ENA Annual Innovation Summary Report 2025

The Voice of the Networks

energynetworks association

Introduction

Ofgem's Innovation Funding

Ofgem, the energy regulator, has introduced funding mechanisms for innovation as part of the network price controls. The current mechanisms include:

Network Innovation Allowance (NIA)

Ofgem created the Network Innovation Allowance to support projects that explore better ways of running energy networks. These projects can be technical, commercial, or operational, and must be directly related to the network itself. Each network gets a set amount of money through the NIA as part of its overall budget. The goals are to de-risk innovation, promote learning, and drive consumer value by helping networks trial new ideas that can make the energy system cleaner, smarter, and cheaper. This funding started during the RIIO-1 price control period, continued through RIIO-2, and will carry on into RIIO-3 for electricity and gas networks, as well as the National Energy System Operator (NESO). The periods covered by these price controls are presented below.

	Electricity Transmission	Electricity Distribution
RIIO-1	2013-2021	2013-2023
RIIO-2	2021-2026	2023-2028
RIIO-3	2026-2031	2028-2033

Network Innovation Competition (NIC)

The Electricity Network Innovation Competition (NIC) was used to fund new ideas through a yearly competition. Networks applied for funding to test and demonstrate new technologies or ways of working. This competition was replaced by the SIF (see right hand side) for RIIO-2.

Some of the projects included in this report were originally funded through the NIC. Some of these projects have continued in longer phases or have been built upon, meaning that the impact of this funding mechanism can still be seen in recent or ongoing innovation work.

Strategic Innovation Fund (SIF)

The Strategic Innovation Fund helps energy networks develop big ideas to support the UK's journey to Net Zero. Ofgem replaced the previous innovation scheme (NIC) with this fund during the RIIO-2 price control period. It supports large, transformational research and development projects that tackle specific challenges set by Ofgem. There are three fixed application windows each year. Over RIIO-2, the fund is expected to provide up to £450 million to support these types of projects.

SIF is competitive and typically allocated for larger-scale demonstration projects that may involve wide industry participation. Network companies must apply through Innovate UK – UKRI and funding is only given to projects that support the transition to Net Zero.

SIF projects follow a three-stage process:

Discovery - Exploring ideas and feasibility

Alpha - Developing and testing

Beta - Building and demonstrating

The three phases are designed to allow innovators and networks to explore truly novel ideas and build upon learnings at each round of funding, while the breakdown of projects into these phases reduces the capital risk at each stage.

Ofgem makes the decisions for SIF funding and Innovate UK - UKRI manages the process and supports innovators in line with the SIF Governance Document.

Introduction

About ENA

We represent the electricity networks that power homes and businesses across the UK and Ireland.

As the voice of the sector, Energy Networks Association (ENA) brings together the owners and operators of licensed transmission and distribution networks. Our members manage and maintain the critical infrastructure that keeps energy flowing safely and reliably.

We work to ensure our networks are among the safest, most efficient, and most sustainable in the world. We influence decision-makers on the issues that matter most to our members, including:

- Regulation and the wider representation in UK, Ireland and the rest of Europe
- Cost-efficient engineering services and related businesses for the benefit of members
- Safety, health and environment across the electricity industry
- The development and deployment of smart technology
- Innovation strategy, reporting and collaboration in GB.

We provide a strategic focus for the sector and act as a central channel of communication. We promote the interests and reputation of our industry and offer a forum for collaboration among our members.

We lead and support a wide range of innovation activities, including hosting events and conferences, such as our Annual Energy Innovation Summit.

CONTENTS

1.

Report highlights

1. Report highlights

1.1 Executive Summary / Key Takeaways

Our **Annual Innovation Summary Report 2025** showcases the impact of innovation across Great Britain (GB)'s electricity networks.

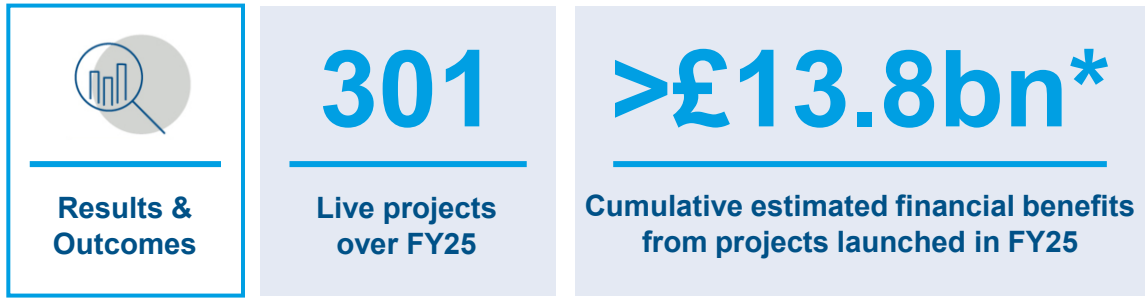
This year's report highlights how our members are investing in innovation to help build the energy system of the future and accelerate progress toward decarbonisation and Net Zero. Through key funding mechanisms like the Network Innovation Allowance (NIA) and the Strategic Innovation Fund (SIF), networks have committed millions of pounds to projects that deliver real-world benefits.

Guided by our shared innovation strategy and six core themes, we're driving a transition that is fast, fair, and efficient.

In FY25 alone, networks registered 120 innovation projects, with estimated financial benefits exceeding £13.8 billion from a total of around £150m of funding provided.

This report features a selection of standout projects, each demonstrating clear benefits for consumers and the wider electricity system.

Figure 1.1 – FY25 Innovation Overview



1.2 This Document

The Annual Innovation Summary Report builds on the individual Network Summary Reports to present an aggregated view of the progress made in Innovation over the past year. All electricity networks have contributed to this report, allowing it to give a cohesive overview of common Innovation themes and achievements through collaboration over the past year.

The report format has been updated this year to focus on guiding you through the innovation landscape and understanding the present picture across different networks, innovation themes, policy developments and key topics. Individual Network Summary Reports have further details on individual achievements and projects undertaken. These reports can be found here.

We intend this document, and the priorities, themes and principles it contains, to help enable collaboration and shape the sector's efforts over the years ahead through the sharing of challenges encountered and learnings taken over the innovation process. Further details on the networks' forward look to meet interim and 2050 targets can be found here.

* Note that financial benefits quoted here are projected future benefits of the impact of the innovation.

1. Report highlights

1.3 GB Electricity Networks

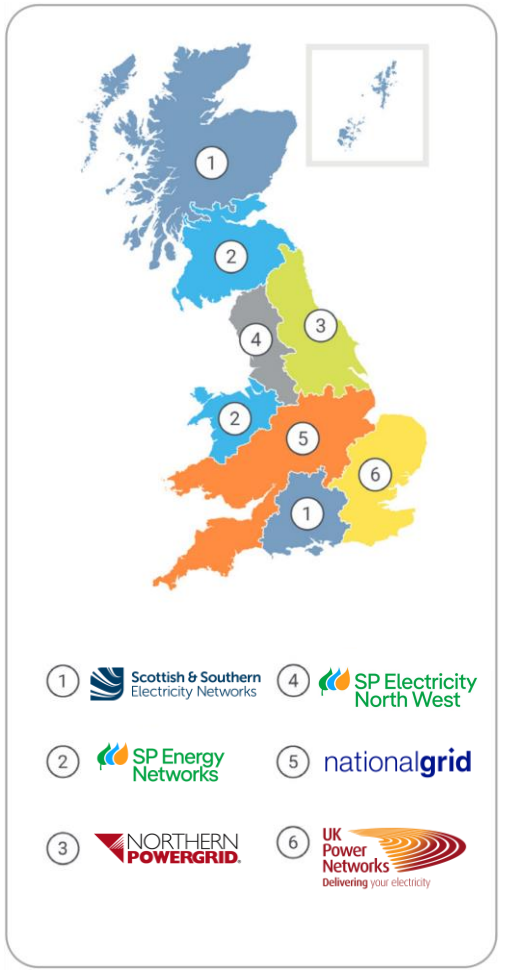
Electricity networks are critical to Great Britain's journey to Net Zero.

The nine network operators and the National Energy System Operator play a vital role in ensuring the electricity grid can meet the evolving needs of consumers in a changing energy landscape. There are two network types:

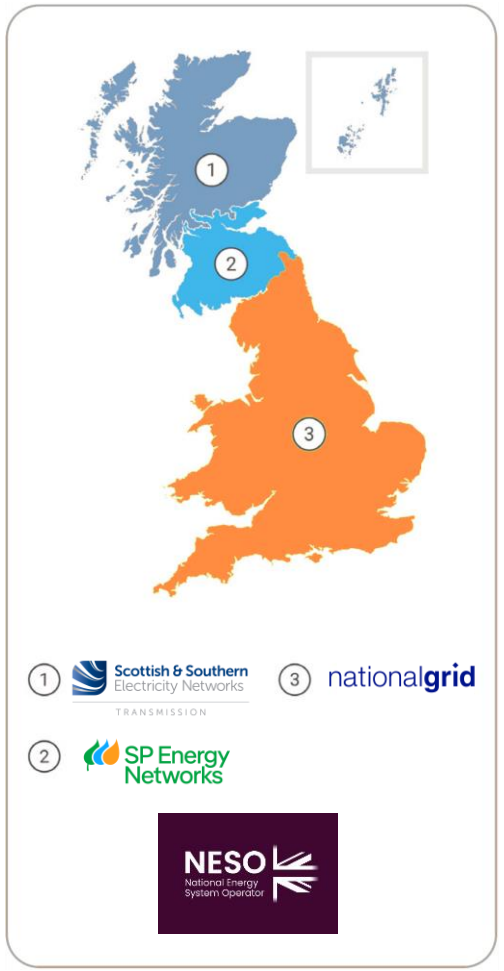
- **Transmission networks** – high-voltage systems that transport electricity over long distances from generation sources to regional distribution networks. They form the backbone of our national electricity system.
- **Distribution networks** – lower-voltage systems that deliver electricity from transmission networks directly to homes and businesses. These operate at a regional level and connect our infrastructure to everyday lives.

Together, these networks enable the transition to a smarter, cleaner, and more resilient energy future.

Figure 1.3 – All of the GB electricity networks, as well as NESO, the system operator for England, Scotland and Wales, have contributed to this report



Electricity Distribution Network Operators (DNOs)



Electricity Transmission System Operators (TSOs)

2.

FY25 Year in Review

2. FY25 Year in Review

2.1 Key Metrics

FY25 marks the second year of RIIO-ED2 for electricity distribution network operators (DNOs) and the fourth of RIIO-T2 for transmission system operators (TSOs). Data on all network projects and benefits have been tabulated and collated in the FY25 IMF[1] data (and the Balanced Scorecard – see Figure 2.1) referenced throughout this report.

The statistics presented in this report are not able to be directly compared to the FY24 report, as although this report represents another year of progress under RIIO-2, the FY24 report collated both electricity and gas networks' innovation data, whereas this year's report focuses solely on electricity networks.

The **Balanced Scorecard** highlights four performance indicator groups identified by the networks as key enablers of innovation: Strategy & Vision, Organisation & Culture, Capabilities & Technology, and Results & Outcomes. The three columns map these performance indicators to the three stages of the innovation process (1 - Initiation and Evaluation; 2 - Demonstration, Iteration, and Learning; and 3 - Deployment and Optimisation) to show how networks are performing against each indicator throughout the innovation process.

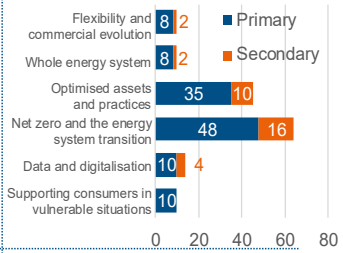
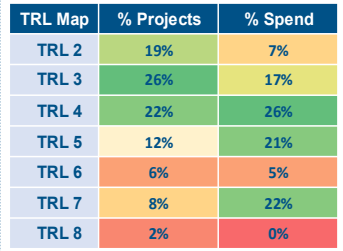
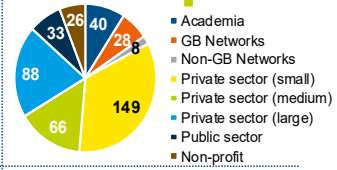
This year's scorecard shows continued strength in the number of ideas generated/received and in the number of projects registered from third party ideas. There have been several notable conferences held this year (discussed further on the next page) that have supported the development of new initiatives to facilitate even more ideas.

The 2025 Balanced Scorecard demonstrates significant progress in the number of projects registered and their distribution across innovation themes. FY25 has seen a robust total of 120 projects registered. Collaboration remains a key focus, as evidenced by the substantial number of projects developed from third party ideas. In FY25, 40 projects originated from external collaborations, while the number of project partners is 438.

[1] Innovation Measurement Framework – a mechanism by which networks submit data on innovation projects

2.2 Balanced Scorecard

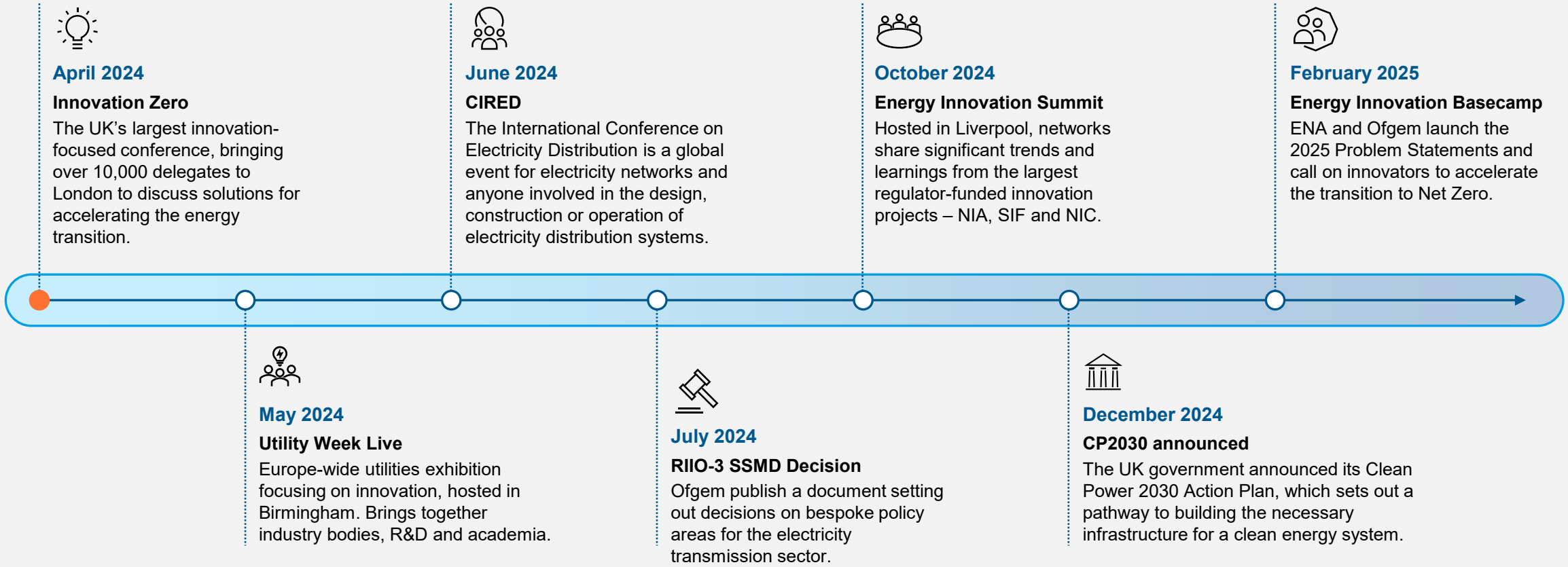
Figure 2.1 – FY25 Balanced Scorecard

	Initiation and Evaluation	Demonstration, Iteration, and Learning	Deployment and Optimisation
Strategy & Vision	Energy Networks Innovation Strategy 2025	244 Attendees at the Basecamp Launch event	
Organisation & Culture	721 Innovation ideas generated		120 Projects registered in the FY25 period
Capability & Technology	475 3rd party ideas received	40 Projects registered from 3rd party ideas	438 Project partners in RIIO-2 
Results & Outcomes	155 Projects being taken forward from ideas generated	301 Live projects over FY25	155 Projects closed in FY25

TRL Map	% Projects	% Spend
TRL 2	19%	7%
TRL 3	26%	17%
TRL 4	22%	26%
TRL 5	12%	21%
TRL 6	6%	5%
TRL 7	8%	22%
TRL 8	2%	0%

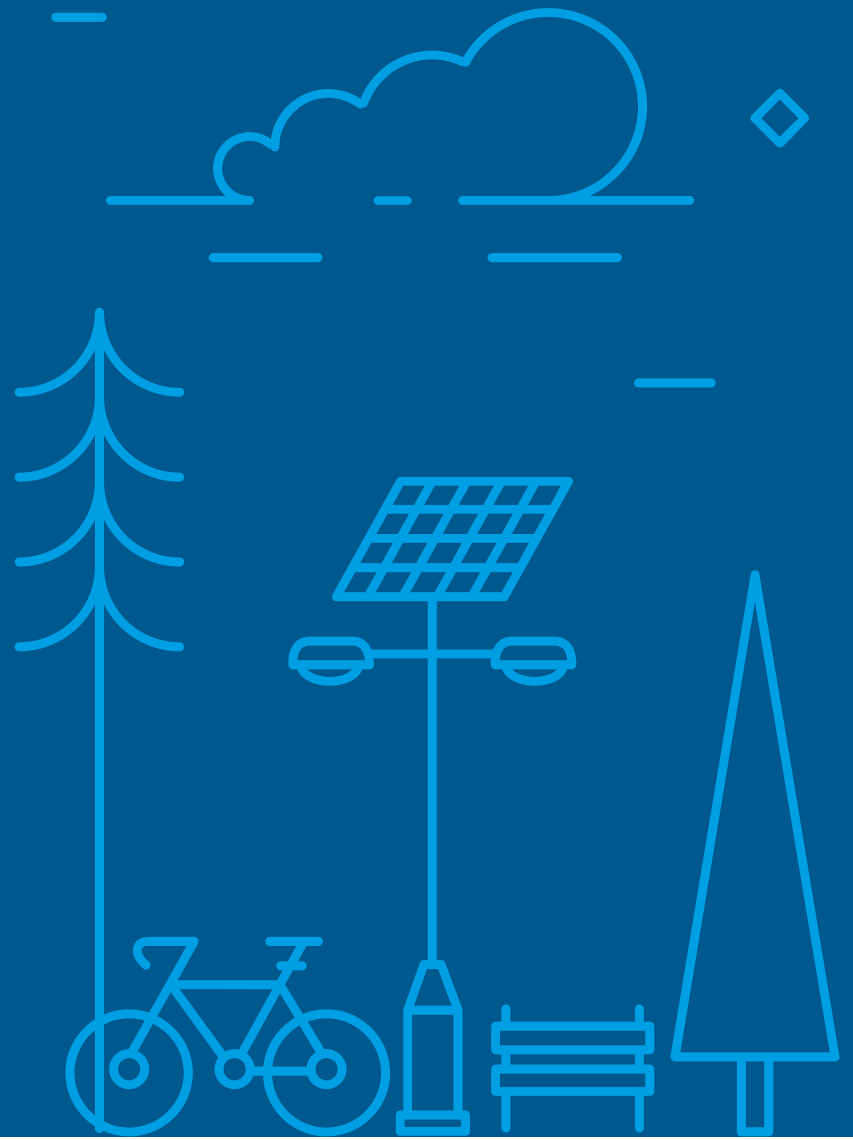
2. FY25 Year in Review

2.3 Innovation Key Event Timeline – FY25



3.

The Innovation Process



3. The Innovation Process

3.1 Energy Networks Innovation Strategy

Our updated Energy Networks Innovation Strategy sets a shared direction for innovation across gas and electricity networks[1].

Published in April 2024, the strategy brings together common principles and themes to guide how we work with innovators on solutions that deliver safe, resilient networks and support the transition to Net Zero.

At its core are three consumer-focused innovation objectives, shown in Figure 3.1 and set by Ofgem, which underpin all network innovation activity:

1. Maintain a safe and resilient network
2. Deliver an environmentally sustainable network
3. Meet the needs of consumers and network users

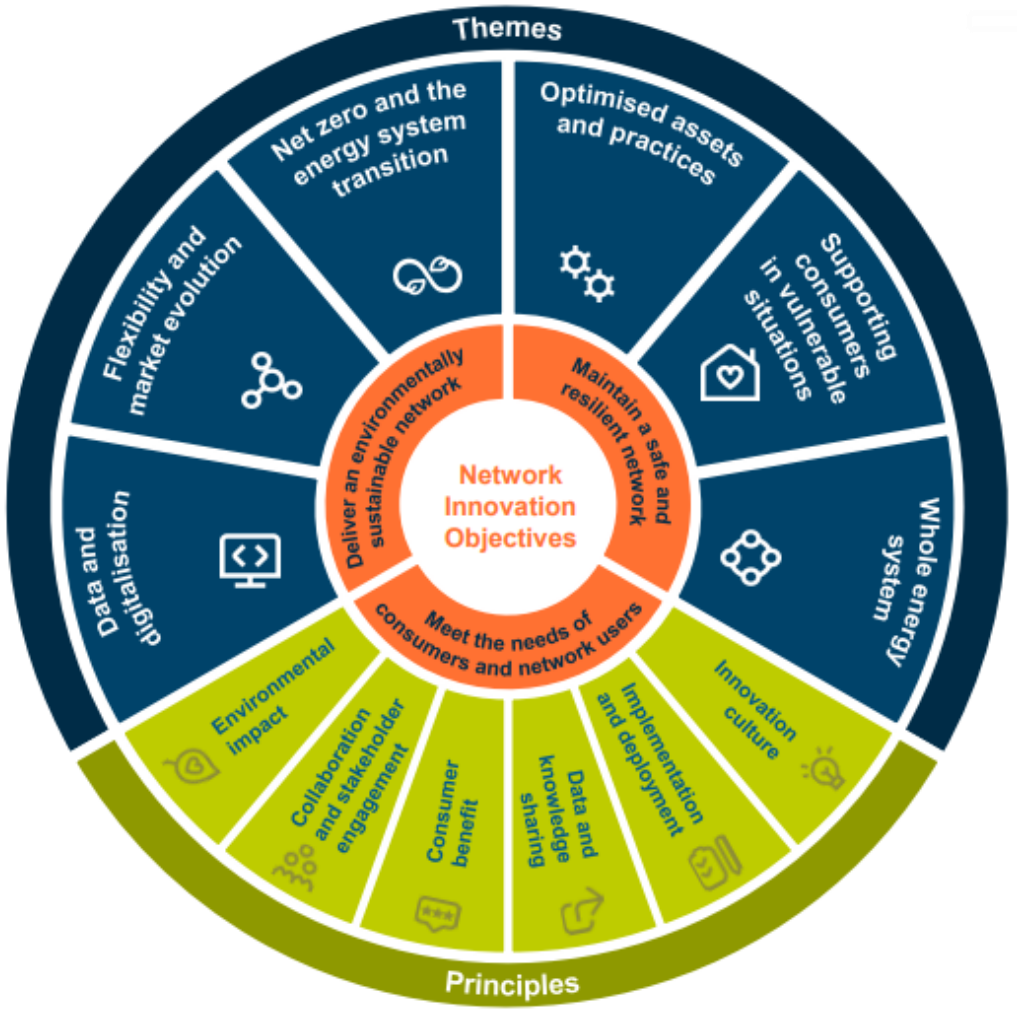
These are supported by a set of network innovation principles that apply throughout every stage of a project, as well as shared innovation themes, which are priority areas that reflect the biggest challenges facing our networks. All innovation projects must align with one of these themes to ensure we're focused on delivering meaningful impact.

Innovation Strategy Roadmap

The Innovation Strategy acts as a roadmap for how network operators can:

- Support the Net Zero transition
- Tackle emerging challenges to Great Britain's energy security
- Deliver better outcomes for customers

Figure 3.1 – The Energy Network Innovation Strategy: Objectives, themes and principles



[1] This will be replaced in future by a separate "Electricity Network Innovation Strategy" to provide clarity specific to electricity networks

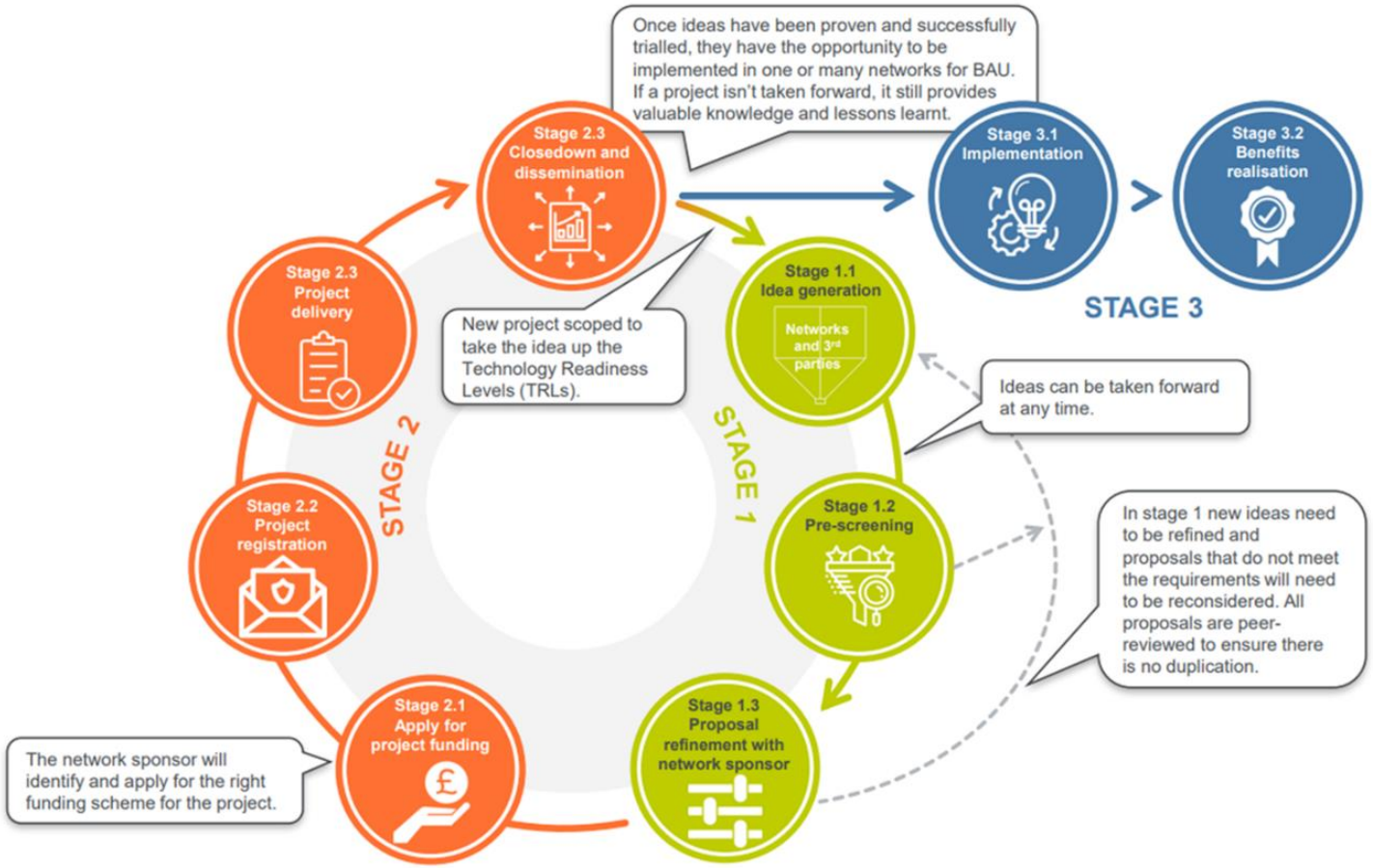
3. The Innovation Process

3.2 Innovation Project Process Overview

Network innovation projects follow a structured process from idea generation through to benefits realisation, regardless of theme or subject matter.

