



Innovation & Research Strategy

December 2021



Foreword

I am delighted to publish this refreshed innovation strategy on behalf of EirGrid Group.

The power system will require unprecedented change over the coming decade. We project that Ireland and Northern Ireland will need upwards of 10 gigawatts (GW) of electricity from clean sources. This will be 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 sustainable energy benefits. How we respond to the challenges we are facing in the next decade will not only affect our ability to achieve 2030 targets, but put in place the capabilities, knowledge, processes and collaborative relationships that will be vital on our journey to achieving net zero carbon by 2050.

Our refreshed 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 people to help make this happen.

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 the innovative programmes are directly aimed at delivering on the Shaping Our Electricity Future roadmap, and will be critical to its success. Additionally, 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 Group's view of the crucial areas of innovation that need to be investigated to ensure we can respond effectively to the challenges ahead.

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. This strategy complements recent publications from the EirGrid Group on Shaping Our Electricity roadmap to 2030, by focusing our collective research and innovative strategies to deliver on Ireland's and Northern Ireland's respective ambitions to 2030, while enabling and supporting the innovation and research in our ecosystem to deliver on longer term net zero carbon commitments.

Whilst our ambition to net zero carbon is decades away, it is vital we begin our journey of discovery now. We need to understand the options and solutions which will work best for the Island of Ireland, to ensure we are on the right path to deliver on a cleaner energy future.



Liam Ryan, Chief Innovation and Planning Officer

1. The Importance of Innovation & Research to EirGrid Group

EirGrid Group is made up of EirGrid plc (the Transmission System Operator for Ireland), SONI Ltd (the Transmission System Operator for Northern Ireland), SEMO (the Single Electricity Market Operator for the Island of Ireland), EirGrid Interconnector DAC and EirGrid Telecoms DAC.

As a group of companies we operate the electricity transmission grid in Ireland and Northern Ireland. We also plan the future of the grid on the island of Ireland, operate the grid every minute of every day, link with neighbouring grids in countries such as Scotland and Wales (interconnection), and run the wholesale electricity market (where electricity is bought and sold by generators and suppliers). In brief, we make sure that everyone has power when they need it at the most economic price possible.

EirGrid Group has a critical role to play on the Island of Ireland helping to deliver on our respective climate ambition targets. We are leading Transmission System Operators (TSOs) in variable renewable energy integration. Through the successful delivery of strategic innovation programmes 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. Over the coming decades, our collective ambition is to achieve net zero carbon emissions, resulting in the need for a transformed energy system. Key to this transformational journey is our ability to innovate and address ever more complex system, market, and infrastructure challenges.

Recent Government policies in Ireland and in Northern Ireland has set ambitious renewable energy targets. In Ireland, the Climate Action Plan states that up to 80% of electricity will be generated from renewable energy sources (RES-E) by 2030. In Northern Ireland, the target in the Energy Strategy for Northern Ireland is to meet at least 70% of electricity consumption from a diverse mix of renewable sources by 2030. Also, in the UK, the government is pursuing net zero carbon emissions by 2050. Both targets will require us to break new ground in the amount of RES-E we manage on the electricity system.



The Shaping Our Electricity Future¹ initiative outlines a secure transition to deliver the 2030 renewable ambition. In consultation with governments, regulators, and stakeholders we have used scenario-based analysis across the whole electricity system to identify a roadmap to delivery of the renewable ambition in an economic and reliable fashion. Given the relatively short planning horizon to 2030, Shaping Our Electricity Future provides a deliverable, economically feasible, dynamic, and transparent roadmap that delivers system reliability while meeting the renewable ambition. This analysis is on achieving at least 70% RES-E by 2030. However, the future evolution of the power system beyond 2030 is also implicitly considered in delivering the broader EU and UK ambition of net zero carbon emissions in the economy by 2050.

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 and operate the island's electricity grid. New technologies will afford customers of all sizes greater control over their energy usage and increase participation in energy markets across all segments of society. This will result in a more complex environment from a system operation perspective presenting new challenges not previously seen before. Increased engagement and collaboration with existing and new partners and stakeholders will be required, actively participating in an innovation ecosystem that champions whole-system solutions.

