Northern Gas Networks

Network Innovation Allowance

Annual Summary 2017-18

Making lives easier...
more clever stuff

we are the network

We're **Northern Gas Networks (NGN)**, the gas distributer for the North of England.

We keep 2.7 million homes and businesses cooking on gas in the North East, Northern Cumbria and much of Yorkshire through a network of underground pipes. We're committed to meeting our customers' energy needs today while innovating to meet the challenges of tomorrow.

Through pioneering technology and close collaboration with other energy companies, we are focused on delivering a safe, reliable supply of gas while exploring a low carbon, low cost energy future for the UK.

northerngasnetworks.co.uk
@NGNgas
innovation@northerngas.co.uk

Meet the **Innovation team**

1. **Richard Hynes-Cooper**
Head of Innovation
rhynes-cooper@northerngas.co.uk

2. **Adam Madgett**
Innovation Portfolio Manager
amadgett@northerngas.co.uk

3. **Jarred Knott**
Innovation and Regulation Support
jknott@northerngas.co.uk

4. **Wayne Smith**
Innovation Implementation Manager
wsmith@northerngas.co.uk

Mark Horsley
Chief Executive Officer
Northern Gas Networks

As the UK looks towards a low carbon energy future, the importance of network innovation and collaboration cannot be underestimated.

The challenges we face in the North are experienced throughout the UK gas industry and tapping the vast pool of knowledge, insight and expertise out there is the smartest and quickest way to meet them.

Whether it's using hydrogen to reduce carbon emissions, locating gas in underground utility ducts, or better understanding the effects our operations have on our most vulnerable customers, working together means networks can action change faster, solve systemic problems, avoid duplication of effort and pass on more benefits to all our customers.

And it's not just network collaboration, our close relationships with the Energy Innovation Centre and local innovators continue to deliver great results and brilliant new technology.

At the midpoint point of the RIIO GD1 price control, it's been time to take stock of our processes and review what we've achieved. What is clear is just how essential the Ofgem Network Innovation Allowance (NIA) stimulus has been to delivering this.

It's allowed so many great ideas to move from theory into practice, increasing efficiency, improving safety, reducing disruption and minimising environmental impact.

All of which ensures we're continuing to provide the best value for money service we can for customers as the UK's future energy mix takes shape. But there is still work to do.

When it comes to future challenges, one of the biggest remains the 2050 Climate Change Act, and how we meet its low carbon requirements while continuing to provide a secure, affordable energy supply.

Our Energy Futures projects are tackling this head-on, exploring the role of hydrogen and whole energy systems in order to deliver bigger and better benefits for the energy customer of tomorrow.

A hydrogen gas network conversion has been forecast to save around £300billion compared to full scale electrification, but the wider benefits are much broader. The potential for job creation and carbon reduction has put hydrogen on the government agenda, the green gas named as one of three plausible pathways to 2050 decarbonisation in October's Clean Growth Plan.

In the meantime, we're continuing to make sure innovation learning and technology are delivering benefits, and becoming business as usual today.

Embedding innovation into our culture has been a key focus point this year, as we worked to listen more to our people and learn about their biggest challenges.

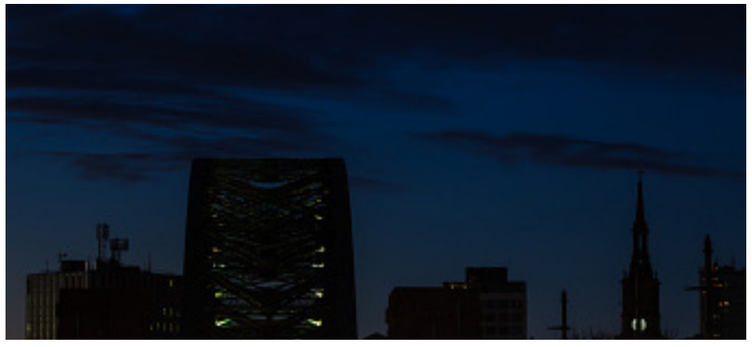
Innovation has evolved into an essential part of the day job and will only become more important in years to come, so it's also greatly rewarding to see new project managers take the lead in trialling and rolling out new technology already making life easier for colleagues and customers.

I hope you enjoy this look-back on our 2017-18 projects, and if you'd like to work with us or learn more, please do get in touch.

Mark Horsley

01

Our **STRATEGY**



Innovation plays a major role in consistently improving what we do, driving efficiency today and into the future.

Whether it's helping us rise to challenges, solve problems or make life easier for colleagues and customers, innovation presents opportunities to do things better.

Our portfolio can be divided into two categories: solutions that can action change right now, and those helping to deliver the energy system of tomorrow.

Our NIA funding is aligned to our strategy, with **five key objectives** designed to deliver improvement through innovation.

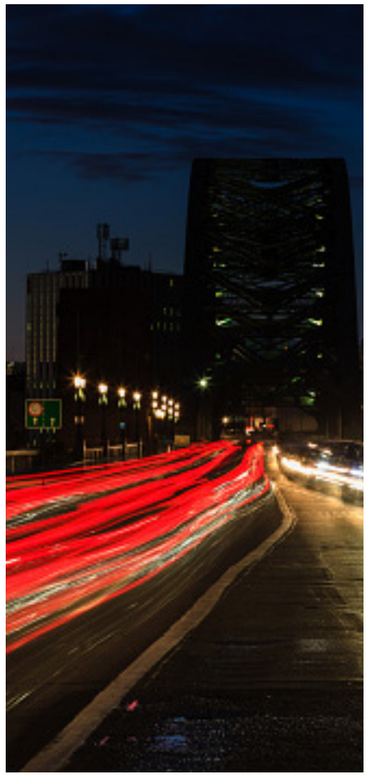
01 **Collaborate with innovative partners**