- The process, illustrated in Figure 3.2 begins with Stage 1 where ideas from networks and innovators are refined and aligned with the shared innovation themes described on the previous page.
- Once an idea progresses to Stage 2, the focus shifts to securing appropriate funding and successful delivery of the project. This stage includes critical steps of project registration, delivery, and dissemination of findings and lessons learnt. Dissemination of new knowledge created enables other projects to build on these insights.
- At this stage if a project demonstrates potential but requires further development, the project is cycled back to the first stage for additional trials or refinements, following a process of continuous improvement.
- In the final stage, Stage 3, project outcomes are realised. For some, this means that proven innovations are integrated into Business as Usual (BAU) operations and benefits are seen. Successful integration ensures that the benefits of innovation are delivered to consumers, smoothly and cost-effectively. Throughout this stage, networks collaborate with regulators, policymakers, and supply chain partners to ensure that innovations are implemented safely and effectively.
- Projects which do not progress to BAU operations can still deliver significant value by supporting policy decisions, contributing to evidence building, furthering learning and providing options to support a just Net Zero transition.

Figure 3.2 - The innovation process

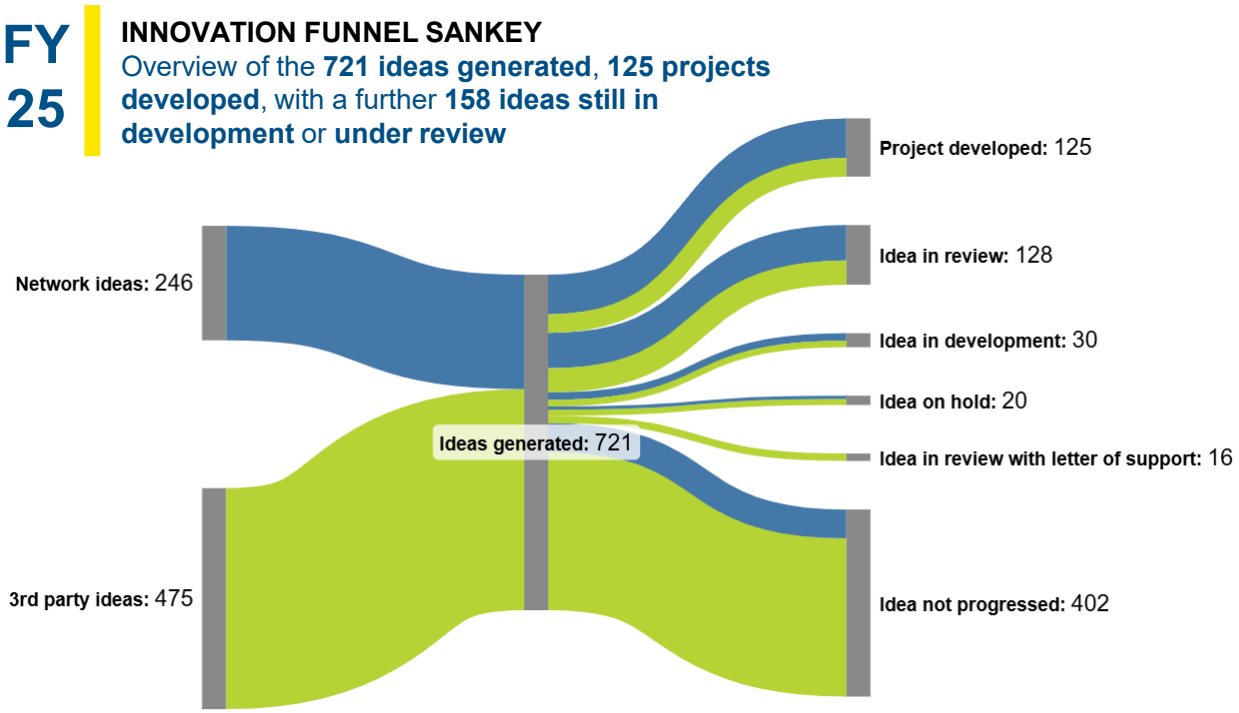


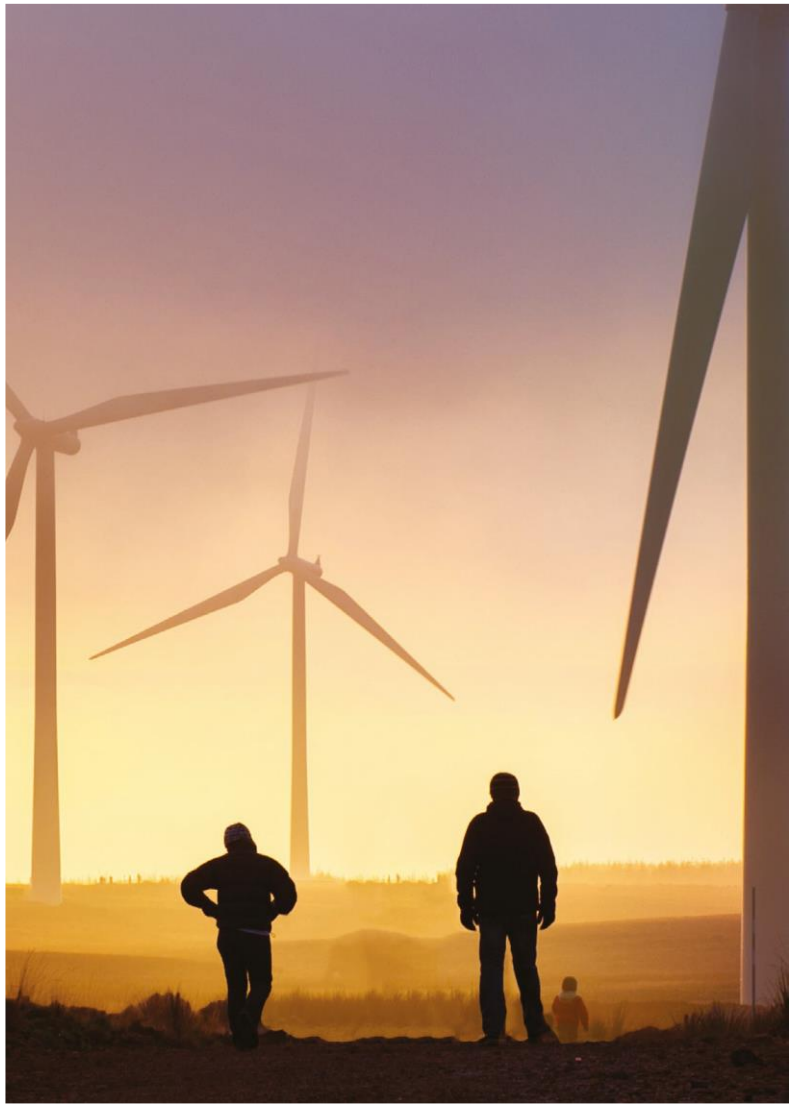
3. The Innovation Process

3.3 The Innovation Funnel

This section demonstrates how ideas are funnelled through the innovation process from ideas generated, to projects developed. The progress of the 721 ideas reviewed by the electricity networks and system operator, of which 475 came from external partners, is shown in Figure 3.3 below. The robust governance process used to evaluate these ideas ensures that those that progress into projects are good value for money and are aligned to the shared set of network goals.

Figure 3.3 The innovation funnel for ideas received in FY25



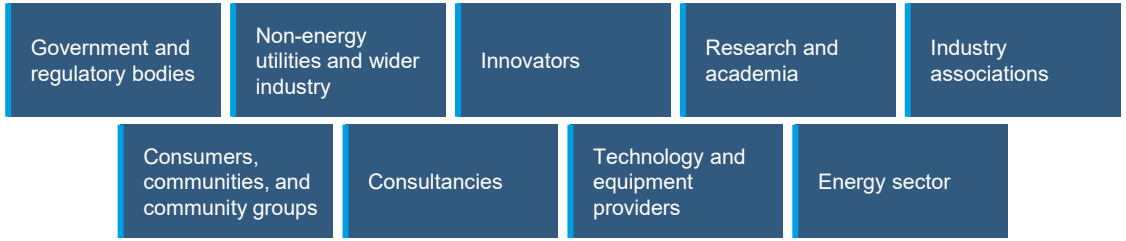


3. The Innovation Process

3.4 Our Stakeholders – who participates in innovation

An electricity network stakeholder is any individual, group or organisation that has an interest in the present or future state of our energy system. This includes:

Figure 3.4 - Electricity network stakeholders



ENA and our member networks work to strengthen engagement with a broad range of stakeholders, including non-governmental organisations (NGOs), public sector bodies and small and medium-sized enterprises (SMEs). We also collaborate with research-focused bodies and academia to foster innovation through shared expertise and experimentation.

Our stakeholder engagement goes beyond individual projects. For example:

- **NESO** welcomed international stakeholders from Japan and Singapore into their control room to exchange ideas on grid decarbonisation through innovation.
- At Utility Week Live in 2024, the **National Grid** Innovation team took part in various interactive sessions to boost stakeholder engagement. Highlights included:
    - Phillipa Slater, Director of Asset Management and Operations Support, led a session on Net Zero flexibility vision for flexible distribution networks.
    - Liza Troshka (Innovation and Deployment Engineer), Nina Klein (Ofgem Flexibility Project expert), and Jamie Bright (UKPN Data Science and Development Manager) to lead a collaborative exchange session: “How can energy companies create an accurate efficiency digital model to understand and forecast constraints?”

3.5 Our Approach to Stakeholder Engagement

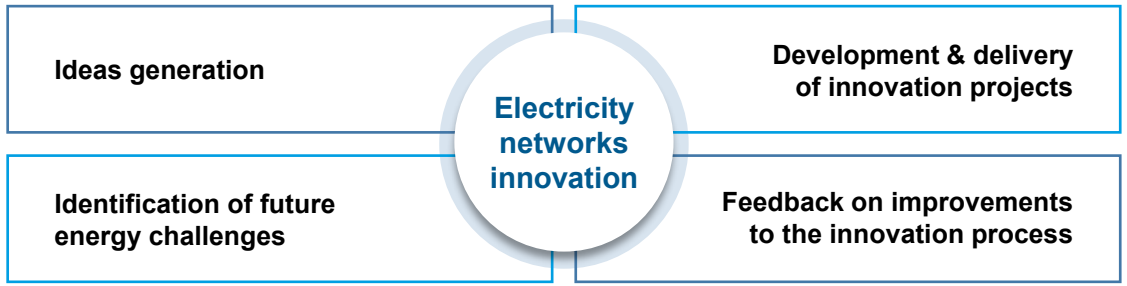
We take a collaborative approach to innovation, ensuring stakeholders have a strong voice and a clear role in shaping the future of our electricity networks.

Our networks work together to deliver meaningful engagement, focusing on:

- **Communicating the strategic challenges** facing our industry and highlighting opportunities for stakeholders to get involved in electricity network innovation.
- **Generating ideas**, fostering meaningful collaboration, and delivering innovation projects with electricity networks working closely and in partnership with stakeholders.
- **Embedding stakeholder feedback** through multiple channels into our governance structures (for example, the industry working groups). This drives continuous improvement and positive change to the electricity networks innovation process.
- **Providing transparent reporting** across our innovation portfolios.
- **Disseminating knowledge** and clearly communicating the outcomes and benefits of delivered innovation.

Stakeholders play a crucial role in the success of electricity networks innovation. Their insights, expertise and participation help us deliver solutions that benefit consumers and the wider energy system.

Figure 3.5 - Role of stakeholders in electricity networks innovation:



4.

POLICY OVERVIEW AND CONSUMER TOPICS

4. Policy Overview and Consumer Topics

4.1 Policy Overview

Policy plays a pivotal role in shaping the future of the UK energy system, setting ambitious decarbonisation timelines that electricity networks are instrumental in delivering. As outlined in Section 3, the strategic direction for network innovation is driven by six core innovation themes. The table below maps selected key policies influencing electricity network innovation to these themes, demonstrating clear alignment between policy intent and innovation focus.

Policy	Overview	Innovation Theme [1]
Clean Power 2030	UK government is committed to at least 95% of Britain's power being produced by clean sources by 2030. This will require whole system coordination and improved grid flexibility to account for increased amounts of low-carbon generation.	• All six innovation themes
Connections Reform	This reform addresses the overly congested grid connections system, changing it from "first come, first served" to "first ready, first connected". This will require improved digital load forecasting capabilities as well as maintaining safe and efficient operation of networks as more (often HV) generation and demand comes online.	• Data and digitalisation • Optimised assets and practices • Net Zero and the energy system transition
Clean Heat Market Mechanism	Establishes a requirement for boiler manufacturers to sell a certain number of heat pumps or other clean heat technologies. To adapt to this additional source and profile of demand, the grid will need to evolve, for example through demand-side flexibility schemes.	• Net Zero and the energy system transition • Flexibility and market evolution
Future Homes Standard	From 2035, new UK homes must cut carbon emissions by 75–80% through energy-efficient design and low-carbon heating. As the country transitions to low-carbon forms of heating, networks must ensure that the most vulnerable customers are not left behind.	• Net Zero and the energy system transition • Supporting customers in vulnerable situations
Zero Emission Vehicle (ZEV) Mandate	Car makers must ensure 80% of new cars sold are zero-emission by 2030, rising to 100% by 2035. To adapt to this additional source and profile of demand, the grid will need to evolve, for example through demand-side flexibility schemes.	• Flexibility and market evolution • Net Zero and the energy system transition

[1] Each policy mentioned can often be linked to more themes than are listed next to it– this column aims to highlight the most significant themes for each policy

4. Policy Overview and Consumer Topics

4.2 Consumer Topics

Innovation in electricity networks delivers benefits that reach far beyond the energy sector. The work our networks do touches on many areas of public interest—from environmental impact to community partnerships. That's why the innovation projects we highlight in this report are chosen not only for their technical value, but also for their wider relevance to consumers and society.

To help demonstrate this, we've grouped key topics into two broad categories: '**Network operation and evolution**' and '**Communities, partnerships and the environment**'.

While this list isn't exhaustive, it reflects the broad and meaningful impact of the innovation delivered by our networks.

Group 1: Network operation and evolution
Optimising and developing network functionality to support the Net Zero transition

Reliability and Resilience

Improving the grid's ability to anticipate, withstand, and recover from disruptions, either natural (e.g. weather patterns) or human-made (e.g. cyber attacks).

Minimising network outages as more renewable energy sources like wind and solar are added.

Integrating New Technologies

Enabling deployment of innovative hardware into the electricity system. Examples include Electrical Vehicle (EV) charging, heat pumps and distributed solar generation.

Artificial Intelligence

Using smart technology like AI to help run the electricity grid more efficiently and make quicker, better decisions. For example, it can help predict energy demand faster, which supports a more flexible and responsive system.

Group 2: Communities, partnerships and the environment
Guiding electricity network innovation to deliver broad societal and environmental benefits

Collaboration with Partners

Keeping strong partnerships between energy networks and outside groups – like businesses and universities – as well as between networks themselves, to help deliver projects faster and more effectively.

Supporting Community Stakeholders

Making sure energy systems work well for local communities, while also making sure everyone can access the network fairly—especially those who may struggle with energy costs.

Climate Impact and Risk

Using more renewable energy to cut carbon emissions.

Helping to enable decarbonisation of other sectors like transport and heating.

Protecting the energy system from problems caused by climate change, like extreme weather.

5.

Innovation Themes and Case Studies

5. Innovation Themes and Case Studies

The Focus of Innovation

Innovation projects from Networks can be broken down into the following shared innovation themes, which were introduced in Section 3:

1. Data and Digitalisation
2. Flexibility and market evolution
3. Net Zero and the energy system transition
4. Optimised assets and practices
5. Supporting consumers in vulnerable situations
6. Whole energy system

This section highlights progress across our shared innovation themes, supported by case studies that show how networks are delivering impact.

Each case study offers a high-level snapshot of a project that reflects network activity in a specific innovation area. To explore the full details, you can follow the project documentation hyperlink, which links to publicly available resources. Additional insights are also available in the individual Network Summary Reports, accessible here.

For more information on referenced policies and topic descriptions, see Section 4 of this report.

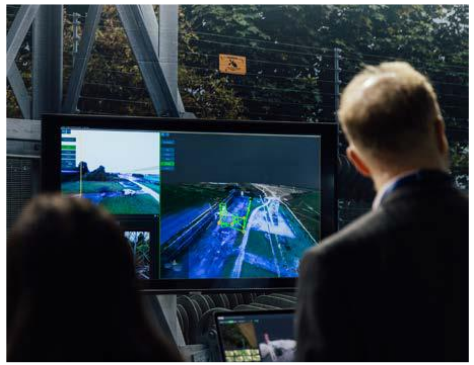
Network acronyms

The following acronyms are used throughout this section to refer to electricity networks and the system operator:

- **SSEN-T / SSEN-D:** Scottish and Southern Electricity Networks Transmission / Distribution
- **SPEN-T / SPEN-D:** SP Energy Networks Transmission / Distribution
- **NGET / NGED:** National Grid Electricity Transmission / Distribution
- **ENWL / SPENW:** SP Electricity North West
- **NPg:** Northern Powergrid
- **UKPN:** UK Power Networks
- **NESO:** National Energy System Operator

5. Innovation Themes and Case Studies

5.1. Data and Digitalisation



Developing new data services, applying data science methods and harnessing the power of digitalisation to solve both system operation and wider stakeholder challenges.

Data and Digitalisation work is often an enabling tool for all projects and evidence-based decision-making by increasing the information available for electricity networks to use in future projects as well as BAU operations and resilience planning. As such, projects which fall under this innovation theme often have objectives which overlap with other innovation themes (and projects under other innovation themes could also be classified under this one).

14

Projects registered to this theme in FY25

Electricity networks have made significant strides in embedding digital tools to improve planning, operational efficiency and increasingly importantly, resilience against cyber attacks.

In particular, efforts have been made to develop AI capabilities - **NPg**'s Artificial Forecasting tool aims to employ AI to improve load forecasting capability, while **SPEN-T**'s Cyber-RIAST and Cyber-SAFEN projects are developing AI-driven platforms to detect and respond to cyber threats and enhance the resilience of digital substations.

Another area of interest is enabling faster and more informed decision making while reducing manual workload. **UKPN**'s HV Auto Quote tool enables customers to self-serve formal connection offers, streamlining the application process.

Importantly, digitalisation is also improving the accessibility of network data for stakeholders, from local authorities to aggregators by supporting more collaborative and inclusive planning, exemplified by **SSEN-D**'s Near Real-time Data Access 2 (NeRDA2) project. This shift toward real-time monitoring, predictive analytics, and digital twin infrastructure will lay the foundation for a more agile and intelligent energy system.

"I've been using the NeRDA data for day ahead and half-hourly ahead grid load forecasting, and then calculating a dynamic grid tariff. This enables the control of flexibilities within the distribution network (such as EVs, heat storages, and heat pumps) to mitigate distribution grid congestion. The NeRDA API operates seamlessly, and the team's responsiveness and assistance have been exemplary."
Omid Mousavi, Lead Data Scientist, KrakenFlex (NeRDA partner)

5. Innovation Themes and Case Studies

Artificial Forecasting – Beta (NPg)

Developing innovative AI-based approaches to augment load forecasting capability, unlocking flexibility as a reinforcement option.

This project will test machine learning algorithms to produce load forecasts and develop AI techniques for modelling load connections.

As DNOs transition to DSOs, the load forecasting process must become increasingly granular to support flexibility dispatch – frequency needs to increase from annual to monthly, weekly and daily, and the scope needs to expand to capture HV / LV transformation points. Previously, networks have typically employed manual approaches to forecast load, so novel approaches are required to enable system flexibility and support network stability under these new conditions.

Available capacity in the network for new low-carbon loads will be freed up thanks to more effective network management, increasing the speed and lowering the cost of decarbonisation.

The project will benefit a wide range of users, including connectees of low-carbon load, flexibility providers and controllers, network customers and other electricity distribution companies.

- Funded: £3,664,540 (SIF)
- Project timeline: February 2025 - February 2027
- Project partners and collaborators: UKPN, Oak Tree Power Ltd, EV Dot Energy Ltd, Faculty Science Ltd
- Project lead: Neal Wade – System Forecasting Engineer

Smarter Networks Portal project page

Benefits

Cost savings for networks:

Reduction in HV / LV reinforcement cost by about 5 -10% (£3.5m-7m p.a. for NPg, increased by a factor of 7 for all DNOs)

Staff cost savings of ~£2m p.a. in NPg, increased by a factor of 7 for all DNOs

TRL change

4 to 8

Integrating New Technologies

Artificial Intelligence

5. Innovation Themes and Case Studies

TOTEM 2 (SSEN-T)

Developing innovative tools and resources for power system modelling and analysis, specifically advancing re-dispatch and simulation capabilities.

Scottish & Southern Electricity Networks TRANSMISSION

Manitoba HYDRO INTERNATIONAL

The UK's power system is rapidly evolving as greater levels of renewable energy are being connected, leading to a much lower level of system inertia and lower short circuit levels. The potential for adverse control interactions between these devices is rising and needs careful consideration within the context of a potentially weaker UK power system.

This project follows on from TOTEM and TOTEM Extension to continue developing innovative tools and resources for power system modelling. These projects provided a multi-party agreement that enables the Transmission Owners to work together to acquire and validate a new system model that will enhance, as well as de-risk the integration of new technologies.

The previous TOTEM projects developed a large-scale EMT model capable of accurately simulating power electronic systems, supporting the development of strategies to futureproof the UK's energy networks. TOTEM 2 successfully enhanced the re-dispatch tool for seamless integration with PowerFactory models, ensuring adaptability to evolving network configurations. In parallel, the project optimised the Scottish network model, significantly improving simulation performance - enabling faster, more efficient evaluation of complex operational scenarios.

SSEN Transmission's technical teams have adopted the outputs of the TOTEM 2 project into business-as-usual operations as part of the broader TOTEM toolset.

- Funded: £100,000 (NIA)
- Project timeline: May 2024 – March 2025
- Project partners and collaborators: Manitoba Hydro International (MHI)
- Project lead: Peter Taddei - Innovation Delivery Project Manager

Smarter Networks Portal project page

Benefits

Risk reduction:

Expected to mitigate the risk of network black out and localised disruption.

Net benefit / cost ratio of £14.93

TRL change

2 to 7

Integrating New Technologies

Reliability and Resilience

5. Innovation Themes and Case Studies

ERA (NGET)

Developing an automated severe weather alert tool to help protect vulnerable assets at risk from extreme weather events, as well as helping networks better react to threats when they emerge.

Electricity assets such as towers and the equipment in substations have been designed to withstand a variety of environmental conditions. The increasing number and ferocity of extreme weather events exposes assets to a greater risk. For example, uncontrolled surface water flooding events are expected to rise along with the cost of damages.

These risks need to be monitored to ensure the network continues to provide consumers with an uninterrupted electricity supply.

This tool will initially focus on flooding risk, pinpointing when and where network assets could be at risk from flooding and erosion. This will play an important role in maintaining uninterrupted electricity supplies.

The tool uses data from the Environmental Agency, the Flood Forecasting Centre, Natural Resources Wales and Previsico's surface water flood risk forecasts, coupled with Previsco's radar based sensors which allow remote monitoring of high flood-risk sites while providing a real-time flood risk assessment.

- Funded: £455,314 (NIA)
- Project timeline: January 2023 – March 2024
- Project partners and collaborators: University of Liverpool, Previsico Ltd, Frazer-Nash Consultancy
- Project lead: Tinashe Chikohora – Strategic Innovation Engineer

Smarter Networks Portal project page

TSO project page

Benefits

Cost saving / risk mitigation

Mitigation of the potential impact of uncontrolled flooding, which posed a £6m risk in damages at vulnerable sites assessed in this project.

Potential for further savings as remit expands.

TRL change

6 to 8

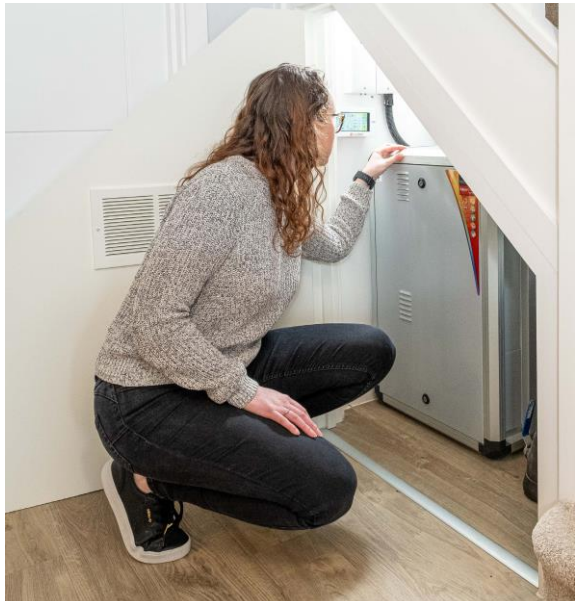
Climate Impact and Risk

Reliability and Resilience

5. Innovation Themes and Case Studies

5.2. Flexibility and Market Evolution

Developing market-based solutions to increase the flexibility and efficiency of electricity networks, accelerating the adoption of low carbon technologies. Particularly focused on exploring innovative solutions around demand-side flexibility, aiming to reduce curtailment of renewable generation.



10

Projects registered to this theme in FY25

The evolution of flexibility markets is reshaping how networks interact with consumers and distributed energy resources, and is becoming increasingly central to network strategy, particularly as larger quantities of renewable generation is being added across the country. Meanwhile, the shift of consumer demand profiles, due to adoption of technologies such as heat pumps and EVs, promoted through policies such as the Clean Heat Market Mechanism and ZEV mandate, present opportunities to explore demand-side flexibility.

Projects across multiple networks are exploring dynamic pricing, demand-side response, and new commercial models to better align consumer behaviour with network needs. This is particularly evident in trials that manage electric vehicle charging, such as **UKPN**'s Shift 2.0 project, and heat demand (for example **UKPN**'s Heatropolis and **NGED**'s EQUINOX projects) to avoid local peaks and reduce reinforcement costs.

These developments are critical to unlocking system-wide efficiency and enabling a more decentralised, responsive grid.

5. Innovation Themes and Case Studies

EQUINOX (NGED)

Developing new commercial arrangements that unlock flexibility from residential low carbon heating across Great Britain.

Ryan Huxtable
Innovation Programme Lead

EQUINOX is the first Network Innovation Competition (NIC) project dedicated to addressing the challenges that Distribution Network Operators (DNOs) may face with the electrification of domestic heat. As part of the energy transition, DNOs may witness a substantial increase in peak electricity demand, requiring significant network reinforcement.

