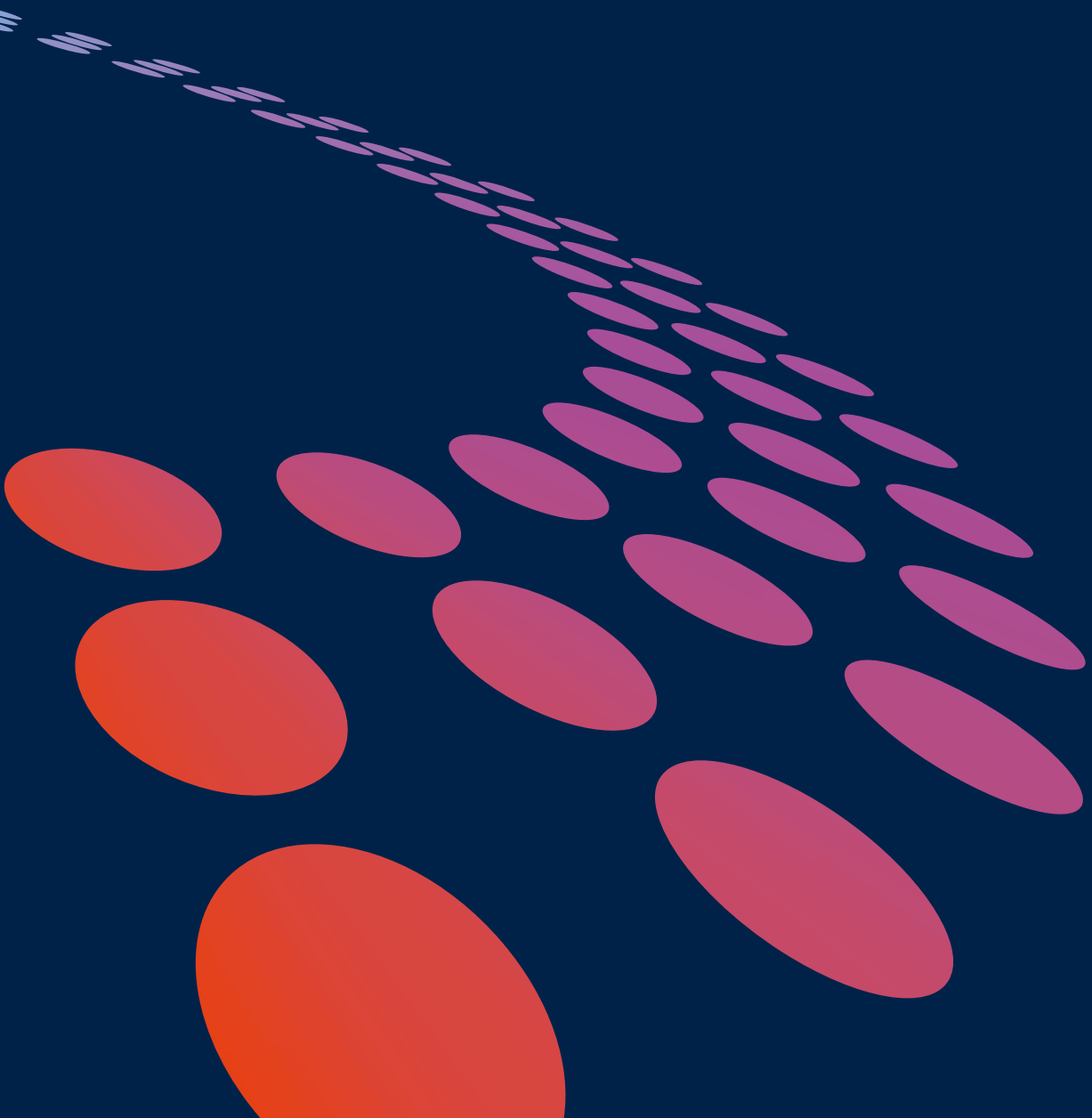
SGN

Your gas. Our network.

Network Innovation Allowance Annual Summary 2013/14



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“Innovation is now very much at the core of everything we do.”

John Morea, Chief Executive Officer, SGN

Foreword

Welcome to our annual summary of Network Innovation Allowance (NIA) activity for 2013/14. For us, innovation is a new way of doing something which adds value to both our customers and our business and it is now at the core of everything we do.

In our first year of NIA funding, we have commissioned 38 projects with around a third being commissioned through collaborative partnerships with the other Gas Distribution Networks (GDNs). Collaboration, sharing ideas and learning towards common goals is at the heart of what we do. Embracing innovation is part of our vision to go above and beyond in the delivery of gas by leading the way in engineering.

