



SGN

Your gas. Our network.



2016/17

**Network Innovation Allowance and
Network Innovation Competition**

Annual Summary

Welcome

to our annual summary of Network Innovation Allowance (NIA) and Network Innovation Competition (NIC) activity for 2016/17. Innovation is at the heart of our business strategy - it underpins our ability to continually add value to our customers and stakeholders by serving them better, keeping them safe, saving them money, and protecting the environment more effectively.

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In 2016/17 our diverse portfolio included 43 projects funded through the NIA funding mechanism together with three NIC projects that look to potentially provide new or better solutions and best practice across key business areas such as distribution, replacement, emergency, repair, pressure management and new gas sources.

Collaboration and shared learning is driving innovation forward in our industry. We couldn't achieve what we do without the support and expertise of all our project partners, colleagues and the other network licensees, and we're extremely grateful for their commitment and hard work throughout the year. It's very satisfying to know we're all working towards a common goal - to add value to our business and our customers.

Angus McIntosh, Innovation & New Technology Manager, SGN

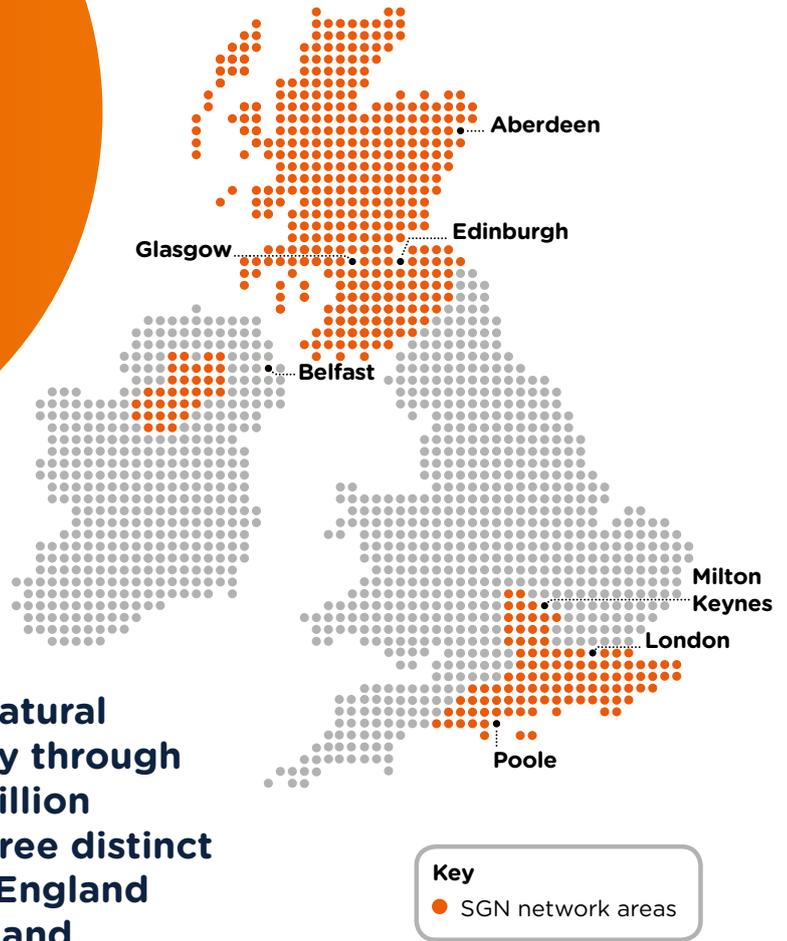
This year we spent £4.5m on NIA projects and £5.4m on our three major NIC projects.

Our vision

Dedicated to keeping our customers safe and warm by leading the way in energy delivery.

Our commitment

We go out of our way to exceed customer expectations. We're innovating for a safe, secure and sustainable future for our network.



About us

We're one of the UK's leading utility companies, distributing natural and green gas safely and reliably through our 74,000km of pipes to 5.9 million homes and businesses across three distinct networks in Scotland, southern England and more recently, Northern Ireland.