There are currently limited viable solutions for DNOs to unlock the flexibility from residential low carbon heat at scale in a reliable, cost-effective, and equitable way.

The project has demonstrated the benefits available to the network through flexibility from domestic heat pumps. The first round of trials acted as proof of concept, while the second and third rounds informed BAU arrangements with a larger and more diverse pool of customers. The trials aimed to include households from all sectors of society, ensuring that commercial and technical arrangements were designed equitably.

Trial 2 results were released in summer 2024, and saw home energy use dropping by an average of 48%. These learnings informed the design of trial 3.

- Funded: £7,766,000, of which £6,980,000 is NIC
- Project timeline: March 2022 - December 2025
- Project partners and collaborators: SPEN, Octopus Energy, Passiv, Welsh Government, West Midlands Combined Authority, Guidehouse, Sero, Scottish Power, National Energy Action
- Project lead: Ryan Huxtable – Innovation Programme Lead

Smarter Networks Portal project page
DNO project page

Benefits

Customer Bills

Trial 2 participants were rewarded financially with an average of £43 per participant over the winter.

Carbon Savings

1,900 tCO2e of direct savings up to 2050 across GB

Demand Reduction

779 MVA capacity released up to 2050 across GB

Integrating New Technologies

5. Innovation Themes and Case Studies

CrowdFlex - Beta (NESO)

Increasing the integration of renewable energy into the grid, reducing balancing costs and decreasing the need for additional capacity or network reinforcement.

Sanna Atherton
CrowdFlex Project Lead

The requirement for domestic flexibility is increasingly apparent. Crowdflex is playing a pivotal role in establishing domestic flexibility as a reliable grid management resource. The project has been conducting large-scale consumer trials and gathering data to develop models to more accurately forecast consumer flexibility. It is an industry wide collaboration, bringing together expertise and innovation from across the sector, including OVO Energy, Ohme EV, distribution, energy industry partners and consultants.

CrowdFlex aims to enhance understanding of domestic flexibility's potential and technical capabilities, as well as consumer behaviours, to inform future market strategies. The first phase of summer trials took place in 2024, with OVO and Ohme EV's customers incentivised to use electricity flexibly, receiving utilisation payments for adjusting their energy usage (turn-up or turn-down) or availability payments for making assets like electric vehicles (EVs) available to the grid for automated control of when to charge.

CrowdFlex is an industry-wide collaboration. The project aims to integrate more renewable energy into the grid, reduce balancing costs, and minimise the need for additional capacity or network reinforcement works, potentially lowering operating costs and consumer bills.

- Funded: £22,530,137 (SIF)
- Project timeline: December 2023 - January 2026
- Project partners and collaborators: NGED, SSEN-D, OVO Energy, Ohme, Centre for Net Zero, AWS, ERM, Centre for Sustainable Energy, Smith Institute, CGI, Smart Grid Consultancy
- Project lead: Sanna Atherton – CrowdFlex Project Lead

Smarter Networks Portal project page
System Operator project page

Benefits

Network Savings

By year 10, it's calculated that CrowdFlex could help enable domestic flexibility to provide a total direct and indirect net benefit of £472m annually, by reducing balancing costs and the need for additional capacity and network reinforcements.

Carbon Savings

Reduce the need for thermal generation equating to a cumulative 10-year benefit of avoided CO2 emissions of 6.3MtCO_2e

TRL Change

3/4 to 7

Integrating New Technologies

"We're excited to be in the Beta phase of the CrowdFlex project and collaborating with key industry partners on this large-scale programme."
Sanna Atherton, CrowdFlex Project Lead

5. Innovation Themes and Case Studies

BiTraDER (ENWL / SPENW)

Investigating an innovative trading market for connected resources to trade curtailment obligations bilaterally within regionally aggregated stacks.

SP Electricity North West

LCP Delta ELECTRON AFRY

As part of the UK's Net Zero journey, DNOs are seeing more requests to connect low-carbon energy sources. To avoid costly and disruptive network reinforcement, they offer flexible (curtailable) connections. These allow access subject to conditions that let DNOs curtail import or export to manage the network. While faster and cheaper, flexible connections carry curtailment risks, making some customers hesitant.

BiTraDER aims to allow new and existing connected customers to mitigate the risks associated with curtailment obligations. The project will investigate, design, build and trial a new market for flexible resources to trade their curtailment obligations with other connected customers. It will develop the bilateral market trading rules, explore the market's ability to operate in near real-time, and determine the functionality required to return the output of the market to the DNO and ESO systems for execution in real time.

FY25 has seen the design of the trading platform and publication of a report which focuses on the methods to implement the designed solution and the lessons learned during the process. The simulation trials started in October 2024 and finished in May 2025.

- Funded: £8,367,858 (NIC)
- Project timeline: May 2022 - July 2026
- Project partners and collaborators: LCP Delta, AFRY, Electron
- Project lead: Christopher Greenfield – Innovation Project Manager

Smarter Networks Portal project page

DNO project page

Benefits

Cost Savings

NPV of £35.5m to ENWL

NPV of £581m to GB as a whole

Carbon Reduction

7,649 tCO2e for ENWL

92,114 tCO2e for GB as a whole

TRL Change

6 to 8

Integrating New Technologies

5. Innovation Themes and Case Studies

5.3. Net Zero and the energy system transition

Enabling and accelerating the UK's transition to a Net Zero energy system, supporting networks' own decarbonisation objectives while facilitating renewable penetration and supporting uptake of low carbon technologies (LCTs). Objectives of projects from other themes may overlap with those in this theme, for example projects looking to improve grid flexibility or whole system coordination.

Network innovation is increasingly aligned with the UK's Net Zero targets and the Clean Power 2030 Action Plan, focusing on electrification, renewable integration, and physical low-carbon infrastructure, exemplified by projects such as **SSEN-T**'s Low Profile Steel Poles and OHL Foundation Uplift projects.

Networks are working closely with local authorities, housing providers, and developers to support decarbonisation at scale. This includes enabling Local Area Energy Planning (for example in **UKPN**'s CLEO project) and trialling alternative heating technologies (e.g. **UKPN**'s Neat Heat Project, which demonstrates the viability of Zero Emission Boilers as heating sources in constrained housing). These efforts aim to ensure that the UK's energy transition occurs in a coordinated and cost-effective manner.

64

Projects registered to this theme in FY25

5. Innovation Themes and Case Studies

Low Profile 132kV Steel Poles (SSEN-T)

New steel pole design for future wind farm connections at altitudes over 300m, reducing steel usage and eliminating the need for permanent maintenance access tracks and concrete foundations.

Scottish & Southern Electricity Networks TRANSMISSION

PLPC LTD POWER LINE SPECIALISTS | energyline | NORPOWER Overhead Line Services

Steel lattice towers are proposed for future wind farm connections above 300m however, they come with high costs, long lead times, and environmental impacts. Currently, wooden poles are not a suitable alternative due to capacity limitations and are not robust enough to withstand climatic conditions above 300m. In addition, creosote preservation used on wooden poles is due to be removed from the market in 2029 at the latest.

This project developed a new innovative and resilient design for overhead powerlines at elevations above 300m and can support with the accelerated delivery of our future network. The design reduces steel usage and eliminates the need for permanent access tracks for maintenance and the need for concrete foundations, as they are directly buried in the soil.

The poles are visually aligned with existing wooden poles to reduce the visual impact of our network and aim to improve the consenting process. The project could support faster energy connections due to a reduction in construction lead times and could save up to 50% on construction costs compared to traditional steel lattice towers.

Following successful testing, the design has now been accepted in BAU deployment. The first deployment has already begun on a high-altitude customer windfarm connection with the structures to be built in early 2026.

- Funded: £1,100,000 (NIA)
- Project timeline: January 2022 - November 2024
- Project partners and collaborators: PLPC, Energyline, Norpower
- Project lead: Peter Taddei – Innovation Delivery Project Manager

Smarter Networks Portal project page

Benefits

Cost saving:

Expected £9.8m cost benefits at the end of RIIO-T3

TRL change:

4 to 8

Reliability and Resilience

5. Innovation Themes and Case Studies

OHL (overhead line) Foundation Uplift (SSEN-T)

Improving the methodology for calculating the uplift capacity of steel lattice tower foundations, identifying opportunities to use less material and space and optimising the shape and surface of the OHL design.

The method for designing overhead line (OHL) foundations has not changed considerably since the 1920's. Initial research work undertaken by the University of Dundee identified that the 'frustum method', which is adopted by most Transmission Operators in the UK and forms industry standards, is generally over-conservative and, in some cases, potentially underestimates foundation uplift capacity by up to 25%.

The project set out to improve the current methodology for calculating the uplift capacity of steel lattice tower foundations. This includes gaining a better understanding of the optimal shape and surface of OHL foundation designs, as well as identifying opportunities to use less material and space for foundations.

The removal or reduction of over-conservative design for OHL foundations would reduce the amount of construction materials required and require smaller scale excavations. This would provide a significant reduction in carbon emissions associated with the construction of OHLs, causing less disruption to the surrounding land and reducing associated costs for energy consumers.

Test results from the University of Dundee's centrifuge have shown that by including a chamfer on the top edge of concrete foundations, we can potentially increase the uplift capacity of the foundation and also reduce the volume of concrete by approximately 18%, resulting in significant carbon savings.

- Funded: £584,307 (NIA)
- Project timeline: December 2022 – May 2025
- Project partners and collaborators: NGET, University of Dundee
- Project lead: Peter Taddei – Innovation Delivery Project Manager

Smarter Networks Portal project page

Benefits

Cost saving:

Potential cost savings from Foundation Uplift of at least £4.7m during asset lifetime, lifetime cost saving on identified projects of at least £8m

Carbon Saving:

Use of new method in 5 SSEN-T OHL projects (approx. 1,500 towers) gives a carbon saving of ~ 1,600 tCO2e, equivalent to the annual electricity consumption of over 2,200 households

TRL Change:

2 to 4

Collaboration with Partners

Climate Impact and Risk

5. Innovation Themes and Case Studies

Powering Wales Renewably - Beta (NESO)

Establishing a strategic long-term approach to planning in Wales, identifying whole energy system needs, and ensuring that the system can be designed and constructed accordingly. The project is now in its R2 Beta phase.

Megan McNeill
Innovation Delivery Manager

To deliver the Welsh Government's decarbonisation plans, prepare for a Net Zero power system and deliver benefits to Wales' citizens and communities, strategic priorities for investment were identified.

Following on from this, the project will deliver a digital twin of the entire Welsh energy transmission and distribution systems. The project is designed to deliver a range of qualitative and quantitative benefits, including cost savings on energy bills for consumers and enhanced CO2 savings through increased renewable generation. It also aims to achieve future reductions in the cost of operating the network by reducing flexibility costs and avoiding curtailment, as well as annual cost savings for users of network services through improved network capacity utilisation.

- Funded: £12,195,722 (SIF)
- Project timeline: January 2025 – January 2029
- Project partners and collaborators: NGET, NGED, Welsh Government, SPEN, CGI, Wales & West Utilities, Cenin, National Gas Transmission
- Project lead: Megan McNeill – Innovation Delivery Manager

Smarter Networks Portal project page

System Operator project page

Benefits

Cost saving:

More generation from cheap renewables and enhanced capacity utilisation leading to lower customer bills

Reduced operating costs for networks due to flexibility and reduced curtailment

Carbon Saving:

Additional renewable generation leading to emissions reduction

TRL Change:

5 to 8

Integrating New Technologies

"We're excited to begin the Beta phase of this collaborative Innovation project with the Welsh Government and industry partners, which aims to advance data sharing between energy organisations to enable more renewable energy on the grid."
Megan McNeill, Innovation Delivery Manager

5. Innovation Themes and Case Studies

5.4. Optimised assets and practices

Developing and implementing techniques for optimising existing business practices and adopting new technologies to boost network performance. Projects under this theme have particularly focused on automation and prediction, especially about faults, outages and asset deterioration.

Innovation in asset monitoring and maintenance is improving reliability, safety and efficiency, helping to reduce costs.

SPEN-T's Innovative Monitoring of GIS Cable Terminations project uses sensors to predict faults before they cause outages, **NGED**'s LV Visibility project is installing thousands of monitors on the network to improve fault visibility and **SSEN-T**'s AIM High project deployed autonomous robots in HVDC converter halls for continuous condition monitoring. These projects all lead to tangible consumer benefits by avoiding unplanned outages and reducing maintenance costs which can then be passed on by way of lower energy bills.

The cumulative impact of these innovation projects is a more resilient and efficient network that can support growing demand without excessive reinforcement.

45

Projects registered to this theme in FY25

5. Innovation Themes and Case Studies

AIM High (SSEN-T)

Testing and deployment of an autonomous robotic system for monitoring High Voltage Direct Current (HVDC) valve halls to improve safety and security of the network, allowing maintenance without unplanned system downtime.

Scottish & Southern Electricity Networks TRANSMISSION

Ross Robotics

HVDC valve halls operate at an extremely high voltage level of electricity, meaning service personnel cannot access many of the electrical environments when energised and in operation.

Historically, HVDC converter stations were monitored using remote systems and static CCTV cameras to check for any issues, however, they do not provide full visibility of the electrical equipment and its condition. Planned outages are put in place to shut down systems to allow engineers to carry out close inspections of the electrical components. In the instance of a condition-based equipment failure the system would need to be shut down through an unplanned outage. By monitoring the condition of equipment using the robot it is expected that these condition-based unplanned outages can be avoided.

For the first time, thermal & UV images were obtained from within energised HVDC halls, helping to understand operational temperatures and assess live plant from within the hall. Having the ability to see inside the halls using the platform allows quicker fault identification and diagnostics to improve network safety. With the robot successfully deployed at Blackhillock HVDC converter station, SSEN Transmission are looking to deploy further robots across future HVDC convertor stations during the RIIO-T3 period.

- Funded: £454,556 (NIA)
- Project timeline: June 2023- October 2024
- Project partners and collaborators: Ross Robotics
- Project lead: Tania Shaw – Innovation Project Delivery Manager

Smarter Networks Portal project page

Benefits

Cost saving:

Annual £200k cost saving from maintenance per site, potential lifetime cost savings over 20 applicable sites of over £22m

TRL Change:

5 to 8

Reliability and Resilience

"We're very excited to have been a part of this important [AIM High] project with SSEN Transmission. The deployment of our robot at Blackhillock HVDC converter hall has delivered a new level of monitoring for this type of critical asset and the data captured will support the transition towards predictive maintenance, with all the operational, availability and commercial benefits it brings."
Dominic Cusk, Managing Director of Ross Robotics

5. Innovation Themes and Case Studies

Cyber-SAFEN (SPEN-T)

Development and demonstration of an AI-enabled cyber security platform to enable a resilient digital power network.

The electricity network links distributed generation, active demand, and local flexibility markets. Digital substations are key to safely and securely controlling power flow, accelerating the digital transformation of power systems. However, this makes them prime targets for cyber-attacks, which could result in widespread power outages. Existing tools are not proven to defend against advanced threats, so new systems are needed to protect networks.

Cyber-SAFEN aims to build and demonstrate an integrated cyber defence (ICD) platform to provide a foundation on which to build essential cyber safe and resilient functions for electricity networks against advanced cyber-attacks. Cyber-SAFEN uniquely focuses on a combined intrusion detection (IDS) and intrusion response system (IRS) powered by advanced AI and machine learning technologies to build a dual defence system against advanced cyber threats.

The IRS serves to verify the accuracy of the machine learning system, acting as a safeguard to the system. The project has shown that through this pairing, cyber attacks can be detected with very high confidence. This added security is an enabler to the digitalisation of substations, which will themselves provide cost and carbon savings (not included in benefits table).

Learnings have been taken regarding the importance of testing solutions in real-world environments, and how future projects can de-risk these trials by developing comprehensive simulation capabilities.

- Funded: £487,000 (NIA)
- Project timeline: May 2022 – April 2026
- Project partners and collaborators: University of Manchester, Energy Innovation Centre, NGE-T
- Project lead: Lara Cardoso – Senior Innovation Engineer

Smarter Networks Portal project page

Benefits

Risk Mitigation:

Reduced risks of outages and damages caused by cyber attacks (e.g. 2015 Ukraine energy system cyber-attacks which resulted in power outages for nearly 230,000 consumers

TRL Change:

2 to 4

Reliability and Resilience

5. Innovation Themes and Case Studies

LV Visibility and LV Pre-fault (NGED)

Supporting our Field Operations teams with a new digital dashboard and installation of over 10,000 LV monitors to prevent faults.

nationalgrid Electricity Distribution

Steven Pinkerton-Clark
Innovation and Deployment Engineer

Jacob Lynch
Innovation and Deployment Engineer

LV Visibility: Installation of over 10,000 LV monitors to provide greater visibility of load-related issues and potential fault activity, providing a more resilient network. The focus is on parts of the network that will provide the greatest benefit, including substations with high customer densities and older parts of the network that are historically more prone to reliability disruptions.

These installed monitors have enabled the running of a second project, LV Pre-Fault.

LV Pre-fault: Data collected from the LV monitors installed through LV Visibility has allowed NGED to gain insight into pre-fault activity. NGED have created a digital dashboard to visually portray alarms that are being flagged, show the potential benefits of responding to these alarms and the likelihood of failure within a given timeframe.

Data collected will inform whether underground cables are in need of immediate replacement or intermediate remedial action. This prevents power cuts by fixing issues before they occur. This supports NGED's core commitments to improve service levels to customers, enhance network reliability, invest in assets, and better utilise the existing network.

These projects are now in the roll-out stage – evaluation / trial stage projects were completed prior through the NIA and NIC.

- Funded: £500,000. LV Visibility is EJP funded, LV Pre-fault is internally funded by NGED
- Roll-out timeline: April 2023 – March 2028
- Project partners and supply chain: Kelvatek, EA Technology, Lucy Electric
- Project leads: Steven Pinkerton-Clark – Innovation and Deployment Engineer, Jacob Lynch – Innovation and Deployment Engineer

Benefits

Cost saving:

Potential to save UK energy consumers an estimated £10.3m by 2040. This could increase to £24.8m if effectiveness of prefault services increases further

Supply consistency

Reduced number of network interruptions

Reliability and Resilience

5. Innovation Themes and Case Studies

QUEST (ENWL)

Developing the technology in use at transforming interfaces, providing the ability to centrally control the voltage on the network at all voltage levels.

To cater for the subsequent increase in electricity demand and generation caused by decarbonisation targets, DNOs have investigated and deployed techniques such as Customer Load Active System Services (CLASS), Smart Street and Active Network Management (ANM) optimisation systems. Whilst these systems have proven successful in helping DNOs to manage the network, they do have limitations.

Using a novel application of proven technology combined with innovative software, QUEST will build an overarching system which operates a holistic voltage control methodology. This will co-ordinate existing and future voltage management techniques, establishing efficient network operation, promoting low-cost connection and use of LCTs, to deliver significant customer benefits.

QUEST develops the technology in use at the 33kV/HV and HV/LV transforming interfaces and adds similar functionality to the 132kV/33kV transformer interface, providing the ability to centrally control the voltage on the network at all voltage levels. This project builds upon ENWL's successful CLASS and Smart Street Innovation and will reduce the overall costs of accommodating increased load on networks. These savings will be passed on to consumers and facilitate the integration of low carbon technologies

- Funded: £9,674,000 (NIC)
- Project timeline: June 2021 – Dec 2025
- Project partners and collaborators: Schneider Electric, Smarter Grid Solutions, Impact Research, Fundamentals
- Project lead: Andrew Howard – QUEST Project Manager

Smarter Networks Portal project page

DNO project page

Benefits

Cost saving:

Saving of £266m by 2050 across DNOs

Capacity release

2,236.7 MVA of capacity released through deferral of reinforcement

TRL change

6 to 8

Reliability and Resilience

5. Innovation Themes and Case Studies

Interconnected HV Substation Battery Monitor (SPEN-D)

Developing and testing a low-cost solution to monitor 30V battery systems in secondary substations and alert operators when intervention is required.

Andrew Moon
Innovation Manager

Multiple times a year in interconnected HV distribution networks, the unit HV zone protection at the nearest upstream secondary substations is not tripping in the event of a network fault, due to faulty batteries. As a result, the upstream HV protection at the primary substation needs to clear the fault, and significantly more customers experience loss of supply than if the unit protection was operating correctly to isolate the fault to a smaller zone. The chance of this occurring can be significantly reduced by remote monitoring of the battery condition which is currently done by a yearly onsite inspection.

This project is developing and testing a basic automated monitoring system using the currently rolled-out LV Monitors to monitor 30V battery systems in secondary substations. The system will be able to alert operators when intervention is required, enabling earlier fault detection and increasing operational reliability.

This project is expected to result in faster restoration times during HV Faults on networks, reducing frequency and duration of power outages for consumers. This will also lead to reductions in charges paid by the network due to Ofgem penalties for Customer Minutes Lost and Customer Interruptions.

- Funded: £249,950 (NIA)
- Project timeline: March 2024 – June 2026
- Project partners and collaborators: EA Technology
- Project lead: Andrew Moon – Innovation Manager

Smarter Networks Portal project page

Benefits

Cost saving:

Expected cost saving for the DNO of up to £206,000 p.a.

Supply reliability

DNO customers are expected to have a more reliable supply thanks to the decrease in interruption frequency

TRL change

3 to 7

Integrating New Technologies

Reliability and Resilience

5. Innovation Themes and Case Studies

VICAP (NGET)

Fully automating capture and processing of corrosion-related condition data for pylon steelwork, using drones and AI to reduce helicopter use.

nationalgrid Electricity Transmission

KEEN AI sees.ai

National Grid Electricity Transmission (NGET) owns 21,900 steel lattice towers in England and Wales. Steelwork condition deteriorates through corrosion, so periodic assessments are made to understand the health of the network. NGET targets the inspection of 3,650 towers each year, capturing images of steelwork from a helicopter. These images are then processed manually. Whilst the exercise is carried out by a limited number of experienced inspectors, where classifications are marginal, there is a risk of inconsistent subjectivity in addition to substantial time and resource needs.

A RIIO-1 innovation project proved the feasibility of automating Overhead Lines (OHL) Steelwork corrosion assessment using multi-spectral and RGB (Red-Green-Blue) imaging combined with clustering algorithms to grade the extent of corrosion. To move towards an end-to-end solution that is suitable for BAU use, the automation needs to include the capability to classify collected imagery and assign the images to the right section of the tower. This project aims to test the feasibility of and build an end-to-end process for collecting, uploading, and processing visual data for an OHL tower steelwork by combining autonomous drone flights with automated data processing platform.

This innovation will lead to better data being collected at lower cost and with lower environmental impact. The project has now ben rolled out into BAU operation.

- Funded: £430,000 (NIA)
- Project timeline: April 2022 – September 2023
- Project partners and collaborators: Keen AI, Sees.ai
- Project lead: Matti Ward – Innovation Engineer

Smarter Networks Portal project page

TSO project page

Benefits

Cost saving:

Savings for consumers of £630k p.a. by reducing fuel and maintenance costs associated with helicopters and speeding up data processing

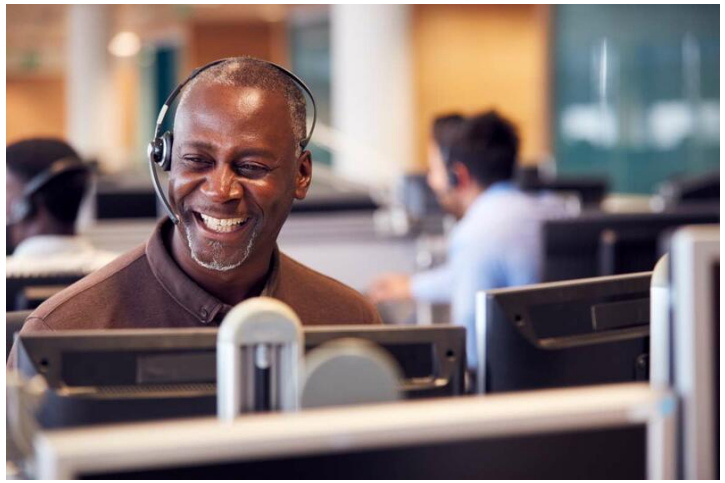
TRL change

6 to 8

Supporting Community Stakeholders

Artificial Intelligence

5. Innovation Themes and Case Studies



5.5. Supporting customers in vulnerable situations

These innovations are exploring how to best support consumers in vulnerable situations to ensure a fair and inclusive energy transition. Projects range from protecting hard-to-reach areas from outages to working with communities to make low-carbon heating affordable and accessible, as set out in the Clean Power 2030 Action Plan. Heating the homes of vulnerable customers should be fair and affordable, as the Future Homes Standard looks to transition to low-carbon heating.

As the UK transitions to a Net Zero energy system, inclusive innovation is crucial to ensure no one is left behind.

This includes a focus on empowering consumers, for example developing digital tools for personalised energy advice, such as **UKPN**'s Aimee, an AI-powered tool aimed at providing support for vulnerable consumers. Another key area of focus is maintaining connectivity and communication during network outages in remote areas, which is explored by **NGED**'s REACH project and **UKPN**'s Keeping Comms Open. Finally, social outcomes such as physical health and wellbeing are directly prioritised by projects such as **SPEN-D**'s WARMTH and **NPg**'s Supporting Warm Spaces.

Projects under this theme are particularly collaborative with local organisations and community groups, underlining the importance of stakeholder engagement. They reflect a growing emphasis on social equity, resilience, and proactive engagement with vulnerable communities.

10

Projects registered to this theme in FY25

5. Innovation Themes and Case Studies

MultiResilience - Beta (NPg)

Investigating how novel low-carbon technologies present opportunities for delivery of resilience services that maintain customer supply during unplanned grid outages.

Resilience is increasingly important as customers rely more on electricity for heat and transportation, with greatest value in rural locations that have a heightened risk of outage. Proliferation of Low Carbon Technologies across LV and HV systems present opportunities, if coordinated appropriately, for delivery of resilience services that maintain customer supply during unplanned grid outages.

Previous projects have demonstrated separate approaches via LV-connected and HV-connected resilient Distributed Energy Resources (DERs). These are small-scale power generation or storage technologies used to provide an alternative to the traditional electricity grid.

Coordination of such solutions can enhance the value case of resilience. The project will compare and contrast technologies and optimise hybrid applications of the two approaches to deliver cost-effective resilience to customers.

This project builds on learnings from both the MicroResilience and RaaS projects, taking the single-deployment cases from both projects and demonstrating the enhanced value of coordinated deployment of solutions in a network area.

This project has greatest value in rural locations that have a heightened risk of outage.

- Funded: £8,317,990 (SIF)
- Project timeline: December 2024 – September 2028
- Project partners and collaborators: SSEN, Smarter Grid Solutions, TNEI Services Ltd
- Project lead: Francis Shillitoe

Smarter Networks Portal project page

Benefits

Cost saving:

Potential savings of £235m-42.8m (conservative estimate) due to a reduction in the costs that DNOs will spend on 3rd party resilience services

TRL change

3 to 7/8

Supporting Community Stakeholders

Reliability and Resilience

5. Innovation Themes and Case Studies

VIVID – Vulnerability Identification Via Informative Data – Alpha R2 (SSEN-D)

Developing new techniques to identify which households would most benefit from offers of practical and financial support.