02 **Be efficient, effective and deliver value for money**

03 **Deliver a portfolio to make us reliable and safe**

04 **Optimise investment to deliver benefit for customers**

05 **Be socially and environmentally responsible**



Projects in our NIA portfolio reflect four areas in which we're continually aiming to drive improvement

AN

Asset and network management

Effectively and efficiently managing our infrastructure with clever solutions to ensure the gas flows along 37,000km of pipes

SE

Safety and Environment

Harnessing pioneering technology to keep our colleagues and customers safe, with minimal impact on our surroundings

CS

Customer Service

Ensuring the 2.7 million homes and businesses across our network continue to receive a safe, reliable energy supply, while putting vulnerable customers first

F

Future Role of Gas

Delivering a low cost, low carbon smart energy system for customers

Gas Network Innovation Strategy (GNIS)

This March we launched the Gas Network Innovation Strategy alongside our fellow networks and the Energy Networks Association.

The strategy identifies the challenges and opportunities the gas transmission and distribution networks face in improving efficiency and supporting UK decarbonisation, examining how innovation can drive down costs for customers and how lessons learned from innovation projects should be shared with wider industry in order to roll out benefits more widely.

And as technology, policy and customer demands change, it sets out the role gas has to play in meeting demand for power, heat and transport today, and into tomorrow, through seven key innovation themes:

- Future of Gas
- Safety and Emergency
- Reliability and Maintenance
- Repair
- Distribution mains replacement
- Environment and low carbon
- Security

The Strategy will be reviewed in two years' time. For the full document visit

energynetworks.org

02

The BENEFITS

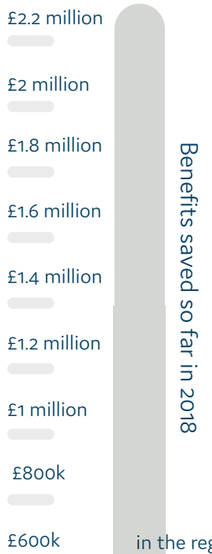
When all is said and done, innovation has one purpose: to ensure we're delivering the safest, most reliable and best value service for customers while meeting the energy challenges of the future.

Last year we set ourselves the '£2million challenge' to capture return on investment for customers through implemented innovation projects. We were just short of the finish line reaching £1.91 million of financial benefits. This hasn't deterred us as we have set the bar higher this year with a target of £2.2 million.

We believe the increased internal engagement we're undertaking will grow awareness of innovation in the business, resulting in greater utilisation.

Ultimately, increased adoption of new technology means we can carry out our works more efficiently and deliver greater value for money.

Our in-house cost benefits analysis system allows us to track utilisation with the business on a monthly basis, to promote awareness of the benefits associated with innovation projects so that usage is increased across the network.



As well as saving costs and driving efficiency, innovation projects have delivered numerous wider **benefits** so far in 2018.

Cut vehicle journeys by

110

We reduced the amount of spoil sent to landfill by

1276m³

Reduced days spent in the highway by

106

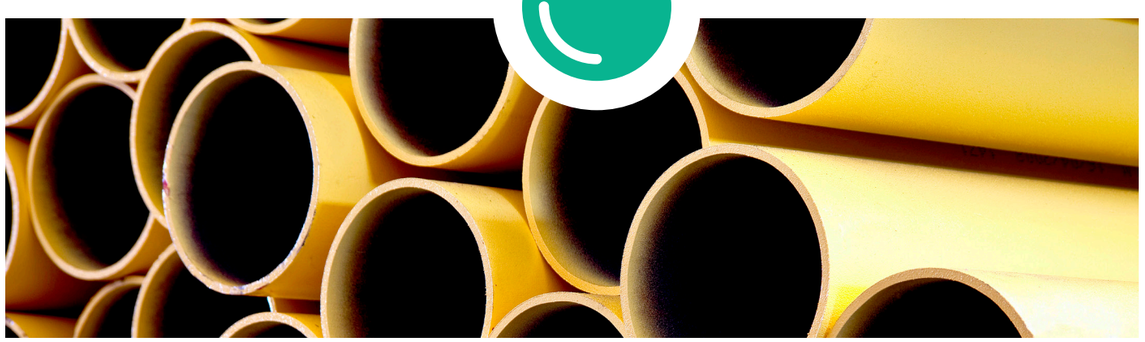
We dug

448

fewer excavations

Reduced customer complaints or local authority defects by

181



COLLABORATION AND SHARED LEARNING

Working with our fellow gas networks means we avoid duplication of effort and that effective solutions to long-standing problems can be rolled out faster while maximising benefits for customers.

Joining the other GDNs and National Grid Transmission on the Composite Repairs project is helping us explore repair technology set to benefit all the networks, driving down costs and increasing efficiency.

Meantime, our flagship Network Innovation Competition projects such as H21 and HyDeploy involve close partnership with the other networks so we can plan for a cleaner, greener energy future for customers at a reasonable cost, with minimal changes to their homes.

And it's not just the gas industry we can learn from. Earlier this year we joined Northumbrian Water, Northern Powergrid and Yorkshire Water for a project to help us better understand the social impact of utility works on our customers. By working through every step of our operational processes, we've been able to create a procedure which highlights potential negative impact and allows us to plan accordingly.
We also reached out to Wales & West Utilities to share best practice and to identify which implemented innovation projects from each network could be adopted. This has resulted in numerous initiatives and ideas being assessed by us for their suitability within our business.

And the process works both ways. Our back blade protector, which prevents road scarring when attached to a mini digger, is now being trialled by other networks, while our gas detection dogs are also attracting major interest.

Total number of collaborative projects since 2013:

52

HOW WE SHARE THE KNOWLEDGE...

Utility companies often face the same challenges and goals, so we share knowledge through a variety of industry forums.