Innovation strategy

Our priority is to deliver natural gas safely, securely and efficiently, while there's also a clear need to:

- Have flexibility in our network to accommodate new and varying gas sources and uses.
- Reduce our environmental impact.
- Minimise disruption to customers as we carry out streetworks.
- Continue our drive to be cost effective.

Our strategy is very much shaped by our customers and stakeholders, and it's important we really listen to questions they may have about costs, how safe unconventional gases such as hydrogen will be, and how new replacement/maintenance technology might affect their daily lives. Their feedback ultimately helps shape our portfolio by validating the projects we decide to progress.



Collaboration

Sharing ideas, knowledge, projects and challenges ensures the most effective use of NIA funding between networks. Around 30% of our 43 NIA projects are collaborative partnerships with other network licensees, but knowledge dissemination is key whether through commercial collaboration, or individual network progression.

We're proactive in our approach, maintaining our reputation as key innovators through accessible and credible speaking opportunities, workshops, and our own inclusive field trials and demonstrations.

The scale of our pioneering and ambitious NIC projects, and how successful delivery could potentially benefit domestic and international stakeholders, means it's vital we share our progress on a regular basis. So far this year, for example, our Real-Tie Networks project team has presented at a number of conferences and workshops such as:

- IGEM Decarbonising Heat Conference
- DNV GL: Synergi gas user seminar and workshop
- Scotland Policy Conferences keynote seminar: Priorities for energy in Scotland – investment, flexibility and the new energy strategy
- Future Networks Conference

We're enthusiastic contributors to a variety of influential industry bodies such as the Gas Innovation Governance Group (GIGG – a collaboration forum hosted by the Energy Networks Association that meets monthly) and the Low Carbon Networks & Innovation Conference which took place in October last year. Alongside other GIGG representatives, we gave a compelling presentation and hosted an interactive workshop on how the gas networks identify innovation projects. We've also engaged with stakeholders, third parties and Small Medium Enterprises (SMEs) to explore how we can create and deliver exciting new innovation projects.

30% of our current project portfolio is collaborative.



“We’ve built strong relationships with the other network licensees over the past four years, and we’re all working effectively together to develop innovation projects that add value.”

**Lucy Mason, Innovation Manager,
Wales & West Utilities.**



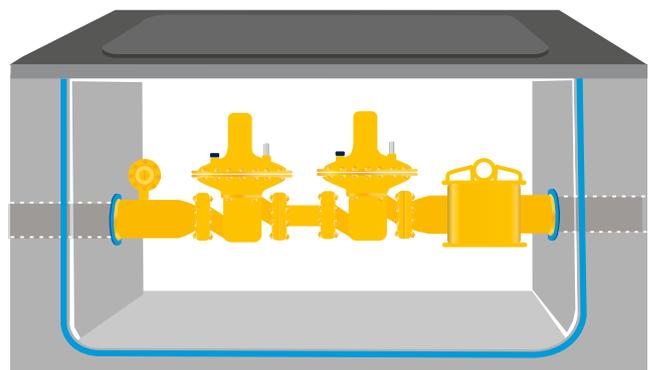
Pit Protect

NIA_SGN0092

A large number of assets within the gas distribution and gas transmission networks are housed below ground in pits as a result of local planning requirements, local community preferences, or acoustic and network configuration. If we bury an asset such as a gas regulator valve, we need the housing to protect it from water ingress which could adversely affect the asset's performance.

In many cases the current pit walls (usually constructed from concrete or fibreglass) are ineffective at preventing water ingress for a variety of reasons, and pits often get flooded. Flooded pits create additional hazards for operatives and can result in assets malfunctioning or shutting down, which in turn leads to additional time and expense needed to rectify the problems.

In collaboration with National Grid Gas Transmission (NGGT) we're progressing a project to develop and field trial two potential coating solutions. Depending on the pit's condition, these coatings could potentially be used separately or together to provide the optimal level of protection.





