## Innovation in motion

# Innovation guided by robust evidence

**Throughout RIIO-T2, our innovation focused on preparing the network for a low-carbon future. Our project portfolio has played a critical role in preparing the network for the energy transition by generating practical evidence, reducing uncertainty and enabling better decision making for the business.**

Innovation projects have gathered robust evidence on how hydrogen and carbon dioxide can be safely transported, how existing assets could be repurposed, and what changes may be required to systems, standards and processes. This work has helped to reduce technical and commercial risk, inform strategic programmes such as Project Union and $SCO_2T$ Connect, and helped ensure National Gas is ready to support the future of energy, as policy and market needs evolve.

Alongside this, a consistent focus throughout RIIO-T2 has been on the transition from research to implementation. The team has focused on embedding solutions identified through RIIO-T1 projects into business-as-usual activity and, where appropriate, learnings from across the innovation portfolio have fed into follow-on projects.

Overall, the RIIO-T2 innovation portfolio has supported the business to strengthen network performance today, reduce future uncertainty and ensure National Gas is well positioned to operate a safe, efficient and flexible transmission system in the future energy landscape.

**MORE INFO:** read more about our 'Innovation Strategy'.

## Funding mechanisms used to deliver innovation projects

There are two main funding mechanisms :

1. **The Network Innovation Allowance (NIA)**
The NIA is a set allowance received as part of our price control allowed revenue. The NIA provides funding for smaller technical, commercial or operational projects related to our network. A total of 69 NIA projects were run across 2025/26, bringing the final total of NIA projects to 152 across the RIIO-T2 period.

2. **The Strategic Innovation Fund (SIF)**
The SIF supports large-scale transformational research and development projects. Funding is provided for projects that can address the innovation challenges set by Ofgem.

Example of a biomethane plant. The Standardised Biomethane Connection Design project is looking to enable faster and cheaper biomethane connections.

# Innovation in motion continued

## Network Innovation Allowance

### The Asset Cortex project

A core focus throughout RIIO-T2 was on strengthening our data and improving data collection methods, by exploring automated tools and processes and the applicability of Artificial Intelligence (AI) solutions. The Asset Cortex project tested whether AI can generate detailed asset information using existing system data, reducing the need for time-consuming manual surveys. By trialling the approach at two live sites, the work demonstrated how AI could support better asset visibility, smarter maintenance and future digital tools, such as digital twins. The findings provide a clear foundation for scaling up the approach and shaping future data and IT requirements, supporting long-term improvements to the efficiency and resilience of the network.

### The Standardised Biomethane Connection Design project

To support the transition to a net zero future, green gases such as biomethane will play a key role, by reducing the carbon intensity of the gas we transport. The Standardised Biomethane Connection Design project focused on making it easier and more affordable for biomethane producers to connect to the National Transmission System (NTS). Working with industry partners, a low-impact alternative to traditional above-ground installations was developed, significantly reducing construction complexity, planning requirements and costs, while maintaining safety and technical standards. The new standardised approach offers quicker delivery and greater cost certainty, and we're looking to run a follow-up project exploring how these designs could be rolled out for future connections. (See image on previous page)

### Other projects preparing for the energy transition

Another fundamental consideration when preparing for the energy transition is how existing processes, policies and procedures may need to change. This was the focus of several of the projects within the innovation portfolio:

**The hydrogen site safety systems project**

This project assessed whether existing fire and gas safety systems remain suitable for a blended natural gas/hydrogen network. It was initiated following feedback from the Health and Safety Executive (HSE), which highlighted the possibility of hydrogen leakage through compressor seals inside compressor enclosures. The project examined whether current protection systems were fit for purpose and where changes may be needed. The project showed that blends of up to 5% hydrogen can be accommodated with minimal change. If higher hydrogen blends are introduced, this work has ensured that National Gas is ready to adapt, having given us a good understanding of the likely cost and effort required to ensure that enclosed assets and complex terminals remain safe and resilient.

The engineering analysis and risk assessment of enclosed hydrogen assets has also been used in the development of design philosophies for ~100% hydrogen pipelines for East Coast Hydrogen. Many of the ignition risks, and detection and suppression solutions, can be carried over due to the potential for hydrogen to accumulate in elevated spaces.

This project will contribute to the safe introduction of hydrogen to the NTS should transmission-level blending be approved. It gives a clearer view of potential upgrades, costs and future safety requirements across the network.

**The high-pressure venting and flaring project**

The high-pressure venting and flaring project addressed a critical and previously under-explored challenge for the hydrogen transition: how excess hydrogen can be safely managed during high-pressure transmission and operational scenarios. From an innovation perspective, the project broke new ground for the gas transmission industry by developing one of the first structured, evidence-based comparisons of transmission pressure hydrogen and hydrogen blends venting and flaring. It moved beyond qualitative assumptions, combining safety analysis, regulatory review and environmental assessments to provide defensible technical, safety and environmental insights, while identifying where existing natural gas practices, standards and regulatory frameworks are not sufficient for hydrogen.

