



# SGN

Your gas. Our network.



2018/19

**Network Innovation Allowance and  
Network Innovation Competition**

# Annual Summary

# Welcome

## Welcome to the SGN Innovation Annual Summary 2018/19.

In 2018/19 we achieved a number of key outputs, investing over £3m in our Network Innovation Allowance (NIA) projects and over £3m of funds awarded by the Network Innovation Competition (NIC).

### About us

We are one of Great Britain's (GB) largest utility companies, distributing natural and green gas safely and reliably through our 74,000km of pipes to 5.9 million homes and businesses across Scotland and southern England.

### Our commitments

We are committed to exceeding the expectations of our stakeholders by delivering value for money and exceptional customer service as well as providing a safe, secure and sustainable future for our network.

### Our vision

Our vision is to keep our customers safe and warm by leading the way in energy delivery.

"We will continue to collaborate with our partners, other network licensees and across all internal functions to enhance innovative behaviours throughout the business. This will ensure that we are all aligned in the innovation strategy that will drive value to our customers and all stakeholders."

John Richardson,  
Head of Innovation

"Decarbonisation is the world's greatest challenge. Our Energy Futures portfolio is at the forefront of research, development and solutions."

Angus McIntosh,  
Director of  
Energy Futures

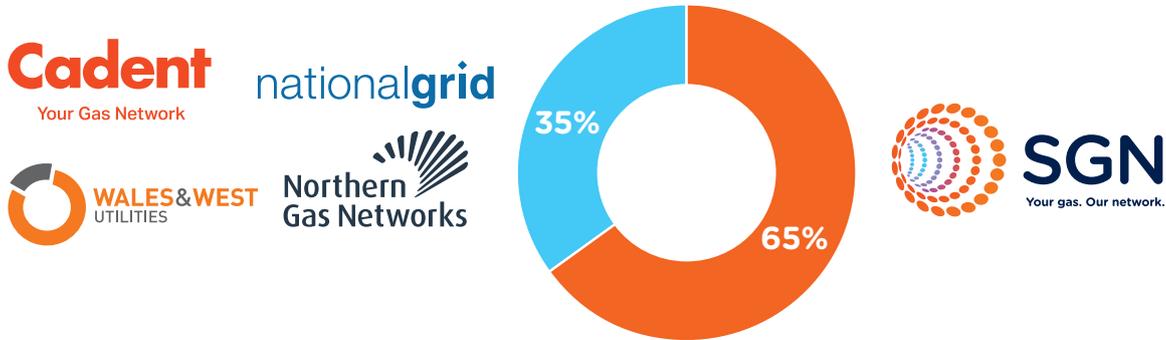
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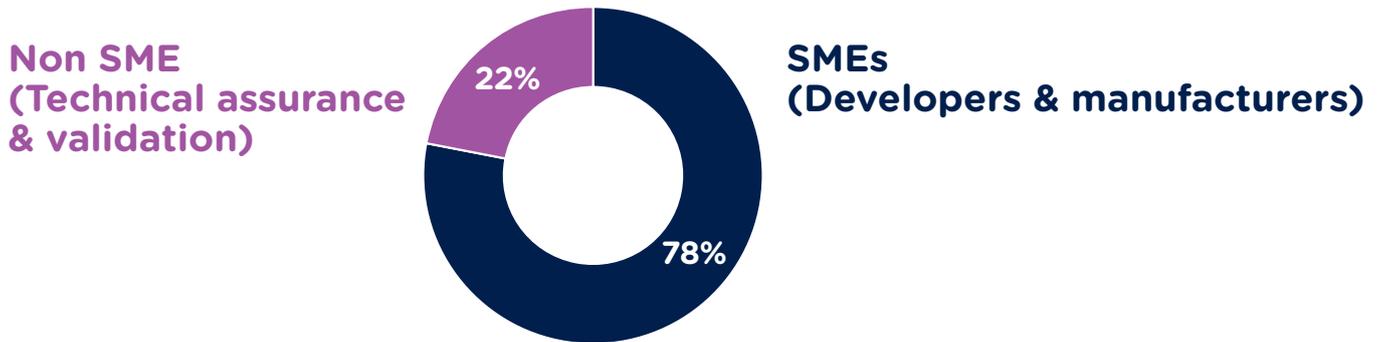
# SGN NIA Overview

We believe that the success of innovation lies in the implementation of technologies, research and learning into Business As Usual (BAU). All of our projects are designed to deliver clear outcomes which will allow for their integration into our business's processes.

## Participation in collaborative projects



## Percentage of spend with project partners type



## Breaking down the portfolio

<b>122</b>	registered NIA projects
<b>43</b>	collaborative
<b>£22m</b>	value of registered projects
<b>111</b>	SMEs involved in projects
<b>54</b>	projects completed to date
<b>21</b>	projects implemented to date
<b>£60m</b>	minimum value of benefits to date
<b>33</b>	research & development outputs
<b>14</b>	projects under implementation review



# Innovation strategy

**Our innovation strategy is to tackle the problems faced by our industry today and the potential future problems of tomorrow. We seek opportunities to develop new and exciting innovation projects which help us do this, while ensuring we continue to deliver gas safely, reliably and affordably.**

Through our innovation projects, we aim to:

- Accommodate new and varying gas sources within our network
- Efficiently react to changes in customers' use of gas
- Challenge industry orthodoxy
- Reduce environmental impact
- Minimise disruption to customers
- Continue to be cost efficient.



**Our strategy identifies the challenges and opportunities the gas networks face. The strategy sets out key research areas that all gas networks will align their innovation projects against:**

1. Future of gas
2. Safety and emergency
3. Reliability and maintenance
4. Repair
5. Distribution mains replacement
6. Environment and low carbon
7. Security

**Our innovation strategy is shaped by the feedback we receive from our customers and stakeholders. It is important we consider their concerns in a dynamic and proactive manner.**

# Our project partners

We have an excellent working relationship with small and medium enterprises (SMEs) and non SMEs that we work with (80% SME and 20% non SME). We have also established an excellent working relationship with companies in America and across Europe. This has allowed us to develop and expand a wide range of Innovation projects.

“It was evident from SGN’s continuous support and feedback throughout the Automated Pressure Tester development project that they are committed to improving the safety and efficiency of integrity testing and live gas operations in the (GB) distribution network.”

Jon Kuriloff, R&D Project Manager, ULC Robotics

“SVI and SGN have been collaboratively working on an NIA-funded project to design and develop a new system for sealing the annular spaces left after mains insertion has taken place. This NIA project is an excellent way of providing a complete system within 12 months and SVI will look to implement it not just within SGN but also throughout the GB gas network.”

