

# Innovation and Research Strategy

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# Foreword

I am delighted to publish this updated Innovation and Research Strategy on behalf of EirGrid and SONI.

The power system will require unprecedented change over the coming years. In Ireland, Climate Action Plan 2023 includes target for electricity of:

- Carbon Budget 1: 2020-2025: 40 MtCO<sub>2</sub> equivalent.
- Carbon Budget 2: 2026-2030: 20 MtCO<sub>2</sub> equivalent.
- Reduce electricity sector emissions to 3 MtCO<sub>2</sub> equivalent per annum.
- 80% of electricity demand generated from renewable sources,
- 9 GW of onshore wind capacity,
- 8 GW of solar PV capacity,
- At least 5 GW of offshore wind capacity.

The Climate Action Plan 2023 also targets the economy to be carbon neutral by 2050.

In Northern Ireland, carbon budgets are still being developed but the Climate Change Act commits Northern Ireland economy to:

- Achieving emissions reductions of 48% from 1990/1995 level by 2030 and net zero carbon by 2050.
- Achieving at least 80% RES-E by 2030.

This will require a fundamental transition for the electricity sector where innovation and research are essential in getting us to where we need to be by enabling solutions to realise benefits of renewable and sustainable energy.

We need to create clarity on how we will enable innovation across the next decade to meet the immediate challenges we are facing.

Collaborative relationships will be vital on our journey to be carbon neutral by 2050. They will inform how we change, plan, build and operate our power system to help us achieve the 2030 targets. They will also enhance our capabilities, knowledge and processes.

Our updated Innovation and Research Strategy is aimed at enhancing our innovation and research capability. It is designed to help us become more innovative by putting in place the necessary support structures, frameworks, and the people who help make innovation part of who we are and how we go about doing what we do. Collaboration with our partners has been fundamental in delivering on our current innovation programmes and will be vital as

we strive to innovate further with our strategic programmes of work. Many of our innovative programmes are directly aimed at delivering on the Shaping Our Electricity Future Roadmap<sup>1</sup> and their implementation will be critical to its success.

Additionally, this latest revision of the Innovation and Research Strategy looks to further enhance these effective partnerships, as well as to build new relationships where required. The proposed strategic innovation programmes are EirGrid's and SONI's views of the important areas of innovation to be investigated. This focused strategy will ensure we can deliver effective solutions to a wide range of technical, economic and social challenges that have been identified by the Shaping Our Electricity Future Roadmap.

As part of the annual innovation reporting process, we will seek to consult on our multi-year innovation programmes. This reporting will include both programmes covered by the regulatory price control as well as proposed new strategic programmes, which will require appropriate regulatory support and funding.

It is vital we begin our journey of discovery now and introduce disruptive innovation into our planning and operational practices as soon as we can. We need to understand what options and solutions are best for the island of Ireland, to ensure we are on the right path to deliver on a reliable and cleaner energy future.



Liam Ryan,  
Chief Innovation and Planning Officer,  
EirGrid Group

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<sup>1</sup> EirGrid Group, Shaping Our Electricity Future Roadmap

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# Importance of Innovation and Research

EirGrid operates and develops the electricity transmission system in Ireland and, more recently, has been mandated to operate, develop and own Ireland's offshore grid. SONI has responsibility for planning the development of the onshore electricity system in Northern Ireland. We operate, implement changes and enhance the wholesale electricity market on the island of Ireland. EirGrid also develops and operates interconnections with neighbouring grids and enables third-party interconnectors. We send power from where it is generated to where it is needed.

Both EirGrid and SONI have a critical role to play on the island of Ireland in helping to deliver on the respective climate targets. We are world leading Transmission System Operators (TSOs) in variable renewable electricity integration. Through the successful progress of strategic innovation programmes such as DS3<sup>2</sup>, we have developed solutions that allow us to currently operate the system with up to 75% renewable generation at any given moment, primarily from wind generation. Our collective ambition is to achieve whole economy net zero carbon emissions, resulting in the need for a transformed energy system. The key to this transformational journey is our ability to innovate and address ever more complex system, market, and infrastructure challenges.

The governments of Ireland and Northern Ireland have set ambitious targets for the expansion of renewable electricity.

