SGN
Your gas. Our network.

Innovation Annual Summary

2023/24

Live document links
This document includes live links on the contents list, to aid navigation and elsewhere throughout the text pages to signpost extra related information, saved elsewhere.

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Foreword from Antony Green, Future of Energy Director

I am thrilled to have joined SGN in 2023 as the Future of Energy Director, especially during this transformative period in the energy sector.

The energy landscape is undergoing significant changes, driven by advancements in technology, the urgent need for sustainability, and changes in regulatory frameworks.

As we move towards a cleaner, more efficient, and more resilient future for energy, I am excited to lead SGN's innovative initiatives and strategic vision. We are focusing on leveraging emerging technologies, fostering collaborations, and driving forward-thinking policies that will shape the future of energy.

At SGN our regions in Scotland and southern England each present unique opportunities and challenges in the pursuit of our net zero targets. Both regions share a common goal: to achieve net zero by replacing the natural gas in our pipelines with greener alternatives by 2045 in Scotland and 2050 across the whole of the UK.

Scotland's vast renewable energy potential, and its advantageous landscape, provides the foundation for innovative projects and sustainable practices to evidence net zero. In southern England, we have the opportunity to utilise innovative technology and infrastructure improvements to reduce emissions and enhance energy efficiency.

By combining these diverse regional strengths, I am confident that we can develop and implement strategies that not only meet but exceed our net zero ambitions, enabling a just energy transition for all.

At this exciting time in the energy sector, the potential for positive change is immense. I am eager to collaborate with colleagues and partners across the industry to explore innovative solutions to drive forward sustainable energy solutions and make a meaningful impact on our environment and communities.

Antony Green.

Antony Green
Future of Energy Director

At SGN our regions in Scotland and southern England each present unique opportunities and challenges in the pursuit of our net zero targets.

SGN at a glance

The SGN Group owns one of the UK's largest and most innovative gas distribution networks, operating across Scotland, southern England and Northern Ireland.

Our purpose

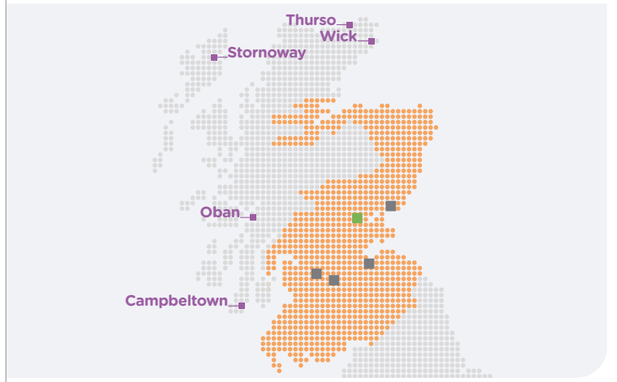
Serving our communities by keeping everyone safe and warm.

Our vision

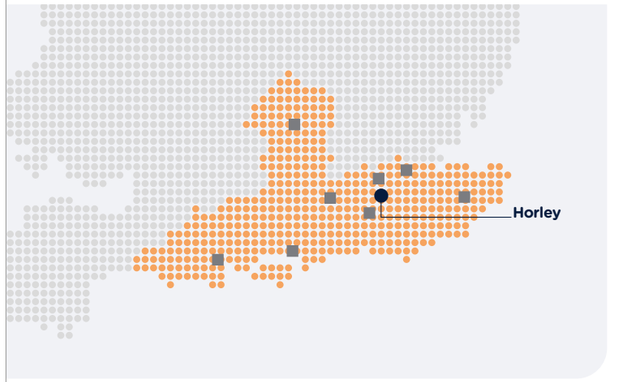
To play our part in a fair and affordable energy transition.

Our values

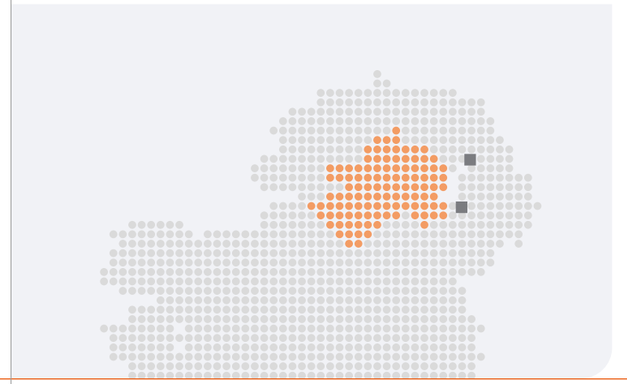
Operations throughout the UK



Scotland
Our network distributes gas across Scotland to 75% of households (1.85 million customers). This includes remote areas through the five Scottish Independent Undertakings (SIUs).



Southern England
Stretching from Milton Keynes in the north, to Dover in the east, and Lyme Regis in the west, including London boroughs south of the River Thames, our Southern network distributes gas to 4.15 million customers.



Northern Ireland
The network in Northern Ireland delivers gas to 4,500 customers across nine towns in the west. Our Evolve business has ambitions of fully decarbonising this network by 2030.

Key
- SGN network areas
- SIUs
- Head office
- Customer service centre
- Offices/depots

The SGN brand portfolio

As our business expands so does our portfolio under both our regulated and non-regulated activities.

Regulated business
Our regulated businesses form the core of our activities in providing a safe and secure supply of gas to our customers throughout our three gas networks.

SGN Your gas. Our network.

evolve Connecting pipes and people

Non-regulated businesses
Beyond our regulated operations, we engage in complementary business ventures, leveraging expertise and diversifying the Group's portfolio.

SGN Place

SGN Heat Networks

mua

SGN Commercial Services

FYLD

SGN innovation overview

We have had another productive year for our innovation activities at SGN.

We have continued to collaborate with our peers in the industry and beyond on a mixed portfolio of projects covering AI, operational efficiency, vulnerable customers and safety to name a few.

As we embed the changes to innovation in SGN by assisting our colleagues in transforming our performance, we are now looking at the rest of RIIO-GD2 as a ramp up to RIIO-GD3 ensuring we are building the insights, network and capability to deliver more innovation to the sector for a decarbonised whole energy system. We have unique challenges and opportunities across the mixed geographies we cover in Scotland and the south of England, and innovation will play a key part in our future delivery of net zero in those areas; whether that is renewables in Scotland capitalising on their potential, or asset management and efficiency in the South to reduce emissions, there will be a broad portfolio of innovation activities.

Looking forward

Key for us over the coming months is strengthening our innovation network, building on academic relationships, finding new partners, and strengthening our relationships across the sector with our peers as we all face the same massive challenge of achieving a net zero whole energy system for all our customers.

Selwyn Rose
Head of Innovation

Selwyn Rose (left) with the SGN innovation team at the Energy Innovation Summit in Liverpool last October.

We have continued to collaborate with our peers in the industry and beyond on a mixed portfolio of projects.

Meet the Innovation team

Stuart Sherlock
Role: Governance & Performance

Stuart comes from a mechanical engineering background and is chartered with the Institute of Gas Engineers and Managers (IGEM). He currently heads the Governance & Performance division within the Innovation team. With a decade of experience in the gas industry, Stuart has developed a diverse set of skills essential for ensuring that the Innovation project portfolio adheres to specific governance and compliance regulations.

The Governance team is focused on ensuring SGN innovation activities are managed in line with the correct process, and that performance is reported and shared effectively. The team also plays a crucial role in maintaining control and effectiveness of operations, guaranteeing that each step in the innovative processes aligns with the correct funding compliances and practices.

Gordon McMillan
Role: Insights

As a graduate of chemical engineering and business leadership, Gordon is the Innovation scouting and discovery lead. Through research and creative exploration, Gordon translates key insights into actionable strategies and plans. These opportunities inform the foundation of the innovative projects, support SGN energy transition and bring value to day-to-day operations.

Having spent just under a decade in the gas industry, Gordon has had various roles from innovation management and project engineering to network strategy and design. He has experience in all aspects of innovation management, from concept creation to implementation.

Mohanvir Singh-Saran
Role: Futures Innovation

Mohanvir leads the Futures Innovation portfolio at SGN. His role is focused on executing innovative projects that will allow SGN to deliver a sustainable energy transition and support existing and future customers. The Futures portfolio discovers, defines and develops new and emerging opportunities within gas and adjacent sectors including green gas, heat networks and transport. The team consists of innovation project managers and PhD specialists with experience across nuclear, academia and innovation consulting.

Previously, Mohanvir led 5G and IoT innovation at BT Group plc, worked in product innovation and startup incubation at Telefónica and delivered consulting engagements at Grant Thornton LLP.

Ollie Machan
Role: Core Innovation

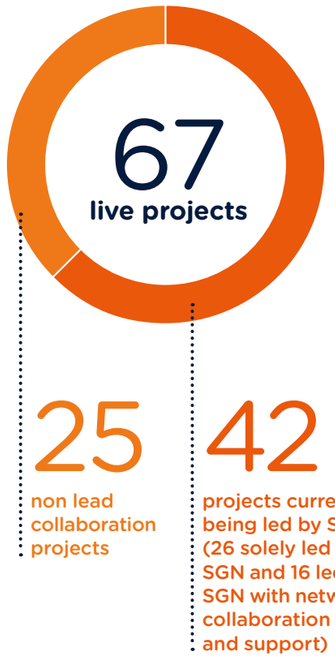
With over two decades of experience in the gas industry, Ollie has carved a niche in several pivotal business areas including distribution network strategy, innovation, and the integration of new technologies. This journey has seen him lead and contribute to a myriad of business improvement initiatives, alongside projects targeting records, asset risk, IT, and strategic planning. Ollie is dedicated to cultivating a robust innovation portfolio aimed at facilitating the industry's transition while enhancing SGN's operational efficiency.

His expertise extends to strategy formulation, driving operational and service excellence, and unlocking value through cutting-edge innovation. Ollie's commitment lies in the delivery of services, platforms, and capabilities that generate operational and enterprise value.

How we fund our innovation activity

In 2023/24 we've continued to foster our culture of innovation and closely collaborate with our business operations to keep our customers at the forefront of our efforts as we advance towards achieving net zero emissions.

Reflecting back on 2023/24 we have:



Continually innovating
Our innovation activity has been facilitated through diverse funding channels, with a primary focus on two key streams: the Network Innovation Allowance (NIA) and the Strategic Innovation Fund (SIF). Our projects are consistently progressing and making steady advancements, delivering valuable benefits to support our customers and contribute to our net zero objectives.