Gas Innovation Governance Group

A monthly gathering of UK gas distributors. Great for sharing case studies about what has worked, and what hasn't, in the world of innovation. This year GIGG has seen a big push to identify implemented projects from each network.

With help from the ENA, the group has developed a tool allowing us to easily view which technology has been rolled out across each network.

The Energy Innovation Centre

The EIC acts as our dating agency for SMEs. Through the EIC we can source ideas and expertise from a community of 2,000 innovators, and invest in local firms.

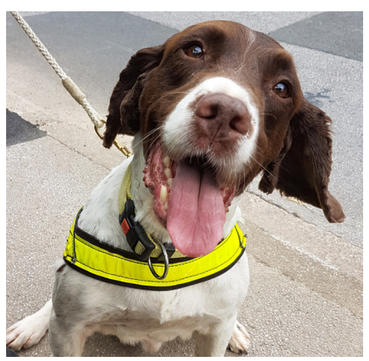
Cross Utility Innovation Group

A regular get-together of water, power and gas providers. Over the past year, partners have been working on a joint project to measure the social impact of network innovation activities.

Low Carbon Network Innovation Conference (LCNI)

The annual industry conference at which utility companies showcase green, affordable energy solutions and share success in resolving network problems.

Last December our project leads shared knowledge and learning with over 1,600 attendees at Telford, while NGN's gas detection dogs Midge and Millie certainly drew a crowd to our stand.



03

OUR CULTURE

LETTING OUR COLLEAGUES SHINE

Innovation projects are a great opportunity to develop the skills and harness the experience of colleagues while improving service for our customers.

In 2016-17, we launched a new step-by-step guide for our project managers, to help them successfully deliver innovation projects from start to finish.

We also provide a range of training and mentoring support and ramped this up in 2017-18 by actively recruiting Innovation Champions to endorse new technology.

Their enthusiasm and experience not only spreads the word on time-saving and problem-solving methods, but underpins our drive to fully embed solutions as business-as-usual.

This year we've hosted an Innovation Tour across the network, taking our technology on the road to offices and depots, bringing in suppliers to demonstrate the kit live.

And we welcomed a host of new project managers into the team, as part of NGN's expanding personal development programme.

Our people have achieved some outstanding results by trialling new solutions on the network and progressing ideas from start to finish.

A strong focus on commercial viability right from the start ensures we're delivering great value for money, increasing efficiency and improving safety, the benefits of which are being passed on to customers.

BUSINESS AS USUAL

Innovative new technology helps keep us at the forefront of delivering great service for customers, but it's also essential to embed new solutions through widespread implementation.

We've seen a great uptake of the clever kit we develop, trial and implement, however there's still more work to do. Effective communication on the benefits of rolled-out technology is playing a key role in increasing the use of business-as-usual innovation.

LISTENING TO OUR INTERNAL STAKEHOLDERS

Our colleagues serve as the best sounding board for potential projects. Before we progress any idea, we send out digital surveys as a 'temperature check' to monitor appetite.

Their knowledge and experience is a great way to understand whether there is demand for the solution, or if it needs further development.

Think tank

OUR THINK TANK

To ensure every successful project stands up to scrutiny, each one is presented and assessed by our Innovation Think Tank in order to earn approval. This internal governance body of specialist colleagues and expert practitioners from across the business means all facets of the project are evaluated, from commercial and financial to stakeholder and safety. Each project is scored on those merits and every one that meets or surpasses the criteria is progressed.

35

ideas evaluated in 2017-18

20

projects approved by NGN's internal Think Tank in 2017-18

Social media is a great way to spread the word fast on clever new solutions to long-standing problems, **so we've harnessed Yammer** – think Facebook for work – as a quick way to share news and project updates, with video a particularly effective and popular tool.

And our people continue to show some ingenious thinking when it comes to developing their own kit in order to tackle issues. Several of these great ideas, including a steering wheel desktop and a Core and Vac sealant, are now being explored as innovation projects.

NIA Funding
Why it matters so much

£12 million NIA investment since 2013

£2.6 million
Total investment this year

4
Awards this year

1. **UKSTT Environment Award**
2. **EIC Best Gas Network Improvement Award**
3. **EIC Best Innovation** Contributing to Customer Quality and Reliability of Gas Supply
4. **Gas Industry Innovation Product of the Year**

06 Network collaboration projects this year

52 Total network collaboration projects since 2013

110 Total NIA projects since 2013

21 Implemented NIA projects since 2013

01 Cross-sector projects this year

35 Ideas evaluated this year

20
New projects have been started this regulatory year

- **09** In research
- **10** In development
- **01** In demonstration

10 Completed

05 In implementation

2017/18
£2.6 million
Total spend in 2017-18

To find out more about all of our innovation projects, please visit **www.smarternetworks.org**

04

Our **projects**

The road to success

Business case
An initial examination of the benefits and costs

Research
A desktop project to see if the project stands up to greater scrutiny

Development
Time to hit the lab

Demonstration
Testing the concept out on the network

Implementation
Final roll-out. Success!

Syphon Design for Polyethylene Networks

Project ID:
NIA_NGN_169

Collaboration:
NGN, ROSEN
Stage:
Implementation

Problem: Syphons were traditionally used to collect water travelling inside the gas network for decades.

But as the UK embarked upon the Iron Mains Replacement programme and switched from metallic mains to plastic pipes, syphons were not thought to be required.

However parts of the gas grid still suffer from water ingress today, sometimes causing low pressure or even loss of supply for customers.

Solution: To tackle this, we've been working with ROSEN to design a lightweight, low pressure network compatible PE syphon providing 24-litre storage.

