to use energy more flexibly and create new opportunities for consumers. Examples include energy storage devices, smart home appliances, and digital platforms for the coordination and trade of flexibility. This section considers three technologies of potential interest to BIC Member Administrations for discussion.

3.1. Smart meters

Smart meters can play a critical role in providing the building blocks for a more flexible and resilient energy system. They facilitate new technologies and services for consumers, including smart tariffs that encourage consumers to use energy at times when it is cheaper, and smart appliances that can make it easier for consumers to realise these benefits. Smart meters also provide opportunities for innovation, enabling technologies such as electric vehicles and microgeneration to be efficiently integrated into the system, helping to lower emissions and cut costs for consumers. Jersey's smart metering roll-out, for example, will aid the island's long-term decarbonisation strategy by enabling new tariffs that encourage customers to move from fossil fuels to heating with low carbon electricity.

Ambitious programmes for the roll-out of smart meters are underway, bringing smart meters to millions of households and businesses across these islands. Given the scale and importance of these programmes, BIC Member Administrations can learn from each other's experience, including best practice for maximising smart metering innovation.

3.2. Electric Vehicle charging

There is a considerable opportunity for Electric Vehicles (EVs) to play a dynamic and complementary role in the move towards a smarter, flexible energy system. Smart charging – that is, shifting the charging of EVs to times of lower demand and prices – can reduce strains on the electricity system, helping to match patterns of supply and demand, and thereby reducing the costs of system operation as we electrify transport. Vehicle-to-grid charging technology can allow EV batteries, when plugged in, to be used as a source of electricity flexibility for the grid – for example, exporting electricity back to the grid for short periods in response to signals from the system operator. These smart solutions can allow consumers to save money by charging smartly, or even selling power from their EV battery.

Member Administrations could collaborate to investigate how smart charging could be most effectively encouraged and explore models for enabling EV charging to support grid balancing.

3.3. Electricity storage

Storage has a critical part to play in addressing the challenges posed by variable renewable generation, by allowing surplus energy (for example, from solar farms on a sunny afternoon) to be captured and released at times of high demand. Falling costs have led to the rise of lithium-ion battery storage systems that can be deployed at various scales – from small battery packs for use in households and small businesses, to large battery storage facilities serving thousands of consumers. Several other storage technologies under development, such as flow machines and compressed air systems, also hold potential for future commercialisation.

There are also challenges for the sector. Regulatory frameworks have not always evolved at the same pace as storage technologies have emerged, resulting in uncertainty over the regulatory status of this technology. Similarly, existing market structures may require reform to allow storage developers to secure the revenues needed to attract investment. Member Administrations could assess the different approaches to regulating storage and ensuring fair access to market, and share experience of storage business models in the market.

4. Smart energy at the local level

Local communities, local authorities and businesses have a critical role to play in enabling a coordinated and cross-sectoral smart energy transition. Naturally, there are challenges with

local energy solutions, such as disparities in resources available to different localities, which limits the ability for projects to scale up and commercialise widely. Nevertheless, important strides are being made.

In Scotland and Wales, there are now national targets for local ownership to ensure individual communities benefit from the energy transition, through investment, up-skilling and jobs. The Scottish Government's Community and Renewable Energy Scheme (CARES) has supported almost 270 community and locally-owned renewable energy projects, while the Welsh Government has engaged with 260 community groups through its renewable energy support schemes, providing technical or financial support to 110. The Welsh Government has now brought together its support for community and public sector to develop a place based approach to energy strategies. It has also recently held a Call for Evidence on local ownership of renewable energy schemes and made loans available to support these where private finance has not been available. Ireland's imminent Renewable Electricity Support Scheme commits to the development of a community-enabling framework that will closely mirror the successful CARES template. Cities across these islands have begun developing new business models for funding energy solutions, such as Bristol's £1 billion City Leap investment fund.

Exciting smart energy projects are also underway in smaller islands and isolated communities in our jurisdictions. Despite often facing unique challenges associated with isolation and more limited technology portfolios, some communities are delivering schemes with considerable potential for wider replicability and benefits among BIC Member Administrations, for example in Jersey, Guernsey, Orkney, the Aran Islands (Ireland), the Isle of Man and the Isles of Scilly.

There are a number of networks, partnerships and groups within Member Administrations dedicated to sharing learnings from such projects with wider communities and institutions, such as UK100, the Carbon Trust and the Association of Public Sector Excellence. It would be useful for BIC Member Administrations to discuss how best they can support and encourage local action, as well as collaborate to improve knowledge sharing and local capacity building.