In Ireland, Climate Action Plan 2023 (CAP23) was published in December 2022 and explicitly sets out updated emission reductions aligned with carbon budgets and sectoral emissions ceilings. It also sets targets of 80% RES-E, 9 GW of onshore wind, 8 GW solar and at least 5 GW of offshore wind energy by 2030.

In Northern Ireland, in June 2022, the Climate Change Act (Northern Ireland) came into force. This legislation commits Northern Ireland to achieving emissions reductions of 48% from 1990/1995 level and net zero carbon emissions by 2050. Part of this legislation updated the requirements of the Energy Strategy in setting a

new target of achieving at least 80% RES-E in Northern Ireland by 2030. The legislation also requires Northern Ireland to introduce carbon budgets, with the first budget to cover the period 2023 to 2027, and also requires that Northern Ireland publish a Climate Action Plan by June 2024.

Given the updated legislation, the Shaping Our Electricity Future initiative outlines a blueprint for a secure transition to deliver a lower carbon intensive electricity system that can deliver up to 80% RES-E power system by 2030 in both Ireland and Northern Ireland.

This significant electricity system transition will need to be delivered while retaining the essential reliability, resilience, and affordability of the Irish and Northern Irish electricity systems. We also need to consider the impacts of ageing infrastructure, the retirement and displacement of fossil fuel generators, an increase in renewable electricity supply, new technologies and storage, a rise in demand from large energy users and distribution connected customers, the social impacts of electricity infrastructure and a change in consumer preferences, behaviours, and expectations for their electricity supply.

The journey to net zero carbon will see many transformational changes. Demand patterns are expected to radically alter as transport and heating sectors are electrified, taken together with demand growth from large industrial energy users, this will result in a significant increase in system demand. A significant portion of the generation that will be developed over the coming years- both large and small scale- will be powered by wind and solar energy. These sources are inherently weather dependant leading to periods of both surplus and scarcity, resulting in a future where large quantities of surplus zero carbon energy needs to be stored, flexibly utilised, or exported from the island. This decarbonised future will cause unprecedented change in how we plan, develop and operate the island's electricity grids.

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<sup>2</sup> EirGrid Group, DS3 Programme

Over the coming decade new technologies such as vehicle-to-grid, smart tariffs, and lower cost renewables will give customers of all sizes greater choice of how they meet their energy usage. We expect that soon all segments of society, through the emergence of the energy citizen, will be able to increase their understanding and participation in energy markets. In the future we anticipate a more complex power system ecosystem, which from a system operation perspective will present unprecedented challenges. We need increased stakeholder engagement and collaboration with our existing and new partners. We need all parts of the power system ecosystem to actively participate as innovation champions to bring solutions that unlock the benefits of whole system thinking.

The purpose of our refreshed Innovation and Research Strategy is to position EirGrid and SONI to innovate at a greater pace and scale to address these ever-more-complex, system-wide challenges.

Whilst the strategy laid out in this Innovation and Research Strategy document identifies a roadmap to delivering increased levels of innovation, the Annual Innovation Report documents provide updates on current projects and point out our ambition for future developments of programmes and potential new initiatives. Many of the innovative programmes are directly aimed at delivering on the Shaping Our Electricity Future Roadmap and will be critical to its success.

A consultation will accompany each of the Annual Innovation Reports so that we can gather the views of our stakeholders. We will also address gaps in our price control allowances and use this process as a mechanism to seek approval from the regulatory authorities in Ireland and Northern Ireland to undertake new innovative programmes.



# Purpose of Innovation and Research

As set out in our strategy 2020-25<sup>3</sup>, our purpose is to “transform the power system for future generations” in support of carbon neutrality by 2050 and to protect our planet for current and future generations. Strategy 2020-25 states our commitment to pursue innovation in all aspects of our work. This refreshed Innovation and Research Strategy is reaffirmation of that commitment and sets out tangible steps to transform us into more innovative companies.