“We strive to design projects to deliver outcomes, not merely outputs. It’s essential we progress our projects through to business as usual.”

Angus McIntosh, Innovation and New Technology Manager

Implementation

Implementation continues to be a main priority and following project completion, we’ve invested over £30m transforming completed projects to business as usual since NIA/NIC funding became available in 2013/14.

We’re already seeing the benefit in our daily operations of several projects that concluded and were implemented last year:

- Opening up the Gas Market and SIUs
- CIRRIS XI™ Robotics system
- 40mm Serviflex
- Tornado Max Adaptor
- Water extraction reel and Y branch
- GECO pump
- Universal T-bar
- Advanced mini bag kit
- Handheld laser scanner (Fast follower)
- Immersion tube preheating



Fast followers

Key to delivering our BAU strategy successfully is implementing innovative processes and products from across GB, including those developed and proven by other network licensees. We regularly review their projects through our ‘Fast followers’ initiative, evaluating the benefits to our customers before moving swiftly to implement the most effective. And of course we disseminate learning from our own projects to help other networks adopt a similar approach.

40mm Serviflex

NIA_SGN0061

The objective of our 40mm Serviflex project is to prove the suitability of using a 40mm flexible pipe to renew 2” steel within the GB gas network. Developed in partnership with Radius Systems, our 40mm Serviflex pipe and fitting system is aimed specifically at large suppliers as an alternative solution for this type of work.

The main application this will benefit most is the replacement of below ground approach mains for network risers. We have almost 200,000 network risers within multiple occupancy buildings throughout our Scotland and southern networks, and this equipment is proving very successful as we carry out this type of replacement work. It further helps us repair and refurbish existing risers in some cases. Implementing the 40mm Serviflex is resulting in both time and cost savings to our business and GB gas consumers.

Our project partners

The NIA and NIC funding mechanisms give us extraordinary scope to broaden our horizons and really push technological boundaries. We thrive on 'what-ifs' and know the best way to make things happen is to work with like-minded pioneers who want to share and develop great ideas. We may actively look for expertise in a specific field, or a company may approach us out of the blue in need of help with their own project. Either way, we have extraordinary working relationships with SMEs as well as multinational organisations based in Europe and North America, built over many years and multiple projects.

Whether they're long-standing or new, project partners give us flexibility and diversity.



“The Tornado Max trials have been entirely successful and showed a considerable reduction in the time taken before allowing the re-occupation of a property that has previously been evacuated due to a gas escape.”

Roger Diment, General Manager, Pipetech Ltd

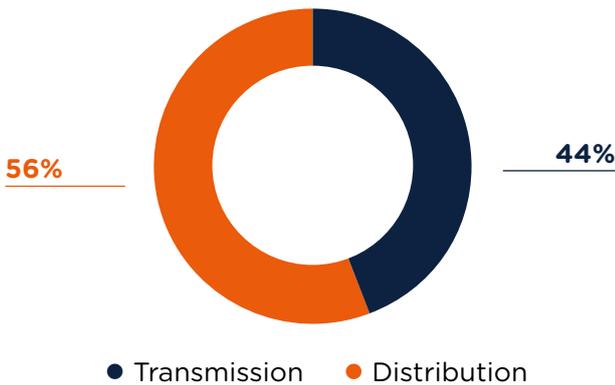
“There is a real desire to improve the gas industry now and for the future, and I'm pleased to play a small part in this process.”

Andrew Ellis, Business Development Manager, DNV-GL

“The continuing level of engagement and enthusiasm to drive the projects to outcome and adoption is refreshing”.

