Innovation Report Summary

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1 Introduction

Welcome to the highlights summary of our 2024 Annual Innovation Report.

As the transmission system operators for Ireland and Northern Ireland, EirGrid and SONI have a unique role to play in supporting the transformation of the power system to meet the needs of today as well as the future. As we continue working towards obtaining 80% of our electricity from renewable sources in line with Government targets, we are also working towards meeting the national climate objectives in the run up to 2050.

Meeting the energy demands of tomorrow presents many complex challenges and moving towards a more sustainable future requires significant transformation. Innovation and research will be essential for helping us solve these challenges while realising secure, affordable and sustainable energy benefits.

Our Innovation and Research Strategy forms an important part of our planning and will help us to ensure we can deliver effective solutions for the future.

In this summary, we share the details of the innovation projects we are currently working on with highlights from the past year.

2 What we're looking to achieve

In 2024, we published 17 research papers, worked with over 20 external bodies and captured over 90 ideas in our innovation process, to support the following goals:

- Integrate more renewables onto the grid.
- Better understand low carbon alternatives and energy storage to help us balance generation and demand.
- Inform our planning and decision making so that we can build roadmaps for future development.
- Explore cutting edge technologies to optimise how we work and create efficiencies.
- Work sustainably while implementing nature restoration measures across our work.

3 What are the challenges?

Meeting our decarbonisation targets, while providing secure and affordable electricity, will be very challenging and means we will need to redefine the way our energy systems work.

In order to do this, as well as meet the energy demands of tomorrow, we will need to identify solutions that are able to account for aspects such as:

- Supporting social and economic growth as we provide power for more new homes and businesses.
- Increasing demand for electricity – we will need more electricity to support changes to how we travel and heat our homes and workplaces, as well as to support a growing population.
- Powering our evolving economy and society by an energy system led by renewables such as wind and solar.
- Building a stronger transmission grid, both onshore and offshore, that can support renewables and an increasing demand for electricity.
- Improving our energy security by investing in low-carbon domestic generation capacity.
- Providing affordable electricity and reducing the impact of volatile fossil fuel prices.
- Putting solutions in place such as clean energy storage, to help meet demand when wind and solar are low.

4 Key research focuses in 2024

Below is a summary of the different projects we are currently working on to help us solve these challenges while working towards a cleaner future:

4.1 Continue planning for a net zero network

As we continue to work towards decarbonising the grid, we are looking to understand what new technologies and innovation can help us create a network, powered by renewables, that can meet the growth in demand. This work includes looking at green fuels such as green hydrogen, as well as different types of energy storage.

4.2 Maximise existing grid infrastructure

Flexible network technologies aim to help maximise existing grid infrastructure so that it can carry more electricity. As part of this project, we are researching a range of different technologies while providing feedback on those that are very new to support their development.

4.3 Increase the System Non-Synchronous Penetration (SNSP) limit

To meet the Government's climate targets, we need to be able to increase what is known as the System Non-Synchronous Penetration (SNSP) limit. This is the percentage of electricity the transmission system can accommodate from renewable sources at any one time.

There are a range of emerging technologies that can help us do this which we are looking into. The current SNSP limit is 75%, which is high by international standards, and our next milestone goal is to increase this to 80%.

4.4 Prepare for a multi-purpose offshore HVDC grid

Alternating current or AC continuously changes direction and is the most common way to move electricity around an electricity grid. Direct Current or DC flows in one direction only and is less common. However, High Voltage Direct Current (HVDC) cables are more efficient over long distances and are becoming increasingly more important as we build more interconnectors as well as offshore infrastructure. As part of our Innovation Strategy, we are researching HVDC technologies and their development roadmap.

4.5 Enhance our understanding of offshore best practices

To support the development of the offshore transmission system, we are researching ways to enhance how we work. To do this, we have already been involved in various collaborative studies and workshops. The next stage will be to gather the shared learnings as well as plan the next areas of focus.

4.6 Minimise any negative impact on the environment

As part of our work, we are looking to better understand the impact of our work on the environment. This programme covers multiple initiatives with the aim of not only minimising any negative effects we have on the environment but also exploring ways we can have a positive impact as we continue to drive a cleaner future.

4.7 Create efficiencies using Artificial Intelligence and Machine Learning

We are looking at how artificial intelligence and machine learning technologies can help us create efficiencies across the grid and control centres. We are also exploring ways in which these technologies may be able to help us forecast and predict outcomes as well as make decisions, through streamlined analysis.

4.8 Continue to research consumer behaviour and investment

As Ireland becomes more sustainable, it is important that we understand the changes in behaviour, policy and investment as well as how best to engage with citizens as they become more energy conscious. This programme of work covers multiple initiatives which are helping to inform our work.

4.9 Continue our partnerships

To support our Innovation and Research Strategy, we are also members of multiple research bodies who collaborate with us and help to inform our work.

5 2024 Project highlights

In 2024, we completed 9 projects in total. Some key highlights include:

5.1 Implementation of enhanced Control Centre Tools

To increase the levels of renewable generation on the grid, a critical step was identified to enhance the stability analysis, voltage control and frequency management capability of our control centre. Following extensive development and research, EirGrid implemented a new set of tools in 2024.

This project delivered three tools which are:

- **Look-Ahead Security Assessment Tool (LSAT)** – this tool enables our grid controllers to analyse the stability of the power system in real time and in the near future.
- **Voltage Trajectory Tool (VTT)** – this tool enables the grid controllers to assess the impact of varying sources of reactive power across the power system to ensure that local voltage management issues are managed efficiently.
- **Ramping Margin Tool (RMT)** – this tool enables the grid controllers to accurately schedule and dispatch the ramping margin services and manage changing demand and generation profiles with increased wind and solar integration.

All of these tools together allow our grid controllers to operate the system more efficiently and allow us to further facilitate the integration of renewables onto the grid.

This project was the result of 5 years' work and its success was driven by the research and expertise of EirGrid's technical team.

5.2 CleanerGrid

In 2024, EirGrid held our first CleanerGrid Award Ceremony. The CleanerGrid competition is run by EirGrid and is designed for students enrolled in a third-level institute (below PhD level) in the Republic of Ireland. The competition invites participants (either as individuals or teams) to submit projects addressing a specific prompt related to Ireland's clean energy transition, with the chance to win cash prizes for themselves and their educational institutions.

We narrowed down the submissions and the top 3 presented their projects at the final.

Due to CleanerGrid's success, we have since initiated a new cycle of the competition, to further support our work in driving awareness and innovation.

6 Next steps

We continue working collaboratively with our partners and are always looking for new opportunities to work on projects helping us to operate the grid with higher levels of renewable generation. Please reach out to us on research@eirgrid.com with any questions you may have.