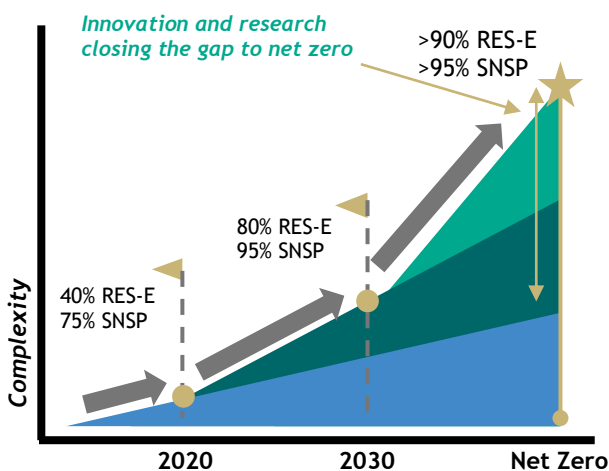
We are currently delivering a portfolio of innovation programmes to achieve government targets on RES-E and emissions. The net zero carbon targets now necessitate enhancing and accelerating our approach to overcome the natural limitations of many established technological, operational and market practices, and delivering ever-greater innovation capability and solutions to address whole system challenges.

Delivering on the targets requires an accelerated understanding of the energy system over multiple time horizons and continual delivery of novel, whole system solutions to overcome the challenges ahead. We also need to accelerate and scale how we innovate, ensuring our efforts are fully focused and coordinated to efficiently solve the highest priority challenges alongside key partners, such as the Global Power System

Transformation Consortium<sup>4</sup> and the best national and international research organisations.

Our Innovation and Research Strategy refresh is a step in activating our innovation purpose, helping EirGrid and SONI to realise our ambition and continue positioning us at the heart of the energy transition. Finally, it identifies several strategic innovation programmes aiding us to meet the targets.

EirGrid and SONI’s role is to provide efficient and effective solutions to decarbonise the all-island power system on behalf of society while maintaining a reliable and secure electricity supply for consumers. In support of this, our Shaping Our Electricity Future initiative outlines a blueprint for a secure transition to deliver an electricity system that can deliver up to 80% RES-E power system by 2030 in both Ireland and Northern Ireland. We recognise that many challenges lie ahead. Our refreshed Innovation and Research Strategy will help prepare EirGrid and SONI to close the gap, recognising the need to collaborate in a different and more comprehensive way across a wider spectrum of stakeholders, working together to solve challenges and successfully meet the government set targets.



## EirGrid Group Strategy 2020-2025

*“Embrace change and innovation to make a real difference”*

## IEA Global status of clean energy innovation in 2020

*“A clean energy transition to net-zero emissions requires a radical change in both the direction and scale of energy innovation.”*

## EU Clean Energy Strategy

*“To reach climate neutrality, we need to decarbonise at least six times faster than anything realised globally so far”*

*“Research and innovation are critical for delivering the solutions and system transformations”*

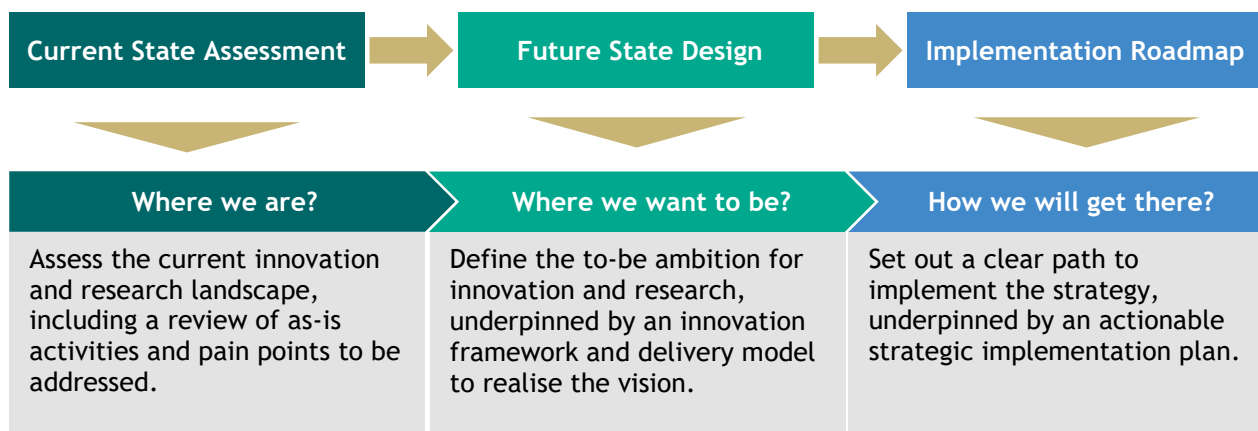
<sup>3</sup> EirGrid Group, Strategy 2020 - 25