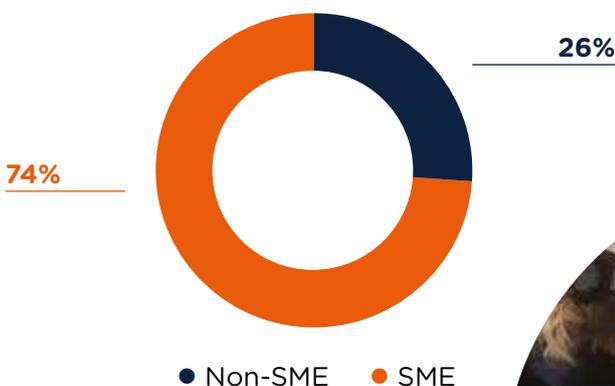
Iain Knowles, Sales Director, Radius

Transmission/Distribution



● Transmission ● Distribution

SME



● Non-SME ● SME





Our 2016/17 portfolio

Network Innovation Allowance

Ofgem's NIA is a funding mechanism to stimulate project innovation within our industry, and is currently set at 0.5% of our revenue for RIIO-GD1. Since 2013 we've invested over £16m (2016/17 prices) in our NIA portfolio.

This section outlines the projects within seven recognised NIA categories that continued into or were commissioned by us during the period 1 April 2016 and 31 March 2017.

During the year we were delighted to win a number of prestigious awards in recognition of our achievements and the individuals who drove the projects forward.



Mains replacement

We invest a significant sum annually on maintenance, refurbishment and replacement of our gas mains.

This year we replaced 996km of metallic pipe with polyethylene plastic pipe with the help of successfully developed innovative techniques that have been implemented into business as usual. We continue to develop projects to address customer concerns in relation to traffic disruption and supply interruption. This includes widening the capability of keyhole technology across our operations, developing more advanced methods to minimise the size of excavations, and reduce disruption to customers. Our progress has helped us achieve the Gas Distribution Network (GDN) record for mains replacement customer satisfaction in Scotland.

Our versatile new technologies have the potential to deliver benefits for the gas distribution industry, the wider utilities industry (water, telecoms), our customers and the public.

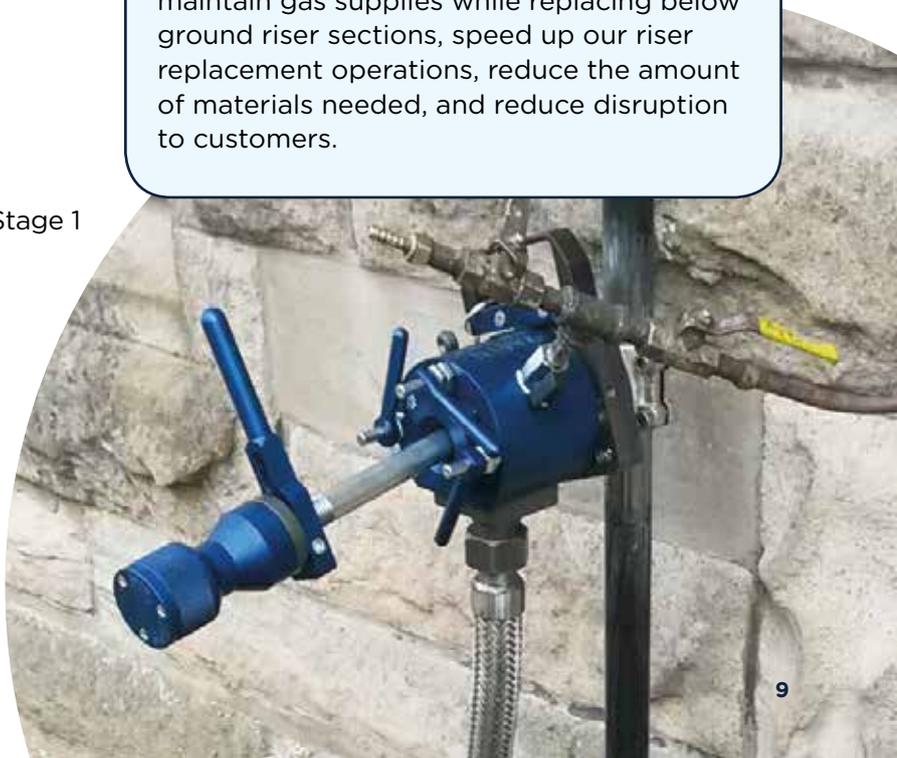
- Mains and service replacement through keyhole (iCore)
- Microstop
- Bond and bolt saddle system
- Core drilling and flow stop
- Olympic rings for RIIO
- SynthoScope
- GasLight Q field portable non-destructive PE material analyser
- Interruption solutions – Live ECV, meter and service replacement (Stage 1)
- Small diameter PE flowstop
- PE flowstop up to 10bar(g)
- Cured in-place pipe (CIPP) Stage 3
- Forged carbon fibre products (FCFP) – Stage 1
- Automated pressure tester