5. Research and innovation funding

Supporting smart technologies and business models at early stages of development will be crucial to enable these to evolve into scalable, commercial solutions that can enter a competitive market. BIC Member Administrations are investing substantial funds to achieve this.

The UK Government's Department for Business, Energy and Industrial Strategy (BEIS) has committed £505 million to accelerate the commercialisation of innovative clean energy technologies and processes in England, Wales and Scotland. This not only includes the £102.5 million 'Prospering from the Energy Revolution' challenge fund (discussed in Section 2), but also £70 million of targeted funding for smart energy innovation, including flexibility markets, demand side response, vehicle-to-grid and energy storage. EU funding has played an important part in enabling a number of local trials of smart energy solutions, such as FLEXIS, SPECIFIC and Smart Living in Wales. The Northern Irish electricity network company NIEN is exploring cost-effective alternatives to conventional network reinforcements, including running six technology trials to test a range of smart and flexible energy solutions to manage its networks more efficiently.

Such projects are vital both for developing and proving the effectiveness of new technologies, and also demonstrating how stakeholders at all levels can contribute to and benefit from the transition to a smarter and cleaner energy system. Innovation support can help these islands become world leaders in new energy solutions, bringing investment and jobs. Inevitably, choices must be made about where funds are directed; some areas must be prioritised above others. For example, should areas that are starting to compete in the market but still face important technical barriers (e.g. lithium-ion batteries) sit at the centre of innovation strategies, or should the attention be on helping technologies and business models at an earlier stage become competitive? Cooperation between Member Administrations could be useful in helping identify common priority areas for innovation support across these islands.

6. Outputs

In each of the themes identified in this paper, it is proposed that Member Administrations cooperate to identify best practice over the next two years. Specific areas that are recommended for consideration are set out below.

Models for enabling smart systems

- What are Member Administrations' overarching strategies to realise the benefits of a transition towards a smart energy system and ensure that consumers are not left behind?

Facilitation of smart technologies

- How are Member Administrations supporting the deployment of key smart technologies?
- How can market frameworks best support the commercial deployment of smart energy systems?

Local and community energy solutions

- How can Member Administrations best support local engagement, ownership and knowledge-sharing in the transition to a smarter energy system?

Innovation funding

- What are the common priority areas for research and innovation across BIC Member Administrations?

To help identify best practice in these areas, visits will be undertaken by the BIC Energy work sector, as part of the wider work programme, to smart energy projects in Member Administrations over the next two years. Visits have been planned for Orkney (September 2019) and the Isle of Man (Spring 2020).

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Annex: Examples of activity in BIC Member Administrations

Facilitation of key technologies

Smart meters

- For England, Scotland and Wales, licence conditions have been put in place to require energy suppliers to take all reasonable steps to roll out smart meters to all domestic properties and smaller non-domestic premises by the end of 2020. Around 13.8 million smart and advanced meters are now operating across homes and businesses. The UK Government is also legislating for the Smart Export Guarantee, which will make the most of the smart meter roll out by requiring most electricity suppliers to purchase low-carbon electricity that consumers export back to the grid.
- Ireland's delivery plan for smart meters provides for the phased roll out of smart meters to every home and business in the country over a six-year period from September 2019. This is a very significant energy infrastructure project. It will involve the installation of new meters for some 2.25 million customers nationwide. The roll out will occur in a structured and phased basis, commencing with an initial delivery of 250,000 meters across 2019-2020 and approximately 500,000 meters in each of the four subsequent years. The priority in initial years is to replace older meters that are approaching the end of their life expectancy.
- The Isle of Man has recently approved plans for the deployment of a comprehensive Advanced Meter Infrastructure system over the next five years.

Electric Vehicle (EV) charging

- For England, Wales and Scotland, the Automated and Electric Vehicles Act 2018 gives the UK Government the power to require all newly installed charge points to have smart charging functionality.
- Ireland currently has a nationwide, but limited, electric vehicle charging network. A new initiative, announced under the first round of the Irish Government's €500 million Climate Action Fund, will aim to significantly bolster the network in the coming years. Up to €10 million is being provided to further develop the nationwide vehicle charging network into a state-of-the-art network capable of facilitating large-scale electric vehicle uptake over the next decade.
- The Scottish Government has also announced its intention to phase out the need for new petrol and diesel cars and vans by 2032. This involves looking at the role of EVs in distributed and local energy networks, alongside initiatives such as ChargePlace Scotland, which will soon deliver 1,000 publicly available charge points around Scotland.
- The Isle of Man is planning smart and comprehensive EV infrastructures which will provide simple pay-as-you-go payment terms and help develop new business models for revenue enhancement.