The project delivered strong strategic value by addressing high-consequence risks early and reducing uncertainty for future hydrogen infrastructure development. The outputs provide a robust evidence base to inform future design choices, operational strategies and policy discussions, including clearer visibility of regulatory gaps and environmental trade-offs between venting and flaring under different scenarios. By doing this work, the project provides greater confidence in how high-pressure hydrogen can be managed safely, strengthening the evidence base needed for informed engineering decisions, regulatory engagement and emergency planning as hydrogen systems develop.

**The integrity management of hydrogen pipelines project**

This project assessed whether existing pipeline inspection, defect assessment and repair methods would remain suitable if hydrogen was introduced into the gas transmission network. It reviewed current approaches across both pipelines and non-pipeline assets, examining how hydrogen could affect different types of defects and where changes to standards or practices may be required. The findings provide essential evidence to support the repurposing strategy for the NTS. Most defect repair methods in the relevant procedures are likely to be acceptable for hydrogen service, with minor design or procedural changes and additional validation of material compatibility. This project provides inspection guidance for those defect types not covered in existing procedures when considering high-pressure hydrogen. Literature indicates that hydrogen has a negligible effect on yield and tensile strength (typically <5%), which supports existing corrosion assessment methods. Further testing is recommended to establish lower bound hydrogen fracture toughness for NTS pipelines and to update defect limits where necessary.

In addition to this, a complementary carbon dioxide integrity management project was also completed. This focused on similar themes with some of the major findings being that the specification of carbon dioxide streams entering National Gas pipelines must be pure enough to stop corrosion (through carbonic acid/sulphuric/nitric acid) or other integrity threats, such as environmentally assisted cracking. The specification chosen for a carbon dioxide stream must undergo validation to show that it will not cause a continuous upset situation and should be monitored closely at each entry point. Additionally, while carbon dioxide carries a different risk profile to that of natural gas, similar repair methodologies and defect assessment criteria can be used to maintain pipelines and assets.

# Innovation in motion continued

## The Strategic Innovation Fund

SIF projects are split into three project phases:

1. **Discovery**: feasibility studies.
2. **Alpha**: for experimental development.
3. **Beta**: for building, operating and/or demonstrating.

Across RIIO-T2, a total of 70 SIF projects were carried out, including Discovery, Alpha and Beta projects. Alongside delivering our own SIF projects, we collaborated with other organisations, such as the National Energy System Operator (NESO), National Grid Electricity Transmission (NGET) and the Gas Distribution Networks, to support their SIF projects and provide input and expertise.

Throughout 2025/26, we saw the successful delivery of three Discovery projects: Rem$O_2$val, AI opportunities for consumer-centric engagement, and quantum optimisation; two Alpha projects: B-Linepack+ and future operability of gas for system integration (FOGSI), and the successful application and launch of the FutureGrid $CO_2$ Beta project.

The completed SIF projects focused on several key topics supporting the energy transition, including potentially increasing biomethane entry to the network, improving consumer engagement and improving future energy planning, as well as strengthening network and maintenance planning and improving asset inspection challenges.

## Discovery projects

**Project Rem$O_2$val**
Project Rem$O_2$val explored whether we can safely enable higher oxygen limits in the gas system, to support increased biomethane entry. The project explored solutions to protect underground storage assets from corrosion risks associated with elevated oxygen levels, and strengthened our understanding of the technical feasibility and commercial considerations. This work aligns with the broader ambition to enable greater biomethane volumes onto the National Transmission System (NTS).

**AI opportunities for consumer-centric engagement**
This project focused on understanding consumer engagement needs and explored how using innovative, AI-powered engagement tools could support this. We recently applied for the next Alpha phase which will assess the top solutions and select one for detailed prototyping and controlled testing. This work directly supports our RIIO-GT3 priorities by fostering trust, strengthening dialogue and enabling timely delivery of multi-molecule network upgrades, while improving accessibility for communities across the country.

**Quantum optimisation**
Quantum optimisation assessed the potential applicability of quantum and quantum-inspired optimisation techniques for future gas network planning. The work identified that quantum optimisation approaches are at an early stage of maturity and are currently most relevant for research and option exploration purposes, rather than operational or investment decision making. The project has contributed to improved understanding of where quantum optimisation may, or may not, be relevant to future gas system challenges.