Ofgem Network Innovation Allowance
The NIA, a cornerstone of innovation during RIIO-GD1 and continuing into RIIO-GD2, supports a diverse array of projects aimed at assisting vulnerable customers and facilitating the transition to net zero.

NIA projects play a key role in identifying potential knowledge gaps that need to be filled in order to provide strong evidence in supporting network conversion for the UK's energy future. In alignment with the 'Energy Innovation Strategy' challenges outlined on page 7, we have progressed a number of projects that address these knowledge gaps. These projects provide vital evidence supporting a transition to a net zero future and assist vulnerable customers.

Information on our NIA projects can be found on pages 14 to 23.

Ofgem Strategic Innovation Fund
The SIF serves as a funding mechanism under the RIIO-GD2 network price control, targeting the Electricity System Operator, Electricity Transmission, Gas Transmission, and Gas Distribution sectors. Its primary goal is to decarbonise the gas and electric energy distribution and transmission networks, delivering benefits to consumers. SIF operates as a competitive funding framework, structured in three phases, progressively increasing investment value from conceptualisation to final implementation.

Information on our SIF projects can be found on pages 24 to 27.

Additional funding
Moreover, a portion of our innovation efforts is funded by third-party contributions and alternative business sources. These resources drive efficiency improvements and process optimisations throughout SGN's operations, supporting the refinement and implementation of products at higher technology readiness levels.

The energy networks innovation strategy

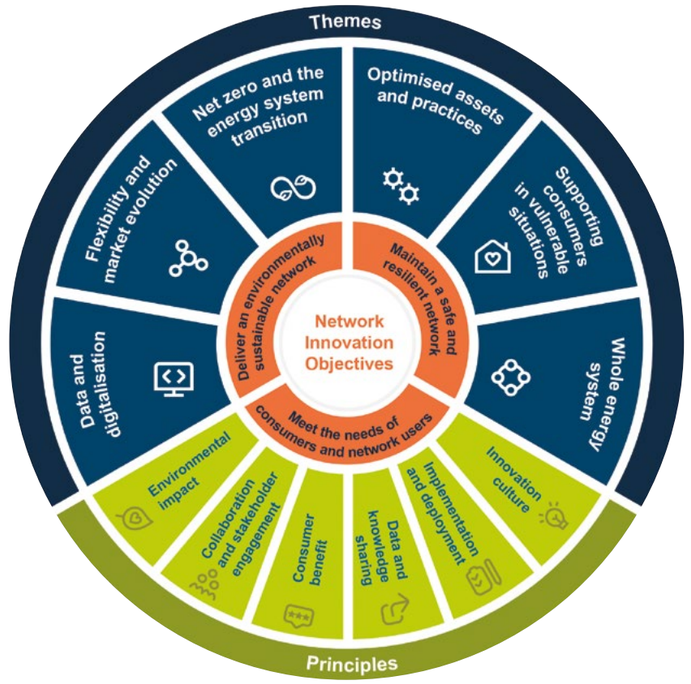
This year, the Gas Distribution Networks (GDNs) collaborated with Electricity Networks and the Energy Networks Association (ENA) to create a revised innovation strategy aimed to produce a collective vision for a net zero transition. The ENA's Innovation Strategy serves as a blueprint guiding network operators in developing solutions that strengthen the transition to net zero.

This collaborative strategy is designed to be both flexible and ambitious, encouraging innovation while avoiding excessive limitations. At its core, the strategy revolves around three primary objectives (Network Innovation Objectives), which are displayed at the centre of the graphic opposite. These goals correspond to the three consumer oriented outcomes established by Ofgem, which are fundamental to all network innovation efforts.

The agreement on network innovation 'Themes' and 'Principles' are also shown in the graphic which sets clear priorities for all networks, fostering a common strategic path. Innovation projects must align with these themes to focus on addressing our major challenges.

A breakdown of these themes and principles is shown on the right.

Network Innovation Objectives



Themes

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

Flexibility and market evolution
Developing and testing market-based solutions to increase the flexibility and efficiency of the energy system; accelerating the adoption of low carbon solutions.

Net zero and the energy system transition
Facilitating and accelerating the UK's transition to net zero greenhouse gas emissions.

Optimised assets and practices
Developing and implementing industry-leading techniques for optimising assets and practices.

Supporting consumers in vulnerable situations
Exploring how best to support the needs of consumers who find themselves in vulnerable situations, today and in the future, to enable a just transition.

Whole energy system
Develop joined-up approaches across sectors and energy vectors.

Principles

Environmental impact
Innovation plays an important role in the UK achieving net zero-carbon emissions.

Collaboration and stakeholder engagement
Collaboration is key to ensure we continue to maximise value of our projects and delivery to our customers.

Consumer benefit
We aim to focus our innovation activities to deliver clear benefit to our customers.

Data and knowledge sharing
Collaboration is important in ensuring that we meet the needs of our customers, therefore we aim to make all information and data available where possible.

Implementation and deployment
With completion of innovation projects, it is important to take the learning and output forward into the business.

Innovation culture
Network companies and regulators aim to adopt an innovation-driven culture across their operations to enhance their capacity for delivering groundbreaking transformations.

Our project partners

Thanks to the incredible support from our project partners, we are on the verge of breaking through technological boundaries and reaching new heights.

Overview
Our team is fuelled by passion and excitement for exploring the endless possibilities that lie ahead. We firmly believe that the key to turning innovative ideas into reality is through collaboration with like-minded visionaries who share our drive for progress.

Working together
Over the years, we have cultivated strong relationships with small and medium enterprises (SMEs) and leading corporations in Europe and North America, working on a wide range of projects together. At SGN, we thrive on collaboration with top engineering and consulting firms to dive deep into groundbreaking technologies such as hydrogen production, distribution, and carbon capture and storage. Our goal is to revolutionise the gas system, paving the way for a fully green gas distribution network that sets a new standard for sustainability worldwide.

DNV

"DNV is delighted to participate in the Intelligent Gas Grid project. The collaboration between project partners, driven by SGN's focus on communication, makes it particularly exciting. The combination of DNV's domain and digital expertise and SGN's desire to explore new ways of managing foreseen network complexity creates a unique blend of physical asset knowledge and technical know-how. This allows the project to push the limits of current practices while maintaining supply safety and ensuring security is at the forefront of activities. Together, we are taking significant steps towards creating a smarter energy sector driven by trustworthy digital solutions."

Graham Faiz
Head of Digital Energy, DNV

PIE

"We are excited to partner SGN in the LTS Futures project, which is exploring innovative solutions to demonstrate that it is technically feasible to repurpose the LTS for hydrogen transportation. This ground-breaking project is conducting fundamental research into how hydrogen may affect pipeline materials and performing full scale tests to understand the influence that hydrogen may have on pipeline integrity – which will lead to a live demonstration trial. The core SGN project team has played a critical role in planning and delivering this complex project."

Gary Senior
Director, Pipeline Integrity Engineers Ltd

Steer Energy

"This past year saw the first field uses of our High Volume Gas Escapes Toolkit, which enables the control of High Volume Gas Escapes from pipelines at operating pressures up to 2barg. SGN has now provided nine field kits across its network, supported through the PCD funding scheme. We have also continued to support SGN's leadership in the drive to net zero, contributing to building the safety evidence for hydrogen use. Often collaborating with others, we have provided fundamental research alongside real-world experimental testing and knowledge to deliver key projects. These include 'Hazardous Area Impact Mitigation Phase 1' and 'Purging Hydrogen Risers' (MOBs)."

Iain Chirnside
Director, Steer Energy

INEOS

"We are pleased to be a partner in the LTS Futures Project, supplying the hydrogen for the trial from our own operations in Grangemouth to SGN. We recognise the importance of hydrogen in accelerating the decarbonisation of energy in support of the drive towards a zero-carbon future. Our work in Grangemouth with SGN underpins our own hydrogen development plans as well as INEOS's involvement in several other projects to develop demand for hydrogen, replacing existing carbon-based sources of energy, feedstocks and fuel."

Colin Pritchard
Sustainability Director, INEOS

FYLD

"Predictive Insights represent a pivotal advancement in industries reliant on field workers. By harnessing real-time data to enhance predictive safety interventions, we are actively reducing the likelihood of potential incidents. Our collaboration with SGN, supported by Ofgem's Strategic Innovation Fund, has been nothing short of transformative. With a shared mission to ensure the safety of every worker, we are accelerating progress toward our collective goal of ensuring everyone returns home safely at the end of each workday. Working closely with the dedicated team at SGN, we anticipate a nationwide implementation of this groundbreaking capability."

Shelley Copsey
CEO, FYLD

FRAZER-NASH CONSULTANCY

"We have worked with SGN on both SIF and NIA projects in recent years, and our people have valued the opportunity to support their drive to develop novel solutions for industry. SGN's collaborative approach to innovation allows us to work closely with them and to deliver successful outcomes for their programmes."

Toby Hazelwood
Power Transmission and Distribution Business Manager, Frazer-Nash Consultancy

utonomy

"Utonomy is delighted to be working with SGN (and National Gas, Cadent Gas, Northern Gas Networks, Wales & West Utilities and DNV) on the SIF Beta Intelligent Gas Grid project and, as we approach the end of the first year, to have further strengthened our working partnership and understanding of how we are able to reduce methane emissions, increase bio-methane injection capacity and increase efficiency of the gas network."

Brian Croal
Head of Customer Operations, Utonomy

IGEM

"IGEM produces the engineering standards that are used by industry to assist duty holders with their compliance with national legislation. We are passionate about engineering a sustainable gas future and are delighted to work with SGN examining the impact of hydrogen velocity on the gas network. The outcome of this research will allow the IGEM standards to be updated, enabling safe transport of hydrogen across the whole of the existing UK gas network infrastructure."

Ian McCluskey
Head of Technical and Policy, Institution of Gas Engineers and Managers (IGEM)

CEE Centre for Energy Equality

"It has been a privilege working with SGN on the Fairer Warmth Hub project. SGN has demonstrated a strong commitment to embedding the Fairer Warmth Hub solution, empowering communities to collaborate in providing low-carbon, affordable warmth to customers in vulnerable situations, small businesses, and wider communities. Their focus on delivering social value has been inspirational and we look forward to continuing our partnership with SGN to ensure equal access to low-carbon solutions for all."