Ireland's Climate Action Plan 2021 commits to increasing the country's offshore wind capacity to 5.0 GW, ensuring Ireland meets its renewable ambition. Following our appointment to the role of Transmission System Operator and the Transmission Asset Owner for Offshore Grid Assets in Ireland in May 2021, we have begun to prepare for this important step on the journey to net zero carbon.

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

Each year, EirGrid Group will publish our annual innovation report. Whilst the strategy laid out in this document identifies a roadmap to delivering increased levels of innovation, the annual innovation report shares an implementation plan of programmes to deliver on that roadmap. It will document progress on innovative programmes throughout the previous years, as well as our ambition for future developments of programmes and new initiatives to begin. 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, and ensure the programmes are deemed appropriate by all. 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.

¹ <https://www.eirgridgroup.com/the-grid/shaping-our-electricity-f/>

2. Why a refreshed Innovation and Research Strategy is required?

As set out in our strategy 2020-25², our purpose is to “transform the power system for future generations” in support of climate 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 a more innovative group of companies. This will be key in achieving the roadmap for Shaping Our Electricity Future, delivering increased System Non-Synchronous Penetration (SNSP), operating at reduced levels of inertia, and utilising advanced technologies to optimise grid operation.

EirGrid Group has a proven track record in the delivery of transformational innovation in support of the energy transition, of particular international recognition are DS3 and public engagement, and are currently delivering a portfolio of innovative programmes to achieve our 2030 goals. We are looking across two time horizons, the innovation to support the 2030 targets and the innovation and research to enable the transition to a net zero carbon system. Our net zero carbon ambition now necessitates enhancing and accelerating our approach to overcome the natural limitations of many established technological, operational and market practices, delivering ever-greater innovation capability and solutions to address whole system challenges.

” EirGrid Group Strategy 2020-2025

“Embrace change and innovation to make a real difference”

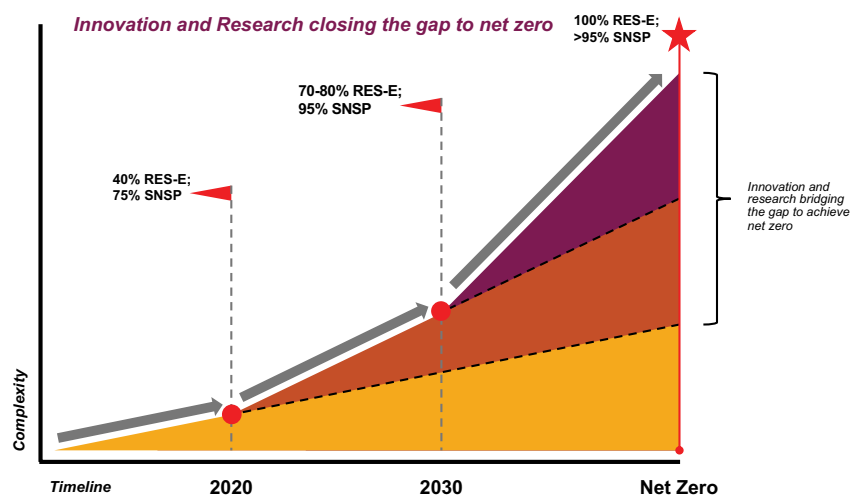
” IEA Global status of clean energy innovation in 2020

“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”



Delivering on our ambition 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 Consortium³ and the best national and international research organisations.

² <http://www.eirgridgroup.com/about/strategy-2025/> - <https://www.soni.ltd.uk/about/strategy-2025/>

³ <https://globalpst.org/>

Our Innovation and Research Strategy refresh is the first step in *activating our innovation purpose*, helping the Group to realise our ambition and continue positioning us at the heart of the energy transition. Finally, it identifies a number of innovative programmes in a co-ordinated and prioritised manner across a *now, next, beyond* lens, building on the success of our in-flight programmes, such as those planned as part of the Shaping Our Electricity Future roadmap.