Small enough to reduce excavation size and ensure easy handling, the syphon can also be fitted with a remote monitoring system which alerts engineers when the syphon is full. This is reducing unnecessary trips to check levels, while ensuring water cannot travel further into the network and our customers continue to receive a reliable gas supply.

Benefit: Since we installed the syphon at one site, there have been no reports of water ingress problems or loss of supply for customers. And we've reduced our trips to check the levels thanks to its clever monitoring technology.

What's next: We're in the process of implementing this technology across the network and sharing the knowledge from field trials with our operational leaders and other gas distribution networks, to demonstrate the difference the syphon can make in areas prone to water ingress.

"It's a simple but effective solution to water ingress problems that increases operational efficiency and reduces our environmental impact.

"Because of its 24-hour monitoring and storage size, the syphon run, where engineers go to check levels, now only needs to happen when required.

"At one site we've gone from emptying the old one-litre syphon every other day, to not needing to visit for six weeks and cutting out a daily 40-mile round trip. "So we're making better use of operational time and creating fewer emissions through fewer journeys, plus there is no chance of customers having their supply interrupted.

"We're now sharing the learning with colleagues and other networks as water ingress is an industry problem across the board, and new technology means we're able to tackle this old issue ever more effectively, meaning less inconvenience for customers."

Steve Pigott
Project Manager

If rolled out network-wide, the syphon would drastically reduce carbon emissions by limiting the need for daily journeys to check water levels. We've calculated that it could save 2.5tCO2e and save £170k every year.

Gas Detection Dogs

Project ID:
NIA_NGN_170

Collaboration:
NGN, K9 Integrity LTD, Newcastle University

Stage:
Implementation

"The dogs' profile has lifted immensely in the NGN operational community.

"At Burmantofts they proved very effective, locating our escape which led to Yorkshire Water finding the water leak causing the problems.

"What else can I say....brilliant!"

John Richardson
Business Operational Leader

Dogs have saved over £92K since start of 2018

Deployed 46 times between January and March

Problem: Locating gas escapes has historically been a pretty messy business, requiring our engineers to dig excavation holes which can cause disruption for customers and impact the local environment.

Two years ago, we completed a fascinating trial which proved sniffer dogs could be trained to sniff out the gas odorant mercaptan.

Solution: To demonstrate they could locate leaks with the same effectiveness of existing gas detection equipment, our Springer spaniels Midge and Millie progressed to a live trials phase out on the NGN network last year, deployed to 14 separate sites.

After acing the live trials, the pair were instrumental in speeding up the resolution of a major gas supply incident in Burmantofts, Leeds last September.

A burst water main kept 550 properties off gas for three days, a large proportion of which housed vulnerable customers. Using the dogs helped reduce the length of the incident, pinpointing the exact spot where water was entering the pipe by tracing the greatest concentration of mercaptan back to its source.

Not only did this help Yorkshire Water repair the damage, but also meant water could be extracted more quickly and our customers got their gas supply back on faster with less digging required.

Benefits: A post-incident calculation showed that overall, costs of £85,000 were saved in Burmantofts and its duration reduced by two days.
Out of this, the dogs' efficiency was calculated to have saved around £35,000 and a day's time in getting customers back on supply.

As well as cutting the need for digging exploratory holes and minimising environmental waste, the dogs' improvement of leak location and repair times meant they became business as usual technology for use across the network in December.

Stars of the show at 2017's LCNI conference, the dogs have attracted interest from other networks keen to explore their potential in resolving water ingress events.

Practical Solution for Built-over Mains

Project ID:
NIA_NGN_169

Collaboration:
NGN, Steven Vick International Ltd

Stage:
Implementation

Problem: During gas mains replacement projects, our engineers often encounter small out-buildings as they swap old metal pipes for new plastic ones. Traditionally, we've diverted mains around these garden sheds or garages, a time-consuming and sometimes messy practice which requires open cut digging that can create disruption for customers.

Solution: After a previous project developed a risk assessment, we've been exploring a process which allows us to safely seal the annular space between an inserted PE gas main and the old metallic host pipe, minimising the need to dig around the structure.

Working with specialist company Steve Vick International Ltd, foam is injected to fill this annular space, reducing risk and environmental impact as well as minimising inconvenience for customers. Three methods have now been developed to suit different types of main location. Following successful workshop trials the process has been trialled live out on the network and is already saving costs and valuable time allowing us to complete these projects more safely and efficiently.

Benefits: The solution allows us to carry out replacement works more efficiently and more safely, by reducing the need for open cut digging. That means less mess and customer disruption, and reduced environmental impact as we're sending less spoil to landfill.

What's next: Now trials are complete, we're implementing the solution. It will be rolled out as a bought-in specialist service later this year. Steve Vick International have developed a new way of mixing and injecting the foam in a portable way. Think of a weed-spraying backpack but with foam.

"When we were trialling the solution there was a lot of demand for it, and we can expect that to increase this summer as we're replacing mains in more gardens.

"This allows us to eliminate risk through less digging, and avoid creating mess and disruption that open cut can result in. But it also means we're reducing the time it takes to complete these jobs.

"For every 100 metres that takes seven days to open cut, insertion takes four. We calculated on one job in Leeds last year that over a total of 550m we'd saved around £87,000."

Neil Travers
Project Manager

- Ability to plan mains insertion without the need for open cut digging
- Ability to calculate savings based on number of built-over mains per project
- Reduced disruption for customers
- Increased efficiency
- Increased safety

Using the foam technology and insertion method saved

£87,000
on one of our gas mains replacement projects

Digital Pressure Test Alert

Project ID:
NIA_NGN_188

Collaboration:
NGN, ControlPoint

Stage:
Development and Demonstration

"The solution allows us to massively increase efficiency on these jobs, and reduce the time customers are waiting to be able to use their gas.

"It also ensures accurate data collection is uploaded live into our systems, and we can plan more effectively in terms of resource."