Andy Ross
Director, Centre for Energy Equality

ROSEN empowered by technology

"ROSEN is delighted to have work with SGN over the last 18 months as lead partner on their Feasibility of Hydrogen in MOBs project. The entire project team, led by SGN, has worked closely together on this complex project with many interdependent elements. ROSEN has worked with SGN on a many innovation and technical consultancy projects over the past 15 years' and we look forward to further collaboration in the future."

Simon Daniels
Principal Engineer, ROSEN(UK) Ltd

Event attendance 2023/24

Energy Innovation Summit

The Energy Innovation Summit provided an ideal platform for showcasing SGN’s dedication to innovation within the energy industry. Our booth attracted considerable attention and allowed us to showcase our innovative projects that are pushing the sector in new directions. Engaging in various presentations enabled us to connect with others who share our vision for a sustainable future. We are excited to continue collaborating with like-minded individuals and organisations to drive progress in the industry.

Utility Week Live

SGN recently participated in the Utility Week Live conference, where we shared insights on our innovative future of gas projects and its significance in the evolving energy landscape. As customer vulnerability emerged as a key topic at the event, we highlighted our initiatives aimed at providing support to vulnerable customers both currently and in the future.

The event provided a platform for us to not only showcase our commitment to customer welfare and technological advancements but also to explore new avenues for industry partnerships and advancements.

SIF Beta UKRI Event

SGN was in attendance with Stuart Sherlock at the SIF Community Forum in Newcastle, teaming up and collaborating with the incredible partners of our Ofgem SIF.

Stuart is also sharing experiences with other industry leaders running trailblazing innovation projects in the energy sector.

Our three Beta projects were granted £13 million to help address key challenges facing the UK’s energy sector in meeting net zero ambitions.

- The Intelligent Gas Grid (IGG) will help enhance network efficiency using real-time data, AI and data-driven algorithms.
- Predictive Safety Interventions are using predictive analytics to reduce risks to our field-based colleagues.
- Velocity Design with Hydrogen is examining the impact of hydrogen velocity on our network using full-scale tests.

COSLA Annual Conference

SGN recently hosted a fringe event at the COSLA Annual Conference to connect with Scottish local authority partners. The Future of Energy team shared the pioneering work they are doing to build an evidence base for hydrogen and develop a vision for a hydrogen ecosystem in Scotland. Local authority support is crucial in helping SGN realise Scotland's hydrogen potential for decarbonising home heating and industry while becoming a world leader in hydrogen production and storage.

NESO visit to DNV Spadeadam

LTS Futures provided an update on the project to the newly formed National Energy System Operator (NESO), IGEM, GDNs, National Gas and DNV. This demonstrated to NESO the opportunity available for repurposing transmission network assets to hydrogen.

Innovation Basecamp

At the Energy Innovation Basecamp, pioneers in the energy sector come together for a dynamic event focusing on breaking down barriers to energy system innovation. This is a series of events that will bring together key players in the industry, including Ofgem, Energy Networks Association, Innovate UK, and all GB electricity and gas networks. Together, we will work towards our shared goal of achieving a net zero power system by 2035.

ESNZ visit to H100 Fife

It was an honour to host the Energy Security and Net Zero Committee (ESNZ) for a tour of our under construction hydrogen demo. Up to 300 homes participating in our H100 Fife trial will soon be visiting the facility to see hydrogen in action before it is installed in their own homes.

Kiwa hydrogen heating trial

The team visited Lochem in the Netherlands to find out more about an ongoing hydrogen heating trial involving 10 homes as well as taking part in an experiment at Kiwa’s Apeldoorn office on its Hydrogen Experience Table. Kiwa is a testing specialist that’s working with Dutch gas network company Alliander to deliver a hydrogen heating trial in Lochem. As part of the trip, the SGN team visited Lochem resident Mr Kruiff, who has been using hydrogen heating since November 2022. Commenting on his experience using hydrogen, Mr Kruiff said: “It’s wonderful, it’s like the gas we had. It’s a very good solution for older homes like these.”

LTS update at Westminster

Our LTS Futures Project Director Nancy Thomson took the stage at the Palace of Westminster for an insightful lunchtime talk which was hosted by TWI presenting on the importance and opportunity for repurposing gas transmission pipelines to hydrogen to meet net zero. She delved into the exciting prospects ahead as we gear up to transform our gas network on the path to net zero.

Toho Gas visit to H100 Fife

We were delighted to host industry colleagues from Japanese energy company Toho Gas. Our guests visited our hydrogen projects in Fife and Edinburgh, where we’re doing critical work to trial the use of hydrogen in our distribution and transmission networks. In Buckhaven, Fife, we’re building the world’s first green hydrogen neighbourhood – H100 Fife, where hundreds of homes will be heated using green hydrogen. In Grangemouth, we’re gearing up to trial a 30km high-pressure pipeline with hydrogen gas. International collaboration is really important for reaching net zero targets, and as well as sharing our own learning, we learned a lot from our colleagues about their carbon neutrality strategy using hydrogen and biogas.

SGN Future of Energy strategies

SGN has two dedicated teams looking at the wider system transition requirements. The evidence delivery team is focused on delivering safety critical hydrogen evidence projects and the hydrogen solutions team are focused on the regional development opportunities.

Hydrogen evidence

We have been leading the way and working in collaboration with the other UK GDNs generating evidence to demonstrate the safe conversion and long-term transition of our gas networks to hydrogen as a potential future solution for home heating informing the Department for Energy Security and Net Zero (DESNZ) who is tasked with making the UK policy decision in 2026. DESNZ is being supported in this process by the Health and Safety Executive (HSE) who is reviewing the evidence gas networks are producing.

SGN's project work in this area is truly reflective of the depth and breadth of technical areas we must assess as part of this Comprehensive Formal Assessment (CFA) process. As shown in this report the projects we are working on cover a wide range of hydrogen evidence areas with the targeted goal of closing any evidence gaps identified within the HSE Safety Demonstrations framework. The mitigation of any risk via the projects we are delivering is linked to the evidence framework addressing the challenge of nine critical areas as shown in the table below.

Primarily, SGN's focus up to August 2024 is in the following areas:

- Network suitability (materials and components)
- Risk assessment
- Capability and training
- Standards and procedures

Post August, SGN's project portfolio will expand to include more evidence-based projects in the following areas:

- Conversion strategy
- Risk assessment
- Controls

The HSE has set up a dedicated Evidence Review Group (ERG) who provide a consolidated view on hydrogen for home heating. The decision to ultimately transition gas networks to hydrogen networks will be made via a CFA that DESNZ will be conducting, with the policy decision expected in 2026.

HSE considerations for policy decision	Evidence category
System architecture	D1-D6
Conversion strategy	D7-D9
Network suitability (materials and components)	D10-D20
Public behaviour	D21-D26
Risk assessment	D27-D39
Controls	D40-D45
Capability and training	D46-D48
Standards and procedures	D49-D53
Policy and regulation	D54-D65

System transformation

The UK and Scottish governments have legally committed to reducing greenhouse gas emissions to net zero by 2050 and 2045 respectively.

SGN's decarbonisation strategy includes the possible conversion of the gas networks from natural gas to 100% hydrogen, establishing an energy vector for low carbon and renewable energy.

Simultaneously, system transformation projects are developing the plans, roadmaps, and infrastructure requirements to enable the conversion of the gas networks to 100% hydrogen and stimulate the hydrogen economy. This activity is underway through the system transformation pre-Front End Engineering Design (FEED) projects, which, across the East Coast and Central Belt of Scotland, Aberdeenshire and the Southern networks (South and South East), are designing and routing new hydrogen transmission pipeline backbones connecting hydrogen production, storage and network injection locations.

The Southern and Scottish Pre-FEEDs

These projects are preparing the system transformation plans for the majority of the Southern Local Distribution Zone (LDZ) and the East Coast of Scotland (south of Aberdeen) respectively through:

- Routing and designing H2 Connect and H2 Caledonia, the new systems of hydrogen transmission pipelines required to connect blue and green hydrogen production, hydrogen storage and hydrogen demands.
- Developing network conversion and sectorisation plans for each grid within the geographies of the projects, detailing the network reinforcements and adaptions required to sectorise each grid and establishing a strategy to transition each safely and progressively from natural gas to hydrogen.
- Managing the interface between prospective hydrogen producers and storage operators, ensuring development timelines are aligned between projects.

These projects are near completion, with fully optimised route corridors designed, all relevant grids analysed in terms of sectorisation plans, and critical relationships in place between hydrogen producers and industrial anchor loads.

H2 Caledonia and H2 Connect

Proposed phasing and optimisation work is now underway which is designing rollout plans in line with possible funding routes, assessing new proposed lines alongside the existing LTS and NTS, aiming to identify areas of new infrastructure which could be avoided and addressing identified technoeconomic gaps in advance of future FEED.

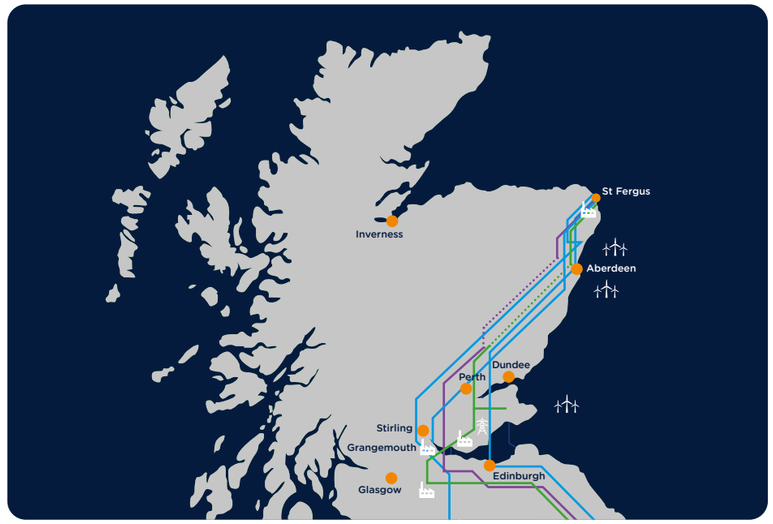
Aberdeen Vision

This project is complete and has routed and designed the Aberdeen Vision Pipeline, connecting hydrogen production at St Fergus with the necessary Pressure Regulating Station (PRS) sites to enable the conversion of Aberdeenshire including the city of Aberdeen, the conversion and sectorisation strategy of which has been completed.