EirGrid Group'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 recent *Shaping Our Electricity Future Report* sets out the roadmap to achieve our 2030 ambition. In delivering on our 2030 ambition, it is recognised that many challenges lie ahead. Our refreshed Innovation and Research Strategy will help prepare EirGrid Group 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 deliver the 2030 roadmap and beyond to net zero carbon.



3. Approach to Developing the Innovation Strategy

We held an open competitive process and retained the services of Ernst & Young (EY), a leader in innovation strategy development, to support us in the development of this strategy. Their expertise aided us in setting appropriately ambitious metrics to deliver on our intent. The strategy development process involved assessing:







- **Where EirGrid Group is today:** 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 and have defined a number of key performance indicators to measure ourselves against this target. Delivering on this innovation and research strategy 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.



From benchmarking against other Transmission System Operators (TSOs), we are aware that this approach to innovation is not just a big step for EirGrid Group but is considered an ambitious strategy for any TSO.

4. Innovation and Research Strategy Overview

The objectives of the Innovation and Research Strategy refresh are:

-  **Vision**
Define what innovation and research means for the entire EirGrid Group, positioning innovation and research to support the achievement of the strategic goals in every EirGrid Group business function
-  **Enhance Our Innovation Purpose**
Accelerate the net zero transformation by increasing innovation efficiency and delivering strategic innovation programmes at scale
-  **Strategic Approach to Research**
Establish a strategic approach to research that will enable long-term innovation
-  **Innovation Capabilities**
Strengthen our innovation capabilities to deliver further success, defining the framework to identify, qualify, prioritise and deliver innovation initiatives that will act as tools to solve problems
-  **Whole-System Thinking**
Promote whole-system thinking and cross-sectorial initiatives with key stakeholders and afford communities the opportunity to actively participate in the energy transition
-  **Strategic Implementation Plan**
Define the strategic implementation plan, including the resourcing requirements and mobilisation of the initiatives outlined in the strategy

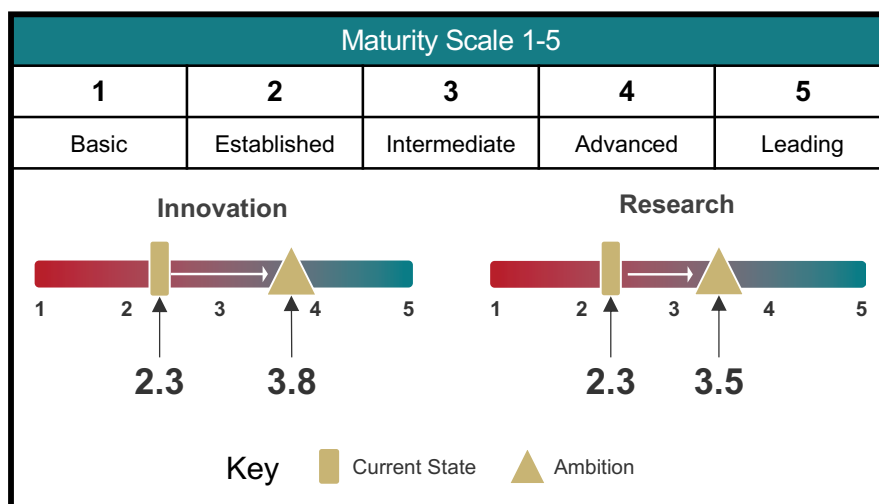
Innovation and Research Strategy Ambition