Chris Green
Project Manager

- Increased operational efficiency
- Allows purge and relight teams to mobilise accurate resource
- Reduced customer disruption
- Accurate data collection
- Cost saving through reduced remedial works
- Improved communication

Fact file

29,000 planned interruptions every year

Problem: When our teams relay a gas service, a test certificate is filled in to prove the pipe has been successfully completed before a Gas Safe Engineer can be dispatched to carry out a purge and relight in the customer's home.

This process relies on paper forms and a series of telephone calls, which means the information can take a while to be logged and customers wait longer for their gas to be switched back on.

Solution: Building on the success of WWU's pressure test, we've collaborated with ControlPoint to use this existing technology and produce a digital test certificate and live data we can directly upload into our systems. This removes a paper trail and prevents delays for our operational teams and customers in getting the gas back on.

The technology involves an adapted digital pressure gauge already employed on the network, and the same database used for the ControlPoint joint electrofusion.

Benefits: This clever device means we're cutting the time it takes between carrying out the relay test and our customers being able to use their gas. That's leading to increased operational efficiency, better resource planning, improved customer experience, improved communication and accurate data collection.

What's next: The project has been trialled by a team in our East Riding patch for the last 10 months with great success, proving the concept works. Field trials look set to follow and subject to business case approval, it's hoped the technology will be rolled out for use across the network.

iStop

Project ID:
NIA_NGN_213

Collaboration:
NGN, Gardner Denver

Stage:
Implementation

Problem: As part of everyday operations, our engineers need to use their vehicles for on-board power during emergency and repair works. While necessary, it's not an environmentally-friendly solution, so we've been trialling a clever way to reduce the impact deploying on-board power can have.

Working with Gardner Denver, we've installed iStop technology on three E&R vans across the network to understand how this can help us reduce emissions, minimise noise and save fuel.

Solution: The device detects when power hasn't been used for a certain time, then using simple stop-start technology, drops the revs down from 1600 to 1200rpm. The revs then return when power is required.
If rolled out across 200 new vehicles in future, iStop has the potential to provide significant fuel savings and reduce emissions.

After fitting data loggers to three Ford Transits, we captured important information helping us understand the average time power is required and used. The iStop was then installed in all three vehicles to log the power used, allowing us to map the difference to learn how much fuel we saved when the technology was deployed. Calculations showed iStop will produce an annual average saving of 61 litres in fuel per vehicle.

Benefits: The iStop technology can cut fuel use, fuel costs, reduce noise and harmful emissions, while allowing our engineers to carry out essential emergency and repair work, keeping customers gas supply safe and reliable.

"Finding ways to reduce the environmental impact of our fleet is hugely important as NGN looks towards a low-carbon future, and new technology allows us to explore this.

"iStop can make a difference, showing an annual average saving of 61 litres in fuel per vehicle every year and reducing noise as well, down from 1660 revs to 1200.

"It's an exciting prospect and we're planning to roll it out to 20 new vehicles from next year."

Mark Squires
Project Manager

- Reduced environmental impact
- Reduced fuel costs
- Reduction in noise
- Operational duties can be carried out as required

What's next: iStop is now a specification requirement for all vehicles requiring on-board power. It will be installed in 20 new vehicles from next year, making a valuable contribution towards minimising the environmental impact of our fleet.

Measuring the Societal Impact of Network Activities

Project ID:
NIA_NPG_013

Collaboration: NGN, Northern Powergrid, Northumbrian Water, Yorkshire Water, WRc, EIC, Collingwood Environmental

Stage:
Implementation

"As a first time Innovation Project Manager, I found representing NGN on the collaboration very rewarding. It gave me a great opportunity to work on something outside of my immediate role, develop new skills and meet new people from within NGN and externally."

Dean Pearson
Project Manager

- Greater value for money for our customers
- Minimising customer disruption
- Increased efficiency through better planning

Problem: Gas, electric and water networks are infrastructure essentials that keep our homes warm, lights on and cups full.

But most of us only become aware of them when supply stops, or works cause inconvenience.

It can be tricky to consistently evaluate and communicate the work utilities do, and plot out the best way to meet our responsibilities with as little impact on customers as possible.

Solution: This year we joined Northern Powergrid, Northumbrian Water and Yorkshire Water for a collaborative NIA project to help networks better measure the social impact of their activities on customers. Sharing knowledge around common problems allows us to evaluate social effects and adapt our processes to do things even better.

Experts from across each organisation - customer care, social strategy, environmental, construction services, economic analysis – were asked about how social impacts are measured and how highly their network prioritises them.

Responses were reviewed by WRc, the EIC and Collingwood Environmental Planning, who researched tools and techniques to measure these impacts. These were then scored in terms of importance, helping to identify gaps in current knowledge.

With such a wide range of activities, locations and communities, there is no off-the-shelf tool to fully assess all social impacts.

But by placing ten network activities in logical causal chains - a clear way of setting out each step of each process and showing its effects - the impact of each and who it affects can be mapped thoroughly and consistently.

This allows quantification, and where that isn't possible, qualitative evaluation means mitigation can be planned if the effects are negative. All this information supplements existing tools such as cost benefit analysis, but means important impacts other than financial benefits are captured.

Benefits: Working collaboratively with other networks gives us access to a huge pool of knowledge and experience, meaning we can solve problems faster and deliver greater satisfaction for our customers.

The project is delivering a better understanding of our communities, how our work affects the lives of those living there and how we can best support them.

Next steps: A final report is being compiled, recommending use, development and next stages required to complete a framework. We're also working on an implementation plan and sharing the learning with Australia Gas Networks.