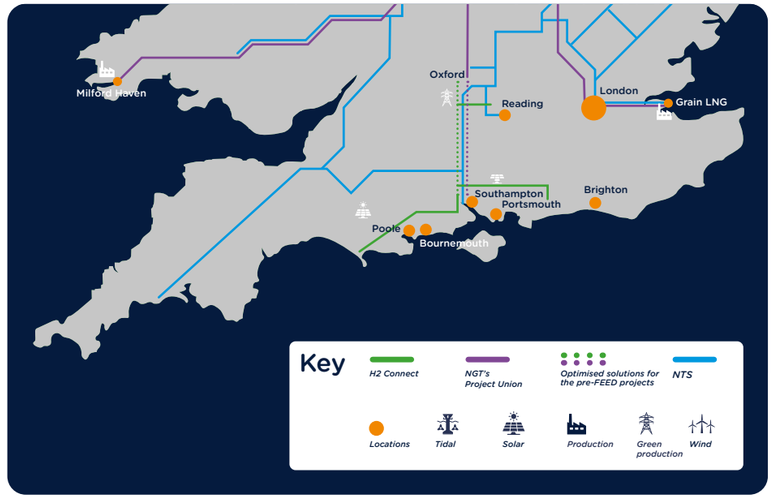
H2 London

This project aims to carry out the same transmission planning scope as detailed above but for the SE LDZ, is nearing kick off, with procurement complete.

H2 Caledonia (Scotland)



H2 Connect (Southern)



Link to more information:

Hydrogen evidence
gov.uk/government/publications/hydrogen-heating-overview/hydrogen-heating-overview--2

System transformation
sgn.co.uk/news/sgn-and-ngt-accelerate-hydrogen-plans-scotland-and-southern-england

Ofgem NIA funded projects

Hydrogen MOBs standards and procedures – Phase 4

Background

The SGN Hydrogen in Multi-Occupancy Buildings (MOBs) feasibility study will research and understand the safety, costs and practicality of converting network pipelines in MOBs from natural gas to hydrogen. Reporting the key features for potential conversion, assessing risks and alternative options. The final project outputs will produce a quantified risk assessment for conversion as well as a draft standard and procedure.

The problem we are trying to solve

Most of the research focuses on hydrogen to date has targeted on smaller, simpler end user systems (e.g., simple one and two storey dwellings) but there is a need to understand hydrogen as applied to MOBs. MOBs connected to natural gas represent a significant portion of domestic dwellings (many of which are classed as vulnerable customers) and non-domestic buildings. It has been identified that flatted properties make up 21% of the UK's domestic heat load. GDNs need to fully consider these properties and make an assessment for likely conversion opportunities.

Our solution

SGN is undertaking a feasibility study to help understand if hydrogen is a suitable solution for decarbonising MOBs. A document landscape review was completed to identify the knowledge gaps that need to be addressed to repurpose existing gas network infrastructure for hydrogen. These gaps are being addressed through both desktop and laboratory testing with results feeding into a quantified risk assessment (QRA). This QRA will provide a risk profile for different MOB types and detail the mitigations required to safely convert MOBs to hydrogen, providing recommendations for a hydrogen supplement to the IGEM/G/5 standard and procedure.

Our partners on this activity

- DNV
- ICS
- ROSEN
- Steer Energy

Links to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0033

smarter.energynetworks.org/projects/nia2_sgn0043

smarter.energynetworks.org/projects/nia2_sgn0047

SGN is undertaking a feasibility study to help understand if hydrogen is a suitable solution for decarbonising MOBs.

Multi-occupancy buildings in our Scotland and Southern networks.

HyScale LOHC – Phase 2

Background

HyScale Phase 2 will deliver a FEED study for a 20kg/day hydrogen demonstration unit utilising Liquid Organic Hydrogen Carriers (LOHCs) as a potential storage solution for the management of inter-seasonal swings in domestic heat demand for a decarbonised hydrogen gas network. The project utilises the LOHC benzyl toluene and a single reactor concept. This builds upon the knowledge gained in the Phase 1 feasibility study and subsequent peer review.

The problem we are trying to solve

There are large inter-seasonal swings in domestic heat demand, with peak demand occurring in the colder winter months. In a scenario where hydrogen is used directly in the gas network to provide heat, hydrogen production would have to be scaled to meet this peak demand. However, these assets would be underutilised when demand is lower in the summer months. Large scale hydrogen storage can provide a solution to manage these seasonal swings, reducing the need to oversize production assets. LOHC technology is one of the potential options for locations that lack suitable geological storage. A LOHC system can be designed to connect to a hydrogen source and associated hydrogen gas network, allowing continued production in the low demand (summer) months through storing excess hydrogen in LOHC. During high demand (winter) periods the LOHC system would release hydrogen to ensure the demand balances are met, optimising the energy system.

Our solution

This project has carried out the design of a demonstration unit that is capable of storing and releasing 20kg of hydrogen per day, utilising benzyl toluene as the LOHC. This has detailed the relevant information required to progress with the construction of the demonstration unit for a trial. In addition, a thorough techno-economic analysis has been completed to provide insight into the financial benefits that LOHC technology can provide a future hydrogen economy. A roadmap detailing the potential route for the scale up of the technology was also produced, providing an understanding of the economies of scale that can be achieved for LOHC systems. Ultimately, this project has produced the engineering and design detail required to proceed with the construction of a demonstrator unit, to showcase the benefits of integrating LOHC technology with a gas network, in terms of optimising the whole energy system.

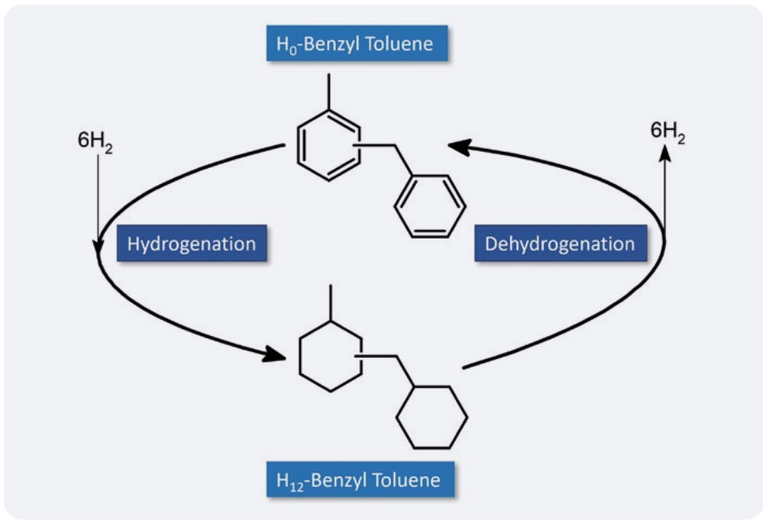
Our partners on this activity

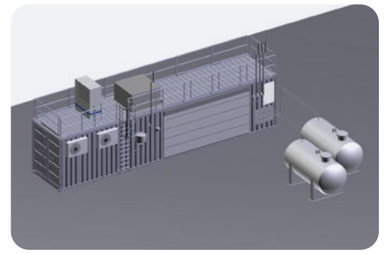
- Blue Abundance
- Environmental Resources Management
- Framatome GmbH

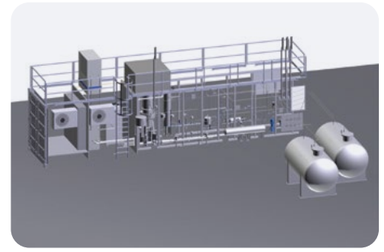
Link to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0024

Left: BT reaction cycle.
Right: Example models of HyScale.







Ofgem NIA funded projects

Hydrogen technical and safety case for domestic heat – Phase 2

Background

Building from Phase 1, the project aims to continue reviewing and assessing the safety evidence to meet the required deadlines for DESNZ and the HSE. This project is set to conduct a thorough review of existing information and progress, and international evidence to identify any gaps in the current and planned evidence development. By creating a roadmap, it will ensure coordination of GDNs' efforts in addressing any gaps and avoiding duplication of work.

The problem we are trying to solve

To substantiate the Government's decision regarding the use of hydrogen for heat, additional evidence must be presented. To facilitate this, the HSE has been commissioned by the Government to evaluate the safety and technical evidence submitted by Gas Distribution Network Operators (GDNOs) and suppliers contracted by DESNZ. Findings from this evaluation will align with the guidelines outlined in the HSE's documentation.

However, there is a challenge in ensuring that the required evidence is delivered to the HSE by September 2024.

Our solution

GDNs have established a new governing body – Safety and Technical Gas Networks Board – empowered to oversee and implement measures to ensure a timely submission of required evidence. This project was carried out to support the Board remit and has delivered a roadmap for heat policy evidence, including identification of the critical path. The roadmap has highlighted gaps and aligned the evidence to the demonstration points prescribed by the HSE. This provided feedback which has been used to inform, improve and clarify other evidence, and utilise the outputs from the Asset Intervention database to align evidence to the HSE considerations.

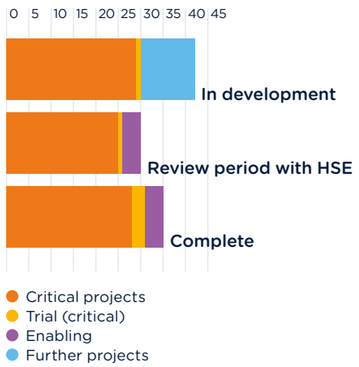
The outputs include a view of the completeness and current position of the evidence gathered to date, along with projections of the position after current projects are delivered. This includes a complete plan to demonstrate how evidence will be delivered for the HSE and DESNZ.

Our partners on this activity
- Arup Group

Link to more information on this innovation project
smarter.energynetworks.org/projects/nia2_sgn0050

The outputs include a view of the completeness and current position of the evidence gathered to date.

Project status



Completed projects

BISEP H2 testing with LTS – Phase 1

Background

The ongoing LTS Futures programme of work included hot tapping activities that were carried out in a flow loop rig at Spadeadam. This provided an opportunity to demonstrate the suitability of the current flow stop tooling within 100% hydrogen through deployment of the BISEP to the existing set up. When successfully completed, a proven double block and bleed leak tight flow stopping technology will be available to the networks, which is an improvement to the current technology.