Simon O'Loughlin
Innovation Project Manager

The Priority Services Register (PSR) is a free UK wide service which provides extra advice and support, including when there's an interruption to your electricity, gas or water supply. VIVID will help find people who, until now, haven't registered for the PSR, are missing from Local Authority support databases or who would benefit from receiving the financial and energy efficiency help they are entitled to.

VIVID will use innovative techniques to unlock the potential of smart meter data by combining it with social and local information to drive inclusion and engagement in the energy market.

These new techniques will be used to identify which households would most benefit from offers of practical and financial support. The project will also investigate the creation and maintenance of a common regional vulnerability reference system.

VIVID successfully completed the R2 SIF Alpha phase. Learnings from VIVID are now being used as part of the VERIFY Beta project.

- Funded: £516,490, of which £448,525 is SIF
- Project timeline: October 2023 – April 2024
- Project partners and collaborators: CGI IT UK Ltd, Aberdeen City Council, E.ON, Quarriers, Smart DCC Ltd, UKPN
- Project lead: Simon O'Loughlin – Innovation Project Manager

Smarter Networks Portal project page

Innovation team email address: futurenetworks@sse.com

Benefits

Cost saving:

Initial CBA modelling shows a potential £50m benefit for consumers, society and networks, assuming that 100k households can be identified and helped with solutions implemented

Environmental impact

Promote energy efficiency and integration of LCTs amongst vulnerable households, leading to reduced carbon emissions

Supporting Community Stakeholders

Integrating New Technologies

"Building on our work to ensure a fair and equitable transition to net zero, our partnership working is also helping us progress LCT take-up amongst the vulnerable community. This is not an easy area to tackle, however our VFES and VIVID projects are helping us to understand barriers and work on solutions."
Andrew Scott, Director of Customer Services, SSEN-D

5. Innovation Themes and Case Studies

Rural Energy and Community Heat (REACH) – Alpha R3 (NGED)

Working with rural community groups to assess decarbonisation priorities and investigate whether a modular energy centre could accelerate their decarbonisation.

nationalgrid Electricity Distribution

Laurence Hunter
Innovation and Deployment Engineer

Government policy to reduce carbon emissions directs domestic properties to shift towards electrification of heating, transportation and installation of local and small-scale renewable energy and storage. This has a significant impact on the usage of electrical networks, necessitating infrastructure upgrades to lift capacity. This will be most challenging in rural areas that make up just over 21% of UK population. To promote best value for consumers, we need transitional solutions to ensure many rural customers can choose to adopt low carbon technologies when it suits them, even if it is ahead of network upgrades.

REACH will work closely with rural community energy groups to understand their decarbonisation priorities and develop a modular rural energy centre that can accelerate their decarbonisation. This can offer communities shared low carbon heating, rapid EV charging, and renewable generation in an areas where commercial markets may not serve customers and where the electricity network has limited capacity.

Working closely with community energy groups, NGED connections, and innovative suppliers, the project will evaluate the feasibility of a novel way to help customers make cost effective decarbonisation plans coordinated with wider development plans.

- Funded: £627,857, of which £487,770 was from SIF
- Project timeline: December 2024 – May 2025
- Project partners and collaborators: Smarter Grid Consultancy, Regen, Passiv, VEPod Ltd, Frontier Economics, Cranfield University
- Project lead: Laurence Hunter – Innovation and Deployment Engineer

Smarter Networks Portal project page

Learnings

Key learning 1:

A modular approach is required as one-size fits all is inappropriate given communities' diverse aspirations

Key learning 2:

Modular energy centres would only be feasible in areas of intact network constraints

Key learning 3:

A repeatable standardised connection agreement would expedite low carbon connections

Supporting Community Stakeholders

5. Innovation Themes and Case Studies

HOMEflex (Household or Microbusiness Energy Flexibility) COMPLIANCE (SSEN-D)

Developing the HOMEflex Code of Conduct, promoting an inclusive, fair and transparent domestic flexibility marketplace.

Scottish & Southern Electricity Networks

Flex Assure

Centre for Sustainable Energy

Simon O'Loughlin
Innovation Project Manager

HOMEflex started before the cost-of-living crisis and the energy price crisis, which was driven by wholesale gas price increases. During this time, the team delivering HOMEflex have engaged with consumers and stakeholders to develop the HOMEflex Code of Conduct (the Code) with the aims of creating standards for an inclusive, fair, and transparent domestic flexibility marketplace from the start.

The Code has proven to be a valuable resource for the sector, but without the Compliance Scheme based on the Code, there will be no mechanism to carry out advance due diligence of providers, ensure Flexibility Service Providers are maintaining standards or any mechanism to ensure standards for complaints and dispute resolution.

This phase of the project will deliver a Compliance scheme to establish standards, help new entrants meet the service levels consumers expect, and deserve, and enable electricity networks to confidently procure flexibility ethically, encouraging the domestic flexibility market to grow in a fairer, more sustainable manner.

HOMEflex Compliance has taken large steps to embed fairness and transparency into the Domestic and Microbusiness flexibility markets. This will result in improved customer experience and confidence, a better understanding of flexibility offers via a clearer framework of accountability, and a greater uptake of flexibility services, benefiting consumers and the energy industry alike.

- Funded: £193,000 (NIA)
- Project timeline: March 2024 – March 2025
- Project partners and collaborators: Flex Assure Ltd, Centre for Sustainable Energy
- Project lead: Simon O'Loughlin – Innovation Project Manager

Smarter Networks Portal project page

Innovation team email address: futurenetworks@sse.com

Benefits

Demand balancing (domestic flexibility in general):

Potential to reduce the GB system peak demand by up to 10% (6.8GW) and to provide up to 37GW of demand turn up flexibility (53% of the GB system peak)

TRL change:

3 to 7

Supporting Community Stakeholders

Integrating New Technologies

"We're delighted to publish HOMEflex's final recommendations report marking a pivotal step toward a fair, transparent, and consumer-focused domestic flexibility market. This work lays the foundation for a voluntary compliance scheme that will help prepare the sector for upcoming government licensing."
Charlotte Roniger, Scheme Manager, Flex Assure

5. Innovation Themes and Case Studies

5.6. Whole Energy System

Optimising the integration and coordination of the operation of electricity networks with heat and other energy networks as well as other utilities and sectors, aiming to accelerate decarbonisation and deliver benefits across the energy ecosystem

10

Projects registered to this theme in FY25

This innovation theme recognises the importance of coordination across the nation's energy system, as networks better understand the interdependencies between electricity, heat, transport, and data.

Projects are exploring innovation strategies with holistic system benefits. For example **SSEN-T**'s INCENTIVE project, which investigates how inertia can still be provided to a Net Zero grid through offshore wind farms. Meanwhile, **NGED**'s Headroom - Whole System Thinking project analyses the impact of increased grid capacity on consumer bills and the country's carbon intensity as the generation mix tilts further towards renewables.

This whole-system perspective enables more efficient investment, better coordination across infrastructure providers, and improved outcomes for consumers. It also reflects a growing understanding that collaboration across sectors is essential in delivering the energy transition.

5. Innovation Themes and Case Studies

Headroom – Whole System Thinking (NGED)

Investigating the impact added distribution capacity will have on electricity costs and the carbon intensity of the grid as more generation connects to the network.

nationalgrid Electricity Distribution

ea technology

Baringa

Laurence Hunter
Innovation and Deployment Engineer

The move towards increased use of the electricity vector will mean that whole electricity system costs will have a higher dependency on distribution connected assets that can provide flexibility. As the rate of electrification increases, distribution network constraints are expected to have a higher impact on the optimisation of the costs, and carbon intensity of the whole electricity system.

This project aims to evaluate the whole energy system to determine the benefit per unit of added headroom. This benefit will be quantified in terms of both the reduced cost of energy (£/MWh) and reduced grid carbon intensity (CO2/MWh) that can attributed to increased distribution network headroom, for each voltage level, at critical times of year, and different constraint scenarios.

The project consists of two phases. It begins by quantifying the magnitude of benefit available from increasing headroom, then delves deeper into how different asset classes and archetypical variances will vary the benefit.

Voltage level analysis indicated that the strongest areas of potential benefit would be on the Low Voltage (LV) and 132 kV networks. Volume-based sensitivity derived a figure of £100 per MWh which is the total system curtailment vs total system benefit.

- Funded: £658,257, of which £560,463 was NIA funded
- Project timeline: September 2023 – May 2025
- Project partners and collaborators: EA Technology, Baringa
- Project lead: Laurence Hunter– Innovation and Deployment Engineer

Smarter Networks Portal project page

Benefits

Cost saving:

£2.5 bn potential savings in the best view (£1.93 bn wholesale, £0.21m carbon cost reduction, £0.35 bn in ancillary costs)

Majority of saving concentrated on 132 kV and LV network capacity upgrades

TRL change:

3 to 7

Integrating New Technologies

Climate impact

5. Innovation Themes and Case Studies

AFLM (SPEN-D)

Developing and trialling an Active Network Fault Level Management (ANFLM) system which improves fault level headroom utilisation.

The management of fault levels has always been challenging and problematic for DNOs, particularly given the safety implications as they can result in equipment failure and a serious personnel and public safety risk. Due to unprecedented growth in distributed renewable generation, fault level headroom constraints are becoming increasingly challenging, often requiring major reinforcement schemes. Fault levels can act as a barrier to the connection of renewable generation and have become a decisive factor in determining the financial viability of distributed generation connections.

This project aims to develop an active network management solution. The results of this will be to avoid or defer network reinforcement works and accelerate the integration of renewable generation.

The project has been re-registered under RIIO-2, and has been progressing satisfactorily. Interface between the AFLM system and the existing control system has been fully developed, while tests have been carried out within the offline development environment.

- Funded: £1,050,000 (NIA)
- Project timeline: March 2024 – March 2026
- Project partners and collaborators: Smarter Grid Solutions
- Project lead: Ralph Eyre-Walker – Environmental and Innovation Manager

Smarter Networks Portal project page

Benefits

Cost saving:

Potential savings of £600,000 per GSP (grid supply point, of which there are over 100 within the SP Energy Network)

TRL change:

2 to 7

Supporting Community Stakeholders

Reliability and Resilience

5. Innovation Themes and Case Studies

Regional Energy System Optimisation Planning (RESOP) (SSEN-D)

Developing the Local Energy Net Zero Accelerator tool, working with DESNZ and Scottish Local Authorities to improve functionality.

Rhys Williams
Project Manager

Regional bodies including Local Authorities (LAs) are increasing their focus on developing Net Zero Plans, including Local Area Energy Plans (LAEPs), through collaboration with utilities, private industry and other energy stakeholders. In order to create LAEPs, LAs require in house energy modelling expertise and energy modelling tools, which most do not have. Many LAs are therefore hiring external contractors to fill this gap, which is an expensive use of resources.

This project aims to develop the Local Energy Net Zero Accelerator (LENZA) tool so that it can be used to create digital LAEPs, as well as working with Scottish LAs and DESNZ to geographically display locations of potential Heat Networks and make LENZA available to all LAs within SSEN's network area to increase testing and functionality.

The project is a continuation in a series of associated projects including Whole System Growth Scenario Modelling Phases 1 and 2.

- Funded: £2,894,576 (NIA)
- Project timeline: October 2023 – October 2025
- Project partners and collaborators: Advanced Infrastructure Technology Ltd, DNV, Field Dynamics (Dotted Eyes Solutions Ltd), Landmark Information Group Ltd, Regen, Centre for Sustainable Energy, UrbanTide Ltd, Faculty Science Ltd, WSP UK Ltd
- Project lead: Rhys Williams – Project Manager

Smarter Networks Portal project page

Innovation team email address: futurenetworks@sse.com

Benefits

Cost saving:

Potential savings of £3.17m p.a. for LAs across the UK as no need to hire contractors to create LAEPs

TRL change:

4 to 6

Collaboration with Partners

Integrating New Technologies

"Oxfordshire sees the power and benefits of the LENZA platform, and it will form a central plank of our LAEP work and the development of our internal LAEP capabilities going forward. LENZA is already used by many people in councils across the county to understand network topography, visualising network scenarios and modelling the impact of local projects.." **Mark Saunders, Oxfordshire City Council**

5. Innovation Themes and Case Studies

INCENTIVE (SSEN-T)

Investigating and demonstrating how offshore wind farms can provide inertia to onshore networks.

Scottish & Southern Electricity Networks TRANSMISSION

NESO National Energy System Operator

CARBON TRUST

Inertia in the GB electricity network is falling, and without novel solutions, adding renewable generation capacity will become increasingly challenging, leading to instability events and increasing operating costs. Historically, renewable generators have not treated system inertia as their problem, as inertia has been high due to (mostly fossil-fuelled) synchronous generation. However, renewable generation is already being curtailed due to low system inertia.

The INCENTIVE project investigated how offshore wind farms can provide inertia to onshore networks. It found that offshore wind, with an INCENTIVE STATCOM supercapacitor or INCENTIVE BESS, can deliver necessary and cost-effective stability services.

Technical testing confirmed the devices could stabilise the grid, but current Grid Code requirements and testing practices do not reflect all system strength benefits – with other technologies rated more highly.

The project proved the economic benefits of INCENTIVE solutions. However, current market incentives were found to be unclear. By undervaluing grid-forming devices and imposing onerous requirements on inertia contribution, the current stability market framework places novel inverter-based assets at a disadvantage.

- Funded: £1,122,973 (SIF)
- Project timeline: June 2023 – October 2024
- Project partners and collaborators: NESO, University of Strathclyde, Carbon Trust
- Project lead: Adnan Mahmood – Innovation Delivery Project Manager

Smarter Networks Portal project page

Benefits

Cost saving - supercapacitor:

Adding supercapacitor energy storage and grid forming converter at would add stability services at a 75% cost reduction relative to standard Stability Pathfinder (SP) procurement. Assuming 50% of GB's offshore wind can be connected, savings of around £1bn could be delivered over 30 years.

Key learning:

Additional barrier to BAU deployment of the grid forming STATCOM with supercapacitors - the '5 second rule', which is based on the capability to deliver inertia

Reliability and Resilience

6.

Continuing the Cycle

6. Continuing the Cycle

6.1 Opportunities Ahead

Innovation continues to deliver progress across all strategic themes, with strong momentum in Net Zero and system optimisation.

During FY25, our networks launched 120 innovation projects, with 83 (69%) focused on the themes of 'Net Zero and the energy system transition' and 'Optimised assets and practices'. These projects accounted for 61% of total funding registered during the year, demonstrating a clear strategic focus.

At the same time, networks are aligning their innovation efforts with broader system goals, such as those outlined in National Grid's Operational Objectives, which take a whole-system view of progress. The most recent publication of the Electricity Networks Innovation Strategy reinforces this approach. It provides a unified framework to innovate in ways that support the UK's low-carbon transition and deliver value to customers.

As we progress through RIIO-2, projects are becoming increasingly iterative, building on learning from previous projects over extended periods of time and across funding streams. For example, SSEN-T's AIM High project, funded through NIA, has paved the way for the ambitious SIF project ODIN (Optimisation and Diagnostics for Innovative Networks). Future projects will also continue this trajectory to ensure that learnings from the past year are taken forward, moving up the Technology Readiness Level (TRL) scale and closer to business as usual implementation.

The next electricity transmission price control period, **RIIO-3**, begins in April 2026, with draft determinations announced by Ofgem in July. Ofgem expects total innovation for electricity transmission spending over the RIIO-3 period (2026-2031) to be far in advance of anything seen previously – total expenditure could exceed £80bn. The next electricity distribution price control period, ED3, is due to start in 2028, with draft determinations yet to be announced.

Looking ahead, networks will be expected to meet a range of requirements to secure project funding. Proposal documents will need to clearly outline how projects will engage stakeholders, assess environmental impacts, and align with the Distribution Network Operator's (DNO's) business plan.

Projects that demonstrate clear decarbonisation benefits, community value, scalability, and responsiveness to public concerns will be well-placed to secure funding and deliver lasting impact.

6. Continuing the Cycle

6.2 Key Learnings

Innovation is delivering results and shaping the future of our networks.

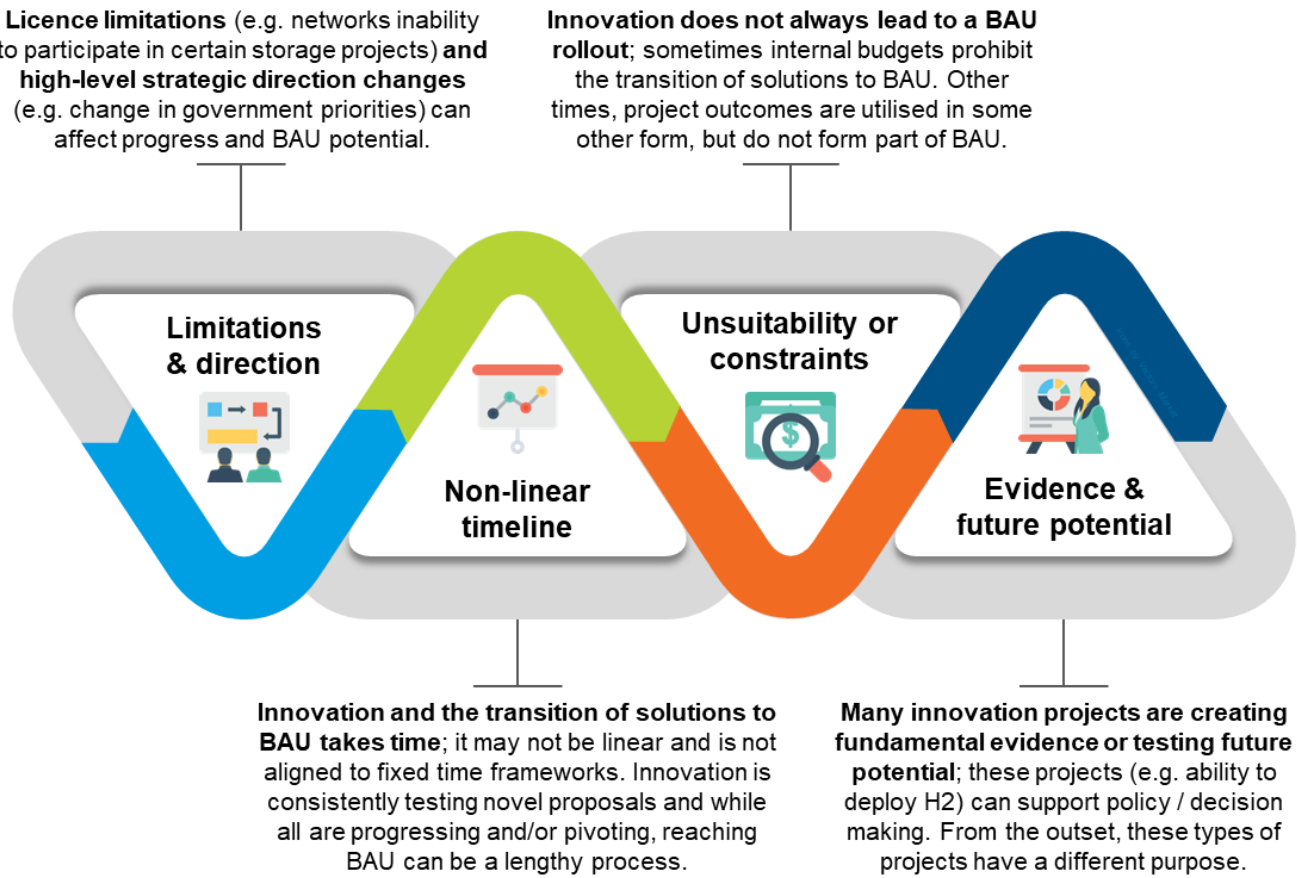
During the FY25 period, networks registered 120 new projects, completed 155 and successfully integrated 23 solutions into business-as-usual (BAU) operations[1]. As projects progress, networks continue to seek opportunities to embed innovative solutions into day-to-day operations.

However, this process is not always straightforward. Innovation takes time, and the path to BAU can be complex.

Networks may face strategic, policy, or operational challenges that require flexibility and persistence. Not every project is ready or designed for immediate rollout. Some focus on building evidence, testing feasibility, or exploring future possibilities. These projects play a vital role in expanding our collective knowledge and preparing the system for long-term transformation.

We've summarised the key challenges and lessons learned in Figure 7.2, offering insights that will help shape future innovation across the sector.

Figure 6.1 BAU challenges and lessons



[1]This imbalance between the number of projects launched / registered and the number completed is to be expected for a period nearing the end of a price control period, as project registration tends to be front loaded for a particular period of this type.

6. Continuing the Cycle

6.3 Recommended Actions

Embedding innovation into BAU requires clear communication, strategic planning, and industry-wide support. This section outlines the key enablers that help networks integrate innovation outcomes into day-to-day operations. A strong focus on communication throughout a project is essential, ensuring that teams across the business understand the value of proposed changes and are invested in successful deployment. To support this, networks are encouraged to develop a clear plan for deployment early in the project lifecycle. This helps align innovation activity with wider business strategy and provides a reference point for demonstrating benefits throughout development.

Support from industry stakeholders is also vital. A consistent methodology for capturing non-financial benefits, such as environmental impact and knowledge generation, would help networks better articulate the value of innovation, particularly to senior leadership and the wider energy sector. This is especially important for low Technology Readiness Level (TRL) projects, which play a critical role in testing feasibility but can be harder to quantify due to their experimental nature. ENA will continue working to ensure future updates to the Innovation Measurement Framework (IMF) reflect these priorities and support the sector's long-term innovation goals.

Unlocking innovation for business-as-usual requires targeted funding and flexible regulation.

Additional funding dedicated to deploying innovative solutions into BAU operations would help networks to overcome barriers such as resource constraints, policy limitations and organisational practice. To support this, Ofgem has introduced a beta version of the Energy Regulation Sandbox, which helps innovators trial new propositions without some of the usual rules applying, and are also planning to launch the Future Regulation Sandbox, an innovative policy instrument to test and trial changes to the energy rulebook in a controlled environment before implementing them. This initiative could help mitigate some of the regulatory barriers to innovation.

However, the specifics of deployment are often outside of the scope of innovation projects, and networks still struggle to quickly assemble the necessary resources. Additional policy support through relaxed licence obligations or the ability to use a more simplified/agile policy process has also been highlighted as an important avenue to boost BAU deployment.

GB Gas Networks Annual Innovation Summary

Supported by Future Energy Networks

GB Gas Networks Annual Innovation Summary

Supported by Future Energy Networks

Report Highlights

This 2024/25 Annual Innovation Summary Report brings together the collective activity of the gas networks – the four GDNs; Cadent, Northern Gas Networks, SGN, and Wales & West Utilities – along with the transmission network operator – National Gas, working under the umbrella of Future Energy Networks (FEN) over the last 12 months, illustrating the value of, and impact delivered by, their innovation projects. Supported by key public funding schemes such as the Network Innovation Allowance (NIA) and Strategic Innovation Fund (SIF), gas networks are investing in innovation projects to enable an equitable energy transition, while ensuring the resilience of the energy system. The process through which these innovation projects have been developed, the associated engagement with energy system stakeholders and beyond, the project outcomes, learnings, the benefits delivered, and how these progress the innovation objectives is explored here.

High-level Timeline

Over 2024/25, significant progress has been made through projects delivered via network innovation funding. While there are many notable milestones, this high-level timeline highlights a selected set of pivotal events which were key in either shaping the progress made or are exemplary cases of innovation and collaboration.

Innovation Zero
April 2024

Utility Week Live
May 2024

All-energy exhibition and conference
May 2024

Future of Utilities Summit
June 2024

International pipeline conference
September 2024

No-Dig Live
October 2024

Energy innovation summit
October 2024

Completion of Hydrogen Heat Programme
Dec 2024

Opening of H100 Fife demo homes
Feb 2025

Energy innovation basecamp
February 2025

SIF community forum
March 2025

Biomethane connect Europe
March 2025

Launch of Green Gas Taskforce
April 2025

2024/25 Year in Review

In November 2023, the five GB gas network companies, comprising the Gas Distribution Networks (GDNs) and National Gas Transmission, announced their intention to resign their membership of the Energy Networks Association (ENA), effective from the end of 2024. On 1 August 2024, these networks formally joined a new membership organisation, Future Energy Networks (FEN). As a result, this report focuses exclusively on the innovation activity undertaken by the gas networks, reflecting the sector's distinct technical, regulatory, and decarbonisation pathways. As such, the statistics in this report should not be compared directly to those in prior, joint gas and electricity reports.

Guided by the six shared innovation themes, the gas networks have committed millions of pounds to innovation projects that will deliver real benefits to consumers across Britain. In 2024/25[1], 48 projects were registered with a total committed spend of nearly £13m. They have also attended and organised over 60 in-person and online knowledge sharing events, fostering engagement with new partners and industry stakeholders.