Richard Ditte, Project Manager, Steve Vick International

“ProHeat has been proud to work closely with SGN in developing a number of strategic projects relating to the future of heat in gas networks. From the development of a new generation of responsive, easy to maintain preheat solutions, to a deeper understanding of the impacts of temperature control on energy use, ProHeat and SGN’s collaboration has resulted in practical strategies and insights for reducing cost and improving the energy performance of GB’s gas networks.”

Stefan Romocki, Managing Director, ProHeat Systems Limited

“SGN continues to be centre and forefront of innovation in the UK gas infrastructure. Their drive and commitment from both their technical and innovation teams has enabled a significant Joint Industry Project to commence work which aims to optimise inspection scheduling for the filter population across the whole of the GB gas network.”

Neil Bramley, Head of Integrity Management, DNV GL

# Collaboration & shared knowledge

Collaborating by sharing ideas, knowledge and learning is key to maximise the potential use of NIA and NIC funding. By working with other gas networks and project partners, we can tackle common ongoing issues and as a result, improve efficiencies.

**Around 30% of our NIA projects and one NIC project are collaborative with other gas networks licensees.**

We have been involved in a number of collaborative and knowledge sharing events, including presenting at the annual Low Carbon Networks and Innovation (LCNI) conference. We also engage with stakeholders, third parties and SMEs to explore how we can create and deliver exciting new innovation projects. Any significant progress and successes are shared regularly at the Gas Innovation Governance Group (GIGG) which we attend with the other Gas Distribution Networks (GDNs).



**“We have worked closely with SGN on the HP Filters collaborative project – still in the early stages, but very happy with how the project has been managed with clear, concise communication to ensure smooth progress.”**

Karl McGregor, Project Delivery Specialist, Cadent

In partnership with SMEs and SGN we showcased and demonstrated 20 of our most innovative projects across our company to colleagues, our Executive and Operation Committee.

The projects, some of which are described below, set out to address problems within different areas of our business including emergency repairs, mains replacement, pressure management and maintenance.

- Pressure Control and Management – Aim is to remotely control governors based on directed feedback from the downstream network to improve safety and leakage. This system is next generation technology compared to the current systems we use.
- Advanced Pressure Tester – This equipment helps to provide the accuracy and consistency of the testing and data recording process.
- Incident Management – The development of an app which will provide the gas industry with an integrated incident response and management platform.

Seven of the partners with which we work collaboratively were also in attendance at the events, and keen to exhibit their projects to our colleagues. Some of our partners told us:

**“This was a unique opportunity for us to engage with a quality cross section of audience rarely assembled by any network in one place at the same time.”**

**Mike Deane, Business Development Manager, Crane Building Services & Utilities**



**“On behalf of TRACTO-TECHNIK UK, may we thank SGN for our inclusion in your very well planned and executed, Innovation Stakeholder technical events. The focus, interest and valued feedback we received from both SGN Executives and Management structures clearly defined SGN’s commitment to deliver the best possible ‘Customer Care’ and network improvements through its Innovation delivery programme.”**

**Billie Turner, Project Manager, TRACTO-TECHNIK**



# 2018/2019 NIA deliverables and outputs

In order to successfully deliver our Innovation Strategy, learning is taken from each NIA project. Over the last year we have achieved a number of key outputs, and the following section provides a snapshot of these outputs.

## Smart Paints and Coating Systems (NIA\_SGN0067)



### Problem

We need to carry out inspections and maintenance at the regulator sites across our company. We use paint and coatings as the primary means of corrosion protection for both above and below ground plants.

An on-site paint inspector oversees all paint and coating activities and decides whether the site needs a full paint coating of the whole site, or just a small area of corrosion requires remediation - this is called a 'patch paint'.

At present we use a two-part paint system. This is usually applied in three or four coats and allowed to dry over a specified period of time. The application of these paints and coatings is time consuming. Even a small to medium site can take up to three months to prepare and coat.

### Solution

As more modern paint systems become available, we have identified a need to assess them for their suitability to our gas network. We must also review and update existing industry specifications to align them with new products and technologies currently available.

Paints and coatings affect the overall health of our assets. This project therefore informs the Asset Health and Criticality Indices which are currently being reviewed and developed.

### Learning and outputs

This project gives Network Licensees an understanding of what new paint and coating systems are available, improves and simplifies the paint and coating selection process and introduces a new paint inspection system. This project also offers Network Licensees new products and technologies for above and below ground assets, providing a more efficient and cost effective solution compared with traditional techniques.

# Bolt Integrity (NIA\_SGN0117)

## Problem

Hundreds of thousands of stud bolts are used across our network and all the other GDNs too. During site inspections a number of stud bolts have been identified as having significant levels of corrosion and require urgent replacement which can be expensive.

It is acceptable to replace stud bolts from an eight bolt flange arrangement during live operation. However, this is not possible for four bolt flange arrangements leading to expensive bypass operations.

Stud bolts are not a recorded asset and therefore the amount, condition and remaining strength is unknown. Because of this, SGN is looking to develop a screening tool to identify the remnant strength of corroded stud bolts.

## Solution

The aim of this project was to investigate how corrosion affects the strength of a stud bolt and to see if it can be approximated by the cross sectional area of the uncorroded material.

In order to determine the replacement extension for stud bolts in plants and pipelines, our screening tool identifies the high-risk bolts to replace. This has been created by collecting specimens from site, using the Hydratight Reinforcement Clamp, and subjecting them to various tests. These tests determine the remaining strength left in a corroded bolt and the results are cross referenced to understand if there is a visible trend.

## Learning and outputs

This project has developed a solution to a known problem that has never been adequately addressed before. The developed screening tool and hydratight clamp has created awareness and understanding of:

- A method and product for replacing stud bolts on four bolt flange arrangements
- The methodology's potential to be adapted to suit other types of applications
- The potential impact of corrosion on stud bolts
- The condition and remaining strength left in stud bolts.



# Oxford Flow Optimised Pressure Reducing Station (NIA\_SGN0098)

## Problem

Pressure Reduction Stations (PRSs), whether above or below ground, are a fundamental element of the gas distribution network. SGN has thousands of PRSs with inlet pressures ranging from 2 to 80bar. PRSs are largely robust, solid and reliable systems, but come with a high capital cost requiring regular high quality maintenance. As a result replacement of PRS equipment is often costly.

## Solution

There is a clear need to have PRSs with: reduced capex, improved reliability and maintenance, improved ease of maintenance, reduced installed size and (in some locations) reduced noise.

SGN have partnered with Oxford Flow (aka Oxflow) under NIA to develop improved PRS designs based on the Oxford Flow regulator concept and other associated technologies. Oxford Flow developed an innovative precision performance pressure regulator that is compact in size and has only one moving part.