Electricity storage

- The UK Government launched the Storage at Scale Competition in January 2019, to provide capital grants to support the demonstration of large-scale energy storage using innovative technologies. A range of electrical energy storage technologies are within scope, with a target minimum output power of 30 MW or minimum capacity of 50 MWh. Power-to-X technologies (for example power-to-gas) with a target minimum input power of 5 MW are also in scope. Up to £20 million will be available from 2019 to 2021. The competition will support up to three demonstration projects with build completion by March 2021 and operational testing to be completed December 2021.
- Ireland's electricity transmission system operator, EirGrid, has adopted a holistic approach to adapting the traditional power systems and market design via its DS3 programme. Storage is one of a suite of solutions actively pursued by EirGrid as it seeks to manage high levels of variable renewables. DS3 seeks to break down implicit and explicit barriers that new technologies – including storage – experience in being utilised. In this regard it has designed new incentives to drive investment in new technologies. It has also developed the DS3 Qualifier Trial programme, restructured the enduring DS3 System Services from seven to 14 products, and has successfully engaged with the National Regulator to increase annual investment from €50 million to €235 million. These arrangements are breaking down the barriers that prevent new technologies like storage from being adapted at scale but are focused on delivering the relevant system services and not necessarily technologies. To this extent, EirGrid considers technologies that provide Frequency Response could also include demand side response and interconnectors. As such it designs these competitions and tariff arrangements as technology agnostic as it can.
- The Scottish Government believes that investment in new Pumped Storage Hydro capacity in Scotland could greatly enhance the flexibility and resilience of the electricity network and power supplies.

Smart energy at the local level

- In England, Scotland and Northern Ireland, a political network of Mayors and city leaders called UK100 has committed to use 100 per cent clean energy by 2050. The network is focused on financing the transition and has supported a national Local Finance event this year, as well as running regional events across England in 2019. The Association of Public Sector Excellence (APSE), a membership organisation of officers and politicians looking at delivering energy projects, provides training events as well as conferences and newsletters. The network covers all aspects of local authority delivery but has a specific energy section within it. This allows join up with other key expertise such as transport and waste.
- Ireland's imminent Renewable Electricity Support Scheme (RESS), mandates a €2/MWh community benefit fund in all qualifying projects and commits to the development of a community-enabling framework such that communities can generate their own renewable electricity or appropriately benefit from developer projects. The three Aran Islands are already working towards becoming self-sufficient in locally-generated renewable energy and carbon neutral by 2022. Under the EU's Clean Energy for Islands Initiative, they are one of six pathfinders selected to spearhead the clean energy transition on islands. Funded through the Irish Government's Better Energy Programme, the project initially focussed on energy

efficiency improvements for businesses, public buildings and homes and then encompassed local energy generation, including solar photovoltaic (PV).

- The Scottish Government has set targets for community and locally-owned energy of 1 GW by 2020 and 2 GW by 2030. As at March 2019, approximately 696 MW of community and locally owned energy was operational. The Scottish Government's flagship Community and Renewable Energy Scheme (CARES), delivered by Local Energy Scotland, has supported the growth of community and local energy across Scotland – with almost 270 community and locally-owned renewable energy projects receiving support since the inception of CARES, through both grant and loan funding. The Scottish Government recognises the importance of building on lessons learnt from projects and sharing these as it seeks to transform Scotland's energy system to one that retains more value in the local economy.
- Orkney is a net exporter of power, with over 100 per cent of its yearly electricity demand met by wind, solar, wave and tidal generation. Grid constraints have led to the development of electrolyzers, fuel cell vehicles and the emergence of hydrogen economy including a pioneering hydrogen ferry project. The new ReFLEX (Responsive Flexibility) project, led by the European Marine Energy Centre, will demonstrate a first-of-its-kind Virtual Energy System interlinking local electricity, transport, and heat networks into one controllable, overarching system.
- In the Scilly Isles, water sustainability and cost, waste management and energy costs all have major impacts. Traditionally dealt with separately and by a mix of public and private companies, the Scilly Isles are building an integrated approach to all three issues. Working with Hitachi and funded from EU grants, they are seeking to be zero carbon and adhere to a policy of zero waste export. Energy from waste, renewable power for water pumping stations and new community and wider investment models combined with data and demand management tools are already having a significant impact.
- The Welsh Government has been seeking to improve use of resources through developing local multi-vector solutions (using alternative means of transporting energy, such as hydrogen), which aim to maximise the use of energy rather than depend solely on storage as the answer to renewable variability. It has been working with Cardiff University to develop a model for a multi-vector zero carbon area and solutions that can add value to networks in balancing generation, use and demand. In addition to this, a number of projects have been established in the Island of Anglesey, which include renewables from marine, wind and solar and aim to maximise the efficiency of the network through generation, use and storage. Anglesey also hosts the Scottish Power Energy Network Angle DC project.
- Jersey and Guernsey are both examples of small grid systems, with peak demand of 161 MW and 89 MW respectively. They provide an opportunity to understand at a small scale some of the issues and opportunities that will come from smarter grid management. Jersey and Guernsey have arguably undertaken a disproportionately greater investment in interconnection (both between the islands and onwards to France) as well as maintaining on island generation for resilience and security of supply. As both islands move away from hydrocarbons, they are looking at transitioning to 'smarter grids' with greater penetration of distributed renewable systems (micro scale). Given the relatively low usage of electricity in the islands, the costs associated with the transition to a smart system will be disproportionately higher than for other jurisdictions. However, the adoption of electric vehicles, smart