The problem we are trying to solve

To demonstrate the operation and deployment of a BISEP flow stopping tool, proving that the tool works to a satisfactory level as deemed by SGN. Therefore, a high integrity line-stopping technology approved for use in 100% hydrogen will have been demonstrated. Following the completion of this project, sufficient evidence will have been collected to safely trial the BISEP tool on the LTS Futures live field trial.

Technical assurance was delivered through two stages:

- **Factory acceptance test with Helinite:** The objectives included reviewing test certificates, defining roles and responsibilities for the tests, and checking the necessary documentation for pre/post-test inspection results.
- **Deployment trials at Spadeadam on LTS Future flow loop within 100% hydrogen:** Outcomes of this work pack were to deploy the tool and provide technical assurance. All observations and audit findings were compiled and reviewed. This included recommendations for future use of the technology and requirements for successful deployment.

Our solution

Deployment of the BISEP provides a double block and bleed/monitor, as the annulus can be vented externally to the pipe. It was deployed and set under 13barg pipeline pressure, and the annulus pressure vented to ambient, to perform a primary seal test. This simulated the onsite loop condition.

The launcher was successfully hydrotested and leak tested in water and helinite gas, commonly used across industries as a leak detection equivalent to hydrogen in terms of atomic size safety.

The BISEP tool successfully completed the first phase of testing, where it was deployed in isolation within the launch tube, where it achieved a full and complete seal. However, the tool failed to operate successfully in the final phase of the test. This was due to swarf in the pipe that was created during the cutting operation but was not removed from the sealing area due to low flow rates and deployment orientation.

Our partners on this activity
- PIE
- STATS Group UK

BISEP product testing being carried out.

Link to more information on this innovation project
smarter.energynetworks.org/projects/nia2_sgn0036

Ofgem NIA funded projects

Materials qualification for hydrogen TD1 pipelines

Background

Current IGEM standards for requirements of qualification testing of onshore pipelines do not contain guidance on specific tests for hydrogen. This project will develop a material qualification procedure for inclusion in standards for assets in hydrogen service. When completed, the project will identify relevant criteria for fatigue, and learning from this project can be applied to other operations to facilitate safe transition to 100% hydrogen.

The problem we are trying to solve

A primary threat to steel pipelines in hydrogen pipelines is the ingress of hydrogen into the steel structure resulting in its embrittlement, degrading its material properties.

Across the GB gas network there are developing projects involving the construction of new high pressure hydrogen pipelines and repurposing of existing LTS pipelines for hydrogen service. The current industry standard for pipelines (IGEM/TD/1) reverts to external guidance in the American standard: ASME B31.12.

There is currently no specified process for testing the suitability of materials used in pipelines that will carry hydrogen, and as such, the hydrogen supplement for IGEM/TD/1 needs to be developed.

Material qualification requires that the material testing is undertaken to determine the change in material properties due to exposure to hydrogen. This project will develop a testing programme to deliver data to outline future manufacturing controls.

Our solution

The objective is to develop the scope for the testing procedure, which is required to qualify materials for steel hydrogen pipelines, and to conduct research in and around the effects of hydrogen on steel grades used for natural gas pipeline manufacture.

Given the impact of the outcome, stakeholder engagement is key in order to disseminate the learnings from the project. Following the completion of this project, guidelines on defect acceptance levels will have been established, as well as how it impacts the pipeline failure frequency.

This will set out a testing programme that will need to be proven and subsequently used to define the materials qualification procedure for steel pipeline manufacture.

Our partners on this activity

- PIE
- Wood

Link to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0039

Example of LTS system.

Hydrogen Storage Legal Assessment

Background

The project informs the development of large scale, onshore, geological storage sites by outlining the legislative framework and the changes that may be required for legal. Widespread hydrogen uptake across the UK is dependent on sufficiently large-scale hydrogen storage facilities to minimise any risk to the nation's energy security. However, due to the relatively recent emergence of hydrogen initiatives, the current legislative environment for large-scale geological hydrogen storage is poorly understood.

The problem we are trying to solve

A key aspect of this system transformation is ensuring energy security and a cost-effective supply of energy for consumers which can be achieved through long term and large-scale hydrogen storage. To support the system transformation to hydrogen, research and development into suitable storage solutions is vital. Without suitable storage options, the result would be an inefficient system which is more expensive to run and the requirement to dramatically scale up hydrogen production capacity to meet 1 in 20 peak conditions (the network standard). The result of failing to investigate hydrogen storage options from a regulatory, consenting and property point of view would be failure in their development.

Our solution

Objectives of the project outputs were to support the overall network in hydrogen storage planning to transition into 100% hydrogen network. By outlining relevant legislation, any potential blockers to the development of large-scale geological hydrogen storage facilities have successfully been identified.

The project outlined what future legal steps may need to be made to enable the development of geological hydrogen storage facilities across a changing energy landscape specifically relating to the following regulatory areas:

- The pertinent consenting and regulatory requirements arising under The Gas Act 1965 (1965 Act) Planning Act 2008 (2008 Act);
- The gas transporter licences held by SGN and ScGN;
- The Energy Act 2023;
- Policy developments relevant in this context; and
- The land law basis for acquiring and using the sub-surface for hydrogen storage.

Our partners on this activity

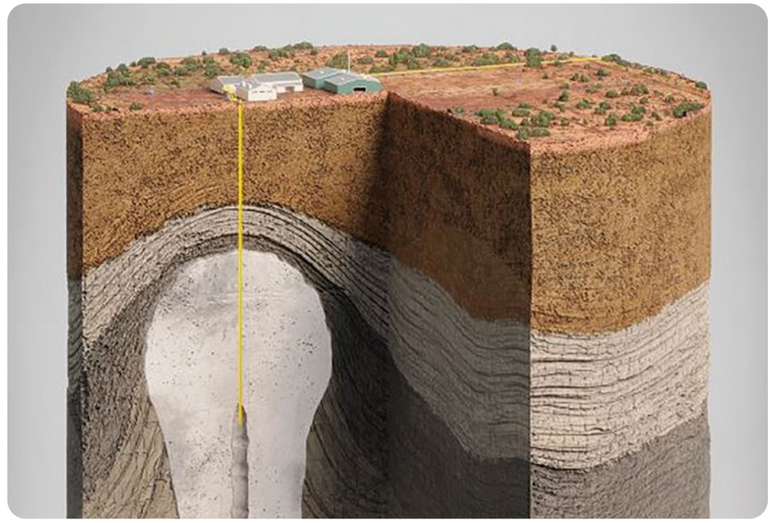
- Addleshaw Goddard

Link to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0040

Gas Act 1986.

Example of salt cavern.



Ofgem NIA funded projects

Electrolyser Horizons

Background

Electrolyser Horizons will assess the feasibility, scale, and potential of a robust and sustainable hydrogen production industry aligned with Net Zero targets. The project will analyse the strengths and weaknesses of various electrolysis methods, with a focus on understanding the characteristics and sources of different inputs essential for sustainable hydrogen production and taking into consideration existing grid infrastructure.

The problem we are trying to solve

Electrolytic hydrogen can be produced sustainably using a range of energy sources. For example, green hydrogen is produced using electricity generated by wind and solar to power electrolysis and pink hydrogen is produced using electrolysers powered by waste heat from nuclear power operations. To enable the use of hydrogen as a key technology in the energy transition, sustainable and low-carbon hydrogen production facilities must be established along with associated infrastructure. One of the main challenges with sustainable hydrogen production techniques is that they can be more expensive than legacy methods such as steam methane reformation (SMR) without Carbon Capture Storage. They also rely on colocation with other energy sources which are not always as easily accessible. Past investment in sustainable hydrogen production facilities has been generally low and Great Britain lacks a clear picture of the technological and geographic opportunities available to maximise electrolytic hydrogen production to help meet growing hydrogen demand and to support widespread uptake.

Our solution

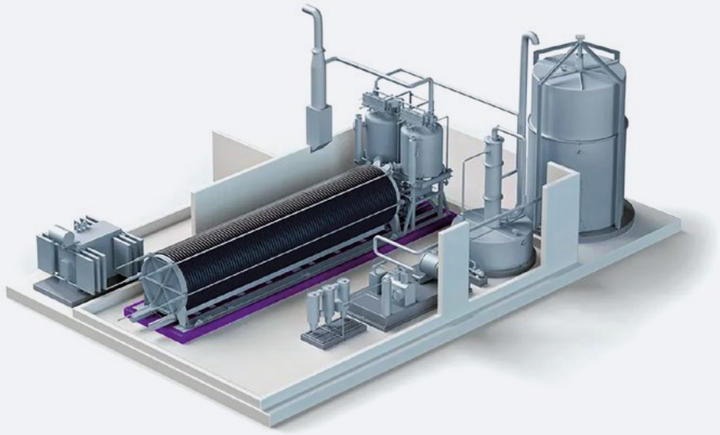
This project will develop an evaluation framework that consists of techno-economic assessment, alongside representative case studies which will have the potential to be applied across the UK, identifying various electrolyser options. The aim is to provide valuable information related to the feasibility, challenges, and unique opportunities for electrolytic hydrogen. The research will also provide valuable insights and recommendations that will contribute to the advancement of the hydrogen sector in alignment with the UK's Net-Zero goals and boost the hydrogen economy to help support the repurposing of the UK's gas grid. Electrolyser Horizons will assess the techno-economic feasibility of different low-carbon hydrogen production methods, their appropriate scales, and locations to provide actionable recommendations for industry stakeholders. An interactive Gas Industry Standard (GIS) database will be developed that visually displays the spatial relationship between energy sources, available resources, optimal electrolysers locations, and existing natural gas and electricity assets.

Our partners on this activity

- Power Networks Demonstration Centre
- The University of St Andrews
- The University of Strathclyde
- The University of Surrey

Link to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0062



Example electrolyser.

HVGET – update for hydrogen

Background

Ensuring our pipelines deliver gas safely and reliably is fundamental for SGN. Damage to high-pressure pipelines can be hazardous and prompt response could prevent major disruption. Handling high-volume gas escapes is well understood with safe procedures in place across the industry. Our gas operatives follow emergency response procedures and tools like the High-Volume Gas Escape Tool (HVGET) to manage these situations safely.