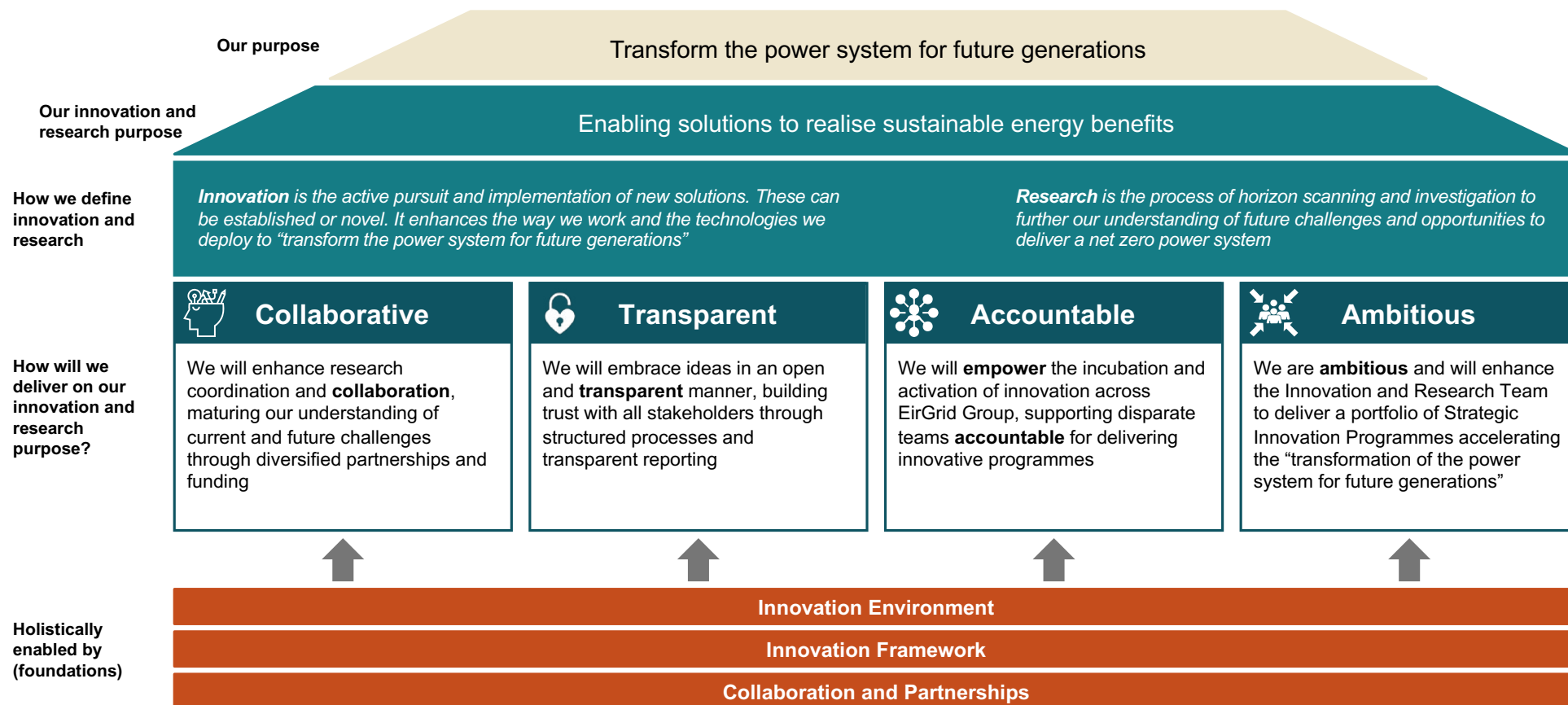
Our strategy outlines our innovation and research purpose as ‘enabling solutions that realise sustainable energy benefits’. To achieve this, our ambition is to enhance our approach to innovation, actively pursuing and implementing new solutions, both established and novel, to enhance the way we work 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 our 2030 goals and beyond to net zero carbon.

We have engaged with a broad spectrum of our employees to understand their experience of innovation and research within EirGrid Group which informed an *As-Is* maturity assessment. On a one to five maturity scale, both innovation and research were scored as 2.3, reflecting the well-established capability within EirGrid Group to deliver a small number of large strategic projects. With this level of maturity and through multiple innovation programmes (as detailed in our annual innovation reports), EirGrid Group has delivered world-leading levels of renewable penetration, with capability of operating the system with up to 75% of instantaneous renewables at any given time.

To set our innovation and research future targets, the ambition of the Northern Ireland and Ireland policies were central, supported by best national and international practices and our experience with previous cutting-edge innovation and research programmes. 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 adapting innovations and research from across the industry to the unique environment of the Island of Ireland. This approach will enable us to work on a number of concurrent strategic programmes, learning fast and moving on to deliver the maximum value to the citizens of Ireland and Northern Ireland.