Balanced Scorecard

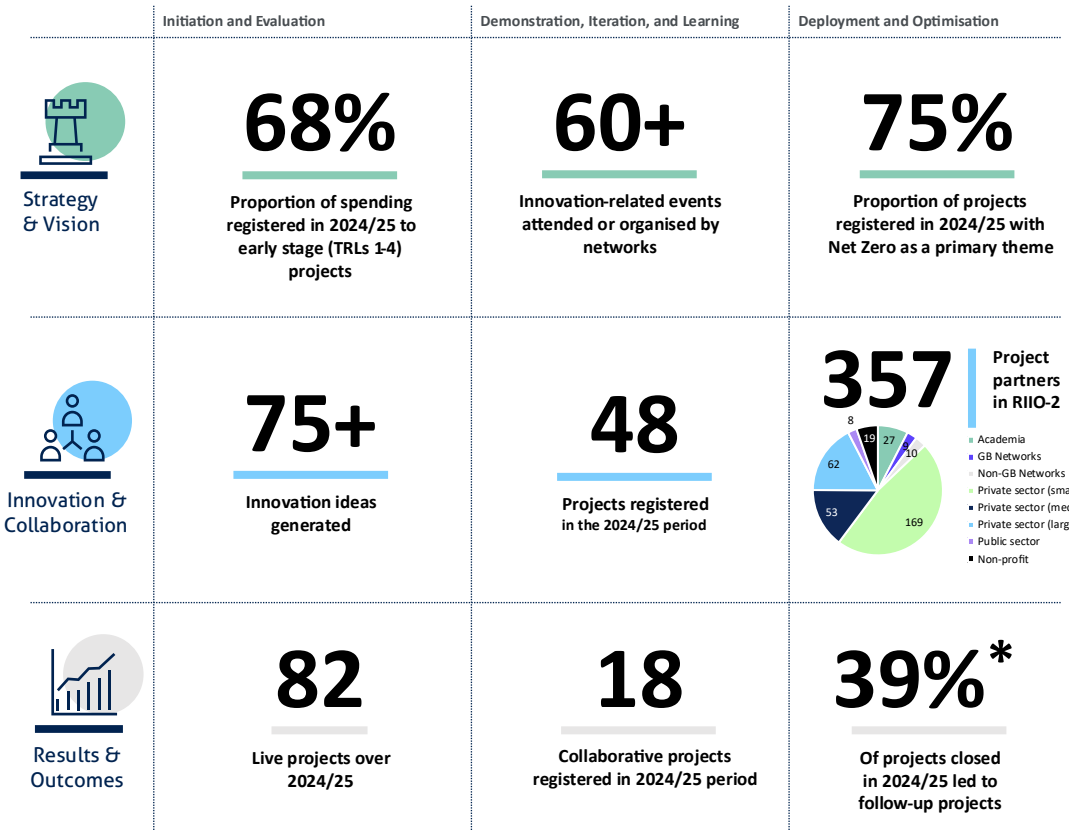


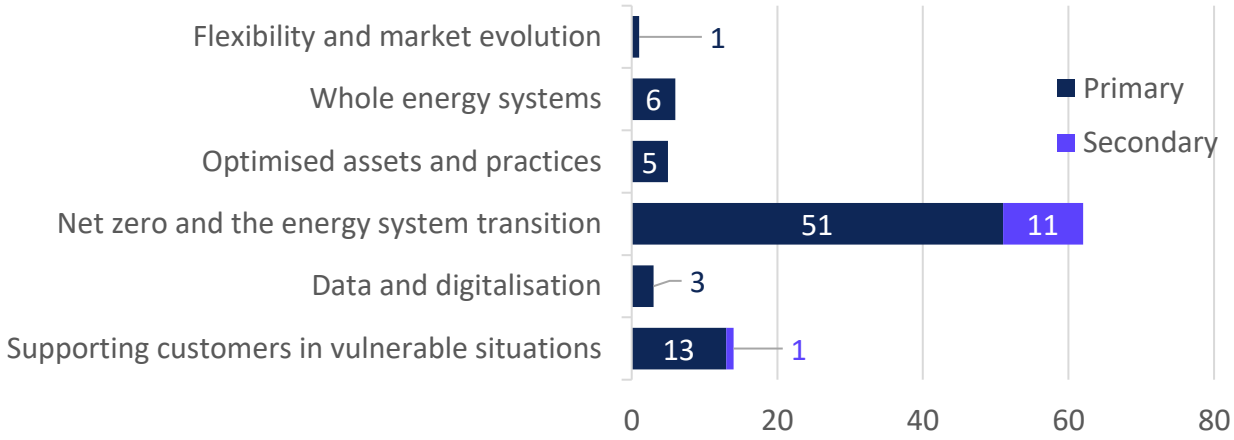
Figure 1. 2024/25 Balanced Scorecard

* This figure is calculated using the projects listed in the IMF submissions as directly leading into a follow-up project, as a proportion of projects which have "next steps" listed. It is likely to be an underestimate, as other projects' findings may still be used as a smaller part of future projects, or directly in future projects which have yet to be formally registered.

[1] This report concerns the 2024/25 regulatory year, running from April 2024 to March 2025.

Project Themes

Innovation projects are classified by their primary and secondary themes – a breakdown is given below.



75% of the innovation projects registered over 2024/25 were listed with "Net Zero and the energy system transition" as the primary innovation theme, reflecting the priority placed on ensuring that gas networks adapt to the UK's energy transition. This includes several areas and technologies; several projects have focused on building the evidence case for how gas networks can be repurposed to carry hydrogen in an energy system of the future, while others have focused on the integration of biomethane into the gas grid.

The second most populated innovation theme is "supporting consumers in vulnerable situations", with 13% of projects registered in 2024/25 listing this as their primary innovation theme - this highlights the continued importance of the gas network in maintaining a secure and affordable energy supply for those most at risk, and in ensuring that the energy transition is fair and equitable.

How Benefits are Delivered

A significant proportion of gas networks' innovation over 2024/25 (and more broadly during RIIO-2) has focused on building the evidence base on how their infrastructure can be repurposed for use in a Net Zero energy system. These projects necessarily begin at the early TRL levels – corresponding to Research and Development (R&D) projects. A breakdown of the TRLs of the of projects registered in 2024/25 is shown in the table below. In that year, TRL 1-4 (i.e. early-stage) projects account for 69% of the work, and 68% of spending. The early-stage nature of this work makes it difficult to quantify the financial value of these projects using simple heuristics or accounting rules; this is compounded by the fact that the projects deliver learnings that will inform future policy decisions, so it will feature more in some future energy system development scenarios than others.

TRL Map	% Projects	% Spend
TRL 1	4%	3%
TRL 2	33%	21%
TRL 3	17%	18%
TRL 4	15%	26%
TRL 5	15%	15%
TRL 6	6%	11%
TRL 7	6%	3%
TRL 8	2%	2%
TRL 9	2%	1%

However, the R&D carried out under these projects builds the evidence-based foundation for further development across the energy system; the insights gained over their duration lead directly to subsequent projects – based on available IMF data, over 40% of the projects which closed in 2024/25 led to new projects, building on the previous findings. These early-stage projects increase TRLs and mitigate the deployment risks associated with innovative technologies. For example, WWU's Smart Pressure Control roll-out project builds on the RIIO-1 Optinet project, outlined further in the report, which deploys the innovation findings from the earlier project into network operation. Similarly, the HyLine project continues to build on learnings from earlier project phases back to 2021, all enabled by innovation funding.

This work is beginning to deliver real world impacts; SGN's pioneering project at H100 Fife is moving into the operational phase, demonstrating the production, storage, and distribution of 100% green hydrogen directly to domestic residences, allowing customers to see how hydrogen is used in the home, and gas engineers to work with hydrogen boilers and cookers in an operational setting. Similarly, Cadent's Project Helix has taken a wearable CO alarm from the drawing board through the prototype stage to field trials, and aims to release a product to market in the next 12 months.

Low-TRL technologies crucial to the net zero transition can also be incubated and brought to market using innovation funding through dedicated trial environments, such as NG's FutureGrid – a high-pressure test facility at DNV Spadeadam, a purpose-built using recently decommissioned NTS assets – where a wide range of tests of hydrogen blending can be carried out in a secure offline environment, replicating every part of the gas transmission system.

The Innovation Process - Objectives

Innovation project goals centre on a set of linked Objectives, Principles and Themes developed in 2024 by the gas and electricity networks in the Energy Networks Innovation Strategy. The adoption of this strategy, outlined in Figure 2, across the energy system ensures that innovation works towards developing a safe, resilient and low-carbon energy system that fulfils its users' needs. Innovation projects will address at least one of these objectives to ensure that efforts are targeted at the most significant challenges networks face.

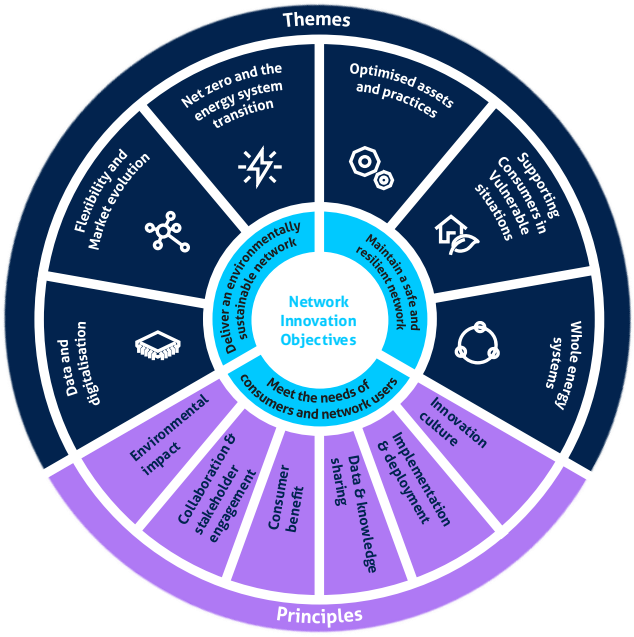
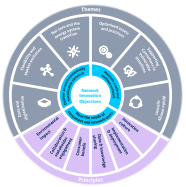


Figure 2. Network Innovation Strategy

What do the projects achieve?



The focus of these **objectives** is to meet the needs of consumers (including those in vulnerable situations) in a safe and environmentally responsible way while maintaining a resilient network.

How do networks approach innovation?

The six **principles** target the way that networks approach innovation, rather than the content or subject of a particular innovation project.

What themes do projects focus on?

The six **themes** are the priority innovation areas developed collaboratively by the networks. Each theme is associated with a set of focus areas which indicate the networks' priorities in that area. These themes and focus areas help direct innovation so that it targets the biggest challenges for the future energy system.

Network progress against objectives

2024/25 innovation projects have made progress against each of these objectives – selected examples and high-level metrics are given below.

Innovation Objective 1: Meet the needs of consumers and network users

Networks have made significant progress against meeting customer needs through innovative projects, such as NGN's Futures Close Heat Programme and Cadent's Finding the Hidden Vulnerable, which have delivered emissions reductions, customer support and financial savings. Both projects have made use of valuable NIA funding support to improve customer experience across the network, especially for at risk and vulnerable households, which would otherwise have been adversely affected. In general, projects benefit consumers monetarily through financial savings, or non-monetarily, such as by improving network resilience or ensuring a secure supply of gas to consumers. Although the latter type of benefits is harder to quantify, it is an important part of the overall value to consumers.

In some cases, the benefits to the consumers are realised following years of consistent work to translate an idea to a BAU rollout. This year, although 69% of registered projects started at TRL 1-4, 58% of active projects will bring their solutions to a TRL of at least 5 at the time of their completion. The evidence gathered by the early TRL projects will enable gas networks bring forward solutions to meet network users' long term and future needs.

Other projects have made use of prior learnings to bring innovative technologies closer to BAU rollout. Cadent's Low Power Hot Water Phase II is an example of a consumer-oriented project which has built on evidence gathered previously – in this phase, prototypes of graphene ink-based heaters manufactured by Haydale, a key project partner and nanomaterials pioneer, are developed and optimised based on the findings of Phase I.

Examples of non-monetary consumer benefits

58%

Of 2024/25 active projects will end at TRLs 5-9

Innovation Objective 2: Deliver an environmentally sustainable network

Numerous projects over 2024/25 have aimed to make gas networks more environmentally sustainable – and significant work has investigated and stimulated the adoption of 'green' gases, including hydrogen and biomethane.

A broad portfolio of work has looked at developing a hydrogen-capable network, connecting future hydrogen production to use sites, with several flagship projects supporting hydrogen integration. These include:

- Project Union from National Gas, in which existing transmission network will be repurposed to create the spine of national hydrogen network, ensuring a continual supply of natural gas while avoiding the cost associated with decommissioning.
- SGN's H100 Fife and LTS Futures projects; the former will develop an end-to-end 100% hydrogen network, connecting generation (through electrolysis) to dedicated distribution network supplying homes in Buckhaven and Denbeath with green hydrogen for heating and cooking, while the latter repurposes 30km of gas distribution network for hydrogen use, demonstrating a world-first connection of two new connections though live welding, and 'hot tapping' of the operating pipeline.
- WWU's HyLine Cymru, in which a new 130km hydrogen pipeline running from Pembroke to Port Talbot will be built, supplying hard-to-decarbonise industrial customers with low-carbon hydrogen.

- East Coast Hydrogen in which National Gas, NGN and Cadent, look to connect the hydrogen production in Teesside and the Humber, salt cavern storage and industrial off-takers in north east England through new and existing transmission and distribution infrastructure.

The work carried out in these projects is jointly developing the knowledge base needed to understand the task of repurposing the gas grid, or parts thereof, for blended or pure hydrogen as a low-carbon energy - the associated technologies are currently in their early stages, as this work continues and develops these technologies toward maturity, later stage projects will investigate the potential role of hydrogen in the gas at greater scale. As detailed below, learnings from these projects will define the networks' contribution to the Hydrogen Heating Programme, which will support the government's decision on hydrogen's use in heating.

Completing the Hydrogen Heating Programme

The Hydrogen Heating Programme (HHP), led by the Department for Energy Security and Net Zero (DESNZ), has been a landmark initiative aimed at understanding whether hydrogen could safely and practically play a role in heating homes and businesses as the UK moves toward Net Zero. From the start, the programme was designed with a clear purpose: to generate the evidence that the Health and Safety Executive (HSE) would need to make an independent judgment on the safety of hydrogen heating.

To guide the work, HSE set out more than 130 specific pieces of evidence required, covering every aspect from technical network adaptations and appliance conversions to consumer behaviour and operational safety. HHP's trials and demonstrations were carefully designed to address each of these requirements, producing a rich and detailed evidence set that would give HSE the insight it needed to assess whether hydrogen could be safely used at scale.

By winter 2024, the programme had delivered the full evidence package. HSE is now reviewing this information through its structured Evidence Review Groups, supported by panels of experts, applying the legal safety test of reducing risk "as low as reasonably practicable" (ALARP). Their conclusions will be reported to DESNZ, Ofgem, and industry, and will directly influence decisions on whether and how hydrogen heating could be rolled out across the country.

While the value of this evidence cannot yet be quantified financially, it represents a uniquely important body of knowledge. It provides government, regulators, and networks with the insight, confidence, and clarity to make informed decisions. From the outset, generating this evidence has been the programme's key objective, and it now stands as a foundational resource for shaping the future of hydrogen in the UK's energy system.

Other work this year has focused on use of biomethane; WWU's Smart Pressure Control project investigates how to manage demand fluctuations to increase networks' capacity for biomethane, while all networks will explore biomethane's use as part of work done by the Green Gas Taskforce, discussed later in the report.

While the incorporation of low carbon gases into the network is a key innovation focus in sustainability, networks are also working to reduce the emissions associated with network operation - through projects such as Reducing Gas Emissions during Pipeline Commissioning.

Taking a wider view, environmental sustainability of the gas grid has also been advanced by projects such as SGN's Carbon Networks, which explored how the network can support the growing Carbon Capture, Utilisation and Storage industry. Powering Wales Renewably, a SIF Beta phase project from the National

Energy System Operator (NESO), addresses environmental sustainability from a system perspective; a holistic view of system environmental impact is crucial as networks look to meet deadlines set out in the Clean Power 2030 Action Plan.

Also supporting these goals, WWU's Accelerating Progress project has developed our understanding of the realistic, achievable and cost-effective options available to gas distribution networks to contribute to the reduction of emissions, and identified cost-effective, feasible decarbonisation measures that could tackle 23% of the gap to meeting carbon budget six emissions targets. This includes continuing progress in reducing methane emissions and increasing the volume of biomethane in the GB gas system. Outputs from the project have been published by FEN and shared with a wide range of stakeholders.

Supporting Clean Power 2030

As RIIO-2 progresses and preparations for RIIO-3 begin, gas networks are investigating paths to meeting government deadlines for decarbonisation. The first of these is Clean Power 2030, which looks to reduce electricity production reliance on fossil fuels and focuses on renewables. To meet this target, a gas power system will still be required, but its use will be limited to times when renewable sources are unavailable. This changes the usage scenario for gas networks and could require winter level gas flows to be supported in the middle of summer.

Gas networks are currently assessing the impact of these changes on the natural gas network and are considering innovative solutions to support these ambitions. For example, National Gas Transmission are adopting a "three-molecule approach", encompassing the continuation of natural gas delivery, while reducing the carbon content through biomethane and hydrogen blending with the use of Carbon Capture, Utilisation and Storage (CCUS) to capture emissions (requiring transport of CO_2), as well as the rollout of 100% hydrogen pipelines.

Projects such as Wales and West Utilities' Accelerating Progress project is identifying new ways for gas distribution networks to cut their emissions and boost their contribution to decarbonisation.

Innovation Objective 3: Maintain a safe and resilient network

Safety of consumers and infrastructure operators is at the heart of all network operations, and many of this year's gas network projects have included a particular focus on the topic, for example SGN's Predictive Safety Interventions aims to reduce injuries and fatalities of workers in utilities- in the Alpha phase, this SIF project deployed a proof-of-concept machine-learning model, which accurately quantifies risk scores in real time, and prompt a preventative or mitigating actions, this model will be iteratively improved and extended in the Beta phase, into which it has now moved. Improving the safety of infrastructure operators will reduce operational costs for the networks and the physical and psychological impact these injuries may have on the workers.

Meanwhile, the Accessible CO Alarm project focuses on consumer safety – developing a prototype of an accessible CO alarm with integrated IoT features, tailored to the needs of vulnerable and disabled individuals.

These projects illustrate the ongoing work focussing on safety across all stages of the gas value chain, from mitigating the risks involved for those working with the physical network to ensuring consumers can use gas safely within their homes.

Networks are also innovating to improve resilience, minimising the chance of outages – NGT's B-Linepack+ project explored the feasibility of intermediate scale gas storage sites to supplement linepack capacity, providing system resilience and flexibility. This programme has received vital SIF funding and has since moved into Alpha phase, and closer to BAU integration.

1-2 tonnes

Estimated storage capacity of B-Linepack+ demonstrator at 30-80m depth

Stakeholder Engagement Driving Innovation

Networks strive to generate additional value via engagement and collaboration with energy system stakeholders and other interested parties, to support the development of novel initiatives and ideas. Key planks of this effort are knowledge dissemination and sharing events, holding webinars, and continuously engaging with existing and new partners. All gas networks also attended the Energy Innovation Summit in October 2024 – their flagship energy network knowledge dissemination event.

Energy Innovation Summit

In 2024/25 the gas networks continued to play an active role in the ENA Energy Innovation Summit.

Networks collaborated on a single platform where delegates could access the major learnings from all NIA and SIF projects. Networks collaborated on a single platform where delegates could access the major learnings from all NIA and SIF projects. The event brings together industry leaders, innovators, policymakers and stakeholders to demonstrate how innovation is delivering on the government's energy strategy.

This year, the Summit was focused on the topic of *Accelerating innovation to deliver Net Zero*, and the agenda prioritised three themes:

- Accelerating system capacity to enable mass integration of low-carbon technologies
- Understanding the challenges of operating in Net Zero and enabling an inclusive transition for all
- Ensuring reliability and resilience of an increasingly critical energy system

Over 2024/25, in addition to the Basecamp, gas networks have deliberately broadened their reach by actively participating in leading industry gatherings such as Innovation Zero, Utility Week Live and All-Energy in Glasgow. They engaged directly with innovators, academics, policy makers and industry players to ensure that insights from the gas sector were shared in diverse settings. This more outward-facing approach is helping to foster collaboration and ensure gas network innovation is integrated into the wider energy transition conversation. By reaching beyond traditional channels, the networks created new opportunities for collaboration, raised the visibility of gas network innovation, and ensured that learning and knowledge exchange extended well beyond Basecamp into the wider energy and innovation ecosystem.

Next Steps

In the coming months, gas networks will continue to build on the projects developed and learnings gained over 2024/25 as they prepare for the upcoming RIIO-3 price control period. Future projects will aim to use these learnings to move up the TRL scale and closer to business-as-usual implementation. Projects already planned in the pipeline that will build on this year's work, include the second phase of WWU's Hydrogen Storage Feasibility Study, which will be NIA funded, and the Alpha phase of NGT's SIF-funded Future Operability of Gas for System Integration project, which will be in its Alpha phase of development.

Networks will continue to work closely together to support the innovation process and are working to strengthen communication and planning throughout project lifecycles, articulating benefits clearly to drive internal buy-in, and advocating for additional funding and regulatory support to enable smoother integration of innovative solutions into everyday operations.

Innovation Context

2025 marks a turning point in how gas network innovation is managed, reported, and mobilised – this year, gas and electricity networks are publishing their *Annual Innovation Summary* reports separately. By focusing on the innovation work of the gas networks, this report provides a clearer picture of the projects, progress and learnings that relate directly to the future of the gas networks, and how it will interface with the wider energy system. The challenges and opportunities gas networks face include building the evidence base for the use of hydrogen, scaling up biomethane, green gases, developing hybrid heating solutions, and ensuring the continued safety and resilience of our existing infrastructure as the transition unfolds. Publishing a standalone report allows us to explore these areas in greater depth, while continuing to collaborate with our electricity colleagues where our work overlaps. Taken together, the gas and electricity reports provide a full view of network innovation across Great Britain; individually, they provide sharper insight into the contributions of each sector.

Value of network funding

Innovation projects deliver value for consumers, the wider energy industry, and networks while supporting the progress towards government policies and targets. Broadly, the outputs of innovation improve network security, resilience, and provide the data and insights the network operators need to make better decisions about how to operate and invest in their networks as the energy system decarbonises. These innovations contribute to the broader transformation of networks to support the Net Zero transition, providing holistic solutions rather than point-to-point fixes. The benefits of innovation can then be passed to network users, for example, in the form of new or improved services, or reduced bills.

How the RIIO structure unlocks innovation and ensures value for money

The RIIO model encourages innovation across the gas sector, resulting in concrete social, financial or environmental benefits, but also less-quantifiable improvements in decarbonising the network or improving consumer vulnerability. Through the Strategic Innovation Fund (SIF) and the Network Innovation Allowance (NIA) funding mechanisms, the RIIO-2 framework guides innovation in the gas sector to ensure that all projects meet Ofgem's eligibility criteria of:

- Facilitating energy system transition and/or benefiting consumers in vulnerable situations,
- Delivering net benefits to consumers,
- Being novel, involving research, development or demonstration, and
- Avoiding duplication

Several foundational capabilities have been developed through innovation work over the course of the RIIO-1 and RIIO-2 price control periods, by leveraging network funding to deliver progress in the innovation space. The RIIO model has enabled iterative improvements and collaborative knowledge-sharing across the GB energy system, underpinned by performance-based incentives. These processes ensure that innovation is original in its approach and complementary to existing work, thereby maximising efficiency and avoiding repetition. Crucially, the RIIO framework provides a pathway for scaling successful demonstrations into business-as-usual, ensuring that technologies and practices deliver measurable consumer value and play a meaningful role in the transition to Net Zero.

As GB moves towards Net Zero targets, natural gas continues to be a critical fuel, and the RIIO structure is driving innovation and progress in the GB gas sector's energy transition. As such, a key innovation area has been the decarbonisation of the gas grid. Recent government strategic policy decisions have indicated support for blending up to 20% hydrogen (by volume) into the GB gas distribution network, and development of hydrogen safety and technical cases is fundamental to supporting the future integration of hydrogen into the gas transmission and distribution networks. Innovation projects, enabled by RIIO, have

supported the development of detailed feasibility and design studies and development of the safety case and physical testing of hydrogen in the gas network through demonstration projects to create the evidence base for policy and future decision making, in both transmission and distribution networks. The work, including Blending Infrastructure for the NTS, Hydrogen Blending in LPG Feasibility Study, Hydrogen Blending: National Safety Evidence Review, HyNTS FutureGrid Deblending and HyDeploy – is essential for improving public understanding and gaining trust in the use of hydrogen as a critical future energy source, especially in hard-to-electrify parts of the GB energy system.

Funding Schemes

This report focuses on two of the largest innovation funding sources, the Strategic Innovation Fund (SIF) and the Network Innovation Allowance (NIA), which deliver significant value to networks and customers through the innovation cycle. Led by Ofgem and Innovate UK, SIF provides significant capital funding to progress innovative ideas into real-world trials of new technologies. As the networks' core innovation funding mechanism, NIA funding is administered directly by the networks to progress all aspects of innovation.

The SIF programme was launched at the start of RIIO-2 as a competitive funding pool focused on areas of strategic importance to the energy system. Funding for these projects is organised into distinct rounds which focus on developing solutions from the idea stage into large-scale demonstrations. This funding stream reduces the risks associated with first-of-a-kind projects for networks and consumers. Recently, the SIF programme renewed its annual application structure to a cycle-based framework, so that funding for potential Discovery, Alpha and Beta projects can be applied for at three points during the year (from 2025 onwards), and projects can apply directly to the Alpha and Beta phases without having necessarily having to pass through the preliminary stages; in 2024/25, gas networks had 5 active Discovery phase projects, 2 in Alpha and 4 in Beta.

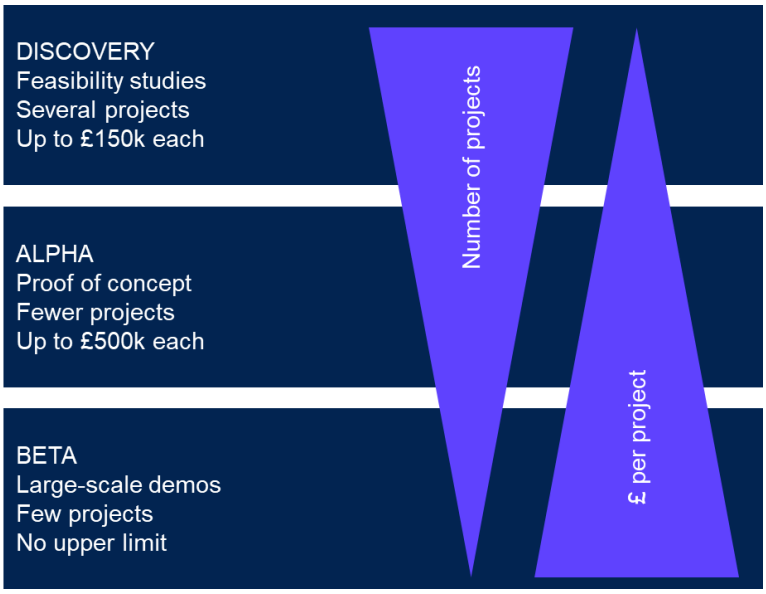


Figure 3: SIF Project Phases

The SIF aims to accelerate the pace of innovation in the energy sector, with a particular emphasis on demonstrating and scaling up new technologies and approaches. SIF promotes collaborative projects that bring together diverse stakeholders to tackle large-scale network challenges, helping build partnerships that can help address complex issues across the energy system. Increasingly, SIF-funded projects are entering into the Beta phase, and these form a significant proportion of the project portfolio spend. Overall, the SIF accounts for 13% of projects and 52% of the funding of gas network innovation projects active in 2024/25, indicating its increasing prominence as an innovation funding source. More information on the progress made across SIF projects are in the SIF Annual Report published by Ofgem and Innovate UK.

For gas innovation projects launched in 2024/25, the NIA represents 92% of the projects and 92% of the funding registered in the IMF[2] in this period. NIA funding is network-led and encourages collaboration between networks, de-risks low Technology Readiness Level (TRL) innovation work, allows for iterative learning, and permits innovation progress across a wide range of issues, enables innovation development up to demonstration level, whilst also complementing other project funding types. The programme requirements are summarised below.

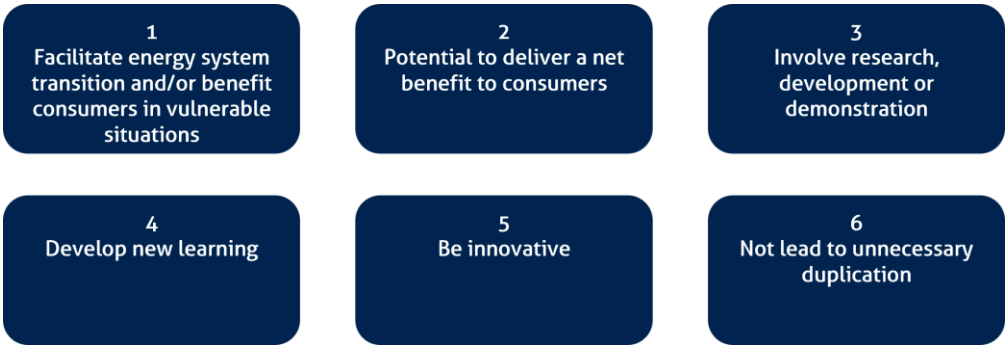


Figure 4: NIA Eligibility and Process Requirements

The table below shows a high-level breakdown of innovation funding in the gas networks space, and accounts for all projects active over 2024/25 (note that as this represents all active projects rather than just projects launched, the numbers presented here are different to those quoted above).