The problem we are trying to solve

The HVGET is a software that predicts indicative hazardous distances associated with gas escapes from damaged pipelines according to the extent of the damage, operating parameters and atmospheric conditions. The tool displays graphically a virtual map to help our engineers safely plan their work and avoid damage while carrying out a range of work according to the established procedures. Nevertheless, the current tool was originally developed for natural gas and unsuitable for hydrogen.

Our solution

This project aimed to upgrade the mathematical model used in the original HVGET, ensuring its compatibility with hydrogen and improving the understanding of below-ground releases for both natural gas and hydrogen. The new model will support SGN in operations for our H100 Fife project by helping our team understand and characterise hydrogen dynamics during high-volume gas escapes. It will also provide our gas operatives with a reliable tool to display accurate data, enabling efficient responses to gas leaks, reducing disruptions, and facilitating timely repairs.

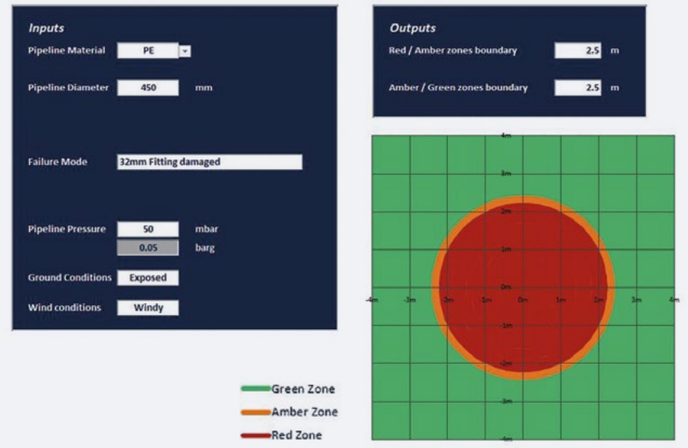
The improved HVGET is crucial for identifying new conditions, updating procedures, and ensuring the continuity and performance of our emergency services. With this advanced software, SGN is now better equipped to handle any situation confidently and efficiently, enhancing safety for our gas operatives and reducing public disruptions.

Our partners on this activity

- DNV

The new model will help SGN understand and characterise hydrogen dynamics during high-volume gas escapes.

Example of model output.



Ofgem NIA funded projects

MASiP H2 – technical & system development

Background

SGN is currently exploring opportunities to build a green future and start working with hydrogen in blends up to 100%. Transporting hydrogen has an impact on the metallurgy of steel pipelines, changing its mechanical properties. Uprated High Density Polyethylene (HDPE) could provide a real alternative to conventional high pressure pipeline technology avoiding the problems and limitations of a limited supply of welders and large volumes of steel required for the traditional approach.

The problem we are trying to solve

Industrial Clusters will be critical in stimulating hydrogen production and hydrogen economies. The development of low carbon hydrogen production in these locations provides the opportunity to deliver significant decarbonisation, secure the future of industrial centres, stimulate powerful macroeconomic impacts locally and nationally, and crucially, establish scaled hydrogen production.

Current British gas industry standards and practices define that this system would need to be constructed with X52 steel. The costs for materials, logistics and construction and deployment could potentially be significant. As such it is key to identify alternative solutions to deliver these large-scale infrastructure project more effectively.

Our solution

There have been previous projects completed with other networks, supporting initial testing and development for the MASiP (Mobile Automated Spiral Intelligent Pipe). The key aims for this project were to:

- Complete a detailed gap analysis
- Define a product qualification plan using industry standards
- Develop integration of the live monitoring system to current operational standards and approaches
- Outline a concept design for a future demonstrator

The GAP analysis identified that a larger range of diameters and higher pressures would be required for future Hydrogen pipelines. Repair techniques and tight radius bends were also identified. The requirement for the repair techniques is critical to industry acceptance and qualification of the overall system. Both require further design and development work.

The specifications of the qualification test plan were developed in accordance with IGEM industry standards. The design, installation and operation of the pipelines, as well as the primary qualification test standard, were based on API 15S. The API 15S standard has been chosen as it specifically covers polymer pipelines with a steel reinforcement which matches the MASiP pipe structure. Aspects of the ASTM D2444 and ASTM D2412 were also considered in testing for impact resistance and external load performance.

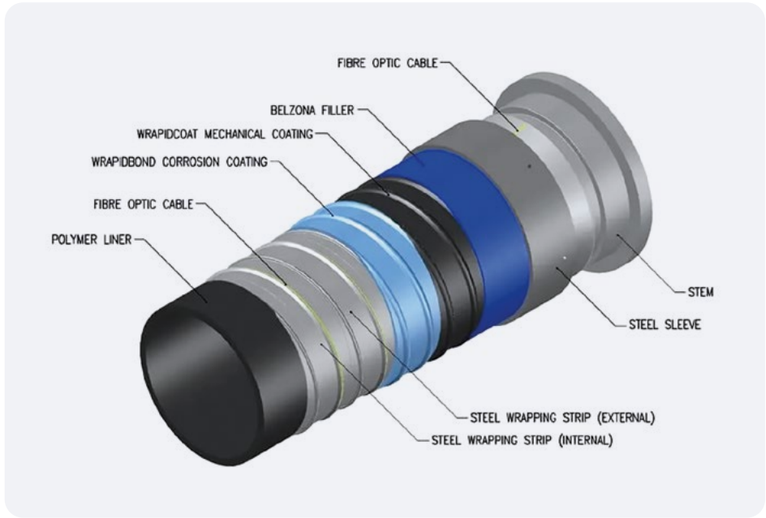
Our partners on this activity

- Sustainable Pipeline Systems Ltd

Link to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0042

Example of MASiP.



Hydrogen Entry Unit – design

Background

We believe a 100% hydrogen gas network in Britain could play a crucial role in achieving net zero targets. With the UK government already supporting blending of hydrogen gas, our immediate challenge is to support blending of up to 2% in the National Transmission System and 20% in the gas distribution system. National Grid Transmission's Future Grid project concluded in 2023 supporting the case for 2% blend of hydrogen within the NTS. Blending will have a profound impact downstream with all SGN's offtake infrastructure impacted.

The problem we are trying to solve

SGN currently has an obligation to accept gas from the NTS through a series of National Offtake sites. At these sites, the following functions are performed:

- Custody transfer is achieved through monitoring of flow, pressure etc
- Calorific value (CV) is recorded for Ofgem's Flow Weight Average CV (FWACV) calculations, impacting on downstream billing
- Gas composition is monitored to calculate gas density for the determination of standard flow

There is currently uncertainty regarding the relevant network assets about the level of impact of an addition of 2% hydrogen in both function and accuracy. The parameters for flow measurement are set out in NGGT T/SP/ME/1 and define an accepted tolerance of ±1% on volume flow and ±1.1% on energy flow over a defined pressure and temperature range. However, a 2% blend of hydrogen at 60bar would have >1% impact on volume flow and >2% impact on energy flow. This is not a linear relationship and therefore accurate monitoring is fundamental to these calculations.

Our solution

The main objective was to develop a blueprint specification to support the upgrade program for Offtake locations on SGN's network. The design identified relevant asset upgrade requirements but also included timescale recommendations and associated roll out costs. This was completed through four work-packs defined by:

- Site survey and problem definition
- Asset recommendation and testing
- Design
- Roadmap and final reporting

The design document was developed, approved and delivered in line with SGN design policy. The design was based on the volume-controlled site, as it had a wider variety of assets. From that blueprint, engineering consultancy Kelton then produced a roadmap for upgrading SGN offtakes.

The roadmap detailed steps required for rolling out all the modifications required across SGN offtakes so that we are able to safely accept blends of up to 20% hydrogen. It also detailed examples of the cost and labour attached to these modifications.

Our partners on this activity

- Kelton

Link to more information on this innovation project

smarter.energynetworks.org/projects/nia2_sgn0018

Above Ground Installation site.

Ofgem SIF funded projects

Predictive Safety Interventions

Background

This SIF project, backed by Ofgem and UK Research and Innovation (UKRI), matches SGN's commitment to enhancing safety through data-driven insights. Through Discovery, Alpha, and now Beta stages, the project is now utilising the power of advanced analytics and digitalisation to create an efficient culture with data. FYLD video risk assessments now stand at the forefront of pre-emptively identifying safety incidents, embodying a shift towards an innovative, proactive safety culture within the utility sector, and setting new benchmarks for operational efficiency and risk management.

The problem we are trying to solve

In the utility sector, particularly within gas networks, the challenge of ensuring operational safety is paramount. Traditional methods of risk assessment are often reactive, in paper form, and lacking previous insights and locational knowledge needed to prevent incidents before they occur. This project tackles the crucial need for a proactive approach to safety management. Leveraging advanced data analytics and digital technologies, it aims to help predict potential safety incidents autonomously, enabling timely interventions to assist the engineer onsite mitigate and think differently. By addressing this gap, the initiative seeks not only to enhance workplace safety but also to instil a culture of pre-emptive risk management, ultimately safeguarding employees and all utility infrastructures.

Our solution

The solution offered by this project lies in the implementation of Predictive Safety Interventions (PSI) technology, integrating advanced object recognition, natural language processing and fatigue indicators to forecast and assist in mitigating safety incidents before they arise. This forward-looking approach utilises machine learning algorithms to analyse real-time data from gas network operations, identifying potential hazards and suggesting preventive measures using internal and external data sources.

By transforming reactive safety protocols into proactive strategies, PSI ensures a safer working environment, reduces risk, and enhances operational efficiency, paving the way for a safer, more innovative utility sector.