<sup>4</sup> The Global Power System Transformation Consortium

# Approach to Developing the Innovation and Research Strategy

EirGrid and SONI held an open competitive process and retained the services of a partner who is a leader in innovation strategy development to support us in the development of our Innovation and Research Strategy. Their expertise aided us in setting appropriately ambitious targets to deliver on our intent. The strategy development process involved assessing:

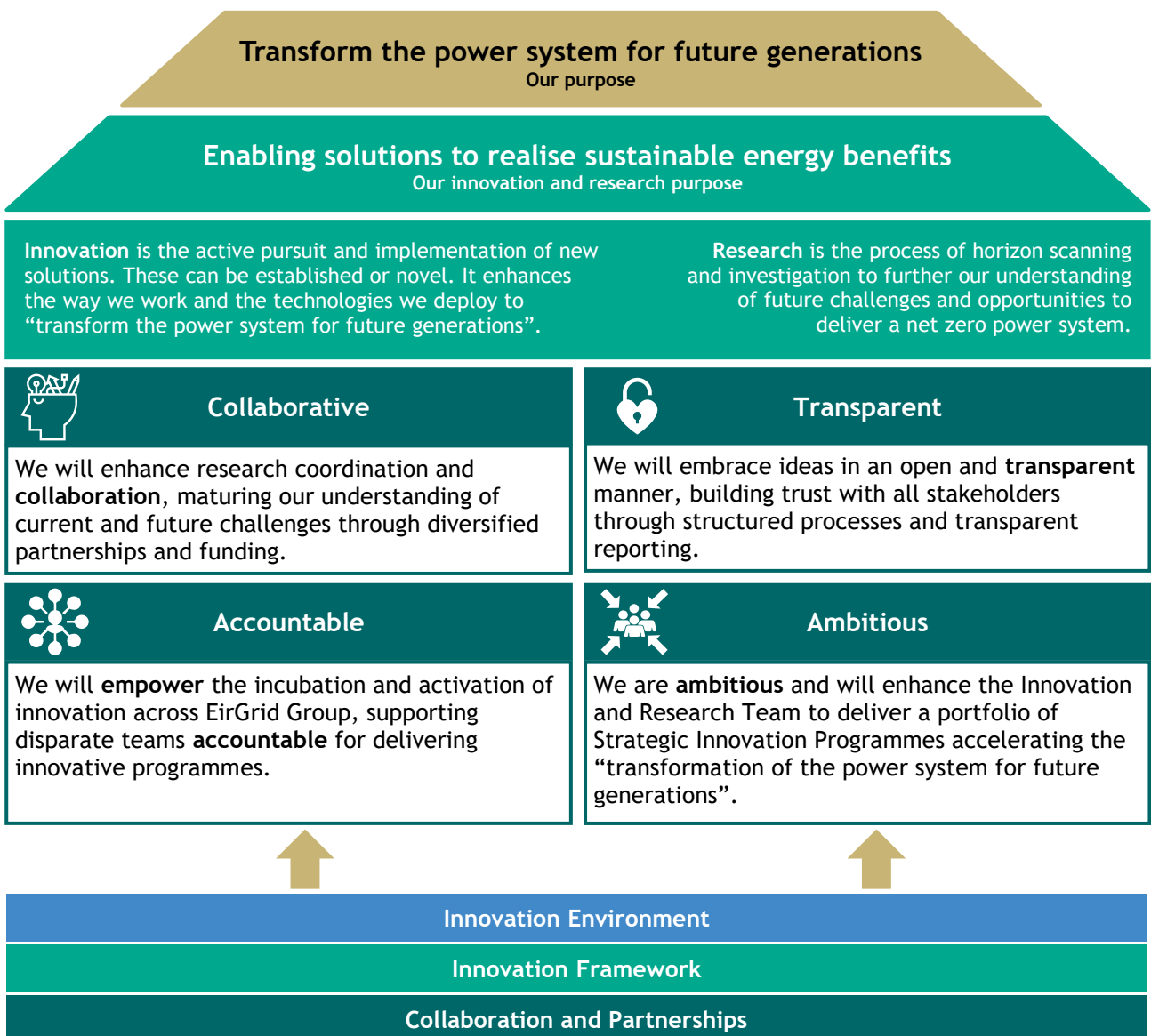
- **Where we are:** Assess the current innovation and research landscape, including a review of as-is activities, existing governance, risk appetite and capabilities to be leveraged and pain points to be addressed.
- **Where we want to be:** Define the to-be ambition for innovation and research, underpinned by an Innovation Framework that activates our innovation purpose, identifies future capabilities needed and articulates a clear and transparent end-to-end process. Develop the delivery model to realise this to-be ambition, including governance.
- **How we will get there:** Set out a clear path to implement the strategy, underpinned by an actionable strategic implementation plan and clear roadmap to deliver the strategic innovation programmes. We have agreed to maintain a moderate risk appetite for supporting innovative programmes. Delivering on the identified key enablers will be a three-year journey that aligns with the end of our 2020-2025 strategy, however within this three-year period we will continually assess our progress and alter the approach as required. The key enablers are covered in the next section.