	NIA	SIF
Proportion of projects	87%	13%
Proportion of funding	48%	52%
Key Benefits	• The **agile**, **robust**, and **flexible** self-governance process of the NIA allows networks to quickly address innovation challenges as they emerge and change in a rapidly evolving landscape. • Allows for quick responses to emerging challenges.	• Projects progress based on demonstrated results in previous phases, lowering funding risk.
	• **Collaboration:** Supports sharing knowledge and working together to make the most of expertise and perspectives across a diverse range of stakeholders, including networks, stakeholders, and third-party innovators. • **Non-competitive nature:** Networks can work together effectively on shared challenges and objectives. • **Trial and error:** Projects with uncertain outcomes (i.e. higher risk, higher reward ideas) can progress with lower risk, particularly those developing/progressing low-TRL solutions. • **Breadth of approach:** Projects encompass a diverse array of sectors and challenges, fostering comprehensive technological advancements that address industry-wide issues from multiple perspectives. • **Working at pace:** The structured yet flexible approach to funding supports timely progress in innovation, enabling networks to meet fast-evolving challenges and decarbonisation targets. • **Iterative improvements:** Projects can be continuously refined over long periods, and successful demonstrations can then be integrated into BAU operations. • **Customer focus:** Both mechanisms require that projects deliver customer outcomes, such as enhanced service reliability, supporting vulnerable customers, and providing cost savings.	

[2] In addition to projects funded via the SIF and the NIA, innovation projects can also be funded via BAU; in 2024/25, no BAU funded projects run by gas networks were reported through the IMF.

Innovation Cycle

All network innovation projects follow a structured three-stage process from idea generation through to benefits realisation, regardless of theme or subject matter network (see figure 5 below). Of course, innovation is an iterative process, and not all innovations lead directly to BAU rollout – some projects instead create foundational evidence or test future feasibility. More information about the innovation process and how to get involved is provided in the Future Energy Networks Innovation Process (FENIP).

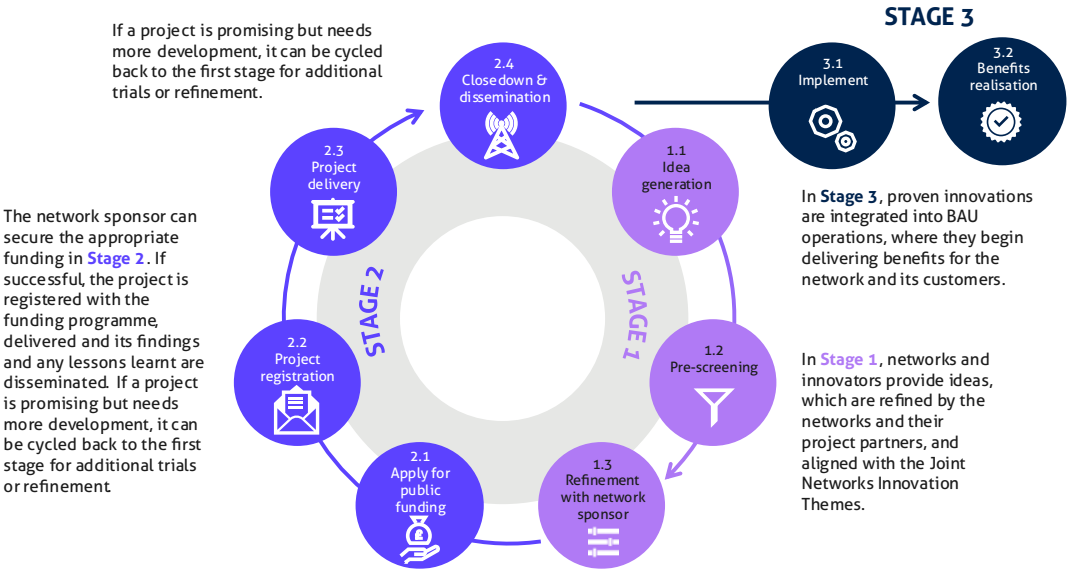


Figure 5. The innovation process

Ideas are funnelled through the innovation process from ideas generated, to projects developed, and finally integration into BAU. This year, data from the IMF[3] show networks reviewed over 75 ideas with 35% of those ideas coming from external partners – the progress of those ideas is shown in the figure below.

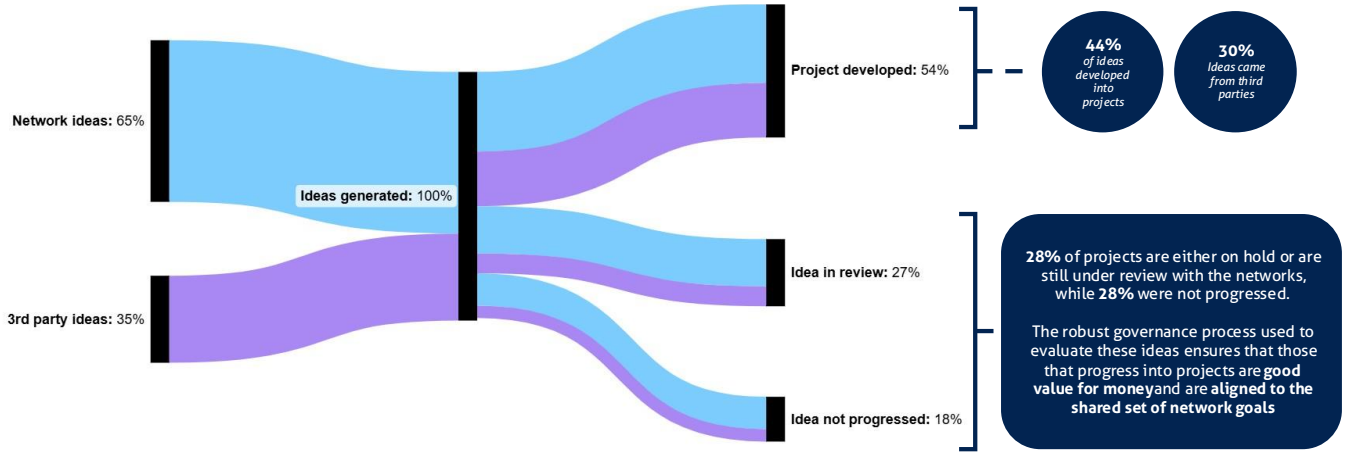


Figure 6. The innovation funnel for ideas received in 2024/25

[3] Data behind Figure 6 and Figure 11 later in the report are taken from the Idea Log in the 2024/25 combined IMF entries from the networks; not all projects are captured in the IMF, so this will not give a complete picture of the development of innovation project ideas in 2024/25, but does give a sense of the flow of ideas.

Innovation as a tool for achieving policy objectives

The UK is transitioning to a Net Zero energy system, with the Clean Power 2030 Action Plan seeing the government commit to 95% of power being produced by clean sources by 2030. This evolution of the energy system policy landscape also includes the UK Government's strategy for driving the adoption of low-carbon gases, including hydrogen, and biomethane. Gas networks will continue to play a role in the evolving energy system and, as shown in the table below, the innovation projects are an important tool for accelerating progress in achieving the UK's policy objectives.

Policy	Overview	Relevance to gas networks
Clean Power 2030 Action Plan	UK government committing to at least 95% of Britain's power being produced by clean sources by 2030.	• Sets out the UK government's strategic vision for the transition to a low-carbon, resilient and digitally enabled energy system. • Unabated gas is likely to shift to a reserve role, with an increased role for potentially carbon-neutral gases like hydrogen and biomethane. Implications for gas network innovation likely to include increased focus on projects around blending hydrogen and biogases and operating the network safely at falling throughput.
Hydrogen Update to the Market 2025	UK government re-commits to hydrogen as a cornerstone of the energy transition and emphasises its role in achieving Net Zero and energy security.	• Provides policy support and facilitates trials for blending of hydrogen into existing gas networks. • Sets out funding mechanisms for hydrogen production schemes with which gas networks may collaborate. • This update identifies sectors in which hydrogen may be a cost-effective solution, for example industrial processes and off-road machinery. Gas networks' innovation may look to serve or adapt to these end uses. There could be a renewed focus on blending and/or repurposing gas networks to carry hydrogen.
Green Gas Support Scheme	The Green Gas Support Scheme (GGSS) provides tariff support for biomethane produced via anaerobic digestion which is injected into the gas grid.	• Incentivises biomethane production by providing tariff support for anaerobic digestion plants that inject to the grid. Projects that innovate in enabling a higher biomethane blend in the gas network are relevant to this policy.
National Policy Statements for energy (EN-1, EN-2, EN-4)	Framework for approving nationally significant infrastructure projects.	• Prioritises infrastructure that aligns with strategic priorities. • Reduces uncertainty for developers and investors, allowing faster deployment of innovative solutions. • "Nationally significant" criteria means that this is likely particularly relevant to transmission networks Projects that develop the evidence base for additional policy statements related to hydrogen or CO_2 pipelines and storage are relevant to this policy.
Future Homes and Buildings Standard	A set of regulations pertaining to new and existing domestic and non-domestic buildings, introduced in 2023.	• Effectively rules out gas boilers, including hybrid and hydrogen-ready boilers, in new homes from 2025. Likely to have implications for the number of connections to the gas network and create innovation demands around a decreasing gas network customer base and throughput.

In June 2025, DESNZ published a policy paper titled "Midstream gas system: update to the Market". It identified three transitional challenges which networks will need to overcome through innovation:

1. Ensuring resilience of gas supply and infrastructure as UK Continental Shelf (UKCS) production declines and reliance on other forms of supply increases.
2. Balancing infrastructure investment and affordability to maintain a safe and reliable network while protecting consumers from spikes in bills.
3. Managing a planned and orderly operational transition as parts of the gas network are repurposed or decommissioned over the longer term

The framework is to be supplemented by a series of consultations and calls for evidence between autumn 2025 and 2026; it will work in conjunction with existing network regulation and funding allocation and will be overseen by Ofgem. The current price control period (RIIO-2) runs until March 2026, and the next round (RIIO-3) will cover the period from 2026 to 2031, during which funding and innovation plans are likely to increasingly reflect these challenges, against a broader background of a declining role of natural gas and the increased role for carbon-neutral gases.

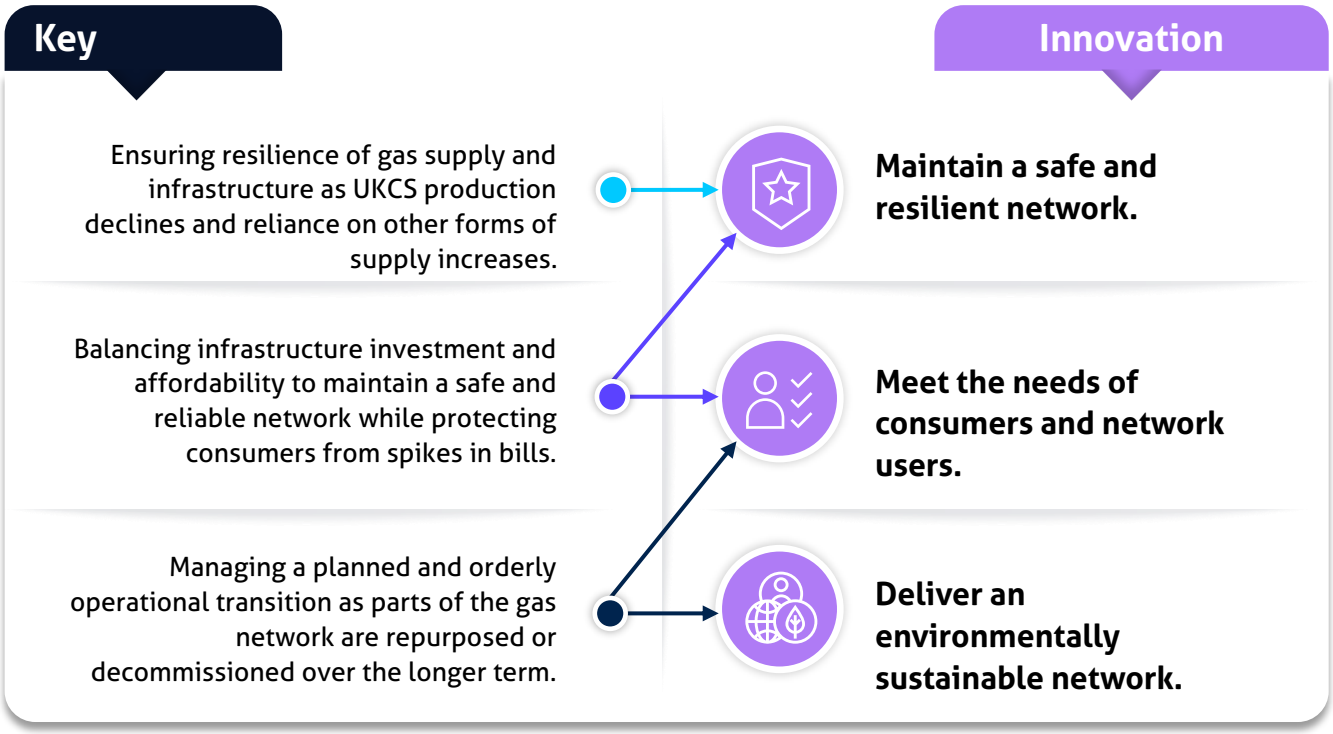
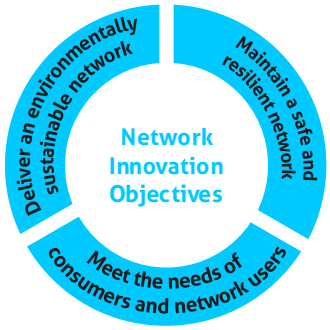


Figure 7: Mapping of key challenges to innovation objectives

Progress against Objectives

2024's Energy Networks Innovation Strategy sets out the three objectives of network innovation funding, based on the policy goals above, and a set of related themes and principles. Innovation projects in 2024/25 have maintained this focus and have driven progress towards the energy network-wide objectives.



Some examples of 2024/25 gas network innovation projects that have made important progress against each of these, and how the objectives and themes have shaped project outcomes, is outlined below.

Objective 1: Meeting the needs of consumers and network users

Delivering benefits to both networks and consumers is core to innovation; where possible, projects aim to quantify benefits which are then collated and reported in the IMF. Each project also uploads an assessment of its expected quantitative and qualitative benefits to the Smarter Networks Portal (for projects commencing before January 1, 2025) and FEN Innovation Portal (for projects commencing from January 1, 2025). The qualitative and non-financial benefits are by their nature more difficult to capture but are essential to innovation progress.

Financial benefits

Innovation can deliver financial benefits for consumers through several routes – research from projects such as Futures Close Heat Programme is exploring how various heating decarbonisation options will be installed and perform across UK housing stock. This project, led by NGN with collaboration from Cadent and WWU, will ensure that future domestic decarbonisation strategies maintain the required heating in homes while minimising the environmental impact.

> "The Digital Platform for Leakage Analytics has been a 4-year project from ideation through to SIF-beta project – and product – delivery. The partnership team has brought together a combination of modelling and sensorisation technologies to step-change the accuracy & transparency of emissions reporting from gas networks. We're pleased to have a clear and funded route through which Cadent & UK gas networks can scale up, apply and deliver benefits following on from the project."
>
> Chis Rison, Head of Smart Networks, Cadent

Financial benefits of 2024/25 projects, although often hard to quantify given the early-stage nature of many projects, range from the low £100,000s to over £1 billion in net financial benefits by 2050, demonstrating the significant potential impact of innovation initiatives – with SIF Beta projects showing particularly promising financial forecasts. An example is the SIF Beta Digital Platform for Leakage Analytics project, which aims to transform gas leakage detection across GB's gas distribution networks through advanced data-driven modelling and testing of gas sensor technologies. The project, led by Cadent, is expected to deliver net cumulative discounted financial benefits across the UK ranging between £0.8 billion to £3.2 billion by 2050 (depending on adoption rates

and technology mixes used), and could facilitate up to 35% reduction in methane emissions from pipes and Above Ground Installations (AGIs) in the 10 years following deployment.

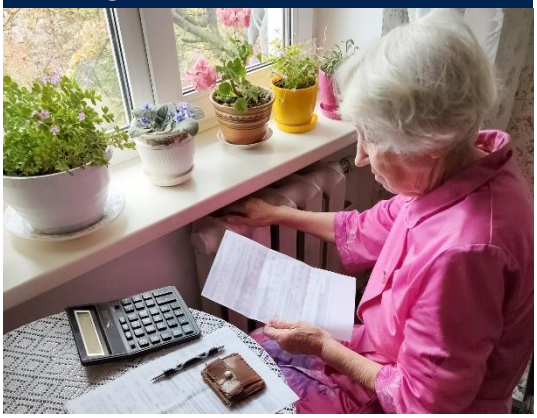
Customer experience and safety

Customers' experience of the of the gas networks also hinges on non-monetary factors such as the network's safety and security of connection, particularly in more remote areas of the country; the Finding the Hidden Vulnerable project aims to ensure that customers on the Priority Service Register receive the support they need in the event of any gas supply interruptions, as detailed below.

Through the project Rethinking Communication for Digital Exclusion, Cadent and several electricity networks are tackling digital exclusion of individuals across the UK from accessing critical information and services. The communication strategies developed through this project will make sure that all consumers, regardless of digital access, receive the information they need on time.

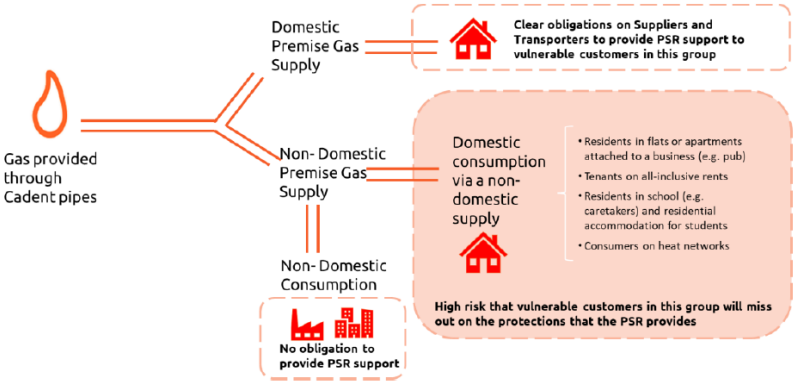
Finding the Hidden Vulnerable

Project ID:	NIA_CAD0115
Budget:	£120,000
Networks:	Cadent
Duration:	Dec 2024 – Feb 2025
Status:	Complete
Funding:	NIA



Overview:

In some situations, customers in vulnerable situations could be missing out on the protection offered under the Priority Service Register (PSR) because they are "hidden" behind a non-domestic supply contract, for example residents in flats or apartments attached to a business. Led by Cadent, the Finding the Hidden Vulnerable project aims to establish whether data-driven solutions can find these hidden customers, to ensure they receive the support they are entitled to. Working with Capgemini, Cadent has completed an exploratory stage which developed and tested a hypothesis about property types likely to house hidden customers in vulnerable situations. They conducted extensive industry research, performed data scoping exercises and completed user interviews.



Learnings and Next Steps:

This work developed and validated the idea integrating existing datasets enables identification of hidden customers at a property and at household level, by studying the length of residency, demographic and household composition, and property classification. This data will be used to test whether a hidden vulnerable data model would enhance our current processes and systems, by providing users with additional customer information that enables improved resource planning. This offers more a proactive approach to serving customers with priority support. Phase 2 of the project – currently under assessment – will deliver a predictive data model using static data sources to identify hidden vulnerable customers.

Network-wide system benefits

The true power of the innovation process lies in the combined impact of innovative projects on system transformation. The work done by individual projects can lead to learnings that can be applied across the networks. For instance, the Decentralised System Resilience project by SGN investigated how gas network infrastructure can support storage and balancing in a decentralised UK energy system.

Projects can also tackle challenges such as the decarbonisation of heating from different angles, as is the case for WWU's Pathfinder projects which support local and regional planning providing invaluable system insights to understand the operational impacts of decarbonisation, allowing a variety of stakeholders e.g. local authorities, to understand engineering trade-offs, and the Future Close Heat Programme.

Additionally, innovation projects can support system-wide transformation. For instance, the gas networks have an important role to play in the adoption of hydrogen in the UK-wide energy systems. Several projects across gas networks are working to push this sector forward from different angles.

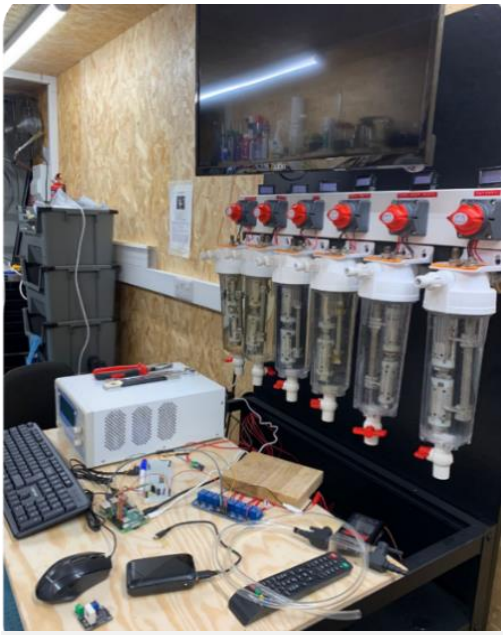
Enabling hydrogen adoption across the UK

Gas networks are exploring different parts of the hydrogen value chain, from the production of hydrogen to its distribution and end-use.

Production

Securing reliable electricity for electrolytic hydrogen production is key to its success. Nuclear power could be a part of the solution, and NGN and WWU have launched the Scaling Hydrogen with Nuclear Energy (SHyNE) project to understand how Nuclear Enabled Hydrogen (NEH) could play a role in the gas networks' decarbonisation. Novel electrolysis technologies are also being explored.

Through projects such as AlCHEM (Advanced Low Carbon Hydrogen and Energy Management), WWU is exploring the use of liquid waste biomass to produce green hydrogen. Its considered biomass electrolysis technology could use 75% less energy than conventional water electrolysis.



Control system used during NextGen Electrolysis - Alpha

The networks are also using innovation to mitigate the impacts of hydrogen production on water reserves. Through the NextGen Electrolysis project, WWU and its project partners are exploring the effects of using different wastewater types, such as harvested rain or river water to produce green hydrogen using novel electrolysis methods. This project has the potential to substantially reduce capital costs, reducing the cost to the consumer and resulting in environmental benefits. The proposed solution offers removal of water treatment processes, providing flexibility and resilience to produce hydrogen, which could provide resilience for the wider system. The beta phase of the project is testing the technology at a Welsh Water treatment facility near Cardiff and at the Yeo Valley production site in Cannington.

Preparing the transmission network

Example of pipeline considered for repurposing

To demonstrate the ability of the National Transmission System (NTS) to safely and reliably transport hydrogen, a high-pressure hydrogen test facility was developed using decommissioned transmission assets for the FutureGrid Phase 1 Facility. Led by National Gas in collaboration with several partners, including NGN, projects undertaken here are contributing evidence for the UK government decision on hydrogen blending. The facility's testing facilities are also being used to demonstrate other technologies such as hydrogen refuelling and the transport of CO_2 in pipelines, leading to cost savings for each project. The FutureGrid projects showed that over 100 standards may require update and review for the NTS to be hydrogen-ready; National Gas' Hydrogen Repurposing Process for the NTS aims to address some of those gaps by developing a process for repurposing NTS assets to transport hydrogen, without this understanding, the cost of stranded assets to the network could reach £6.5 billion.

Preparing the local transmission network

SGN's Local Transmission System (LTS) Futures safely repurposed a mothballed 30km pipeline running from Grangemouth to Granton, to provide evidence that the pipeline can carry 100% hydrogen. The trial has also led to innovations in operational and maintenance processes. In this project, 'live hot work', where connections are made to a live pressurised pipeline, was completed for the first time on an in-service hydrogen pipeline. The project also developed training packages for SGN to upskill operational staff for live trial activities. The results of LTS Futures will serve as a blueprint for repurposing the LTS network for hydrogen use and will provide guidance for UK Government Energy Policy decisions.

Trial site preparation

Connecting hydrogen production with end use

East Coast Hydrogen

Several networks are developing hydrogen pipelines to connect the points of production to the point of end use. For instance, East Coast Hydrogen is a collaboration between National Gas, Northern Gas Networks and Cadent to connect planned hydrogen production and storage with industrial users in the region, over the next 15 years. Starting by connecting the industrial clusters of Teesside and the Humber Region, East Coast Hydrogen aims to connect to distributed hydrogen demand in Yorkshire, Tyneside and the East Midlands before eventually connecting with other networks further afield to create a national hydrogen network .

East Coast Hydrogen will provide the opportunity to connect up to 11 GW of hydrogen production capacity and up to 4 TWh of hydrogen storage by 2030.

Utilising the NZARD UIOLI fund East Coast Hydrogen was able to submit a reopener this year and received the financial award to complete the 2 year Front End Engineering Design stage. Receiving this funding has allowed work to begin on the network infrastructure needed to transport low-carbon hydrogen, East Coast Hydrogen will then look to connect producers and storage providers to a range of customers, who expect to need over 63 TWh/year of low-carbon hydrogen to decarbonise their operations. This fuel switching will save up to 12 $MtCO_2$ per year by 2037.

Using hydrogen

Gas networks could help provide the infrastructure to facilitate further adoption of hydrogen vehicles. The HyDrive project from WWU investigated the feasibility of connecting hydrogen refuelling stations (HRS) to the current gas network. While more work remains to be done to develop this concept, this project will help identify what role GDNs will play in hydrogen mobility. Projects such as FutureGrid Deblending have also explored the integration of hydrogen mobility and the NTS.

Furthermore, the Hydrogen in Multi-Occupancy Buildings (MOBs) projects (link to page for phase 4), led by SGN, are investigating how MOBs can be converted from natural gas to hydrogen. They will provide standards and guidance that can be adopted by all GDNs.

HRS testing at FutureGrid facility

Objective 2: Delivering an environmentally sustainable network

As mentioned in the policy section above, with the publication of the Clean Power 2030 action plan the UK government has committed to at least 95% of Britain's power being produced by clean sources by 2030. The gas network will therefore need to innovate and evolve as it moves to support energy sources such as hydrogen and biomethane, as well as integrating with renewables to create a coordinated whole energy system. Alongside this, networks are also seeking to ensure that maintenance and construction operations on their physical infrastructure are delivered in an environmentally sustainable way which minimises impact on the local community and wider society.

The UK's gas network offers an opportunity to repurpose existing infrastructure in the transition to a low-carbon economy, reducing capital costs. For instance, pipelines can offer a low-cost route for distributing large quantities of hydrogen[4] - cost benefits may be greatest where repurposed pipelines avoid the need to build new, dedicated hydrogen infrastructure. Both routes are being explored through projects such as HyLine Cymru, led by WWU with partners in the South Wales Industrial Cluster (SWIC), and Project Union, led by National Gas and for which funding was approved over the 2024/25 period.