## Learning and outputs

Field trials have been carried out involving the replacement of existing Axial Flow 'Active' regulator and its associated Pilot from the Working Stream, with the new Oxflow components. Two further field trial stages are planned and expected to be underway shortly. These stages also involve replacement with the Oxflow components at two different sites, one in Scotland and one in the south.

It is expected this new technology has potential to make a significant impact on the lifetime cost of low and mid pressure PRSs, as well as impact on noise and environmental considerations. Other expected key benefits are improved long-term reliability and a significant reduction in maintenance due to the lack of moving parts involved with the regulator's operation.



# Stent bag (NIA\_SGN0031)

## Problem

Impact damage to a pipeline or a gas main, typically from excavators and mini diggers, can lead to a significant escape of gas, a loss of supply and can incur a significant financial cost with considerable environmental damage.

Depending on the extent of the damage, the main priority is to try and maintain the gas supply to customers while ensuring maximum safety. The current method for achieving this is to temporarily repair/control the leaking pipe with a repair clamp and/or sandbags, and then construct a bypass around the damage, subsequently cutting out the damaged section. The caveat to this method is that it must be carried out within a critical time window before too much gas escapes through the damaged pipe and a loss of supply occurs.

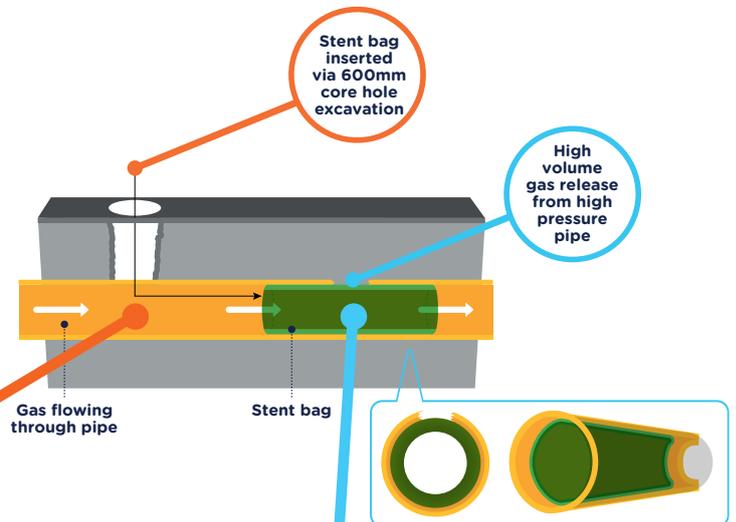
If the supply is lost in this way, air can be drawn into the gas system which can create potentially explosive atmospheres within the network. Therefore often the only available method for safely dealing with network damage is to close a valve upstream and turn off the supply to customers until the damage has been remediated. After the damage has been remediated, supply to customers is restored by means of a purge and relight at every affected household. This is a costly and time consuming operation.

## Solution

Using techniques developed from the medical industry, an inflatable stent bag has been developed which can be inserted within the pipe and expanded to fill and seal a damaged pipe. This extends the critical time window for dealing with gas mains damage, minimises the amount of gas escaping into the environment and prevents the need for a costly customer restoration programme.

## Learning and outputs

The stent has now been fully tested and has proven the functionality as expected. The tests proved that the leakage could be vastly reduced or stopped whilst maintaining the gas flow when the Stent is fully deployed in the main over the leak.



**Deployment of uninflated bag**



**Inflated bag**

# Network Innovation Allowance

**NIA projects give network operators an opportunity to develop projects that drive benefits for our customers as part of Ofgem's RIIO-1 price control. SGN has developed several NIA projects which promote safety, security and efficiency within our network.**

Innovation is integral to finding better ways to operate and manage our network, ensuring a secure and affordable gas supply for our customers. We do this by investigating new technologies to help us tackle current and future challenges faced by our ageing network.

Our NIA portfolio covers a range of innovation and energy future challenges relating to the following key research themes: Future of gas, Safety and emergency, Reliability and maintenance, Repair, Distribution mains replacement, Environment and low carbon, and Security.



# Case Studies

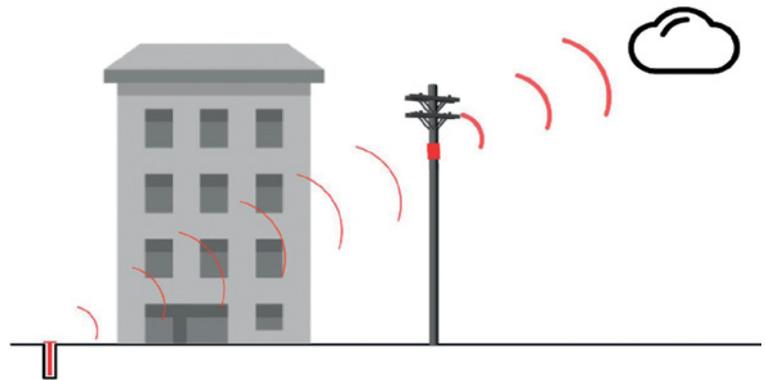
The following NIA case studies aim to ensure minimum disruption to our customers, as well as provide safety to customers and our staff. The following projects address the key research themes of 'Safety and emergency', 'Reliability and maintenance', 'Repair', 'Distribution mains replacement' and 'Environment and low carbon', where a project snapshot has been provided.

## Remote Site Monitoring Device (NIA\_SGN0110)

Future of gas <input type="checkbox"/>	Safety and emergency <input checked="" type="checkbox"/>	Reliability and maintenance <input type="checkbox"/>	Repair <input type="checkbox"/>	Distribution mains replacement <input type="checkbox"/>	Environment and low carbon <input type="checkbox"/>	Security <input type="checkbox"/>
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GDNs have 'at risk' mains that are not leaking but require frequent monitoring as a risk management measure prior to being directly replaced. SGN also has sites where work is being carried out but they remain live and require periodic checking.

These scenarios require personnel to frequently visit the site to take the gas measurements and report findings. This is a significant demand on our resources and, depending on the location of our site, can take several hours.

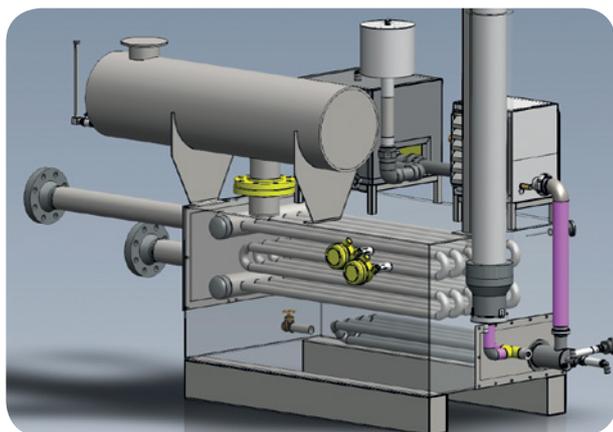


The Remote Site Monitoring Device is an alternative solution which uses a battery powered remote monitoring device that, when installed, will allow gas readings to be automatically transmitted directly to the Cloud. This will allow readings to be monitored remotely and more frequently for a fraction of the cost.