Composite Repairs

Project ID:
NIA_NGGD0094

Collaboration:
NGN, SGN, Cadent, WWU National Grid Transmission, DNV-GL

Stage: Development

"Traditional methods of repairing our assets aren't always the quickest. Using an epoxy shell is a superb method but requires weeks to fabricate and install.

"The composite repairs technology can be completed at a fraction of the current cost, so the financial benefits are obvious."

Chris Rodgerson
Project Manager

- Time-saving and cost-saving method
- Reduced downtime
- Increased efficiency

Problem: We transport our gas through 1200km of high pressure pipeline, before the pressure is regulated for use by customers. Sometimes these thick metal pipes require repairs on above-ground bends and tees, which can be time-consuming and expensive to carry out, often taking weeks to complete using established methods.

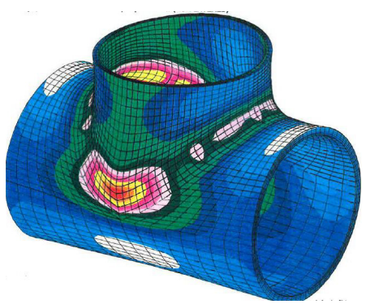
It's a problem which affects all the distribution networks, so we joined Cadent, WWU, SGN, National Grid Transmission and DNV-GL for a collaborative project examining a new repair method often used in the pipeline industry.

Solution: Composite material brings two different constituents together to create one stronger substance. For this project, pre-cut carbon fibre sheets were impregnated with resin, and wrapped around damage on a whole variety of complex shapes, until the desired thickness of repair is achieved. A bit like wallpapering, but with a hard and durable finish.

Left to cure, this creates a strong, lasting solution and a sound technical basis for all the GDNs to add a new repair method to the toolbox.

Benefits: This clever technique saves time and money, and means asset repairs can be completed much faster at a fraction of the cost.

What's next: Testing the method on a variety of complex shapes to verify the technology has produced great results. A methodology document is being developed to determine best practice and minimum thickness of a repair, while fatigue testing of composite repairs on forged bends has shown no degradation.



STASS (System Two Assess and Seal)

Project ID:
NIA_NGN_205

Collaboration:
NGN, Synthotech

Stage:
Development and Demonstration

"The robot is providing an agile solution for large diameter mains repairs while gaining visual intelligence of pipe condition to inform future decision making.

"This is being delivered by in-house craftsmen to help the way we approach high-impact works on large diameter assets."

Richard Hynes-Cooper
Head of Innovation

- Reduced need for excavation
- Increased operational safety
- Increased efficiency
- Reduced customer disruption
- Reduced environmental impact
- Maximised best-of-breed technology to better inform asset management and smarter ways of working

Problem: Our network contains around 1700 kilometres of large diameter mains which require regular upkeep and assessment; often a tricky and time-consuming process given their location underground.

Solution: To tackle this, we've worked with specialist supplier Synthotech to build a state-of-the-art, best of breed robot that can travel down our pipes and show us what's happening beneath the surface.

Transmitting live footage back to the operator via a special camera, STASS combines keyhole technology with bond-and-bolt pressure techniques, allowing engineers to assess the pipe from inside and then apply 'flexspray' to seal internal joints.

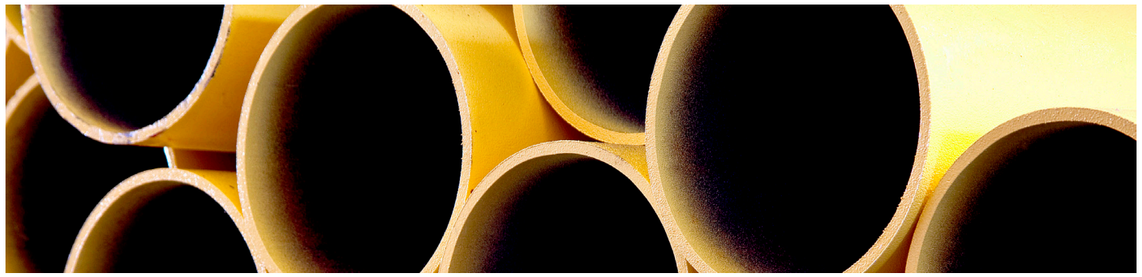
Benefit: As well as improving our asset management techniques, sending the robot inside our pipes is reducing the time it takes us to complete our jobs, from an average of three weeks down to just one, meaning we're digging fewer holes, creating less spoil and reducing costs. It's also improving safety by minimising the need to dig.

Not only is the robot preventing problems before they occur, it's also helping our Emergency and Repair teams locate gas escapes faster, reducing disruption for customers while increasing efficiency.

What's next: The robot is being trialled out live on the network, so we can further understand its most effective deployment.

05

THE FUTURE ROLE OF GAS



The gas network has a pivotal role to play in the UK's energy system of the future. We're developing a whole range of low carbon projects today in order to deliver cleaner, greener solutions for our customers tomorrow...

NETWORK INNOVATION COMPETITION

Every year, the gas networks bid for a share of £20 million Ofgem innovation funding, for flagship projects set to deliver environmental benefits, reduce costs and maintain security of supply as Britain moves to a low carbon economy.

Here's an update on our NIC projects...

H21 NIC

Collaboration: Cadent, Wales & West Utilities, SGN, DNV-GL, Health and Safety Laboratory

Problem: With the Climate Change Act committing the UK to an 80% reduction in 1990 carbon levels by the year 2050, the race is on to find sustainable, reliable and affordable forms of energy to power customer homes and businesses.

Solution: In 2016 we launched our pioneering H21 Leeds City Gate study. Based on a blueprint of the city of Leeds, this proved the gas network could be converted from natural gas to 100% hydrogen at a realistic cost with minimal customer disruption. Hydrogen is zero carbon at the point of use, producing just heat and water when burned.