Microstop

NIA_SGN0018

This project seeks to develop an alternative means of live network riser transfer. In general, the below ground section of steel risers is most prone to degradation and corrosion. Often, if the network riser is installed internally in a multi-occupancy building, it won't have been subjected to the same corrosive forces. As such, most above ground pipework can be retained when carrying out replacement activities. Partial replacement of network risers provides a good outperformance opportunity, delivering both replacement length and number of meter points where remaining pipework is found to be in satisfactory condition (further to risk assessment). This includes technical appraisal as well as field trialling of the appropriate equipment.

Our technical appraisal, risk assessment and subsequent field trials in 'live gas' scenarios of the Microstop system will determine whether it meets the necessary standard to be used on the GB network, and can deliver benefits to our customers. If we find it is fit for purpose, we'll be able to maintain gas supplies while replacing below ground riser sections, speed up our riser replacement operations, reduce the amount of materials needed, and reduce disruption to customers.

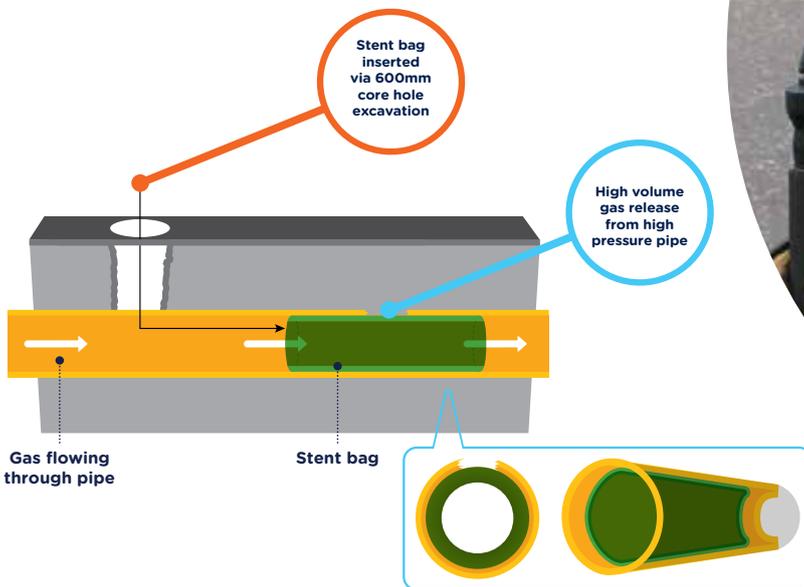


Emergency

We provide a comprehensive 24/7 gas emergency service to protect life and property, which is costly and can significantly impact our customers and the general public.

Innovation is playing a big part in helping our operational teams and contractors deal with major incidents such as gas escapes or water ingress quickly, safely and more effectively. For example, our water extraction wheel detects and removes water from low-pressure networks through a single excavation, and is now fully deployed in all our operational depots.

- Advanced gas detection
- Stent bag



Stent bag

NIA_SGN0031

Accidental damage to our pipes by an excavator or mini digger can lead to gas escapes and loss of supply, resulting in significant financial costs and environmental impact. Using an inflatable stent bag to fill and seal a pipe from the inside could extend the critical time window for dealing with gas mains damage, minimise the amount of gas escaping into the environment and prevent the need for a costly customer restoration programme. We've been testing a prototype off-site so we can evaluate the bag/process before planning live field trials.