## ACE (Advanced Condensing Exchanger) (NIA\_SGN0124 & NIA\_SGN0145)

Future of gas <input type="checkbox"/>	Safety and emergency <input type="checkbox"/>	Reliability and maintenance <input checked="" type="checkbox"/>	Repair <input type="checkbox"/>	Distribution mains replacement <input type="checkbox"/>	Environment and low carbon <input checked="" type="checkbox"/>	Security <input type="checkbox"/>
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Our ACE stage 1 (NIA\_SGN0124) and stage 2 (NIA\_SGN0145) projects are carrying out conceptual designs of a new solution for different ranges of compact ACE. We aim to reduce the high replacement cost of water bath heaters and older atmospheric boiler houses by increasing asset life and reducing rebuilding costs.



The conceptual design of ACE facilitates a process arrangement where the heat exchanger can be mounted in such a way to ensure the coolest process fluid will be located at the bottom of the bath to maximise condensing performance, while significantly reducing plant footprint.

The next step is to take this project from conceptual design to field trial at Godstone Hill PRS.

# High Volume Gas Escapes (NIA\_SGN0118 & NIA\_SGN0146)

Future of gas	Safety and emergency	Reliability and maintenance	Repair	Distribution mains replacement	Environment and low carbon	Security
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High Volume Gas Escapes (HVGE), although uncommon, pose a risk to individuals and infrastructure in their vicinity. The cause of HVGE is often third party damage, but it is SGN’s responsibility to remedy the situation safely and quickly. In effect, there are three issues that need responding to:

1. Ensuring safety to public and contractors by removing risk of explosion etc.
2. Mitigating the consequences of the loss of gas.
3. Ensuring continuation of supply to customer.

The specific aim of HVGE stage 1 (NIA\_SGN0118) was to identify and develop a number of prototypes for internally and externally responding to HVGE from pipelines operating up to 7 bar (excluding those within buildings). Five concepts were investigated which include:

1		<b>Internal Access Tools</b> - A flow driven ‘drogue’ to provide an alternative to push rod systems to convey tools from a remote injection point to the leak site through the pipeline itself.
2		<b>External Access Tools</b> - A modular system including long handled tooling and remote arm for deploying tools remotely, keeping operators out of the pit and working in a safer environment.
3		<b>Internal Sensors</b> - To provide information about the incident conditions where no external access to the leak is available.
		<b>General Sealing Tools 1</b> - An inflatable plug, which replaces the current practice of using wooden wedges.
4		<b>General Sealing Tools 2</b> - A retained clamp which is quickly deployed and provides a seal on the outside of the pipe.
		<b>General Sealing Tools 3</b> - An internal patch which is deployed through the leak and uses the gas pressure to energise a seal on the inside of the pipe wall.
5		<b>Internal Plug Seal</b> - This provides a means to effect a seal remotely from the leak where no external access is available.

Following completion of Stage 1, a follow-on project Stage 2 (NIA\_SGN0146) has started this year which involves testing a number of prototype tools with associated deployment methods. This seeks to develop methodologies to enable permanent repairs to be made when a leak in a low or medium pressure pipeline results in a HVGE.

This is a safety critical area which focuses on dealing with HVGE situations for SGN, which are also common throughout the other GDNs.

# Pressure Control and Management (NIA\_SGN0122)

Future of gas 	Safety and emergency	Reliability and maintenance 	Repair 	Distribution mains replacement 	Environment and low carbon 	Security 
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Site 1 - Greatbridge DG

We rely on several pressure control systems to manage our distribution networks. However, some of the existing technology is outdated. While considering a solution to this problem, we found a new engineering design company called Utonomy. The concept involves the fitting of an electronic actuator to the regulator pilot, which will ultimately be able to remotely control and adjust the governor setting in 'real time', potentially reducing the number of visits to site to manually adjust settings.

This technology will allow us to better manage our resources and free up significant manpower. It also has the added potential benefit of the ability to adjust pressures at any given time. This could enable our network managers to manipulate network pressures in order to achieve maximum network optimisation.

This NIA project initially tests the functionality of the technology on our distribution networks by ensuring the actuator can be used to manage pressure settings in a similar fashion to that of 'clocking', before developing and trialling the more advanced remote control application. This technology will eventually have application across all pressure tiers.

In February 2019, significant progress was made on the project. We installed the new system in five network sites in Romsey. These sites are now fully commissioned and operational.



Site 2 - Cupernham Lane DG



Site 3 - Alma Road DG



Site 4 - Winchester Hill DG



Site 5 - Senlac Road DG

## Advanced Mini Bag Kit (NIA\_SGN0088)

Future of gas



Safety and emergency



Reliability and maintenance



Repair



Distribution mains replacement



Environment and low carbon



Security



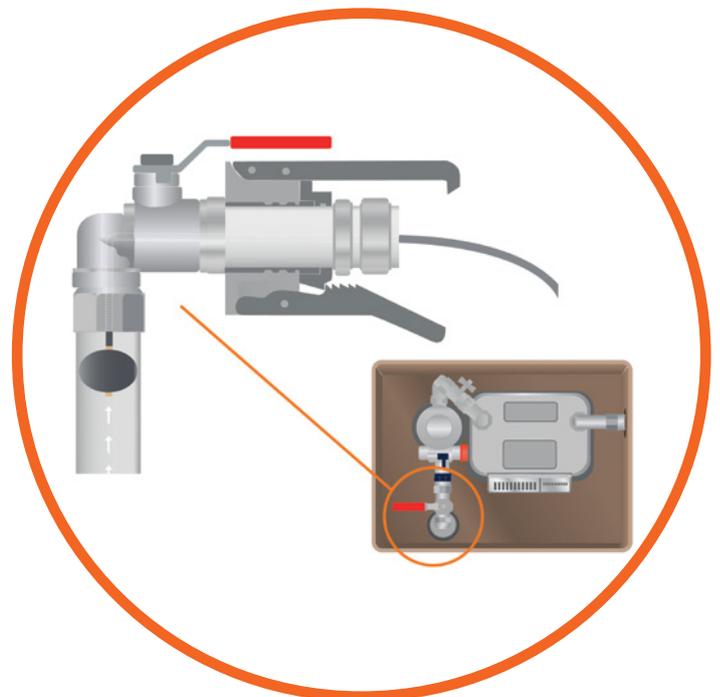
An Emergency Control Valve (ECV) is a safety mechanism on a gas service pipe which connects a gas meter to the gas mains. Its purpose is to control the flow of gas and can be switched off in the event of an emergency/gas escape, or where there is no gas meter installed.