Working with a project steering group on the agreed ambition, we quantified these targets as a 3.8 for innovation and a 3.5 for research. The aim of our Innovation and Research Strategy is to close the gap between our *As-Is* maturity, and *To-Be* ambition over the next three years. We will continue to engage with staff members across the group to understand their perspectives as well as benchmark externally to quantify the degree to which our approach is delivering on this ambition.





Innovation & Research Strategy Content

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 a number of 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.
- **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.

Collaborative Key Enablers

A number of the key enablers were identified as having the potential to enhance our ability to engage and collaborate more effectively with relevant stakeholder and partners as we innovate. They are simple in description, however have the potential to reap great benefit to EirGrid Group, our partners and stakeholders.

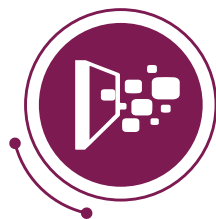
Key Collaborative Enablers



Strategic Research



Innovation Trials Sandbox



Time and Space to Innovate



Enhanced Funding Management

Strategic Research

- **Description:** To ensure the strategic needs of the organisation are met, enabling us to solve future challenges, a strategic approach to research is required. We will share and discuss our priorities in a co-ordinated manner, enabling the identification of a broad spectrum of research that can support these goals. We will look to increase the diversity of our research partners nationally and internationally and ensure that we are learning from what others are doing in the wider eco-system.
- **Rationale and Benefits:** Align EirGrid Group's research activity and funding with priority challenges. Enhance research capability through partner diversification. Secure additional funding to increase volume and value of research into EirGrid Group.

Innovation Trials Sandbox

- **Description:** Current frameworks provide strictly defined process for new technologies. We are now in a world of transformative change and these frameworks may unduly prevent innovation. This proposal is to unleash the potential of customers to solve problems by exploring an Innovation Trials Sandbox; facilitating innovation trials or bring to market new technologies, products, services, or business models. We need to explore this concept with the regulatory authorities and with our stakeholders.
- **Rationale and Benefits:** Enhance the ambition and scope of innovation trials. Secure mechanisms to eliminate barriers to trials of new technologies, products, and services in support of innovators, assess lower technology readiness level (TRL) solutions and quantify benefits so that we learn more about these before their wider deployment.

Enhanced Funding Management

- **Description:** Currently the majority of our funding for innovation related activities comes via the regulatory price control process. This proposal seeks to optimise funding arrangements currently available and diversify funding options for future innovation and research. 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.
- **Rationale and Benefits:** Ensure alignment with EirGrid Group priorities through effective planning and management of funding. Increase the scale of resources and innovation through diversified funding sources, joint funding applications and efficiency.

Time and Space to Innovate

- **Description:** There is currently a very ambitious programme of works to deliver on our strategy and the 2030 ambitions. We recognise however that we need to provide our people the time and space away from their day jobs to innovate. This involves providing our people and partners an environment to work creatively on current and future challenges for the power system.
- **Rationale and Benefits:** Afford our people opportunities and time to innovate away from operational responsibilities. Establish a flexible (physical and virtual) collaborative space to position EirGrid Group at the forefront of innovation in the TSO space. Attract Ireland, Northern Ireland, and international partners to collaborate.

5. Strategic Innovation Programmes

On a cyclical basis, over a number of years, EirGrid Group goes through price control processes with the respective regulatory authority. This process is to identify the activities and the funding needed to deliver on the activities.

A number of innovative project and programmes are either in flight or due to commence as part of programmes of work, such as Shaping our Electricity Future. As part of the development of our new Innovation and Research Strategy we took the opportunity to do a horizon scan of activities which we felt warranted further investigation. Combining both EY and EirGrid Group's global network of TSOs and other industry experts, we identified a small number 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 are capable of meeting our future ambition.