Repair

Our repair projects aim to make sure the tools and techniques we're developing to manage and upgrade our ageing infrastructure are effective and provide value for money. This includes reducing disruption to customers and the general public, our operating costs, and the impact we have on the environment. Our award-winning trenchless technologies Large CISBOT and Core and Vac are now helping us deliver effective repair solutions on a daily basis.

- Development of specification for PE repair systems
- Self-amalgamating tape (Stage 3)
- Gas polymerisation (Stage 2 - Engineering development)
- Advanced mini bag kit
- PhotonFix™ (Seeker particles Stage 3)
- Leakage sealant standards
- Ironclad (component prototype phase - graphitisation Stage 2)

Robotic roadworks and excavation system

NIA_SGN0104

The Robotic Roadworks & Excavation System (RRES) is the future for precision excavation and utility operations technology. The system will fuse advanced robotic arm technology with a mobile platform, and will be controlled by Artificial Intelligence (AI) using a suite of sensors and feedback controls to enable autonomous, safe and efficient mains excavation. Once exposed, the RRES will attach a newly developed universal access fitting to the main to enable a set of inspection and maintenance operations to be performed. This next generation system will enable urban and large rural excavation to be performed faster and at a lower cost, and with greater safety than is currently possible using even the most advanced methods available today.

We commissioned a feasibility study under NIA to generate a robust evaluation of the concept, and are submitting an NIC bid to Ofgem in 2017. We're looking for approximately £7m funding and the project will take three years to complete, starting in April 2018.



LTS and storage

This specialist transmission pipeline system and storage installations area of our business is very important but costly to manage and maintain. We're investing in projects to help us minimise costs by either improving our technology or streamlining operational processes/ techniques to make us more effective and fitter for the future.



Smart paints and coating systems

NIA_SGN0067

We have many above ground assets that require on-going surface maintenance with paint or other coating systems to protect them from the elements and prevent corrosion. New coating systems come onto the market all the time and we need to assess their suitability for use on our network. The problem is no two manufacturers work to the same performance standards so we've set up our own.

We started a 12-month test programme in December, trialling selected coatings on a variety of pipe surfaces above and below ground before carrying out accelerated corrosion and abrasion testing in a laboratory. A final report in early 2018 will enable us to select the most suitable products for our network.



“The active participation of SGN staff members in the field trial has provided valuable feedback on the usability and potential applications of the candidate coating systems.”

Ramoon Ahmed, Rosen-Group

Pressure management, maintenance, electrical and instrumentation

We're partnering pioneering companies and academic institutions to find ways we can optimise our control systems to increase energy efficiency.

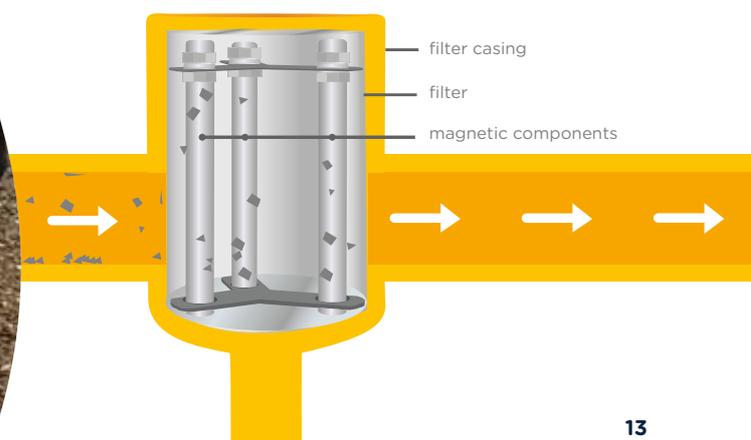
- Magnetic filtration in medium to low-pressure networks
- Starline/Marwin valve bolt replacement
- Wireless instrumentation field trial
- Automated regulator maintenance (Phase 1)
- Pit protect
- Remote site monitoring device
- Strategic pipeline heat study
- Corrosion mapping system for buried Orpheus regulator modules (Phase 2)
- Oxford Flow optimised pressure reducing station