Sometimes, due to the design and more specifically age of ECVs, it may not be possible to completely close the valve because of internal debris, or the seal may have perished. This is deemed an 'uncontrolled' leak and the gas engineer working needs to immediately replace the valve.

To replace semi-concealed ECVs, a gas engineer must call a team to excavate and 'squeeze off' the service line so as to isolate the flow of gas. It is at this point the ECV can be replaced safely. This additional work introduces a significant increase in cost and environmental impact due to an increased number of engineers on site and an excavation being required.

The Advanced Mini Bag Kit allows the exchange of ECVs while removing the need to excavate and physically isolate the gas service. The design is user friendly, lightweight and provides a 'no blow' solution for semi-concealed and historic ECVs.

We also do not need to excavate during the replacement process which can be carried out by a single operative.



# Mains and Service Replacement through Keyhole (iCore) (NIA\_SGN0056)

Future of gas	Safety and emergency	Reliability and maintenance	Repair	Distribution mains replacement	Environment and low carbon	Security
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The Mains and Service Replacement through Keyhole project, commonly referred to as iCore, aims to reduce or eliminate excavations, multi-stage reinstatement, operational footprint, complex traffic management and disruption to our customers, while maintaining safety and efficiency.



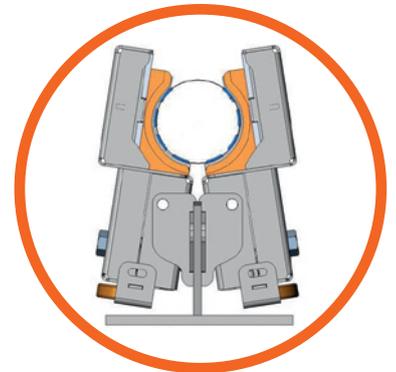
The iCore process involves three operations: the coring operation, to cut and remove the top surface of the carriageway (core); the vacuum operation, to remove the sub-base and expose the gas main; and the above ground keyhole operation which uses long handled tooling and a range of tooling heads to carry out inspection and service connections. Once complete, the keyhole excavation is reinstated using the vacuumed sub-base material followed by replacing the core we removed initially.

The project is split into two elements. Element one covers all three processes outlined above with the design, development and manufacture of a keyhole pipe installations and removal system. Element two involves the design and development of a system that can push or pull PE pipe, from 63mm to 180mm in diameter, inside an existing metallic pipe through a keyhole excavation up to 600mm in diameter.



We are currently developing element two with our project partner, TRACTO-TECHNIK, who has modelled, manufactured and begun testing a new mains insertion wheel and PE pushing/pulling machine. The insertion wheel is designed to fit within three interlinked core holes, but it can also be used within a standard excavation.

The PE pushing/pulling system has modular insert grips which can be adjusted depending on the diameter of the pipe being pulled with the wheel. This creates sufficient grip to pull a variety of pipe diameters through a keyhole excavation.



# Energy Futures

**The gas network plays a vital role in maintaining a secure and affordable gas supply to our customers, where we are always looking at new and innovative projects that provide future benefits to the gas networks. Our future of gas projects focus on building on the existing gas network by introducing new and renewable gas sources. They also promote a low carbon, integrated and cost-effective energy system.**

The UK's gas networks have significantly higher capacity for energy delivery (compared to the electrical grid), provide flexible storage and can potentially open a route to a whole system approach to decarbonisation through hydrogen. A key part of the next price control (RIIO-2) will be to build the evidence base through innovation, to support the development of policy and regulatory change around the decarbonisation of the gas network.



# Assessing the Gas Network Decarbonisation Pathway (NIA\_SGN0144)

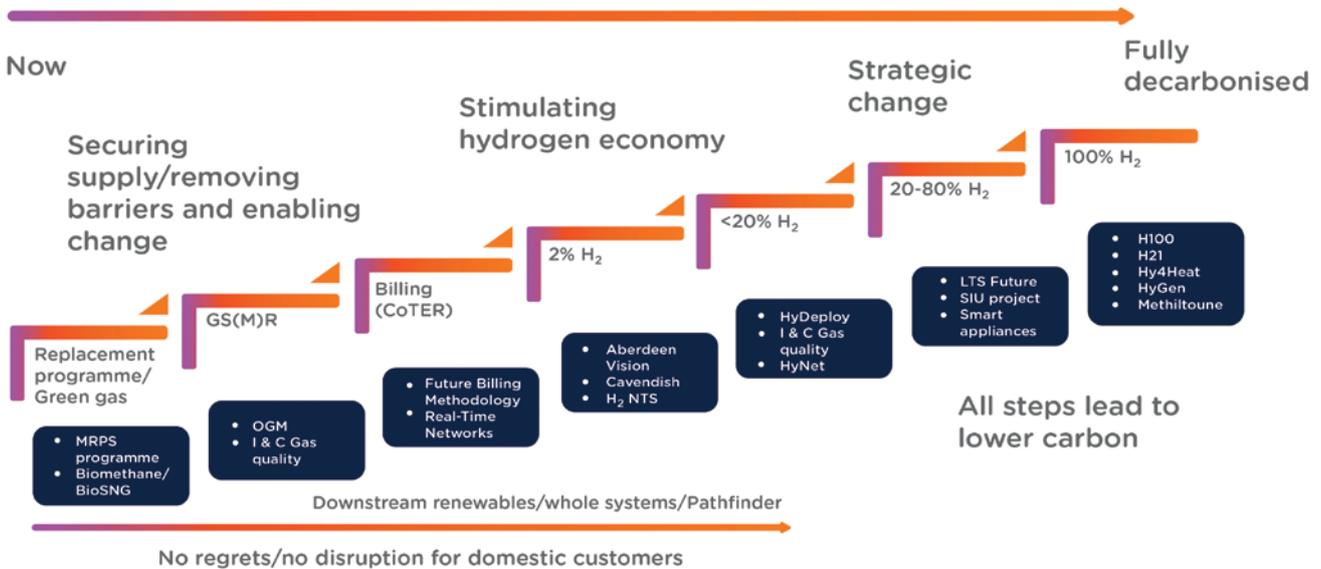
The UK and Scottish governments have committed to targets to reduce carbon emissions by 80% of 1990 levels by 2050. This will require significant decarbonisation of heat. With peak heat demand at least four times higher than peak electricity demand, we recognise the critical role our network plays in delivering warmth to residents of GB.