# Overview of Innovation and Research Strategy

Our Innovation and Research Strategy outlines our innovation and research purpose as ‘enabling solutions that realise sustainable energy benefits’. To achieve this, our ambition is to enhance our approach to innovation, actively pursuing and implementing new solutions, both established and novel, to improve the way we work and the technologies we deploy. We will also enhance our approach to research, horizon scanning and investigating to further our understanding of future challenges and opportunities to deliver on the government targets.

We have defined an ambition which recognises our pioneering renewable integration capability in tandem with a need to be a fast follower of advancing innovation where appropriate. The fast follower approach enables us to utilise our investments strategically, minimising risk by adopting innovations and research from across the industry to the unique environment of the island of Ireland. This approach will enable us to work on several concurrent strategic programmes, learning fast and moving on to deliver the maximum value to the citizens of Ireland and Northern Ireland.





The focus of the strategy is to identify and define the factors that will enable us to deliver on our ambition. These core foundational elements can be summarised as follows:

- **Innovation Environment:** To enable our teams and collaborators to innovate effectively, we must work in an environment that enables and encourages innovation. We have identified several key enablers that will directly challenge current thinking and look to leverage opportunities both internally and externally. As the environment changes and the needs of innovators adapt, these key enablers will be reviewed and updated accordingly. Delivering on these key enablers

will be a three-year journey that aligns with the end of our 2020-2025 strategy.

- **Innovation Framework:** Enhancing the processes, governance, and toolkits to deliver innovation at scale that will help us realise our future ambition.
- **Collaboration and Partnerships:** Enhancing a connected and inclusive stakeholder ecosystem that ideates, incubates and activates innovation collaboratively with others.

We have identified several key enablers having the potential to enhance our ability to engage and collaborate more effectively with relevant stakeholders and partners as we innovate



### Research Forum

To ensure that research projects and research needs are shared and coordinated across EirGrid and SONI, we established the Research Forum. It aims to enable subject matter experts across the companies to share information on research activities to enhance knowledge sharing and facilitate a co-ordinated and efficient approach. We want to push this further to enhance research capability through partner diversification, secure additional funding to increase volume and value of research.



### Time and Space to Innovate

Our people are eager to innovate and are bursting with great ideas. As innovation requires time and space to thrive, we want to offer our people opportunities and time to innovate away from operational responsibilities. Therefore, we are going to expand our range of flexible (physical and virtual) collaboration spaces to provide our people and partners an environment in which they can work creatively and cooperatively on pioneering solutions to challenges.



### Innovation Champion

To ensure that every idea - whether incremental or pioneering - gets heard and progressed appropriately, we want to establish a network of Innovation Champions. Their task will be to promote ideation within each Chief Office supporting our people developing their ideas. They will oversee sharing ideas within the organisation and connecting like-minded people.