appliances and heating systems can offer cost saving opportunities like grid scale balancing advantages through the use of, for example, car batteries as a distributed storage system.

Research and innovation funding

- Ireland's DS3 programme has an annual budget of up to €235 million to support the development of smart system services in support of the integration of renewables onto the grid. In addition, the €500 million Climate Action Fund offers the potential for innovative interventions that, in the absence of support from the Fund, would not otherwise be developed. The Better Energy Communities Scheme supports community-based partnerships, many of which include local businesses and enterprises. Support is provided to improve the energy efficiency of homes, businesses and community facilities in a local area. The scheme provided funding of €20 million in 2018 to 37 projects across the country, upgrading 1,189 homes and 454 community buildings. In the previous four years the scheme had funded 172 projects to the tune of €68 million.
- In Scotland, the Low Carbon Infrastructure Transition Programme (LCITP), co-funded by the European Regional Development Fund, focuses on supporting the acceleration of low carbon energy infrastructure projects across the public, private and community sectors. Since 2015, LCITP has supported the co-development of over thirty 'proof of concept' and development proposals for low carbon projects. LCITP launched the £60 million Low Carbon Innovation Funding Invitation in January 2018 offering support for projects in three priority areas – integrated energy systems, low carbon heat and ultra-low emission vehicle infrastructure.
- Northern Ireland Electricity Networks (NIEN) is doing some work in the area of smart energy systems as part of their plans for providing greater access to the distribution network and their transition from DNO to DSO. NIEN's six technology trials aimed at developing cost-effective alternatives to conventional network investment are:
 - i. LV active network management (LVANM) – investigating how meshing the network will increase headroom for low carbon technologies;
 - ii. Smart asset monitoring (SAM) – increasing network headroom using real-time thermal rating technology;
 - iii. Demand Side Response (DSR) – establishment of a DSO flexibility market;
 - iv. Facilitation of Energy Storage Services (FESS) – to identify and remove any barriers that exist to customers deploying energy storage devices;
 - v. Demand Reduction through Voltage Conservation (DRVC) – seeking to manage network constraints; and
 - vi. STATCOM – actively managing network voltage through the installation of a STATCOM on an 11 kV circuit.
- In Wales, a review is currently underway looking at funding for innovative developments to help deploy current and future sustainable demonstrators and pilots, being initiated by actions such as Smart Living. In addition, for more developed schemes, the public sector has access to the Welsh Government's Energy Service. This service is delivered by a consortium of the Energy Saving Trust and the Carbon

Trust. The service aims to support the public and community sector to develop energy efficiency and renewable energy projects to reduce carbon emissions, provide cost savings, generate income and bring wider community benefits. This service brought together the Welsh Government's Local Energy Service and Green Growth public sector support to ensure a more place-based approach, supporting joint working between the two sectors and SMEs. Additionally, the Welsh Government's Local Energy Fund provides development and capital loans that can support smart innovations that contribute to decarbonisation. The loans are provided when commercial lenders are not in a position to lend to projects at an early stage of development and with high levels of risk. By doing this the Welsh Government aims to ensure that more cutting edge projects are developed and the local decarbonisation benefits are realised.

- The Isle of Man will be launching an innovative leasing scheme for domestic air source heat pumps, which is expected to increase awareness of low carbon heating and provide an affordable financing solution to compete with conventional and competitively priced fossil fuel boilers. Digitalisation of EV and heat pump sales on the island will help to highlight 'clusters' and the benefit of delayed network reinforcement through either development of new tariff structures to encourage off-peak electricity usage or encourage demand side response.

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