GB has one of the most advanced and efficient gas infrastructure networks in the world, with over 24 million customers connected to 284,000km of pipeline, including almost 85% of homes.

Low carbon solutions which utilise our existing gas network infrastructure could allow for the decarbonisation of heat at the lowest cost and minimal disruption to customers. Therefore, it is essential we demonstrate the ability to use and repurpose our existing gas network infrastructure.

As we seek to develop plans for our next price control period from 2021 (RIIO-2), we are undertaking projects that aim to evidence the steps that lead to the decarbonisation of the gas network. In the short term we will continue to support and facilitate blending green gas into the network, such as biomethane and biosynthetic natural gas (BioSNG) and demonstrate the potential for 100% hydrogen networks.

## The gas quality decarbonisation pathway



Following broad agreement with all network operators, the gas quality decarbonisation pathway shown above sets out the key steps to stimulate and implement a net zero decarbonisation solution. This includes removal of regulatory barriers, the stimulation of a hydrogen market and strategic changes towards a hydrogen economy.

Underpinning each step are a series of research and development projects that evidence the techno-economic, safety and practical requirements. A number of these projects are identified in the following Case Studies.

# Case Studies

NIA funding is used to tackle future challenges faced by the GB network. The following projects relate to the key research themes of 'Future of gas' and 'Environment and low carbon', where a project snapshot has been provided.

## 100% Hydrogen (NIA\_SGN0105)



Introducing hydrogen into the energy system is a potential solution and could play a major role in the path to decarbonisation of heat, as well as having applications in power and transport.

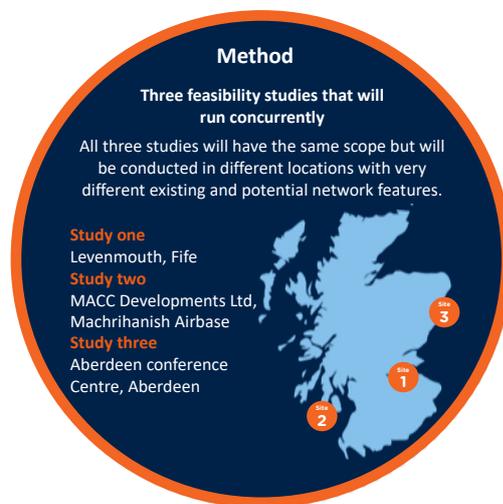
The key advantage over natural gas is it does not produce carbon when burned. Therefore, there is no pollution release into the atmosphere, making hydrogen an attractive energy alternative. Our H100 project will conduct a feasibility study which will enable us to assess the viability, from both a technical and commercial viewpoint, of constructing and operating the UK's first 100% hydrogen gas distribution network.

Our project will assess the suitability of three potential sites in Fife, Machrihanish and Aberdeen which offer varied opportunities, challenges and characteristics. All three sites have attributes representative of the wider UK gas distribution system, making them prime candidates for a demonstration.

The project programme consists of multiple work packages which are all under way with various project partners and in varying stages of completion. These include:

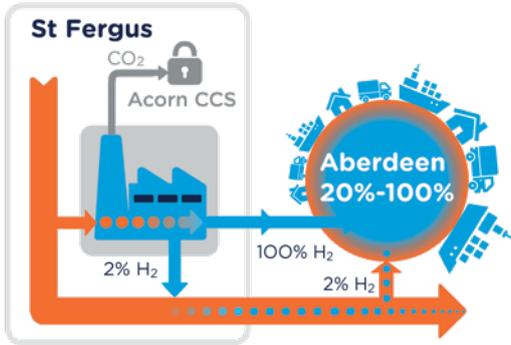
- Stakeholder and Customer Strategy
- Safety Case & Operational Procedures
- PE Materials and Jointing Techniques
- Characteristics of Hydrogen
- Consequence Testing
- Hydrogen Logistics (Production & Supply)
- Metering & Appliance Validation Program
- Odorant & Gas Detection
- Commercial Arrangements
- Academic Partnership
- Feasibility and Front End Engineering Design (FEED) studies

At the beginning of 2019, the feasibility contracts were awarded to three separate contractors, one for each site. The feasibility study will run for the first half of the year and will then enter the FEED phase from summer onwards. We expect this to conclude in the fourth quarter of 2019 and aim to have the safety case submitted to the Health and Safety Executive (HSE) for review at the turn of the year. The approval from the HSE will ultimately allow the project to progress into the construction phase in 2020/21.



## Aberdeen Vision (NIA\_SGN0134)

Future of gas <input checked="" type="checkbox"/>	Safety and emergency <input type="checkbox"/>	Reliability and maintenance <input type="checkbox"/>	Repair <input type="checkbox"/>	Distribution mains replacement <input type="checkbox"/>	Environment and low carbon <input checked="" type="checkbox"/>	Security <input type="checkbox"/>
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Our Aberdeen Vision project could provide new market opportunities for hydrogen and carbon capture. The St Fergus gas terminal, 40 miles north of Aberdeen, is a key strategic National Transmission asset. It provides an entry point for gas and supplies over one third of the UK's gas.

This location offers an opportunity to develop hydrogen blending in the National Transmission System (NTS) and the regional gas distribution network. From the terminal, we are proposing a new 100% hydrogen pipeline to Aberdeen where currently the use of hydrogen for transport is the most advanced and widespread in the UK.

## East Neuk (NIA\_SGN0138)

Future of gas <input checked="" type="checkbox"/>	Safety and emergency <input type="checkbox"/>	Reliability and maintenance <input type="checkbox"/>	Repair <input type="checkbox"/>	Distribution mains replacement <input type="checkbox"/>	Environment and low carbon <input checked="" type="checkbox"/>	Security <input type="checkbox"/>
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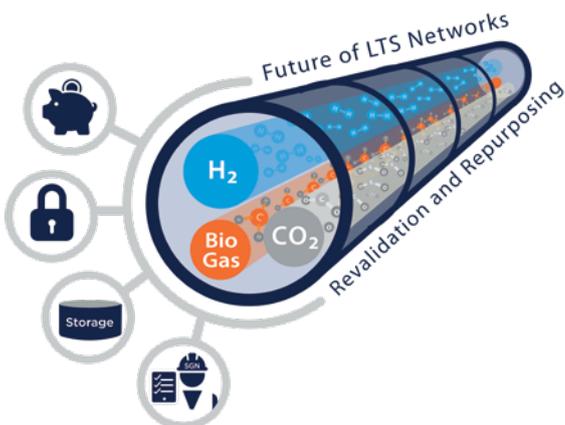
Alongside Scottish Power Energy Networks (SPEN), our East Neuk project is a techno economic assessment of the energy system, which reviews the energy system optimisation and explores how the gas and electricity networks, both present and future, could maximise local energy generation, distribution and efficiency.