- Programmes in the *now* timeframe will be instrumental in aiding us to deliver on our 2030 ambition of 70 - 80% RES-E and 95% SNSP (system Non-Synchronous Penetration).
- *Next* Programmes are aimed at pushing the boundary beyond our 2030 ambition.
- Programmed targeting the *beyond* timeframe are laying the foundations to enable net zero carbon.

Programmes to deliver benefits in the “Now” Timeframe:

1 - Flexible network strategy

Objective

Understand and utilise 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 targets, flexible network technologies, such as Dynamic Line Ratings and Dynamic Power Flow Controllers, need to be investigated and trialled. 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.

2 - Champion the emergence of the energy citizen

Objective

Understand and facilitate consumers’ changing interaction with power system technologies and services.

Benefit

Enhance EirGrid Group’s understanding of the disparate energy citizen segments, their behaviours and what drives their choices. Prepare EirGrid Group 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 the technologies and the scale at which consumers are investing in and how these can support EirGrid Group transform the power system for future generations. Support our public engagement strategies⁴ by disseminating best practice research on community engagement and participation.

3 - Lead the island’s electricity sector on sustainability

Objective

Increase the visibility of the impact our collective actions have on the environment and assist in reducing this impact.

Benefit

Enhance EirGrid Group’s and society’s understanding of the impact the power sector has on the environment and the natural ecosystem of the island. Enhance EirGrid Group’s understanding of how to leverage its capabilities to champion sustainability and biodiversity on the island. Prepare EirGrid Group to innovate alongside our partners and society in the pursuit of a fully sustainable and circular power system with minimal impact on our environment over every timeframe.

⁴ <https://www.eirgridgroup.com/site-files/library/EirGrid/EirGrid-Public-Engagement-Strategy.pdf>
https://www.soni.ltd.uk/__uuid/eddbfb33-2c82-441e-b7e1-77d529df4ac1/SONIs-Powering-The-Future-Grid-Development-Process-brochure-20-8-21.pdf

Programmes to deliver benefits in the “Next” Timeframe:

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

Objective

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

Benefit

Enhance EirGrid Group’s understanding of next generation artificial intelligence and machine learning technologies and use cases. Prepare EirGrid Group to lead multi party collaborations on whole system open data initiatives to drive the digitisation, decentralisation, and decarbonisation of the energy system. Build EirGrid Group capability in explainable artificial intelligence and data transparency to bring society, decision-makers and industry on the machine-enabled decision-making journey.

5 - Grow EirGrid Group ‘s capabilities to support new role as offshore TAO

Objective

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

Benefit

Enhance EirGrid Group’s understanding of best practice and next generation offshore Transmission Asset Owner capabilities and solutions. Prepare EirGrid Group 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.

Programmes to deliver benefits in the “Beyond”

6 - Prepare for a multi-purpose offshore HVDC grid

Objective

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

Benefit

Enhance EirGrid Group’s understanding of HVDC technologies and their development roadmap. Prepare EirGrid Group to embrace and develop HVDC assets considering the asset lifecycle from technology qualification to asset management. Prepare EirGrid Group 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.

7 - Support the understanding of pathways to 100% SNSP through pioneering research and technology trials

Objective

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

Benefits

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

8 - 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 generation via emerging technologies such as hydrogen.

Benefits

Enhance EirGrid Group’s understanding of the opportunities and challenges resulting from a range of novel technologies that are quickly becoming technological and economically feasible at scale for example electrolysis or power to X. Understand possible synthetic production and demand scenarios to assess impacts on generation and transmission development. Prepare EirGrid Group to facilitate and capture benefits arising from the mass deployment of these new technologies for the benefit of the power system and its customers.

6. Next Steps

This strategy outlines our vision and ambition to enhance our innovation and research capability over the next three years.

We have already made significant steps in the Shaping our Electricity Future report to outline the roadmap required to deliver on a power system which can operate with at least 70% renewable electricity.

On an annual basis we will publish an Innovation Report. This will outline the innovative projects and programmes of work which are enabling the delivery of Shaping Our Electricity Future. The report will also outline some of the longer term strategic innovative areas which we believe we need to investigate and seek feedback on these. We will then provide this to the regulatory authorities and request additional allowances if necessary.





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