Since 2016, H21 has moved on at pace. It's now a collaborative Network Innovation Competition programme involving all the UK gas networks, focused on delivering the essential safety evidence required for a 100% hydrogen conversion.

This work mirrors the government's own £25 million 'Hy4Heat' programme, designed to examine hydrogen for use in buildings, and stimulate manufacturers to produce hydrogen-compatible appliances.
Both projects will complete at the same time, and following field trials should deliver all the safety evidence needed for the government to progress towards a policy decision on hydrogen by the early 2020s.

What's happening now?: 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.

We'll be working with the Health and Safety Laboratory in Buxton to complete this, before exploring how natural gas and hydrogen behave in a range of simulated gas escape scenarios at DNV-GL's base at Spadeadam in Cumbria. Field trials will follow.

HYDEPLOY

Collaboration: Cadent, Keele University, ITM Power, Health and Safety Laboratory.

Phase: Development

Problem: The UK faces a stern challenge in the Climate Change Act, and with over 80% of the population using gas for heating and cooking, progress on decarbonising heat has been slow.

Solution: HyDeploy is exploring the potential for blending up to 20% hydrogen created by an electrolyser, to reduce carbon emissions.

This green energy trial will establish the level of hydrogen which can be safely used by customers with no need to change their existing gas appliances, and trialled on a closed network at Keele University's campus.

Benefits: If rolled out UK-wide, blending hydrogen with natural gas has the potential to save over 6 million tonnes of carbon every year. That's the equivalent of removing 2.5 million cars from our roads.

What's next: Appliance testing has been completed at the Health and Safety Laboratory, and subject to Health and Safety Executive approval, a live trial is expected to begin in June 2019.

City CNG

Problem: Transport accounts for a quarter of the UK's total greenhouse gas emissions, with heavy goods vehicles and buses a major contributor to poor air quality in our cities. But uptake of alternative fuels has been limited by a lack of infrastructure and vehicle choice.

Solution: To tackle this chicken-and-egg situation, we're partnering Leeds City Council and longer term the private sector to provide a high-pressure connection supplying gas to a compressed natural gas (CNG) filling station. CNG cuts nitrous oxides and particulate matter by 90% compared to Euro 6 diesel engines, and CNG engines are quieter too.

Benefits: Increased uptake of CNG can reduce emissions and noise pollution, helping to improve air quality and subsequently, public health.

What's next: Work on the site is expected to begin in late 2019. As well as providing the land, Leeds City Council are supplying a ready-made client for the station, by converting their fleet of bin lorries to CNG over the next five years.

Low Carbon Gas Pre-heating

Problem: To transport gas to homes and businesses across the North, we have to warm it up through a process called pre-heating. Although established methods such as water baths and boilers are effective, they can be energy intensive.

Solution: We commissioned a survey to explore alternative solutions, trialling new technologies Low Pressure Steam and Thermo Catalytic System against accepted methods to understand what works best.

Benefits: Exploring new sustainable and economical technology through suppliers not traditionally involved with the utilities industry could deliver significant efficiencies for the UK gas distribution business.

What's next: We'll be sharing the data live-streamed from each trial site later this year for the industry to learn from.

NIA projects
Building a hydrogen future

"It's vital that we invest in new technologies to help create decent, well-paid jobs and grow our economy.

I'm glad to see businesses in Leeds like Northern Gas Networks at the cutting edge and working towards a low carbon future.

Its innovative H21 project shows how the private sector can lead the way in helping reach our 2050 emission reduction targets.

It is crucial the government backs business with an industrial strategy that has a plan to create jobs and foster investment across the country at its heart."

Rachel Reeves MP
BEIS Committee Chair

H21

Project IDs: NIA_NGN_210,207,206,204

Building the case for a hydrogen future has seen our original H21 Leeds City Gate project spin out into five separate strategic Network Innovation Allowance projects, set to share learning over the next three years.

Drilling right down into the detail of how the gas network can be adapted to transport hydrogen, these expand on the blueprint of a Leeds conversion to understand how it can be mirrored in other major urban centres and determine the infrastructure required.

Taking centre stage this year is the H21 North of England project we're leading in partnership with global energy giant Equinor and Cadent.

This will set out the design requirements of the infrastructure necessary for large-scale hydrogen production, storage and transmission in order to produce a clean energy system providing heat for the North of England, including the major conurbations of Liverpool, Manchester, Leeds, Hull, York, Newcastle and Teesside. Central to this will be the requirements of carbon capture and storage infrastructure to ensure clean hydrogen.

We'll share the learnings later this year from the project that could present a credible 'first policy' option for government. In addition to this major study are four more projects...

- **H21 Domestic Metering:** We're working to understand the suitability of existing domestic and commercial meters, assessing their suitability for operation on a hydrogen network.

- **H21 Strategic Urban Modelling:** Examining how a 100% hydrogen conversion of the natural gas distribution networks would be carried out in other major urban centres in the UK. This has built upon the knowledge obtained in the H21 Leeds City Gate project to expand the modelling to the major urban areas in the North of England (Liverpool, Manchester, West Yorkshire, Hull, Teesside and Newcastle) and to Bournemouth, Bristol, Cardiff and Edinburgh. We're working with all the UK distribution networks to deliver this.

- **H21 Keighley and Spadeadam:** Designing and building test rigs to understand how hydrogen behaves inside current gas network infrastructure, to feed results into the H21 NIC project.

- **H21 Field Trials:** This will involve the creation of detailed designs for the build and construction of the H21 NIC project field trial sites.

06

A WHOLE SYSTEMS APPOROACH

"Gas networks can store vast amounts of energy, making them a key player in the energy system of the future.

By taking a whole systems approach, bringing the long term strategy, delivery and operational maintenance of the gas, electricity and transport systems together, we're more able to exploit the benefits of joining them.