Magnetic filtration in medium to low-pressure networks

NIA_SGN0070

We have a number of systems that have historically suffered with mains dust problems when the inlet filter element gets blocked during peak demand. This requires regular site visits to exchange the filter elements to sustain the optimum outlet pressure, so we tasked our partner Cairdon to develop magnetic elements that could be installed in our existing filter housing. Field trials started in September 2016 within our Bournemouth and Poole network - a low-pressure, large integrated network where high volumes of dust have collected during winter months in the past. The magnetic filtration system has proven very successful so far.



New and renewable gas sources

With over 80% of peak energy demand supplied by the gas network in GB, it has a very significant role to play in meeting energy needs and the journey to a lower carbon future.

Key to this is a flexible distribution network that can adapt to the country's evolving needs by introducing new and renewable gas sources. The projects in this category aim to make sure gas continues to be a core part of the energy mix for years to come.

- 100% Hydrogen
- Siloxane impact study
- Combined fuel cell – heat pump research study
- Impact of distributed gas sources on the GB gas network
- Energy map and plan

100% Hydrogen

NIA_SGN0105

The gas network delivers six times more peak energy than the electricity network, so we have a major role to play in the journey towards decarbonisation. Our aim is to research and evaluate the feasibility of a safe 100% Hydrogen distribution network. The first phase of the project will be feasibility and FEED (front end engineering design) studies at three locations in Scotland to determine the viability from both a technical and economic viewpoint, of constructing the first 100% Hydrogen network at one of these locations.

Customer acceptance will be critical to the success of this project, so building the evidence case for safe distribution is essential. To do this effectively we need to demonstrate in stages that the distribution of hydrogen carries no greater risk than natural gas. Phase 2 of this project will construct and operate a new PE network. This network will be operated for an extended period, and used to demonstrate hydrogen distribution is safe when using modern materials and jointing techniques before conversion of a potentially aged mixed material network is undertaken.



Other

We're able to register projects that don't fall within any of the other defined NIA categories but still comply with Ofgem governance criteria in this section so long as they have the potential to deliver value to GB gas customers. These initiatives are often collaborations between GDNs.

- IGEM gas quality working group
- Risk trading 2
- Development of a risk based approach for safe control of operations

IGEM gas quality working group

NIA_SGN0107

Over the next three years we'll be working closely with the entire energy industry to agree and approve an IGEM standard covering GB gas quality specification to facilitate a change from GS(M)R. This flexibility will benefit both customers and the industry as the nature of the composition of gas being used in GB changes. As innovation and diversity of supply continues this would present GB with a robust, flexible, appropriate and future-proofed mechanism.

IGEM will take the lead in establishing and facilitating the core working group which will comprise key stakeholders and experts on matters relating to schedule 3 of GS(M)R. The group will engage and consult our industry, map industry groups, and identify links and necessary representation within the UK and the EU. They will collate subject matter from across the gas industry and other key stakeholders to create a database of current and previous studies. This database will potentially identify a number of offshoot projects, subject to a materiality and cost benefit assessment. Alongside this technical review, we'll also be considering the legislative and regulatory case for change.

"I strongly feel we are at a time of immense change in the energy landscape as we look to embrace the challenge of decarbonisation while ensuring the security of supply and affordability."

Ian McCluskey, Head of Technical Services, IGEM

Network Innovation Competition (NIC)

Ofgem's NIC is another stimulus mechanism to promote more substantial innovation projects within our industry and is worth £18m, with a £2m discretionary reward for well-executed projects.

Real-Time Networks

SGNGN03

We're into the second year of our £8m NIC funded Real-Time Networks (RTN) which aims to demonstrate a flexible 'real-time' GB gas network is capable of meeting the current and evolving need for a more efficient, low carbon, affordable gas future.