### Digitise the Innovation Process

Digitisation is key to speed up the pace of innovation. To increase innovation process, scale, pace and efficiency, we want to enable digital management of enterprise innovation - from generation of ideas by internal and external sources through to the selection of ideas for implementation - by leveraging an innovation platform. This will allow us to share information and make it available to everyone within the company, thus promoting transparency of the process.



## Training and Development

We want to accelerate EirGrid and SONI's innovation maturity. To enable our people to innovate in a targeted and efficient way, they need to be adequately empowered. Therefore, we aim to complement EirGrid and SONI's training and development system with a set of Innovation and Research relevant training material. Leveraging this, we strive to establish an Enhanced Innovation and Research Team along with baseline innovation competency across EirGrid and SONI and promote advanced innovation skills in roles across the companies.



## Innovation Trials Sandbox

Some of the new technologies require new approaches to trials and demonstrations. We want to unleash the potential of customers to solve problems by exploring an Innovation Trials Sandbox. This means enhancing the ambition and scope of innovation trials, securing mechanisms to enable new technologies, products and services in support of innovators, assessing lower Technology Readiness Level (TRL) solutions and quantifying benefits so that we learn more about these before their wider deployment. Therefore, we need to continue exploring this concept with the regulatory authorities and with our stakeholders.



## Enhanced Funding Management

This enabler seeks to optimise funding arrangements currently available and diversify funding options for future innovation and research. Additional sources will complement the regulatory funding sources. Examples include research funding available within Ireland, Northern Ireland and across Europe. We also want to be involved in future partnerships and collaborations around funding opportunities. Therefore, we want to further enhance alignment with EirGrid and SONI priorities through effective planning and management of funding and increase the scale of resources and innovation through diversified funding sources, joint funding applications and efficiency.

# Strategic Innovation Programmes

Several innovation projects are either in flight or due to commence as part of programmes of work, such as Shaping our Electricity Future. During the development of our Innovation and Research Strategy we took the opportunity to do a horizon scan of activities which we felt warranted further investigation. We identified a small number of trends in the energy sector which we are currently not investigating. As part of the Annual Innovation Reports we will look at these and make recommendations for activities which we believe warrants further detailed

exploration. The innovation report will also flag if further regulatory allowances are required to deliver on these areas.

The programmes outlined have different lenses as to when the benefits will be realised, however all need to begin imminently to ready ourselves, so we can meet the targets.

These programmes are of importance now and many will continue to be so after 2025. We will continually assess these programmes and will evolve them as learnings emerge.

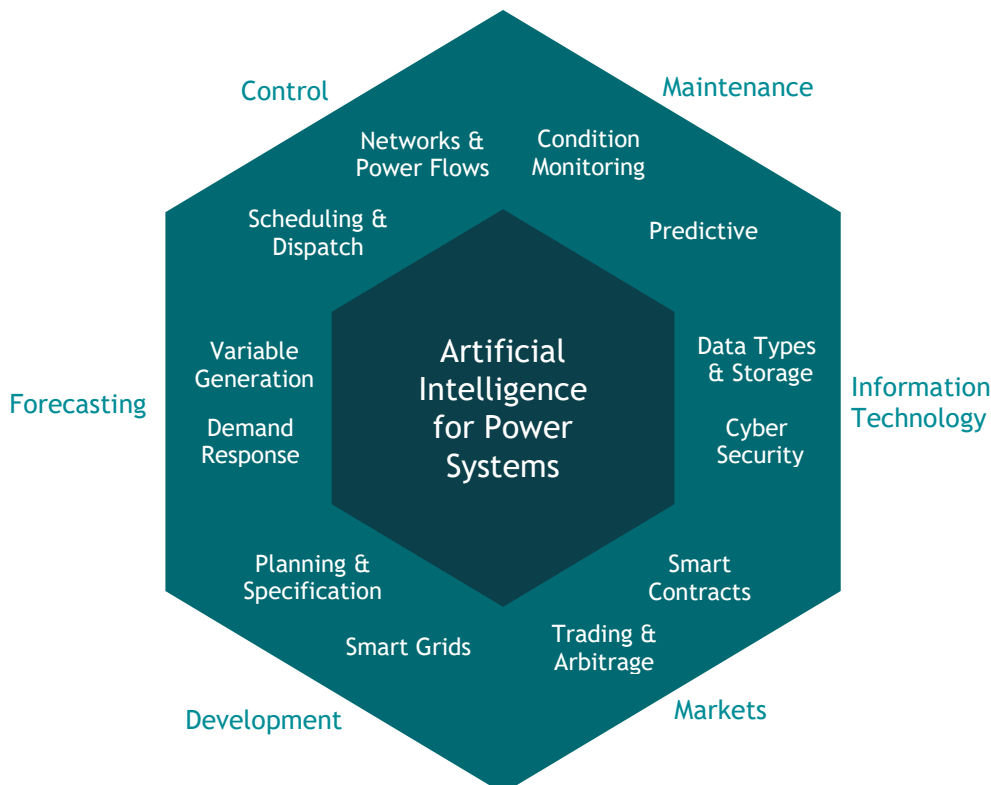
## Enhance data-driven decision-making leveraging artificial intelligence capability