This can help us answer the three elements of the energy trilemma: better costs for our customers, increased resilience and accelerated decarbonisation of heat, power and transport."

Keith Owen
Project Manager

"As part of our Industrial Strategy this Government is working closely with partners in the energy sector to position the UK at the forefront of global efforts to develop carbon-free energy solutions.

The InTEGReL project demonstrates how the private sector – working with the UK's world class Higher Education sector – can take a leading role in helping Britain reach our 2050 emission reduction target. This Government is committed to supporting low carbon energy solutions in the UK, and our recent £246 million investment in battery technology and £25 million in the development of hydrogen gas technology have been central to this."

Greg Clark, Secretary of State for Business Energy and Industrial Strategy

InTEGReL

Project ID: NIA_NGN_208

Collaboration: Northern Powergrid, Newcastle University

Stage: Demonstration

Problem: When it comes to future challenges, one of the biggest to date remains the 2050 Climate Change Act, and how we meet its low carbon requirements while continuing to provide a secure, affordable energy supply for customers.

But the challenge also presents an opportunity for transformational change delivering greater flexibility for customers. To explore this, we're harnessing knowledge from the power sector and academia.

Solution: In September 2017 we launched InTEGReL, our whole energy systems project at Low Thornley near Gateshead, in partnership with Northern Powergrid and Newcastle University.

InTEGReL is the UK's first fully integrated energy system development and demonstration facility, bringing gas, electric and transport (oil) together into one place.
InTEGReL will create more efficient ways to store and transport energy, and develop flexible, affordable solutions for the customer of tomorrow.
Benefits: InTEGReL is bringing gas, electricity and transport together to better understand how these systems merge together, and how to manage that interaction most effectively.

By exploring which energy technologies and solutions are needed most by customers, InTEGReL will help to deliver those at the lowest cost and help to drive a reduction in UK carbon emissions at the same time.

What's next: Working with Northern Powergrid and Newcastle University, the facility is focused on creating capability for battery storage and renewables and vehicle-to-grid charging systems, as well as exploring new energy solutions for customer homes.

ITM Power recently led a BEIS-funded Power-to-Gas feasibility study at the site, which revealed the gas network's capability for supporting this exciting technology. Through an electrolyser, surplus electrical power can be converted into clean hydrogen and stored inside the gas network. We'll be examining the next steps for this technology with ITM in the months to come.

Green hydrogen will be further explored on the site, along with advanced research and education facilities.

07

REVISITING **LAST YEAR'S PROJECTS**

A look back at 2017

Many of the NIA projects featured in our 2017 Summary continue to go from strength to strength, delivering major cost savings and making life easier for customers and colleagues.

HERE'S AN UPDATE...

Water ingress:

We're constantly exploring ways to minimise customer disruption from this industry-wide problem. Four separate tools have been developed to help us manage water ingress more effectively, and we're now in the process of implementing them into the business.

In addition to the PE syphon, we're continuing to work with ROSEN on several projects, to speed up the process of identifying and extracting water from the network.

Water volume calculator:

Using specialist modelling techniques, this tool can tell us how much water is likely to be inside the gas network after a water ingress incident, and how much we need to extract.

GIS Maps:

By cross-referencing Ordnance Survey maps and Environment Agency data, we're able to pinpoint likely locations of water ingress, enabling us to carrying out proactive repairs.

Portable dew point tester:

We're making use of old sensor technology which measures the moisture content of the gas. Used in conjunction with the environmental flood data tool it allows us to accurately identify where moisture is entering the network.

Syphon waste water:

Water extracted from a gas main is often contaminated and can't be disposed of in public sewers. Working with Capture Green, we're continuing to explore the potential for filtering this water on site, removing the impurities and therefore the need to tanker it away.

Back blade protector:

This simple piece of recycled digger track is so effective it's now saving us £300k a year.

Fitting the protector to a mini digger's back blade not only prevents damage to the highway, but reduces customer complaints and makes use of sustainable materials.

We've been rolling it out to all our diggers over the last year and the protector has also attracted interest from other networks.

OptoMole:

Using the latest probe technology to detect gas in underground telecoms ducts, this fibre optic gadget delivers instant readings.
With a cable extending 100 metres, OptoMole is locating escapes faster, reducing our need to dig, minimise disruption for customers and ensure greater value for money.

Working collaboratively alongside WWU, Cadent and the EIC, field trials have proved the technology works. There's more work to do to understand the applications in which it can be most effective, so the next steps will involve a solo trial on the NGN network.

Alternative ECV Exchange Kit:

Emergency control valves are designed to shut off the gas to a property in an emergency, but occasionally they need replacing. This can be a tricky and disruptive process, particularly if the meter is partially buried.

Two NGN colleagues developed a clever system to carry out replacement more efficiently on semi-concealed meter boxes, through a stopper which is threaded into the service pipe and then inflated – capping off the supply without the need to dig down.

Thanks to collaboration with WWU and ALH Systems, this kit saves around £300 per job, and £60,000 per year. It's now been implemented as business as usual on live jobs around the network.

Health and Safety Monitor:

The health of our engineers is central to success of NGN gas network operations. But exposure to noise and vibrations can lead to long-term health conditions such as industrial deafness and HAVS (Hand Arm Vibration Syndrome) if not properly managed.

To prevent this, we've been working with specialist supplier J3llyh34d to develop a prototype wearable health monitor packed with sophisticated sensor technology.

Worn like a wrist watch, it records real-time data by logging exposure to noise and vibration while measuring body heat.

Early testing delivered impressive results and the monitor is now undergoing further development before a wider live trial involving colleagues on the network.

Northern Gas Networks
1100 Century Way,
Thorpe Park Business Park
Leeds, LS15 8TU

@NGNgas
/northerngasnetworks
northerngasnetworks.co.uk