Our partners on this activity
- Cadent
- FYLD
- National Gas Transmission
- Northern Gas Networks

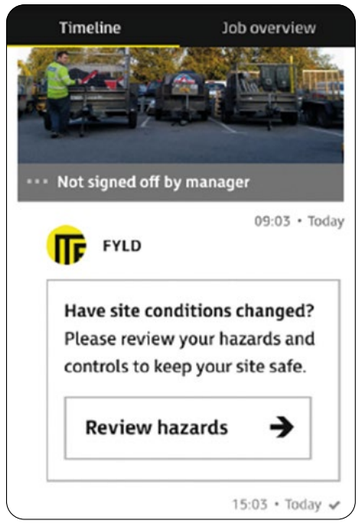
Links to more information on this innovation project

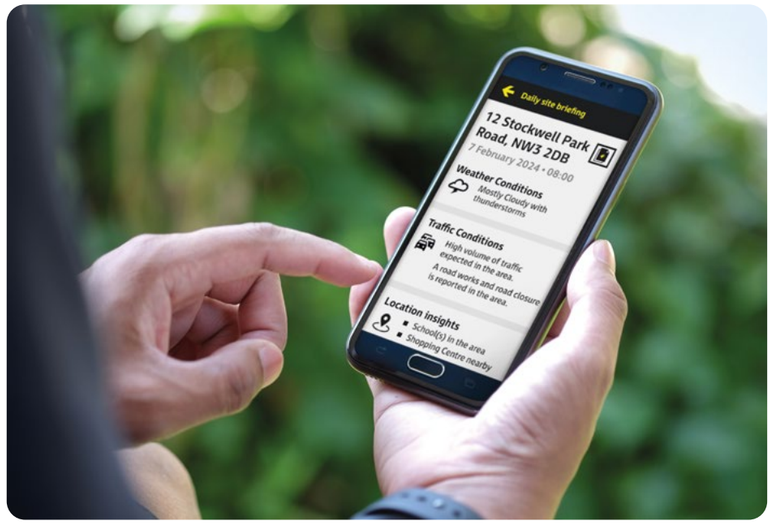
youtube.com/watch?v=UI2UUREKcN0

Discovery
smarter.energynetworks.org/projects/10027191

Alpha
smarter.energynetworks.org/projects/10037420

Beta
smarter.energynetworks.org/projects/10068173





FYLD platform.

Intelligent Gas Grid

Background

This 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.

The problem we are trying to solve

IGG has identified three problems that need to be resolved in gas networks. The first issue is leakage reduction, where the current technology of profiling is most relevant.

However, this system is problematic during cold snaps because low pressures create multiple alarms. The second problem is anomaly detection, where the current practice is manual and reactionary. Escapes are mostly detected by the public smelling gas or experiencing boiler and/or other domestic faults. Governor faults are often only investigated by the network owner after downstream knock-on effects have occurred.

Thirdly, IGG aims to address the issue of biomethane injection. The current practice involves annual seasonal adjustments being made at medium pressure supply governors to facilitate contractual minimum injection rates. However, these adjustments are manual, costly, and time-consuming, and the timing of changes is sensitive to unseasonal weather in shoulder months.

Our 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 network 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.

Our partners on this activity
- Cadent
- DNV
- National Gas Transmission
- Northern Gas Networks
- Utonomy
- Wales & West Utilities

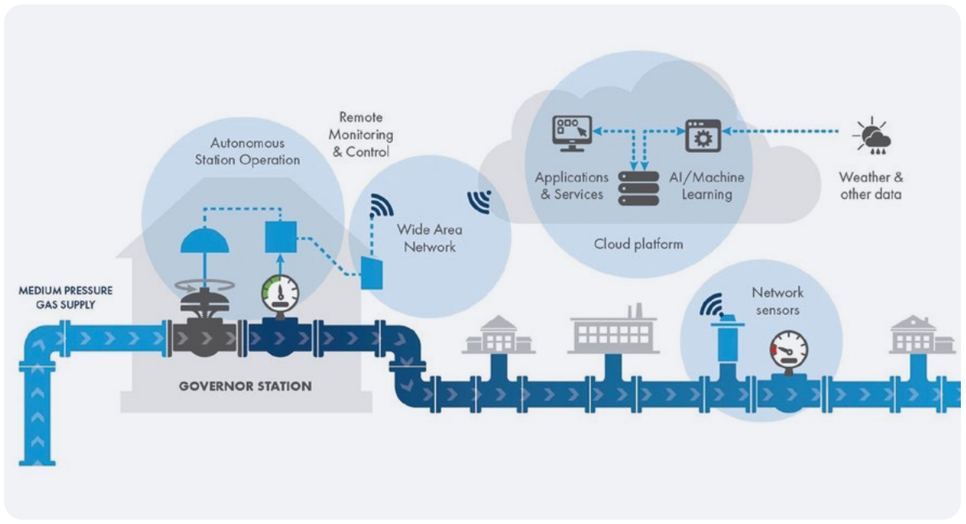
Link to more information on this innovation project

youtube.com/watch?v=gnQbpZjeHYo&t=31s

Discovery
smarter.energynetworks.org/projects/10027183

Alpha
smarter.energynetworks.org/projects/10037416

Beta
smarter.energynetworks.org/projects/10063754



IGG Network setup.

Ofgem SIF funded projects

Velocity design with hydrogen

Background

The Beta Phase is an innovation project focused on addressing the current limitations placed on velocity in the gas network. This phase will expand on earlier phases by developing a full-scale test rig at DNV Spadeadam to investigate the opportunities and challenges associated with converting the gas network to 100% hydrogen. The outputs of this project will provide evidence to amend the current industry standards governing gas network velocity.

The problem we are trying to solve

Velocity limits have historically been imposed by the industry to ensure safe design and operation of the network. These precautionary limits help to ensure network integrity is not compromised through particle transportation, erosion, noise, or vibration.

Compared with natural gas, hydrogen carries around one third of the energy by volume presenting a challenge when considering network conversion. To deliver the equivalent energy to customers on the network the flow rate will have to increase. This can be achieved by either increasing pressure, pipe size, or velocity. The latter would be the most logical and cost effective way to achieve this, provided the increase had no adverse effect on the integrity of the gas network.

Keeping existing velocity limits across our network while utilising 100% hydrogen would result in an estimated reinforcement cost of £832 million for low pressure systems alone, with an additional £1,644 million for service connections.

Our solution

A primary test rig will be constructed at DNV Spadeadam to undertake a series of tests to validate modelling conducted in the earlier phases of this project. The rig will contain elements focused on the primary areas of the study.

The Erosion and Particle Transport rig will explore the impact of increased velocity on the behaviour of the debris in the network and assess the impact on various material types including PE, steel, and cast iron. The Noise and Vibration rig will explore the impact of increased velocity on noise and vibration in a range of network configurations and protrusions like thermowells and small bore connections.

This physical testing will also be supplemented by computational fluid dynamic (CFD) modelling for a selection of networks to explore the impact of existing gas velocity limits with a 100% hydrogen network and the anticipated cost savings from a potential increase in velocity limits.

Our partners on this activity

- Cadent
- DNV
- Institution of Gas Engineers and Managers (IGEM)
- National Gas Transmission
- Northern Gas Networks
- Wales & West Utilities

Link to more information on this innovation project

youtube.com/watch?v=sEfTQfuTra8

Discovery
smarter.energynetworks.org/projects/10027185

Alpha
smarter.energynetworks.org/projects/10037659

Beta
smarter.energynetworks.org/projects/10068217

Rig being set out ready for fabrication.

Hy-Fair

Background

Hy-Fair addresses the challenges faced by Consumers in Vulnerable Situations (CIVS) and small businesses during energy transition. Hy-Fair Fairer Warmth Hub will provide a central environment equipped with specialised tools and tailored guidance to empower community champions, individuals, and small businesses, and allow networks to deliver a fair energy transition. Hy-Fair's innovative features include a streamlined system to access financial support, guidance and resources, data analytics for precise planning, and community engagement tools.

The problem we are trying to solve

During the Discovery Phase, our understanding of the problem has evolved. The initially identified challenges faced by CIVS and small businesses during the transition to hydrogen gas were discovered to extend beyond hydrogen, encompassing a wider range of low carbon technologies.

Affordability, safety, consumer preferences, and potential disruption emerged as common challenges across all stakeholders. Additionally, the perspectives of different demographic groups and businesses differs, with many specific challenges being geography-based, necessitating localised solutions and tailored consideration and support throughout all phases of net zero transition. Discovery Phase research demonstrates that CIVS and communities often prefer support from local organisations rather than larger entities.

Finally:

- Current consumer information offerings can be difficult to access and are complicated.
- Typical 'top down' projects can add additional risk to investments through planning and engagement difficulties and objections.

These issues compound together, making the energy transition less accessible for those most in need of support.

Our solution

Hy-Fair aims to reduce miscommunication that can currently hinder transition efforts, with a particular focus on CIVS. Fairer Warmth Hub will help individuals and communities work together with larger organisations like DNOs, GDNs, suppliers and public bodies. To achieve this, it aims to provide tools and a support network, filtering and demystifying best approaches for individuals.

In Alpha Phase the following have been prototyped and user tested:

For individuals: the Fairer Warmth App streamlines access to financial support and guides, simplifying the energy transition process for consumers and businesses.

For community champions: the Fairer Warmth App and training toolkit with relevant e-learning videos support champions and organisations in becoming advocates for sustainable practices and energy transition advice.

For organisations: the Analysis and Planning Data platform employs data analytics to understand unique needs, enabling precise planning for an inclusive transition.

For all stakeholders: the Fairer Warmth Hub mock design encompassing all the tools above.

Our partners on this activity

- British Gas New Heating
- Cadent
- Centre For Energy Equality
- Energy Systems Catapult
- Fife Council
- Lane Clark & Peacock
- National Gas Transmission
- SP Distribution
- Wales & West Utilities

Link to more information on this innovation project

youtube.com/watch?v=SzYPYwoW3GE

Discovery
smarter.energynetworks.org/projects/10054930

Alpha
smarter.energynetworks.org/projects/10083475-correct-1

Customers interacting with Fairer Warmth Hub.

H100 Fife

We're committed to decarbonising our gas networks to help reach net zero. Hydrogen is a credible alternative to natural gas because it can heat homes and cook food in the same way as we do now and doesn't produce any carbon when it's created using clean energy.

Overview

H100 Fife is leading the way in decarbonising home heating. It will be the first 100% green hydrogen-to-homes zero carbon network anywhere in the world, demonstrating the potential for the whole British gas network to deliver hydrogen gas.

The project is taking place on the east coast of Scotland in Levenmouth, Fife. The area has access to a 7MW offshore wind turbine, an adjacent existing gas network, and a dedicated energy park.

We'll be demonstrating an entire end-to-end hydrogen network, from the wind feeding the turbine all the way to the green hydrogen supplying our customers' home appliances. This includes power generation, hydrogen production, hydrogen storage, pressure reduction, odorisation, distribution and customer connections.

H100 Fife is constructing a new hydrogen network running in parallel with the existing natural gas network, giving customers the choice of taking part in the project or staying with natural gas. The project is providing critical evidence for the UK Government which could shape the way we heat our homes in the future alongside other renewable technologies.