Reducing the carbon intensity of natural gas in the National Transmission System (NTS) has been an innovation focus for many years, with the use of biomethane, and biomethane injection particularly, a key focus. A complementary option is blending hydrogen into the gas network, alongside a low carbon certification scheme, which could enable demand to decarbonise before the switch to pure hydrogen or electrification infrastructure is complete. Hydrogen in the NTS (HyNTS) is a broad and significant portfolio of projects developed by National Gas to build evidence on hydrogen blending and assess its viability and impact on the NTS – this is examined more closely below. Topics covered include gas analyser feasibility studies, deblending feasibility and demonstration, linepack studies and understanding blending infrastructure requirements for our hydrogen blended future.

National Gas have also constructed the FutureGrid test facility at DNV Spadeadam to carry out a wide range of essential hydrogen tests, including some which require high pressures in a secure, offline environment. The outcomes of these projects will demonstrate how the NTS can safely and reliably transport hydrogen.

[4] Transportation of hydrogen as compressed gas is cheaper via pipelines than through tube trailers. Source: Hydrogen Transport and Storage Cost Report

HyNTS programme – operational methodologies

Project ID:	NIA_NGT0222
Budget:	£841,312
Networks:	National Gas
Duration:	Apr 2024 – Mar 2025
Status:	Complete
Funding:	NIA

Benefits:

Identifying missing information needed to update the rules and procedures for hydrogen.

This will support a testing program that collects the necessary evidence to make these updates, ensuring that hydrogen networks can operate safely and effectively.

Overview:

The HyNTS programme is building evidence for the hydrogen safety case and network capability for transporting hydrogen, leading to Project Union, which is a programme to develop a new hydrogen network. Projects under HyNTS will prove the capability for repurposing portions of the network, rather than relying solely on new build assets.

To ensure safe transportation of hydrogen, operational procedures and policies will need to be updated to reflect hydrogen's different physical properties to natural gas. The HyNTS Operational Methodologies – Phase 1 project aims to review internal policies and procedures and identify what evidence is required to update them to operate a hydrogen transmission system.

Progress:

Several projects have identified the required updates to policies and procedures. Building on this, this project identifies the internal operational procedures to gather the required evidence to update them and identify any need for new policies.

"The Operational Methodologies project has been a vital step in preparing our network for a hydrogen future. By systematically reviewing our internal policies and procedures, we've built a clear picture of where updates are needed and where new guidance must be developed. This work strengthens our ability to repurpose existing assets safely and efficiently, ensuring we continue to deliver value for consumers while supporting the UK's Net Zero goals. It lays the foundation for the physical testing now underway in our HyNTS Operational programme, helping us move from insight to implementation with confidence".

- Katie Petherbridge, Innovation Delivery Manager, National Gas

Learnings:

Many documents from NGT's policy suite were reviewed, and it was found that several of these documents are now withdrawn or no longer relevant to NTS operation. This underscored the importance of a methodology update. Several key themes were repeated across many documents, specifically the Safe Setting to Work and Safety and Technical Competencies (STC) which will require updating for hydrogen operations.

Next steps: The findings from this project will be used to guide innovation projects across the HyNTS

As the demand for natural gas reduces, parts of the NTS can also be repurposed to transport carbon dioxide. The availability of a transportation system is a key enabler for the large-scale adoption of carbon capture, utilisation and storage (CCUS), as it may not be possible to store the CO_2 at the point of capture. Through projects such as Carbon Networks, Wales and West Utilities (WWU) is exploring the to understand the role for gas networks in the growing UK CCUS market. While several projects are working towards the repurposing of the NTS to support the low-carbon transition, projects such as Reducing Gas Emissions During Pipeline Commissioning by Northern Gas Networks are working to minimise the environmental impact of gas operation in the meantime.

Reducing gas emissions during pipeline commissioning

Project ID:	NIA_476
Budget:	£83,175
Networks:	NGN
Duration:	Dec 2024 – Oct 2025
Status:	Live
Funding:	NIA

Overview:

In 2019, Northern Gas Networks partnered with ROSEN to explore how to reduce emissions from the operation of their gas network. The project found that their highest emitting activity was the commissioning of gas mains. This is because gas needs to be purged through the new network before it can be reconnected with the existing one. NGN took this as an opportunity to revise the standard purging calculation tabled used by gas engineers.

NGN re-partnered with ROSEN to explore this topic further and determine how these calculations could be refined to minimise the amount of gas released during pipe replacement and upgrades.

Learnings:

NGN developed updated calculation tables with shorter purging times.

Benefits:

87,000 tonnes of methane annually

Potential emission reductions from new gas purging calculations if successful and rolled out across the NGN network, without any operational disruption or additional costs.

Next steps:

NGN and ROSEN are now preparing to conduct 10 field trials across pipes of varying diameters to validate their effectiveness.

Innovation projects frequently build on the findings of previous innovation work, for example, HyLine Cymru will build a new 130km hydrogen pipeline from Pembroke to Port Talbot with the intention of delivering the low-carbon hydrogen needed for decarbonisation of industry in southwest Wales. The project has been built on learnings from earlier project phases enabled by innovation funding as shown in Figure 8. The construction and operation of the pipeline would lead to several technical, economic and environmental benefits to both the network users and the rest of the energy system. For instance, it could unlock up to 3GW of offshore wind generation by providing a route to market for clean energy producers. Furthermore, through the displacement of fossil fuels, the pipeline could support the removal of up to 10% of the GB industrial emissions (3.2 $MtCO_{2e}$/year).

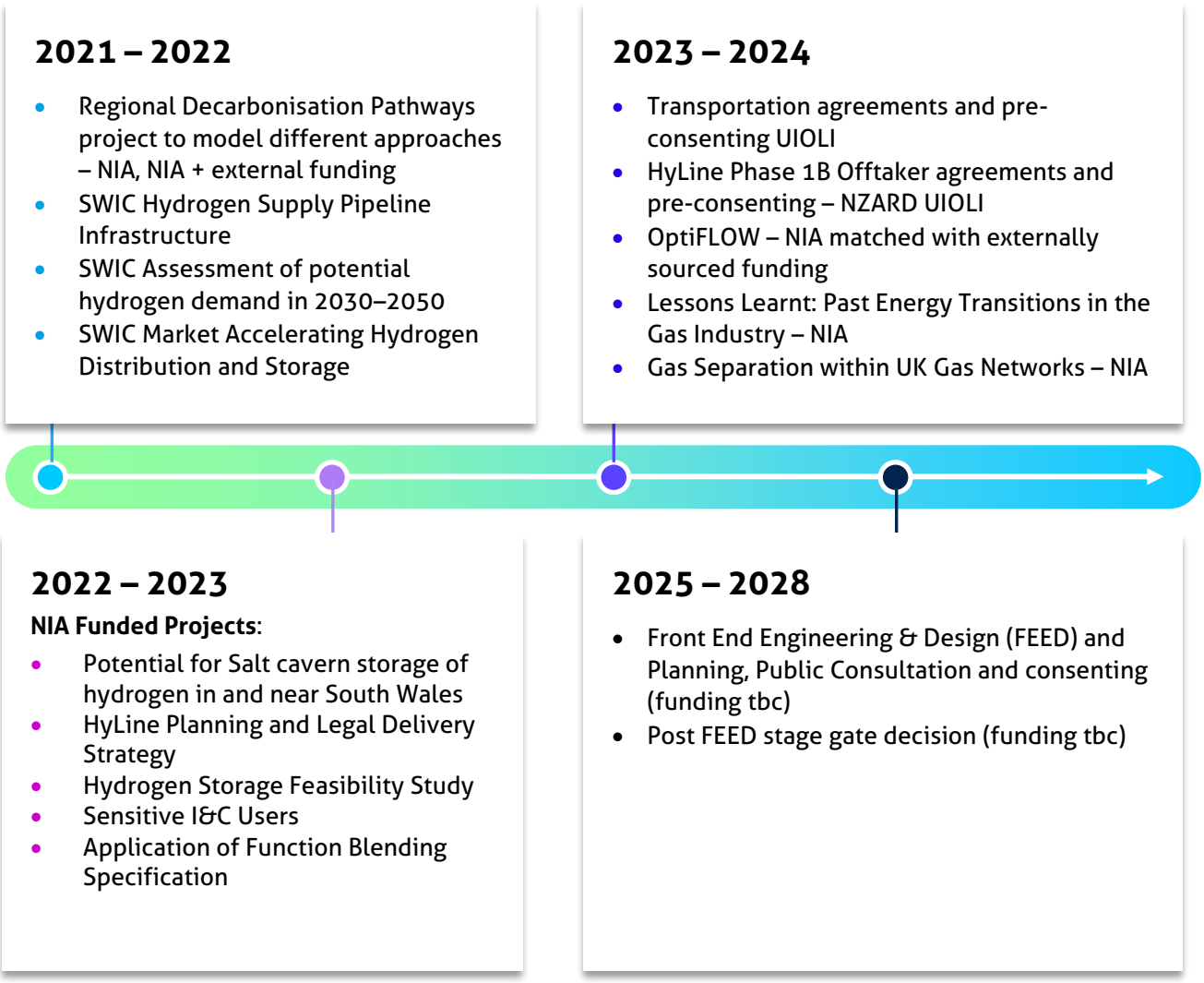


Figure 8: HyLine Cymru timeline

Innovation Themes

The Energy Networks Innovation Strategy connects the objective of an environmentally sustainable energy system with the themes of "data and digitalisation", "flexibility and market evolution", and "Net Zero and the energy system transition" – below, we identify how projects from the last year have been informed by consideration of these themes, and improved our understanding of them.

Data and digitalisation work is often an enabling tool for later projects and evidence-based decision-making by increasing the information available for networks to use in future projects as well as BAU operations and resilience planning, with a view to enabling or unlocking a greener energy system.

Projects in this area focus largely on building digital tools and advanced modelling techniques to support more efficient operations and planning. They often span multiple themes, for example, Cadent's Digital Platform for Leakage Analytics (DPLA) SIF project, supported by NGT, focuses on reducing gas (both methane and hydrogen) leakage to improve system efficiency to support Net Zero targets[5]. The project integrates advanced analytics and machine learning to enhance network monitoring and so environmental outcomes. Meanwhile, WWU have joined the Powering Wales Renewably project, which will create a digital twin of Wales' entire energy system. This will improving coordination across energy networks. The project is a collaboration involving NESO, the Welsh government, CGI, National Grid Electricity Distribution, National Grid Electricity Transmission, National Gas, SP Energy Networks and CENIN Renewables.

[5] This project is also discussed separately in the Collaborative initiatives in 2024/25 section

Powering Wales Renewably – SIF Beta

Project ID:	10121485
Budget:	£12,195,722
Partners:	NESO, Welsh Government, WWU, National Grid Electricity Transmission, SP Energy Networks Distribution, SP Energy Networks Transmission, National Grid Electricity Distribution, National Grid Transmission Plc
Duration:	Jan 2025 – Jan 2029
Status:	Live
Funding:	SIF Beta – Round 2

Overview:

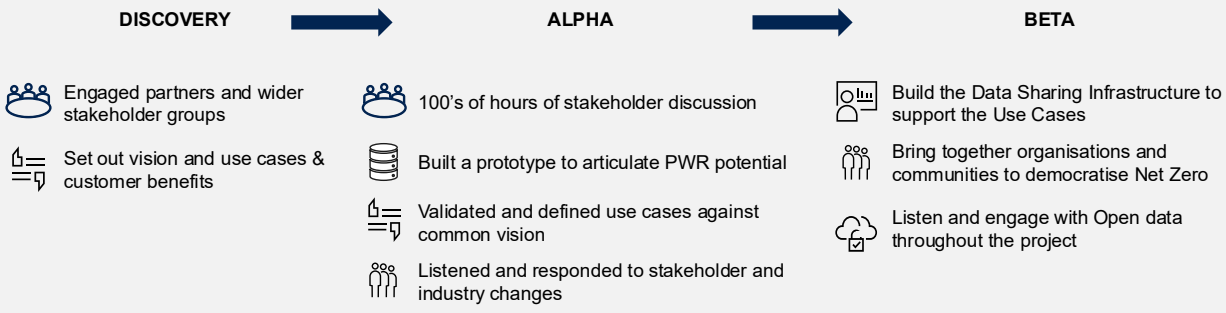
Pweru Cymru yn adnewyddol (Powering Wales Renewably, PWR) brings together stakeholders across the Welsh energy system to accelerate Wales' transition to Net Zero power.

The Beta phase of PWR will integrate datasets and digital technologies to create a digital twin of Wales' energy transmission and distribution systems - this digital twin will serve as a common interface for a range of stakeholders, improving the locational visibility of system challenges and the status of the whole energy system. WWU will provide critical information on the gas distribution network across Wales, showing network location along with capacity, large connections and sharing insight on how low carbon gases can be generated and used in the gas network.

The current Beta phase builds on previous phases: the Discovery phase - completed in 2023 - established stakeholder priorities and needs, and the Alpha phase - which finished in 2024 – built a prototype to articulate the potential of PWR. The project also integrates learnings from projects like **FALCON**, **DINO**, and **NESO's Virtual Energy System**.

The pilot system exceeds the state-of-the-art map overlays and generalised heat maps by locationally linking multiple datasets to a fully connected intelligent energy network model, allowing for better data analysis across a combined transmission and distribution network model.

Progress: The project builds on the progress in the previous SIF phases.



Benefits:

Technology, Commercial and Integration Level improvements:

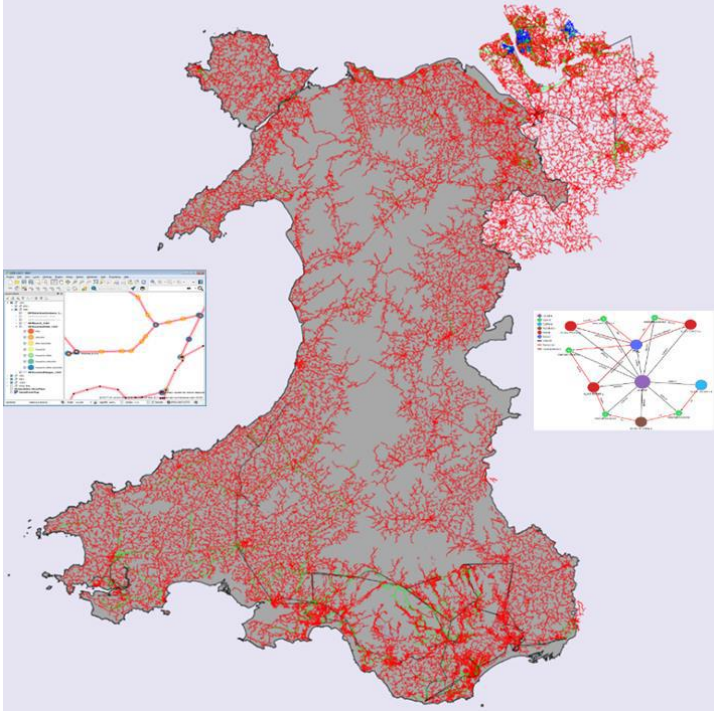
	End of Alpha	Target in Beta
TRL	5	8 - Integration of multiple systems and data sources demonstrated at scale
IRL	4	7 - Prove the integration between systems and interoperability
CRL	5	8 - Agreement of commercialisation strategy, scale-up approach and business model

Financial benefits:

- The network portfolio can be better coordinated, leading to cost savings in operation, when all network operator requirements for energy and capacity flexibility are visible.
- PWR will provide an informed, easily adaptable basis for investment across the energy system.
- Through PWR, more of the existing and new network capacity could be utilised, and this could save costs for users of the network services.

Environmental benefits:

The additional renewable generation achieved through the project will be key to displacing fossil fuel use.



"Visibility and understanding of the whole energy system is essential to deliver effective and efficient decisions around Wales' future energy system. Powering Wales Renewably will support better coordination, as well as help to connect more renewables, and could save up to 2m tonnes in CO2 emissions."

- Ben Carwardine, Project Manager

Flexibility and market evolution

Developing market-based solutions to increase the flexibility and efficiency of the energy system, accelerating the adoption of low carbon solutions.

The theme of **flexibility and market evolution** also focuses on new network demands; work under this heading is important for accelerating the uptake of low carbon technologies and increasing consumer participation in the energy transition. This is particularly important given the new network responsibilities focused on system operation, associated with the launch of NESO.

An example of progress this year against this theme has been the exploration of the potential for gas networks to repurpose existing assets for flexible zero carbon heating solutions in the Heat Network Transition Study project, which also evaluates alternative options where repurposing is not feasible. Valuable lessons have been learned regarding how gas networks can support the transition to low-carbon heating while ensuring commercial sustainability.

Net Zero and the energy system transition

Facilitating and accelerating the UK's transition to Net Zero greenhouse gas emissions and beyond to an inclusive, fully sustainable energy system.

"Biomethane is the unsung hero in energy system decarbonisation and we want to focus our efforts on maximising the capacity of these sites, as well as increasing future connections. The smart pressure control project being progressed in one area of our network, could result in an additional 11 million scm a year of biomethane, equivalent to 10,000 homes being heated. Further roll out will achieve wider Net Zero benefits from biomethane"

Helen Fitzgerald, Project Manager for Smart Pressure Control

Net Zero and the energy system transition is a core focus for most innovation projects, enabling gas networks to meet their own decarbonisation objectives and support the decarbonisation of their customers.

This theme continues to grow in importance as networks work towards Net Zero targets, with work in this space enabling networks to meet the ambitious targets set out in the government's Net Zero Strategy[6]. Innovation to enable the successful operation of future hydrogen networks has been a focus, with National Gas' Hydrogen Site Safety Case Programme and NGN's Scaling Hydrogen with Nuclear Energy (SHyNE) looking to understand hydrogen networks' safety and scaling challenges respectively. SGN's Hydrogen in Multi-Occupancy Buildings (MOBs), now complete, examined the decarbonisation challenge of transitioning MOBs to hydrogen in a multi-phase project, with each stage building on previous learnings. Findings included recommendations on standards related to gas in buildings, draft management procedures and an understanding of the feasibility of MOBs' transition to hydrogen.

[6] https://www.gov.uk/government/publications/net-zero-strategy

The Smart Pressure Control trials are also a key opportunity to prepare the gas networks for the adoption of biomethane as part of a low-carbon energy network. WWU have rolled out trials and installed smart technology at biomethane sites in 2024/25 that could result in over 10,000 more homes heated with biomethane thanks to increased injection capacity, while other networks will look to follow suit moving into the 2025/26 regulatory year. WWU is working to use solar/battery-powered motorised actuators, integrating with its SCADA (Supervisory Control and Data Aquisition) technology, managing system pressures in response to exit and entry requirements. This represents a significant improvement on manual adjustments and will support biomethane sites to maximise their export capacity. It also reduces the need for engineer call-outs and could save costs for customers.

Objective 3: Maintaining network resilience and safety

The resilience of the gas network is foundational to its ability to meet the needs of the consumers and other network users. The goal of building a resilient network is to minimise network outages - improving the grid's ability to anticipate, withstand, and recover from disruptions, whether natural (e.g. flooding or other extreme weather), technical (e.g. pipeline corrosion or valve malfunction) or human-made (e.g. cyber-attacks or conflict leading to supply chain issues). Safety is also central to gas network innovation – all projects must be delivered safely, considering the wellbeing of both consumers and those who work to operate the networks' physical infrastructure. This must continue to be a central focus as gas networks' role in the energy system evolves and the blend of gas they carry changes.

Maintaining network resilience

"We've developed a significant portfolio of projects to understand the implication of hydrogen blends on the National Transmission System (NTS). This portfolio is referred to as the Hydrogen in the NTS (HyNTS) programme."

Corinna Burger, Head of Innovation, National Gas

The importance of network reliability and resilience remains unchanged under a shift of the blend of networked gas towards hydrogen. National Gas' HyNTS programme, discussed under Objective 2, assesses the implication of hydrogen blends on the NTS and how to use the gas to ensure a resilient Net Zero transition.

Physical deterioration of network assets is a major contributor to system faults and the impact of hydrogen on this process is likely to be different to that of methane. Multiple projects within the HyNTS programme address this issue – for example, the HyNTS Corrosion project examines the failure modes of pipeline coatings which prevent corrosion for hydrogen networks.

Improving network safety

Network safety is intrinsically linked to resilience; both can be endangered by network faults and incur financial costs for networks. However, while problems with network resilience result in network outages, safety issues can lead to injury or worse. One notable project which aims to revolutionise safety in gas networks is the Predictive Safety Interactions (PSI) – Beta project. The project – a partnership between SGN, Cadent, NGT and NGN – is another example of cross-network collaboration in innovation.

As networks look to adapt and repurpose their infrastructure to support the growing role of hydrogen in the energy system, important concerns have arisen regarding the safety of carrying hydrogen in the gas network, particularly due to its greater flammability relative to methane gas. National Gas Transmission's Hydrogen Site Safety Systems project – part of the HyNTS programme – examines the feasibility of addressing these issues by repurposing existing safety systems.

Hydrogen Site Safety Systems

Project ID:	NIA_NGT0265
Budget:	£252,600
Networks:	NGT
Duration:	Jun 2025 – Oct 2025
Status:	Live
Funding:	NIA

"This project marks an important step in ensuring our infrastructure and operational approaches are ready for hydrogen blending. By understanding how our fire and gas systems respond to hydrogen, we're not only safeguarding our assets and people, but also enabling a safe and scalable transition to a low-carbon energy future."

- Alistair Carvell, Hydrogen Innovation Engineer, National Gas

Overview:

This project will examine the suitability of existing Fire and Gas (F&G) detection and suppression systems for use with hydrogen blends of up to 20%. These systems comprise: fire detection, fire suppression, gas detection, and associated control systems. They are found in compressor cabs and at network terminals.

Through CFD modelling, three representative F&G systems will be individually assessed for compatibility with blends and will then be used as examples to make wider inferences on the suitability of other F&G systems on the network. Where assets or control systems are not suitable, this project will not design a new system but recommend where changes should be made and demonstrate how those changes safely manage risk – including cost estimation for upgrade or retrofit.

Benefits:

This project will provide a baseline understanding of the readiness of existing fire & gas (F&G) suppression and detection systems, found within compressor enclosures and at gas terminals, to remain effective for use against natural gas/hydrogen blends.

It will identify the blend concentration at which F&G system changes will be required to maintain current safety levels.

This project ensures key network safety systems will remain appropriate for future gas blend scenarios.

Learnings:

The H2 Site Safety Systems project assesses whether existing fire and gas detection systems across the National Transmission System are suitable for hydrogen blends up to 20%.

Following an evaluation of the legacy and modern compressor enclosures and the Bacton Terminal, the project identified our overall F&G system suitability and has recommended the changes required.

Next steps: This research will be critical for enabling the safe transition to hydrogen blending and supporting the decarbonisation of gas infrastructure on the path to Net Zero.

Predictive Safety Interventions (PSI) – Beta

Project ID:	10068173
Budget:	£1,189,696
Networks:	SGN (lead network), Cadent, NGT, NGN
Duration:	Aug 2023 – Feb 2025
Status:	Live
Funding:	SIF

Benefits:

Savings could result from reduction in lost-time injuries and the reduced cost to capture data on indicator

Overview:

This project uses machine learning to predict and prevent safety incidents before they occur, creating a predictive safety model for the gas sector. This model identifies site hazards automatically and prompts engineers to re-evaluate risks during the job as conditions change.

According to HSE annually released statistics, at least 10,000 working days were lost to injury in the wider utility sector in FY22, with the estimated cost of fatal and non-fatal injuries standing at more than £160m.

PSI has a direct target to prevent the occurrences of fatal and non-fatal injuries, which will reduce the cost of operating energy networks as well as the obvious wider societal benefits

Building on a successful Alpha phase which validated proof of concept of the machine learning model, the Beta phase enhances real-time risk scoring by integrating diverse data sources like weather, traffic, and human factors. It delivers tailored safety interventions to fieldworkers and managers, improving site safety and operational efficiency.

PSI is a high-TRL, large-scale Beta project, and so is poised to scale nationwide and even globally upon completion, bringing safety and operational cost improvements.

Explore more about the project through the project video

Innovation Themes

Connected to the objective of network resilience are the themes of "optimised assets and practices", "supporting consumers in vulnerable situations", and "whole energy system" – below, we identify projects from 2024/25 which have done work developing those themes.

Optimised assets and practices projects look to deliver solutions efficiently whilst maintaining a focus on reliability and security of supply – core network responsibilities which will continue to be important given the increasing variety and flexibility of network demands, and external pressures and threats to supply.

The optimisation of network assets remains a strategic objective for all networks, central to ensuring they can meet today's demands while preparing for future challenges. Each network continues to explore new technologies and techniques to enhance operational efficiency and safety, reinforcing their shared commitment to maintaining safe and resilient systems.

Many of these projects overlap with other themes, the key unifier being that they achieve their goals largely through operational improvements of existing infrastructure. For example, NGN's Reducing Gas Emissions During Pipeline Commissioning project aims to meet Net Zero and climate goals through targeted changes to existing purging procedures – reducing the quantity of natural gas vented during commissioning operations by up to 80%. WWU's Accelerating Progress project also targets emissions reduction at each stage of the existing gas distribution value chain, identifying mechanisms to do this and developing a framework to analyse costs and benefits associated with these options.

Accelerating Progress

Project ID:	NIA_WWU_02_68
Budget:	£125,773
Networks:	
Duration:	Nov 2024 – Feb 2025
Status:	Complete
Funding:	NIA

9MP Toby Perkins keynote speech at the launch of the Accelerating Progress report in the House of Lords

10Toby Perkins MP, Josh Newbury MP and FEN CEO James Earl at the launch of the Accelerating Progress report in the House of Lords

Overview:

This project explored the potential measures for cutting emissions from gas transmission, distribution and usage that could close the gap between the projected emissions and the targeted reductions needed to achieve net zero by 2050.

The scale and cost-effectiveness of the emissions saved from effecting each identified abatement option were assessed. The study also identified the policy and regulation needed to facilitate the proposed abatement options and suggested further areas to be investigated to support the UK in reaching the emissions reduction goals.

Progress:

The results from the report were published on the IGEM FEN website and were shared through the parliamentary Group for Energy Studies' Winter Warmer event in Westminster in early 2025.

Benefits:

- If the measures that the study identified are carried out, up to 23% of the gap to meeting the carbon budget six emissions goals (2033-2037) for UK industry and buildings.
- These decarbonisation measures could also encourage energy system flexibility, while maintaining its robustness.

Learnings and Next Steps:

WWU is still building on learnings from other network innovation work to understand and deliver the measures needed to accelerate progress towards decarbonisation – some abatement options require more research into their technical feasibility, while the implementation of others – such as hydrogen blending – need to be aligned with policy.

"We've identified potential measures for cutting emissions from gas transmission, distribution and usage through this project. If implemented, the recommendations could tackle almost a quarter of the emissions which need to be cut from UK industry and buildings to meet carbon budgets in the mid-2030s, as well as allowing for greater system flexibility and customer choice."

- Matthew Hindle, Head of Net Zero and Sustainability, WWU

Supporting consumers in vulnerable situations is an important consideration across all innovation projects - RIIO-2-funded projects use a vulnerability assessment tool to determine how they might affect vulnerable consumers, allowing networks to identify and mitigate against potential negative impacts.