### Objective

Support the development of EirGrid and SONI's next generation artificial intelligence capability to enhance data driven decision making and transparency.

### Benefit

Continue the collaboration at EirGrid and SONI for next generation artificial intelligence technologies and use cases. Build EirGrid and SONI's capability in explainable artificial intelligence and promote data governance and open data to bring society, decision-makers and industry on the machine-enabled decision-making journey. Explore opportunities to use artificial intelligence or machine learning capabilities across a variety of areas including network planning, forecasting within both control centres and predictive maintenance to support asset management for EirGrid.



## Flexible Network Strategy

### Objective

Continue understanding and utilising the benefits of flexible network technologies to maximise the use of the transmission grid while minimising the requirement for new network build.

### Benefit

To meet our carbon emission and renewable energy targets, we have investigated flexible network technologies, such as Dynamic Line Ratings and Dynamic Power Flow Controllers. These technologies can provide a means to reduce network congestion, act as an alternative to extensive new network build, provide system services/operational flexibility, maximise utilisation of existing network assets, enable greater output from RES-E generation hubs and create potential economic/reliability benefits. We are at a stage where we are implementing these technologies and we must find innovative ways of extracting the most benefit. For example, understanding most suitable locations for large scale demand and generation.

## Understanding pathways to 100% SNSP

### Objective

Translate net zero carbon pathway research into real-world trials of next generation technologies and routes to integration.

### Benefit

Enhance EirGrid and SONI's understanding of pathways to 100% SNSP by assessing the impact and real-world performance of mass integration of emerging technologies such as inverter-based resources (wind and grid scale PV), grid forming control, electrolysers, and distributed energy resources (for example small scale PV). Prepare EirGrid and SONI to operate at 100% SNSP by delivering minimum viable products (MVPs) and trials to further inform EirGrid and SONI's understanding of the solutions required and routes to integration.

## Champion the Emergence of the Energy Citizen

### Objective

Continue understanding and facilitating consumers' changing interaction with power system technologies and services.

### Benefit

Continue enhancing EirGrid and SONI's understanding of all aspects of an active energy citizen, their behaviour and what drives their choices. Prepare EirGrid and SONI to play our role in facilitating the relevant national policies with respect to community participation and best practice pre-application community consultation programmes. Trial and iterate solutions to gain deeper understanding of new energy technologies (for example small scale PV, smart tariffs etc), the scale of consumer investment and how these can support EirGrid and SONI transform the power system for future generations. Support our public engagement strategies by disseminating best practice research on community engagement and participation.

## Setting the course for the Control Centre of the Future

### Objective

Identify what security tools and capabilities are required to maintain the protection of EirGrid and SONI's control centres now and in the future.

### Benefit

Maintain the use of only the best security tools with regard to detection, protection and monitoring. Foster excellent relationships with reputable, well-established security partners. Continue to improve and modernise security posture to meet the demands of the evolving threat landscape. Intensive engagement of the EirGrid Enterprise Security team in identifying new tools and features as well as establishing the Control Centre of the Future.