Progress

Our brilliant team is making great progress across all the project's workstreams.

Upstream – hydrogen production and storage

Progress continues with the construction of the hydrogen production and storage site, led by Altrad Babcock, who was appointed as the main work contractor in January 2023.

Key developments include the installation of essential infrastructure for the electrolyser building, management building, and energy centre.

Working closely with Nel, the supplier of our electrolyser, we've completed the electrolyser design and are in the process of installing the electrolyser modules which will create green hydrogen for the project. In January 2024, four out of six storage vessels were installed at the H100 Fife hydrogen production and storage site. The vessels will ensure the project can provide a constant source of hydrogen for even the harshest of winters.

Below: Public engagement activity underway regarding the H100 project.

Over: Construction progress continues on the hydrogen production facility in Levenmouth.

The construction of our H100 Fife Demonstration Facility was completed in October 2023. We are currently in the process of installing the hydrogen appliances and making the final touches in preparation for opening up to participants.

Midstream – distribution network

Smart Utilities was awarded the contract for the construction of our 8.2km hydrogen distribution network, beginning work in May 2023. As of April 2024, Smart Utilities installed 5.6km of PE pipework within the network area and remain on schedule.

The network construction is taking place in phases to minimise disruption. Its network is scheduled for completion in August 2024, prior to customer connections.

Downstream – metering and in-home works

We have made significant progress in the downstream elements of the project which relate to our H100 Fife participants and their homes. This includes completion of property surveys, issuing Customer Connection Agreements, procurement of appliances and a key driver for the progress was the appointment of Warmworks, our Downstream Delivery Partner. Its remit is central to the key customer journey stages including customer engagement, recruitment, property surveys, installation works associated with converting homes to hydrogen, and aftercare.

We also established the Hydrogen Information Sharing Group which will serve as a platform to support suppliers, shippers, and the metering community to ensure they are informed, and their systems are ready to accommodate our proposed approach for hydrogen billing, settlement, and metering.

Hydrogen-ready boilers, like this one from Baxi, can be fitted as direct replacements for conventional units.

The H100 Fife demonstration facility in Methil.

Downstream – customer engagement and recruitment

We're grateful for the overwhelming support from the local community. As of April 2024, a total of 413 homes had registered their interest in taking part in H100 Fife. Initiatives such as community sponsorships, public events, and educational collaborations have contributed to increased project awareness and registrations.

Community events like the Construction Public Information Event and the Big Summer BBQ, have drawn significant community interest, further solidifying our commitment to the community for the long term. Door-to-door engagement also proved to be effective, with our dedicated team engaging directly with residents to provide information and address queries. Our continued efforts in this area during the reporting period has reinforced our status as a trusted member of and honest broker in the local community.

LTS Futures Project

The LTS Futures Project forms part of the UK's National Hydrogen Research Programme to deliver a net zero decarbonisation solution for customers.

Overview
We're testing the compatibility of the Local Transmission System (LTS) to transport hydrogen, by repurposing a decommissioned 30km pipeline which runs from Grangemouth to Granton. We are working to provide evidence that the pipeline can carry 100% hydrogen instead of natural gas. The project will culminate in a first of its kind live trial in 2025.

Progress
In April 2023 the project successfully passed through its first Stage Gate, illustrating the suitability of the Grangemouth to Granton pipeline for the live trial. Stage Gate Two is now progressing on all fronts.

Live trial design
Detailed design of a 1.2 km tie-in hydrogen supply pipeline for the live trial has been completed and construction is now in progress. This will connect the hydrogen supplier, INEOS to the Live Trial pipeline.

Design of a bespoke hydrogen entry unit is underway, enabling flow control, pressure control and odorisation of the hydrogen prior to it entering the Live Trial pipeline.

Design and construction of a bypass midway along the Live Trial pipeline is underway to enable further control over pressure and flow. At the pipeline terminus, design and construction of a flaring facility is underway to dispose of waste gas.

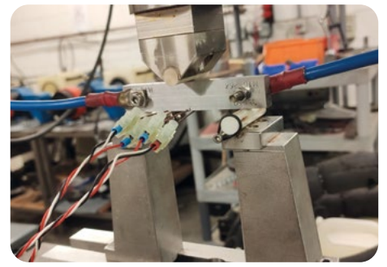
Laboratory testing
Laboratory Testing at The Welding Institute involves testing natural gas pipelines material from the 1960s and 1970s. This will provide an understanding of how the material responds to loads and defects. The material has been taken from the Lie Trial pipeline and elsewhere in the SGN asset base.

Offsite testing
Offsite testing at DNV Spadeadam involves hydrogen testing of ex-service material and components.

Operational procedures need to be tested to evaluate if they need changed when working with hydrogen.

Below: We're working in Grangemouth to construct a new 1.2km hydrogen supply line.
Over: The project team at the DNV site.

"DNV has been working with SGN and the other project partners to deliver the LTS Futures off-site testing programme. The close collaborative approach has allowed the development of a number of world-first tests delivering critical research to support wider LTS Futures Grangemouth to Granton live trial and ultimately the energy transition decision."
David Hall
Principal Project Manager, DNV



Preparation for hydrogen supply line.

Laboratory testing.

World-first live welding and hot-tapping operations have been carried out on old pipeline material transporting hydrogen at DNV Spadeadam. This has developed operational procedures for the live trial. We're also carrying out burst and fatigue tests on materials with defects, like cracks and dents, and also on a vessel containing several small-bore branch connections.

Venting and flaring trials with hydrogen have also been carried out.

Live trial
The live trial will validate the suitability of LTS pipelines to transition from natural gas to hydrogen. We're developing several Work Instructions to support this covering the following areas:

- Commissioning and decommissioning
- Operations and maintenance
- Emergency response
- Venting and flaring

The Work Instructions will feed into a training package where SGN will upskill operational staff to become competent for working on the live trial.

Emergency response workshops for key stakeholders and resilience partners are also planned.

Safety case
The final element, Element 5, involves a Case for Safety and QRA. QRA stands for Quantitative Risk Assessment and has been completed for both the new 3-inch hydrogen supply line and 18-inch Grangemouth to Granton pipeline. The Case for Safety provides a high-level overview of how the live trial will be conducted and has been submitted to the HSE for review.

Next steps are to complete construction of the new hydrogen supply pipeline and the hydrogen entry unit which SGN operatives will be trained on for the live trial.

Price Control Deliverables

This project is aligned with the Ofgem-approved Price Control Deliverable for Gas Emission Reduction.

The project involves procuring products for a comprehensive rollout across the Scotland and southern regions throughout the remaining RIIO-DG2 period, focusing on equipment and techniques designed to reduce gas emissions. The implemented solutions will reduce our gas emissions while making the working environment safer for our operatives when managing gas escapes.

The Gas Escape Reduction Project is progressing as planned, with equipment currently being manufactured and delivered to both Scotland and southern stores. Ongoing training sessions are being carried out in both regions to ensure effective use of the new equipment, and the initial user feedback has been positive.

Gas escapes are rare but, if the escape is large, it can pose a serious risk to people and nearby infrastructure due to the large volume of gas released and the extensive workforce required to address it. Additionally, gas escapes have the potential to cause significant disruptions to customer supplies, leading to prolonged interruptions.

The Stent Bag and High Volume Gas Escape Toolbox (HVGET) solution provides a safer and more efficient alternative that ensures a secure supply to our downstream customers. The innovative Stent Bag equipment maintains the security of supply while our operatives isolate the main section in a safe environment, away from the hazardous area of the gas escape.

Stent Bag
The Stent Bag equipment has been developed based on the successful insights from previous Network Innovation Allowance projects. The developed process involves inserting a sealing stent system into the main, remotely from the gas escape. The Stent Bag is then pushed internally along the main and expanded to seal the area around the leakage point. Unlike traditional flow stop bags, the stent maintains gas flow to customers downstream of the affected area.

HVGET
The HVGET is designed to provide a safer and more efficient method for stopping gas escapes through a range of interim and permanent repair options, enabling quicker and more cost-effective solutions. The project has developed four tools, each tailored for specific types of leaks, which together comprise the toolbox.

Stent Bag in use.

HVGET training to SGN employees.

Glossary of key terms

AI – Artificial Intelligence
ASME – The American Society of Mechanical Engineers
CFA – Comprehensive Formal Assessment
CFD – Computational Fluid Dynamic
CIVS – Consumers in Vulnerable Situations
COSLA – Convention of Scottish Local Authorities
CSE – Centre for Sustainable Energy
DESNZ – Department for Energy Security and Net Zero
DNO – Distribution Network Operator
ENA – Energy Networks Association
ERG – Evidence Review Group
ESNZ – Energy Security and Net Zero Committee
FEED – Front End Engineering Design
FYLD – Digital, mobile platform, using speech and image recognition
GCC – Gas Control Centre
GDN – Gas Distribution Network
GDNO – Gas Distribution Network Operator
GSMR – Gas Safety (Management) Regulations
HP – High Pressure
HSE – Health and Safety Executive
HVGET – High Volume Gas Escape Toolkit
IGEM – Institute of Gas Engineers and Managers
IGG – Intelligent Gas Grid
IT – Information Technology
LDZ – Local Distribution Zone
LOHC – Liquid Organic Hydrogen Carrier
LTS – Local Transmission System
ML – Machine Learning
MOB – Multi-Occupancy Building
NESO – National Energy System Operator
NIA – Network Innovation Allowance
NGT – National Gas Transmission
NTS – National Transmission System
Ofgem – Office of Gas and Electricity Markets Ofgem is responsible for regulating the gas and electricity markets in the UK to ensure customers' interests are protected
PC&M – Pressure Control and Management
PCD – Price Control Deliverable
PE – Polyethylene
PPE – Personal Protective Equipment
PRS – Pressure Regulating Station
QRA – Quantified Risk Assessment
RIIO-GD2 – The price control period that will run from 1 April 2021 to 31 March 2026
RIIO-GD3 – The price control period that will run from 2028 to 2033
SE LDZ – South East Local Distribution Zone
SIF – Strategic Innovation Fund
SIUs – Scottish Independent Undertakings
SMEs – Small and Medium Enterprises
UKRI – UK Research and Innovation
TWI – The Welding Institute

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If you smell gas or are worried about gas safety you can call the National Gas Emergency Number on **0800 111 999**

Carbon monoxide (CO) can kill. For more information visit **sgn.co.uk/help-and-advice**