Consumers are at the heart of networks' innovation, and protecting those at risk of fuel poverty and network outages is more important than ever, as the energy transition risks leaving behind some of those who need the most support. These projects often result in wider societal benefits than direct financial or carbon savings.

Some projects innovate specifically with vulnerable consumers in mind; Cadent's Finding the Hidden Vulnerable project centres on validating and deploying a model to identify customers in vulnerable situations who are missing out on particular protections in the event of supply interruptions. It can then be ensured that these customers receive the support they need in this event.

SGN's Accessible CO alarm project looks to protect vulnerable consumers from a different danger – that of carbon monoxide poisoning. The project is expected to deliver a fully developed and tested prototype. Insights generated could pave the way for cross-network adoption, creating broader societal benefits and improving the industry's reputation for innovation and social responsibility.

Project Helix

Project ID:	NIA_NGN_359
Budget:	£100,100
Networks:	NGN (lead network), Cadent, NGN
Duration:	May 2022 – Mar 2024
Status:	Live
Funding:	NIA

Overview:

Carbon monoxide (CO) poisoning is responsible for roughly 40 deaths and 4,000 A&E visits every year in the UK. Alarms notifying the gas' presence are usually wall-mounted or portable. However, despite a few advances in the industry, there have never been wearable carbon monoxide detectors - until now.

In partnership with Newcastle-based wearable medical technology experts Affotek, NGN launched Project Helix, an R&D venture to develop the first wristwatch to detect carbon monoxide. This cutting-edge prototype has been designed with scientists from Newcastle University to protect the wearer from the dangers associated with CO via wearable technology. The project team engaged with the NHC IPIP communities and the CO Research Trust to understand the effects arising from CO inhalation and set the right parameters for detection.

The device uses sensors to detect CO concentrations around its wearer, while monitoring other vital functions such as heart rate, blood pressure, respiratory rate and blood oxygen level. It links to a mobile phone app, which alerts the wearer to the life-threatening gas. The watch can detect CO as low as 7 PPM (parts per million), giving a much earlier indication of CO in any environment. This sensitivity is particularly important for pregnant mothers, as even low levels of CO can damage their unborn child - wall-mounted and portable CO alarms typically only detect CO at concentrations of 40-50 PPM over an eight-hour period, and 400 PPM for 4 to 15 minutes.

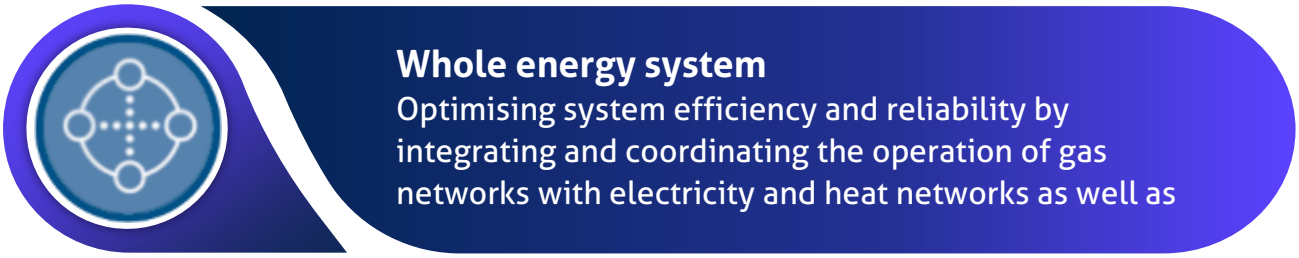
Learnings and Next Steps:

The prototype will be developed further to provide vulnerable customers with increased protections. Field trials are now underway on the global-first product with the aim of bringing it to market in the next 12 months. The project team could build an additional 50 devices to broaden the user testing with the Internet of Caring Things.

Once the device has been adequately tested, gas networks will be able to deploy it at scale to protect all their customers, especially those that may be at particular risk to CO poisoning.

Benefits:

- Reduces cases of CO poisoning through earlier and more effective detection, preventing death, disability and poor health amongst its users.
- Eliminates risks associated with current CO detectors, such as customers not installing their CO alarm per manufacturer's instructions or false alarms.
- Detect CO when the wearer is out in potential higher risk CO situations – such as when driving, cycling, or taking part in outdoor activities on roads where air quality is affected by various emissions.
- Increases mental and physical wellbeing from the reassurance of the monitor.
- Improves public awareness of the health risks linked to CO poisoning.



The **whole energy system transition** theme stresses the importance of broader thinking and coordination across networks. Collaborating across network types, value chains, and with non-network stakeholders will help to deliver innovation objectives as efficiently as possible and at the lowest possible cost to consumers. As the UK continues its decarbonisation journey, interactions across the energy system become increasingly important. Meeting future demands will require energy networks to collaborate closely with a broader range of partners in exploring decarbonisation pathways. This collaborative need aligns with the shift towards greater responsibilities for distribution networks as they take on a broader range of system operation responsibilities.

Gas networks specifically will need to reassess their role within the future of the country's energy system, and are considering how existing assets can best be utilised. SGN's Carbon Networks and Decentralised System Resilience projects are both early TRL studies delivering assessments of some potential future roles of the gas networks. The Carbon Networks project looks at possible alignments with adjacent markets such as CCUS, while the Decentralised System Resilience project investigates the opportunities for gas infrastructure to support storage and balancing in a decentralised UK energy system.

At the other end of the TRL spectrum, NGN's Navigator project, which is near BAU deployment, is developing a Whole Energy Systems Pathway tool, which will enable regional energy system planning capability to inform nationwide, regional and local planners. This planning capability is crucial – as National Grid ESO transitions to NESO and takes on the role of Regional Energy Strategic Planner, the focus on the alignment of gas network planning and Local Area Energy Plans will increase, requiring consideration of the balance of all energy vectors.

Stakeholder Engagement for Innovation

Approach

Networks follow a collective and strategic approach to collaborate with stakeholders and build partnerships through their innovation work. Underpinning the strategic approach to stakeholder engagement, energy networks are dedicated to the principle of collaboration, and to making every contact with stakeholders count. Stakeholder engagement can highlight issues related to future energy system operation that may not yet be identified or experienced, and energy network engagement will seek continual feedback from a diverse array of stakeholder groups.

To enable ongoing interaction and ensure that innovation projects respond to industry challenges and stakeholder feedback, energy networks work with stakeholders to test innovation proposals and issue challenge statements. Information gained from engagement facilitates positive outcomes within the industry and learning and knowledge dissemination.

To incorporate the views of stakeholders throughout the innovation process; gas networks identify four main areas of focus:

- Active engagement and ensuring clarity regarding the key strategic challenges the industry is facing
- The approach to idea generation, and providing access for third parties to engage and undertake innovation projects
- The approach to ensuring clear and consistent visibility and reporting of the innovation portfolios across the energy industry
- The approach to knowledge dissemination and communicating the benefits delivered through innovation projects.

This section details that approach and provides examples of successful stakeholder engagement undertaken throughout 2024/25.

Who participates in innovation?

Gas networks collaborate with a wide range of experts and stakeholders across their project portfolios, helping to ensure projects can draw on deep expertise and incorporate a diverse set of perspectives, as summarised in the image below[3].

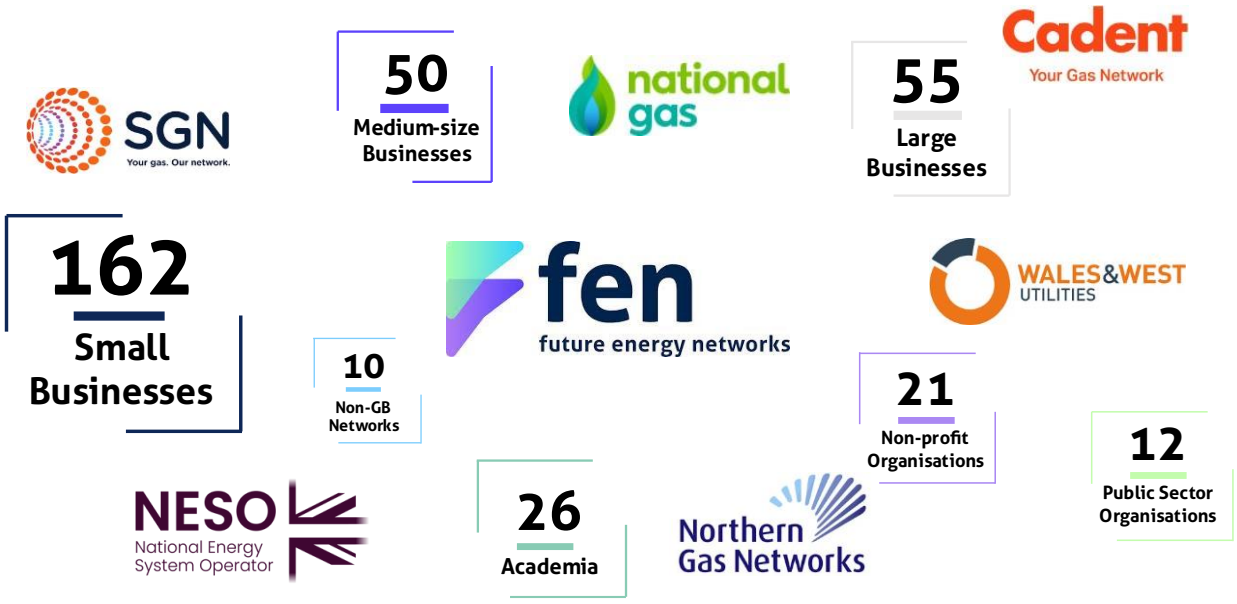


Figure 11. GB energy networks and their innovation partners in 2024/25

Collaborative initiatives in 2024/25

Beyond project work, numerous events and initiatives have fostered consistent industry-wide collaboration. These provide opportunities for dissemination of learning – both during and after completion of projects – amongst the GB Gas Networks, direct stakeholders and wider industry sectors and bodies, ensuring that outcomes are shared to maximise the benefit for customers – some examples are provided below.

Figure 12: Excerpt of 2024/2025 engagement

Energy Innovation Summit

The Energy Innovation Summit has long been the ENA's flagship knowledge dissemination event, providing a platform for energy networks to share insights, engage directly with UK energy network stakeholders, and showcase progress on regulator-funded innovation projects. In parallel with the organisational changes associated with ENA and FEN publishing individual innovation reports, the gas networks have evolved their engagement strategy opting for a more targeted presence at the Summit, broadening their reach by disseminating project outcomes across a range of complementary third-party events. By engaging through forums such as Utility Week Live and Innovation Zero, alongside their contributions to the Summit the Gas Networks sought to reach a wider and more diverse audience. This approach allowed them to align project dissemination with stakeholder interests across multiple platforms, while still supporting collaboration and knowledge exchange within the broader innovation ecosystem.

The result of these efforts was an expanded portfolio of project partners for this year and an exciting pipeline of innovation projects to be rolled out in the next financial year.

Innovation Zero

Innovation Zero is a UK government-backed international congress, the 2024/25 edition of which took place in April-May 2024. The event attracted experts across a wide range of sectors, including climate change mitigation, cleantech innovation and implementation of low carbon solutions. Delegates from all UK gas networks attended and ran a shared stand, showcasing their innovative solutions to an audience of over 10,000 innovators, policymakers, investors and corporate leaders and demonstrating the collective commitment to reaching Net Zero.

FEN Energy Innovation Forum

The gas networks will continue to attend industry led public energy innovation events and fora several times per year. These events are normally based around a theme, with presentations on a range of projects from across the energy networks.

Basecamp 2025

Gas and electricity networks are asked to share some of the specific technical challenges they are facing, both in the short-term and as progress is made towards a Net Zero future. Challenges at the 2025 event were centred around three themes:

- Building Better, Faster and Safer: Modernising the design of planning, procurement and construction projects to deliver better, faster and more innovatively.
- Decarbonising Network Operations: Considering the requirements of Net Zero commitments in every stage of project lifecycles, to reduce the emissions associated with present and future network operations.
- Maximising Use of Existing Infrastructure: Making the most of the networks' current infrastructure, to reduce the consumer cost and environmental impact associated with new construction projects.

For Basecamp 2025, the Gas Networks adopted a more focused approach, prioritising the sharing of specific technical challenges and contributing to targeted discussions around the three core themes of the programme. This decision reflected a strategic choice to engage where their input would add the greatest value, while allowing space for a broader range of voices and ideas to surface. By stepping back from a major showcase presence, the Gas Networks aimed to encourage collaboration, highlight practical challenges, and ensure that the outcomes of Basecamp remained directly relevant to progressing innovation towards Net Zero.

Outputs of collaboration

Collaboration between networks and across network types is also critical in making sure innovation considers impacts to the whole energy system. This past year gas networks have launched 18 **collaborative projects** (with more than one network operator providing input and / or funding).

Cadent's Digital Platform for Leakage Analytics exemplifies gas networks collaborating to address challenges under SIF's whole system integration and data and digitalisation innovation areas, while simultaneously addressing a range of user needs. It is currently in its Beta phase. The project is supported by all of GB's GDNs and National Gas Transmission (NGT), and aims to improve data monitoring and insights, leading to better efficiency and resilience of the networks. The project will enable knowledge dissemination with regulatory bodies, GDNs and customer groups. Key project benefits include reduced gas emissions, cost savings across the network and safety improvements – with leaks followed by immediate action.

The Intelligent Gas Grid project showcases collaborative efforts between multiple gas networks and the private sector. The project refines AI and machine learning techniques for real-time pressure management and predictive maintenance. This reduces gas escapes, and improves efficiency of mains replacements, in turn leading to cost benefits for consumers. The Beta phase of the project involves technology scale-up to enhance network reliability by automating pressure adjustments and reducing methane leaks. It builds on insights from the Alpha phase, where the focus was on proving the concept through targeted research and operational data collection.

The **Hydrogen Heating Programme (HHP)**, led by the Department for Energy Security and Net Zero (DESNZ), is a landmark initiative aimed at understanding whether hydrogen could safely and practically play a role in heating homes and businesses as the UK moves toward Net Zero. The programme aims to develop the evidence base the Health and Safety Executive (HSE) would need to make an independent judgment on the safety of hydrogen heating.

HSE set out more than 130 specific pieces of evidence required, covering every aspect from technical network adaptations and appliance conversions to consumer behaviour and operational safety. HHP's trials and demonstrations were carefully designed to address each of these requirements, producing a rich and detailed evidence set that would give HSE the insight it needed to assess whether hydrogen could be safely used at scale. Gas networks have collaborated extensively to deliver evidence that could demonstrate the safe and long-term transition of gas networks as a potential future solution for home heating. The evidence was generated through projects such as the EUSE – Hazardous Areas Within Building from WWU.

This represents a considerable body of knowledge which will provide government, regulators, and networks with the insight and confidence to make informed decisions on the future of hydrogen in the UK's energy system. Projects have already started to build on this body of work, for example, Cadent's Understanding the value of remote detectors project aims to further supplement this evidence base with a behavioural assessment of how consumers value remote hydrogen detectors.

All five gas networks and FEN are founding members of the **Green Gas Taskforce (GGT),** which was launched in April 2025. The GGT is a collaboration between thirteen of the largest biomethane generators, shippers and traders in GB, the British gas networks and four significant industry groups. The taskforce will drive forward the GB biomethane industry by generating new evidence over the next two years highlighting the potential for its use to deliver UK energy system goals of decarbonisation and energy security.

Figure 13: Green Gas Taskforce members

Intelligent Gas Grid – Beta

Project ID:	10063754
Budget:	£6,304,121
Networks:	SGN (Lead Network), Cadent, DNV, National Gas Transmission, NGN, Utonomy
Duration:	Aug 2023 – Aug 2026
Status:	Live
Funding:	SIF

Overview:

The Intelligent Gas Grid (IGG) project looks at understanding the potential network benefits from using data driven algorithms and decision making (Artificial Intelligence (AI) and/or Machine Learning (ML)) to control the gas network autonomously and intelligently. This project builds on learning from an earlier NIA project, Pressure Control & Management (PC&M), which saw the successful delivery of Utonomy's Remote Control Pressure Management Electronic Actuator System.

Problem definition:

IGG has identified three problems that need to be resolved in gas networks:

- Leakage reduction system is problematic because low pressures create multiple alarms
- Anomaly detection, where the current practice is manual and reactionary. Governor faults are often investigated by the network owner after downstream knock-on effects have occurred.
- Biomethane injection adjustments are manual, costly, and time-consuming, and the timing of changes is sensitive to unseasonal weather in shoulder months.

Solution:

This project aims to explore potential solutions for the network by integrating AI/ML autonomous control with Utonomy's remote control pressure management technology by:

- Enhanced network performance and pressure management to reduce methane emissions.
- Anomaly detection for early identification and diagnosis of networks' faults like water ingress, gas leaks, and asset malfunctions.
- Biomethane injection, allowing for efficient feed-in of biomethane plants to the network.

Overall, the integration of AI/ML technology with Utonomy's remote control pressure management system holds promise for enhancing the efficiency, sustainability, and reliability of the UK gas network.

Benefits

Smarter, autonomous operation of gas network regulators:

- Reduces leaks, and the associated fugitive methane
- Simplifies network operation
- Increases the biomethane injection capacity of the network

Together with the automatic fault reporting of the smarter gas grid, these will also reduce costs and increase the sustainability of the network.

Learn more: Intelligent Gas Grid.

Next Steps

Opportunities Ahead

Over 2024/25, gas network innovation has delivered progress across all outcome areas and strategic themes, with a particularly strong focus on green gases. The announcement of the creation of the Green Gas Taskforce in April 2025 is indicative of the innovation opportunity presented by the energy transition - bringing together the five GB gas networks, biomethane producers, shippers, and industry groups. The Taskforce is advocating for the role of biomethane and other green gases in achieving Net Zero, supporting energy security, and expanding the UK bioeconomy, and outputs from the Taskforce will feed into and demonstrate the value of innovation projects under this innovation theme.

At the same time, networks are aligning their innovation efforts with broader system duties, such as those outlined in National Gas' Roles and Responsibilities, which take a whole-system view of progress. The most recent publication of the Energy Networks Innovation Strategy (published by ENA, but adopted by FEN) reinforces this approach. It provides a unified framework to innovate in ways that support the UK's low-carbon transition and deliver value to customers.

The next price control period for gas transmission and distribution networks, RIIO-3, will begin in April 2026, with draft determinations announced by Ofgem in July 2025. Gas distribution could be allocated a £46m Network Innovation Allowance (NIA), while gas transmission could have an allocation of over £11m of NIA. All network and system operators will have access to portions of a Strategic Innovation Fund (SIF) totalling over £500m.

As RIIO-2 progresses, projects are becoming increasingly iterative, building on learning from previous projects over extended periods of time and across networks and funding streams. For example, Cadent's Air (oxygen) ingress in isolated installations project, funded through NIA, has paved the way for two further air ingress-related innovation projects: Air Ingress in Multi Occupancy Buildings (MOBs) and Domestic Air Ingress Mitigations. These subsequent projects, while still operated by Cadent as the lead network, are also collaborations with WWU and, in the case of the former, SGN.

Future projects will also continue this trajectory to ensure that learnings from the past year are taken forward, moving up the Technology Readiness Level (TRL) scale and closer to BAU implementation.

Key Learnings

During 2024/25, gas networks registered 48 projects and completed a further 56. As these projects progress and many end, networks are increasingly looking to deploy the developed solutions and their learnings into BAU. However, this process is not always simple or straightforward and can bring about its own set of challenges – networks face limitations and high-level strategic changes; innovation takes time, and the process is not always linear; innovation does not always lead directly to a BAU rollout; and some projects focus on creating evidence or testing future feasibility and so are developed without the intention of being rolled out into BAU as they support the wider learning and knowledge required to transform the network. A summary of these challenges and the lessons learned is presented below in Figure 14.

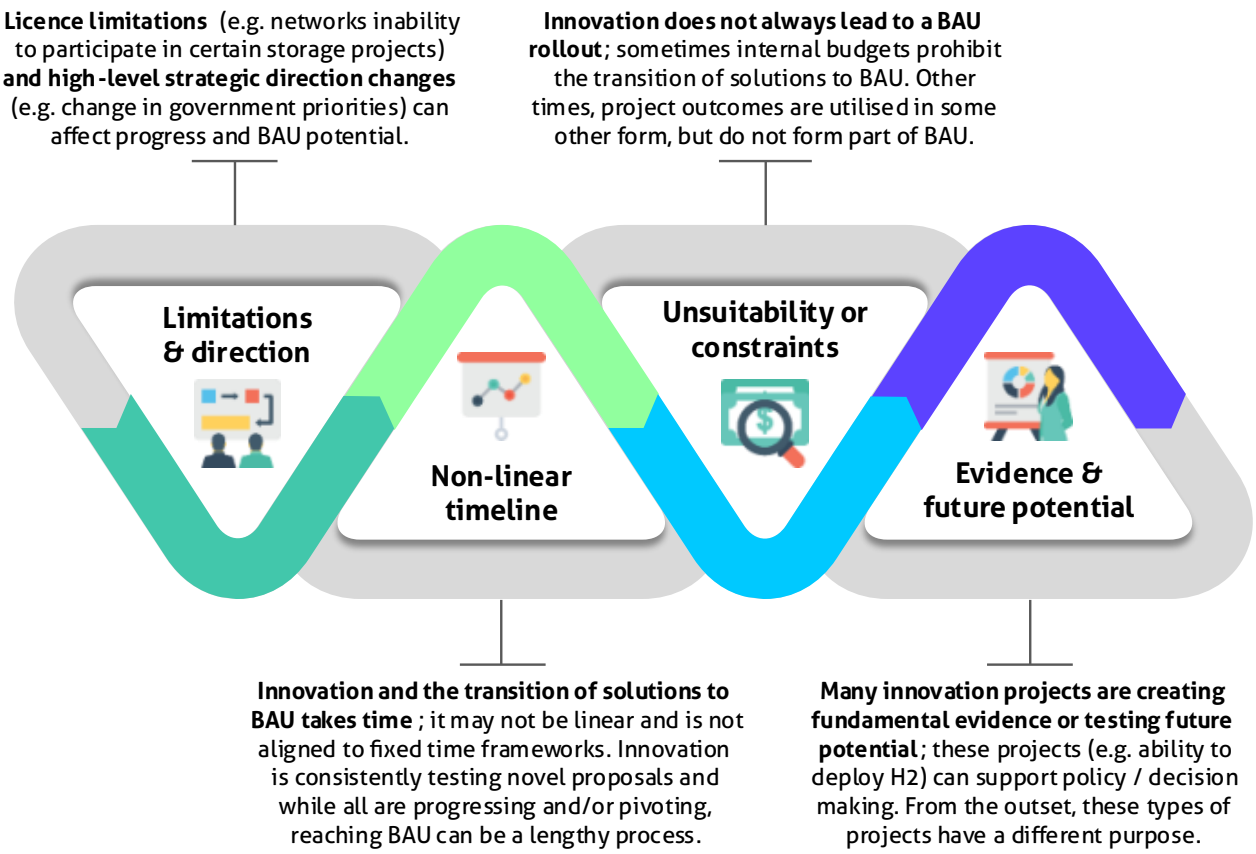


Figure 14: BAU challenges and lessons

Recommended Actions

In line with the innovation risks and challenges, networks have reflected on the key enablers and support needed for integrating the outcomes from innovation into BAU. Enablers centre around the value of communication and planning throughout a project. These include communication and engagement across their businesses, to make sure that all staff are invested in successful deployment. Making this communication effective requires a well-articulated analysis of benefits to show other parts of the business the value of proposed changes. This value can be further articulated through a plan for deployment which can be referred to throughout the solution development process and alignment of innovation team strategy with the wider business strategy.

Some networks also feel that additional funding earmarked for deploying innovative work into BAU would help overcome the resourcing, policy and organisational practice hurdles to integrating these solutions into everyday operations. To address this, Ofgem has introduced a beta version of the Energy Regulation Sandbox, which helps innovators trial new propositions without some of the usual rules applying, and are also planning to launch the Future Regulation Sandbox, an innovative policy instrument to test and trial changes to the energy rulebook in a controlled environment before implementing them. This initiative could help mitigate some of the regulatory barriers to innovation. However, the specifics of deployment are often outside of the scope of innovation projects, and networks still struggle to quickly assemble the necessary resources. Additional policy support through relaxed licence obligations or the ability to use a more simplified/agile policy process also emerged as an important avenue to boost BAU deployment.

The networks have also identified support from industry stakeholders which would help in this process. Building on the focus on communication and internal buy-in, networks identified a need for a consistent methodology to account for non-financial project benefits. It is often difficult for networks to articulate the environmental and knowledge benefits of their innovation work and justify the return on investment for

these projects to both senior leadership and the wider energy industry. Compounding this challenge is the high proportion of low-TRL projects, which are critical for pushing innovation forward, but for which quantification of benefits is challenging, due to their experimental nature and uncertain outcomes. ENA will also be looking to ensure future updates and improvements to the IMF feed in to and align with this report.

Appendix I. Network overview

Gas Distribution and Transmission Networks

As this report is focused on RIIO-2 funded innovation over the regulatory year 2024/25 (April 2024 to April 2025), it is focused on the key innovation progress by the gas and electricity networks in the third year of the RIIO-2 period. Unlike last year's FY24 report, the projects initiated by the electricity and gas networks are reported separately and only those involving the gas networks are reflected in key reporting metrics (such as the balanced scorecard) as well as in the case studies and projects linked throughout the report.

Each network has prepared an individual innovation summary for 2024/25 (linked in the table below) and the insights from these individual reports have been used to create this overarching summary report. The networks have also contributed to this report through engagement in workshops to scope the narrative and discuss challenges across network types.

Network Type	FEN Network Member
Gas Distribution	Wales and West Utilities
	NGN
	Cadent
	SGN
Gas Transmission	National Gas

About FEN

The Future Energy Networks (FEN) is a subsidiary of the Institution of Gas Engineers and Managers (IGEM). FEN's members include the owner and operator of the GB gas transmission network, National Gas and the four Gas Distribution Networks (GDNs) – Cadent, Northern Gas Networks, SGN and Wales & West Utilities.

About ERM

This report was written by Environmental Resources Management (ERM) in partnership with FEN and the gas networks. ERM is a leading sustainability consultancy focused on helping clients identify, manage, and exploit the innovation challenges and opportunities presented by the energy transition.

Appendix II. Acronyms

Acronyms	Description
AI	Artificial Intelligence
BAU	Business As Usual
CCUS	Carbon Capture, Utilisation and Storage
CO	Carbon Monoxide
DESNZ	Department for Energy Security and Net Zero
ENA	Energy Networks Association
FEN	Future Energy Networks
GB	Great Britain
HHP	Hydrogen Heating Programme
HSE	Health and Safety Executive
IGEM	Institution of Gas Engineers and Managers
IMF	Innovation Measurement Framework
LAEPs	Local Area Energy Plans
MOB	Multi-Occupancy Buildings
NESO	National Energy System Operator
NIA	Network Innovation Allowance
NTS	National Transmission System
Ofgem	Office of Gas and Electricity Markets
PPM	Parts Per Million
RIIO	Revenue = Incentives + Innovation + Outputs
SCADA	Supervisory Control and Data Acquisition
SIF	Strategic Innovation Fund
SWIC	South Wales Industrial Cluster
TRL	Technological Readiness Level
UKRI	UK Research and Innovation

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