Our pilot trial is under way in Medway (Kent), where we've worked hard to engage with local residents and businesses to install data loggers to the meters of volunteer customers. These will remain in place for two years and tell us about gas usage.

As well as customer demand, the impact of gas quality, flow and weather temperature will feed into the development of our real-time demand model. We're installing 10 sensors at six different sites around the Medway area to collect this information.

Our demand model will also respond to demand changes caused by changing weather conditions, so we're collecting local weather data with a finer granularity than is currently used.

Other GDNs and DNOs have given us their support and promoted the project to their businesses.





ROBOTICS

Reducing cost through innovation

Robotics

We're continuing to address the risk factors of operating the large diameter cast iron gas mains in our network with our pioneering CIRRIS™ Robotics system, developed and commercialised in partnership with ULC Robotics.

We invested £12m in an ambitious pilot programme using a combination of our fully implemented Large CISBOT and our new CIRRIS XI™ inspection robot on 1,487 meters in Paisley Road West in Glasgow. ULC has been testing the system improvements made as a result of our trial findings.

This pilot programme is an invaluable and necessary step to full-scale commercial use of the technology, and as confidence is built and the commercial application of the system is established, we'll scope a wider programme.

We've now begun Element 4 of this automated live asset replacement system to complete the project. The final components are specialised fitting and pipe materials, and a remote service line connection robot.

“Since the pilot programme, we have taken critical steps to improve the daily operations of the CIRRIS XI and better understand the inspection data. Through testing, refinements and data collection we are developing a robust, full-scale commercial system to help SGN manage their CI assets more effectively.”

Tony Hranicka, ULC Robotics



Opening up the gas market (Oban)

The Oban network safely stored, injected, distributed and used gas with WI ranging from 49 MJ/m³ to 53.2 MJ/m³ during the one-year trial period.

Key conclusions from the project:

- In numbers it looked like this:
- 20+ successful customer and stakeholder engagement campaigns completed.
 - 1,787 appliances were inspected.
 - 1,104 Oban customers got involved giving us >90% access rate.
 - 18 appliance laboratory tests and 7 special appliance tests were carried out.
 - 47 unsafe appliances were replaced free.
 - 1 year network trial carried out using gases with Wobbe Index outside GB regulations.

Using Oban as a statistical representation of GB, it's estimated that 2% of the GB appliance population would currently be classified as 'immediately dangerous' against the Unsafe Situations Procedure.

Domestic and small commercial appliances correctly installed, serviced and operated can safely burn gas with WI of up to 54.76 MJ/m³.

The cost of maintaining the current GS(M)R limits is grossly disproportionate to the risk involved in widening the WI limits to 53.25 MJ/m³.

Currently only 10% of the available LNG can be accepted into the GB gas network without processing. Increasing the WI range to 53.25 MJ/m³ would allow up to 90% of the globally available LNG to be injected into the GB gas network without processing.

There is a significant incentive to change the allowable gas quality in GB (specifically the WI) to save circa £325m per annum by avoiding the need for Nitrogen ballasting.



We presented our completed NIC funded OGM project to 100 influential gas quality stakeholders in October. Due to the closure of Avonmouth, this project became essential in ensuring security of supply for 7,777 customers in remote communities in Oban and the other three Scottish Independent Undertakings.



Next steps

Over the first four years, we've successfully implemented a number of innovation projects to help optimise performance in the GB gas distribution networks. Our focus over the next year is to continue building on this success by meeting and exceeding the following goals:

Efficiency: Aim to develop new products, techniques and ways of working that improve efficiency of what we do and add value to our customers.

Flexible networks: We aim to understand the needs of our customers, both services and application.

Implementation: We'll continue to successfully implement valuable projects.

New partnerships: We'll build new working partnerships to drive innovation across the industry. If this is you, or you'd just like to find out more about us, please get in touch.



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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:
www.sgn.co.uk/Safety/Carbon-monoxide