East Neuk will examine the use of hydrogen as a medium for using excess electrical energy, which is currently constrained in East Neuk, Fife. They will also study the effect of how an overlay of electrical and gas networks can optimise the reduction of constraints on the electrical network by using hydrogen.



## The Future of LTS (NIA\_SGN0139)

Future of gas <input checked="" type="checkbox"/>	Safety and emergency <input type="checkbox"/>	Reliability and maintenance <input type="checkbox"/>	Repair <input type="checkbox"/>	Distribution mains replacement <input type="checkbox"/>	Environment and low carbon <input checked="" type="checkbox"/>	Security <input type="checkbox"/>
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We own and operate the Local Transmission System (LTS). This critical asset distributes gas at high pressure from the NTS to towns and cities.

For this NIA project, we are working with Health and Safety Laboratory (HSL) to evaluate the future role of the LTS. This will involve a feasibility study to establish if the decommissioned existing 30km LTS from Granton, in Edinburgh, to Grangemouth could be revalidated or repurposed in the context of a decarbonised gas grid.

# Network Innovation Competition (NIC)

**Similar to NIA, NIC projects are another Innovation funding mechanism that aims to deliver technology, carbon and environmental benefits for gas customers, while engaging and collaborating with a range of third parties and GDNs.**

The NIC is an annual opportunity for networks to submit large-scale projects to compete for a share of Ofgem funding to develop and demonstrate new technologies, operating and commercial arrangements. Funding is awarded to the projects which aim to provide low carbon benefits, reduce costs and maintain security of supply.

## H21 NIC Collaboration

**With the Climate Change Act committing the UK to reduce carbon emissions by 80% of 1990 levels by 2050, the race is on to find sustainable, reliable and affordable forms of energy to power customer homes and businesses.**

In 2016, lead gas network Northern Gas Network (NGN), along with Cadent, Wales & West Utilities and SGN, with project partners DNV GL and HSL launched the H21 NIC collaboration project. This project focuses on delivering the essential safety evidence required for a 100% hydrogen conversion.

The NIC project's first phase involves collecting lots of different types of pipes, joints, connections and valves that we use on our network today and designing a test programme to understand how they would behave on a 100% hydrogen network. This will be carried out by HSL.

Once testing has been carried out, a range of simulated gas escape scenarios will be tested at DNV GL's base at Spadeadam to explore how natural gas and hydrogen behave. Following from this field trials will be carried out.

The project is currently recovering the assets needed for testing. SGN, along with the other gas networks have been providing different types of assets to the project that are not present on NGN's network.



# Real-Time Networks (SGNGN03)



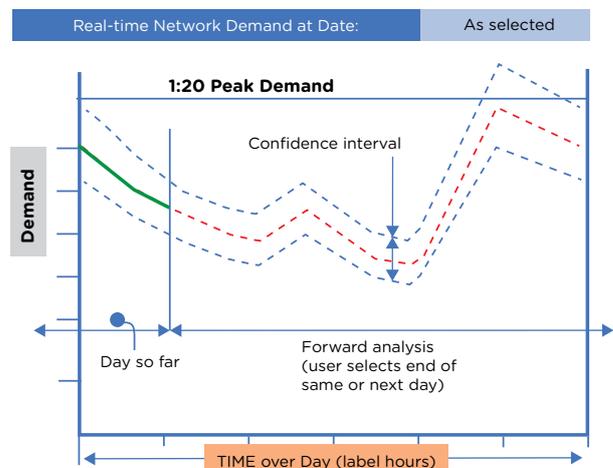
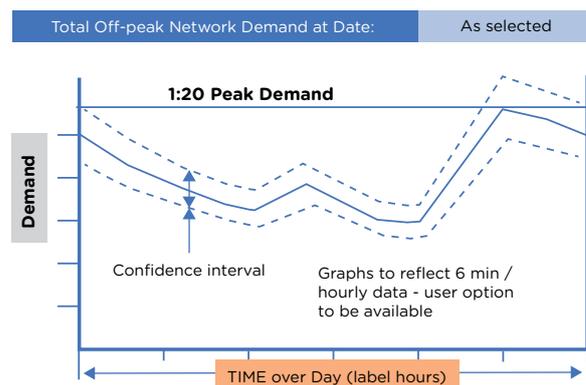
**Our £8m NIC-funded Real-Time Networks project aims to demonstrate a flexible gas network that can react to current and future changes, whether at network or consumer level.**

**For this, we are gathering gas performance and consumer demand data, which feeds into our newly developed Cloud Data solution to facilitate real time modelling, analysis and advanced forecasting.**

Consumer demand data continues to be gathered from data loggers installed at 1,200 of our customer meters across the south east since December 2017. This statistically representative sample, from a range of domestic, commercial and industrial consumers, has afforded some of the most meaningful gas demand research carried out in the last 40 years.

In 2018, we benefited from relative climate extremes, including near peak demand in March from the 'Beast from the East' and July's near record breaking heat wave. Furthermore, our newly installed weather stations have allowed us to understand how local variations in weather conditions impact on both consumer behaviours and gas.

At present, network modelling relies on historic annual data and consumer diversity assumptions. However, the real time model uses live data to link the types of property people live in with their gas demand. This gives us a more exact view of consumer demand and provides a better understanding of gas usage patterns. These patterns can be used to develop new billing mechanisms for potentially more accurate customer costs.



The modelling results so far have indicated a potential substantial reduction in demand. During the next steps of the project, we will continue to gather gas consumption data to further develop our real time demand model and validate the reduction in peak demand.

Gas quality, flow, pressure and temperature data is also being gathered using novel sensor technology at key points along our network in the south east. We have completed sensor installations at three of six bespoke sites, all of which are transmitting data to develop our real time model. Each site is being powered using innovative, low carbon sources, such as newly installed solar panels, wind turbines and connecting to existing street furniture. Data from boil off gas at Isle of Grain is also providing gas performance data to further support the model's development.



As part of the project, downstream renewable technologies have been tested to establish their potential impact on GB's energy networks. Different types of renewable technologies, which could increasingly be used in customer homes, such as Air Source Heat Pumps and micro Cell Heat Pumps, were tested in controlled identical conditions. The tests provided an enhanced view of each technology's performance and identified what the wider impact would be on the network as a result of installation of these technologies. Full results from this research have yet to be published.