## Alpha projects

**Future operability of gas for system integration (FOGSI)**
FOGSI examined how future gas system operability could be affected by changing demand patterns, flexibility needs and coordination requirements with the electricity system. The project highlighted areas where closer alignment between gas and electricity planning may be required, including differences in operational timescales, forecasting approaches and decision-making processes. The outcomes have strengthened our ability to hold informed, evidence-led discussions about the potential future role of gas infrastructure. The insights from the project will support future innovation and strategic planning, helping to ensure that gas system considerations are appropriately reflected in the transition to an integrated, resilient and net-zero-ready energy system.

**B-Linepack+**
B-Linepack+ explored whether underground Lined Rock Shaft (LRS) hydrogen storage can replace lost pipeline linepack flexibility, as the system transitions from natural gas to hydrogen. The project delivered a mature concept design for a first-of-a-kind LRS demonstrator, supported by whole-system energy modelling, cost-benefit analysis and deployability studies across Britain. Detailed engineering confirmed that high-pressure hydrogen storage in lined rock shafts is technically feasible and scalable, with quantified safety, constructability and regulatory pathways. The project has materially de-risked a new class of operational hydrogen storage, providing a strong evidence base for a Beta demonstrator and informing future hydrogen network design, resilience and regulatory frameworks.

## Beta projects

There are two ongoing Beta projects that are focused on identifying future opportunities for the UK's gas networks.

**FutureGrid $CO_2$**
This project is addressing key technical challenges associated with transporting carbon dioxide within the gaseous phase, by observing how carbon dioxide behaves when transported in repurposed pipelines and assets.

The project outcomes will contribute to Carbon Capture and Storage (CCS) projects such as S$CO_2$T Connect, helping to realise the goal of net zero by 2050 and the decarbonisation of hard-to-abate sectors.

CCS is the only viable way for some hard-to-abate sectors to decarbonise and is a crucial path to clean power and hydrogen production. For the UK, CCS paves the way for decoupling economic growth from emissions, enabling us to keep industry and jobs without failing to hit our legally binding environmental targets.

The project is making great progress and is currently moving ahead of the original schedule. The outputs include a range of areas to help critically analyse and validate theoretical models of gaseous $CO_2$ behaviour, contributing to safety and regulatory compliance, as well as helping to increase confidence for all stakeholders across the $CO_2$ transport value chain. Activities include routine operational studies, such as observation of $CO_2$ behaviour within the flow loop and venting operations. Hazard-focused testing is also a key focus, with pipeline integrity, impurities and corrosion management all being examined to reduce risk and support the safe deployment of $CO_2$ transport infrastructure.

The results from this project are key to building the evidence forming a major component of our safety case. This is especially important since $CO_2$ pipelines now fall under Pipeline Safety Regulations (PSR) as Major Accident Hazard pipelines. The team is fully focused on delivering valuable insights, in close collaboration with project partners, to support the safe and timely deployment of future $CO_2$ transport infrastructure.

# Innovation in motion continued


**FutureGrid deblending**

FutureGrid deblending for transport is a pioneering initiative demonstrating how Great Britain's existing gas infrastructure can be repurposed to deliver pipeline-fed hydrogen for transport and mobile power applications.

This project is a critical step in enabling zero-emission transport by showcasing how hydrogen can be separated, purified and compressed for use in fuel-cell vehicles and other clean energy systems.

Hydrogen blending into the NTS offers a scalable route to decarbonisation. However, many transport applications require high-purity hydrogen. Deblending technology allows hydrogen to be separated from natural gas blends and purified to fuel-cell grade, enabling reliable supplies for refuelling stations and mobile power.

Without deblending, hydrogen refuelling stations are limited to local production or tube trailers, which often leads to supply constraints. This project aims to solve that, by demonstrating a pipeline-connected hydrogen refuelling solution whilst also working with stakeholders across the full supply chain to produce a rollout and commercialisation strategy to understand the future potential of this demonstration.

The programme for the FutureGrid test facility has been revised to allow testing for the FutureGrid $CO_2$ project to be accelerated, to meet key milestones related to the deployment of CCS in Scotland. The deblending project timeline has been updated, with delivery now expected to extend by around 12 months. Installation and commissioning of the deblending equipment will commence once $CO_2$ testing is complete, with operations expected to start in early 2027.

During this period, we will continue to provide hydrogen refuelling capability and welcome further vehicle demonstrations, alongside continued stakeholder engagement. In parallel, we're advancing our commercialisation strategy to define key requirements and outline the roadmap for hydrogen deblending beyond the testing phase.

## Innovation in summary

Throughout RIIO-GT3, innovation will be central to maintaining a safe, resilient and efficient transmission network while supporting the transition to net zero. Building on the strong evidence base developed through RIIO-T2, our innovation programme will focus on improving network resilience and safety, reducing operational and construction emissions, and accelerating the use of digital and data-led solutions. Activity will increasingly be aligned to clear business outcomes, supporting the move from research into practical implementation.