## Lead the island's electricity sector on sustainability

### Objective

Accelerate and expand implementation of existing grid-wide evidence-based environmental measures, and wherever possible, move beyond impact avoidance/reduction to enhance the environment in response to the biodiversity and climate emergency.

### Benefit

Continue to enhance EirGrid and SONI's and society's understanding of the impact the power sector has on the all-island environment, and support learning and skill development to achieve the transition. Deliver societal benefits and support societal engagement with EirGrid and SONI by publishing evidence of clear and measurable action on environmental protection and enhancement. Prepare EirGrid and SONI to innovate alongside our stakeholders and customers in the pursuit of a fully sustainable and circular power system with minimal impact and enhancement of the environment over every timeframe. EirGrid and SONI will continue to evaluate emissions based on Science Based Targets and will make any results transparent. Integrate and retrofit assets with biodiversity mitigations and, where possible, enhancements. Standardise nature inclusive design on EirGrid delivered offshore grid assets and support and advise developers in their own sustainable contestable design. This requires consideration of the effects of the continued growth of offshore windfarms on marine ecosystems to include hydrodynamics and sediment transport, fisheries, birds, and marine animals.

## Prepare for a multi-purpose offshore HVDC grid

### Objective

Understand the capabilities and dependencies to delivering a multi-purpose, multi-terminal, multivendor high voltage direct current (HVDC) grid.

### Benefit

Continue enhancing EirGrid and SONI's understanding of HVDC technologies and their development roadmap. Prepare EirGrid and SONI to embrace and develop HVDC assets considering the asset lifecycle from technology qualification to asset management. Prepare EirGrid and SONI to support the development of multi-purpose HVDC grids by understanding the implications for infrastructure development, multi-jurisdictional grid operation and multi-purpose, multi-jurisdictional markets. Participate in international working groups to further develop policies, technical standards, financial and legal frameworks for HVDC offshore grids.

## Grow EirGrid TSO capabilities for developing and operating the new offshore grid

### Objective

Support EirGrid to develop scalable processes and solutions to manage the development of an offshore network.

### Benefit

Enhance EirGrid's understanding of best practice and next generation offshore Transmission Asset Owner capabilities and solutions. Prepare EirGrid to fulfil its role in the planning, development, operation, and maintenance of an offshore transmission system throughout the three phases of the network development model. Enhance ways of engaging with communities and developers through novel solutions, processes, and data. Reduce the cost and risk of working offshore through digital solutions.

In Northern Ireland, SONI continues to support the Department for the Economy in its development of an Offshore Renewable Energy Action Plan.

This includes a collaborative approach with a number of key stakeholders and government departments.

# Plan for a net zero carbon, customer focused, export capable power system

## Objective

Facilitate a plan led, whole system approach to scheduling and exporting large volumes of renewable energy via electrical interconnection or via emerging energy carriers such as hydrogen and its derivatives

## Benefit

Continue to enhance EirGrid and SONI's understanding of the opportunities and challenges resulting from a range of emerging renewable technologies that are quickly becoming technologically and economically feasible at large scale, for example solar PV and offshore. Continue to investigate production scenarios of hydrogen and its potential to act as a long-term seasonal store of renewable energy. Continue to investigate other technologies to complement Ireland and Northern Ireland's large renewable resources such as batteries, pumped hydro storage and additional electrical interconnection with neighbouring countries. Prepare EirGrid and SONI to facilitate and capture benefits arising from the mass deployment of these new technologies and the benefits to the power system and its customers of potentially becoming an energy exporter.

## Next Steps

This strategy outlines our vision and ambition to enhance our innovation and research capability.

On an annual basis we will publish an Annual Innovation Report. This will outline the innovative projects and programmes of work which are enabling the delivery of Shaping Our Electricity Future roadmap. The report will also outline some of the longer-term strategic innovation areas which we believe we need to investigate and seek feedback on. We will then provide this to the regulatory authorities and request additional allowances if necessary. We will refresh the Innovation and Research Strategy as new learnings emerge and we will evolve the Strategic Innovation Programmes where needed to ensure we realise our Innovation and Research purpose.