# Robotic Roadworks and Excavation System (RRES) (SGNGN04)



**Our £7.3m NIC funded Robotic Roadworks and Excavation System (RRES) project aims to revolutionise the way that utility companies carry out operations.**

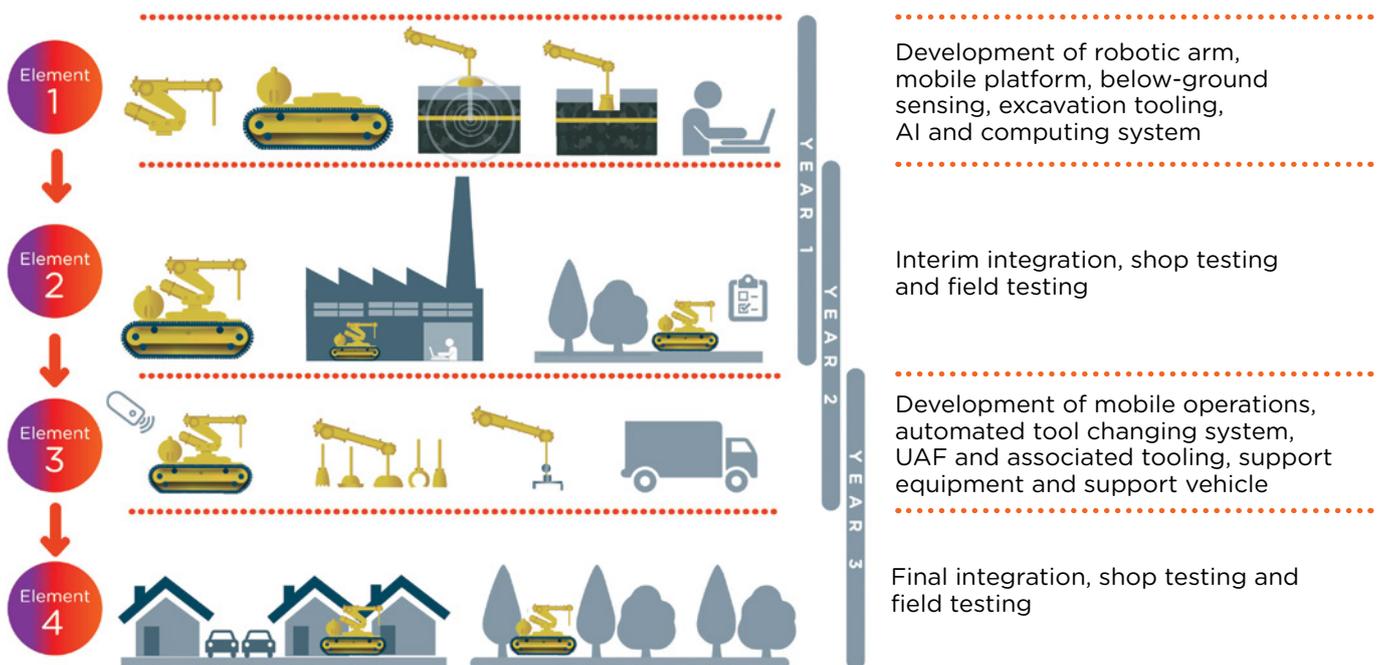


Utility excavations are necessary to inspect and maintain buried infrastructure, but are disruptive, labour-intensive and can lead to unintentional damage to neighbouring plant. Reducing the requirement for extensive safe digging practices could significantly reduce both the social cost of works and associated emissions.

By combining cutting edge robotics, advanced custom tooling and artificial intelligence, RRES will improve existing methods of excavation, repair and maintenance operations.

As RRES will take up less space than conventional sites and remove the operator from the hazardous zone, the system will have significant financial, safety and environmental benefits. Robotic automation of works will remove the operator from the immediate excavation site making it safer for operatives. Furthermore, since RRES will provide a complete end to end solution, disruption to our customers and stakeholders will be radically reduced.

## The project has been broken down into 4 main elements



Since the RRES project commenced in 2018, the team have been working on designing and testing its individual components. Once we have finished development in each area, we will integrate each subsystem and start testing the RRES prototype.

## Excavation

A key element of the RRES project is the Soft Touch Excavation™ – rapidly removing spoil without damaging buried assets. The traditional method of core hole spoil removal is a two-person operation wherein one person utilises an air lance equipped with a high-power air nozzle to agitate the ground, while another person operates a vacuum hose to remove the disturbed spoil from the hole. While commercial air nozzles and lances are commonplace in utility excavation, the project aims to make substantial improvements in the size, efficiency and power of this technology, with a goal of developing multiple versions for different ground types; including difficult to excavate hard-packed clay.



## Robotic Arm

Another core component of the RRES is the robotic arm which will conduct excavation and operations on buried piping with high precision, repeatability and accuracy. The robotic arm module is comprised of the robotic arm and associated motor drivers which enable the operation of end-effectors, grasping and excavation tooling. The robotic arm will mount to the mobile platform, which will provide it with motion and stabilisation.

## Sensing

When human operators excavate, they use their eyes and senses to control backhoes and other large construction equipment. In order to embed the RRES with the ability to ‘see’ its environment, the RRES team is developing 3D visualization techniques to capture 3D point clouds of the excavation and surrounding site.

A point cloud is a set of data points which represent points in 3D space which can be used for measurement, navigation and to generate extremely accurate 3D models of environments.

In the RRES system, point clouds are being paired with proprietary software to measure the depth of the excavated hole and to support the control/guidance of the arm and excavation tooling to enable safer operation, more accurate path planning and greater efficiency. With the proper presentation of this dataset to the operator and to the computer control systems, it can be used as a tool for manual or automatic control of the excavator head, sensors and road cutting tooling during the operation.



# Next steps

This year, we have successfully implemented a number of innovation projects to help optimise performance in the GB GDN.

Our focus over the next year is to continue building on this success by meeting and exceeding the following goals:

## Efficiency:

We aim to develop new products, techniques and ways of working that improve the efficiency of what we do and add value for our customers.

## Energy Futures:

We aim to be responsive to the emerging energy needs of customers and stakeholders by providing a means to, evidence, support, demonstrate and facilitate decarbonisation and whole system solutions.

## Implementation:

We will work with all functions to successfully implement valuable projects.

## Continued Engagement:

We will maintain and build strategic partnerships to drive innovation across the industry.

## Message of thanks from the SGN Innovation Team

“We would like to take this opportunity to thank all our project partners, participants, our colleagues and the other network licensees for their commitment and hard work throughout the year. It is through this engagement that we are able to develop new and exciting innovation products and services which aim to improve operation performance and safety within the gas network.

We are delighted that across the industry innovation is gaining momentum and the benefits are already being realised through our implemented projects. We look forward to building on the success so far through NIA and, in particular, continuing to work collaboratively and share learning with other network licensees.”

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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](http://www.sgn.co.uk/safety/carbon-monoxide)