We have utilised the NIA to deliver a strong, well-balanced portfolio of projects which has allowed us to advance industry knowledge, technology, competition, products and services, and develop new ways of working. We firmly believe this portfolio demonstrates learning that will provide positive contributions to the challenges faced by Great Britain's (GB) energy sector.

John Morea
Chief Executive Officer

We commissioned 38 innovation projects in 2013/14

Executive summary

This is the first annual summary to be produced under Ofgem's NIA. Our approach to innovation is stimulated by a clear vision: to add value to our customers and our business.

RIIO

RIIO (Revenue = Incentives + Innovation + Outputs) is Ofgem's (the energy regulator) framework for setting price controls for network companies. This price control period runs for eight years from April 2013 and as such, Ofgem has published its final proposals for the revenue we will receive over that time.

RIIO is designed to encourage us to:

- Put stakeholders at the heart of our decision-making process
- Invest efficiently to ensure continued safe and reliable services
- Innovate to reduce network costs for current and future consumers
- Play a full role in delivering a low carbon economy and wider environmental objectives

We have reassessed our strategy to meet the unprecedented challenges of securing significant investment to maintain a reliable and secure network, and deal with the changes in demand and generation that will occur in a low carbon future.

The opportunity presented to us

Innovation is a key element of the new RIIO price control. The introduction of Ofgem's innovation stimulus package provides new funding opportunities, enabling us to broaden our areas of focus and continually deliver innovation as part of our normal operations. There are two funding incentive mechanisms available from Ofgem:

- Network Innovation Allowance (NIA) – to fund smaller innovation projects which will deliver benefits to customers. This equates to 0.5% of our revenue
- Network Innovation Competition (NIC) – an annual competition to fund selected flagship innovative projects which deliver low carbon and environmental benefits to customers

"Innovation is an essential ingredient in the delivery and outperformance of RIIO."

- John Lobban, Managing Director, Scotland, SGN

Where do we currently stand?

We were prepared for the introduction of NIA and during the first year we focused on leading innovation in the gas industry. Our growing portfolio demonstrates the diverse areas of innovation we are working on. We have established constructive relationships with key gas industry suppliers, Small and Medium Enterprises (SMEs) and academic institutions across the energy sector both in GB and overseas. Significant new learning has already been achieved and our projects reveal to our stakeholders how we are spending customers' money effectively.

Total expenditure of £3.549m on effective and efficient NIA projects in 2013/14

NIA Expenditure for 2013-14

This year's NIA portfolio aims to provide positive contributions to the challenges faced by the GB energy sector as a whole, both today and in the future.

How are we embedding innovation?

Innovation is now very much at the heart of everything we do.

“We strive to design projects to deliver outcomes, not merely outputs. It is essential that we maximise projects progress in to business as usual.”

Angus McIntosh, Innovation and New Technology Manager, SGN

We have a proven track record under the Innovation Funding Incentive (IFI) of embedding innovation into ‘business as usual’ leading to better solutions and cost efficiencies for our customers.

Throughout 2013/14 we have fully implemented a number of successful innovation projects, such as new kits and equipment for 500 engineering teams following the successful 20mm serviflex pipe in 1¼” metallic services project and the roll-out of 50 mains inspection camera kits for both metallic and plastic pipes.

Knowledge dissemination

We make sure that we fully engage with the other GDNs, share project findings and results, along with disseminating learning as part of our commitment to the GB gas consumer.

The images show our innovation team sharing knowledge on site with National Grid (NGG) on the mains inspection cameras project funded under IFI, with Northern Gas Networks (NGN) on Core and Vac and also with all the networks on site at our **NIA_SGN0019 - Large CISBOT** trial in London.

30%

of projects in 2013/14 have been funded collaboratively

1. **GDN technical visit to our Large CISBOT site**
From the left: Greg Penza (ULC), Angus McIntosh (SGN), Alec Breen (NGN), Rob Kodadek (ULC), Paul Slater (NGG), Robert Ben (NGG), Pat Nathan (NGG), David McLeod (SGN) and Ian Marshall (Wales and West Utilities) not shown.

2. **National Grid visit Edinburgh**
Angus McIntosh (Innovation and New Technology Manger, SGN) and David McLeod (Innovation Delivery Manager, SGN) shares the learning from our IFI mains inspection cameras project with Andrew Newton (Innovation Project Manager, NGG) and Darren White (Innovation Portfolio Manager, NGG).

3. **We travel to Yorkshire**
Our Core and Vac team work in collaboration with NGN to demonstrate the benefits of combining two innovative technologies together.

About us

We provide a safe and reliable gas supply to each of our 5.8 million customers through 74,000km of gas mains services and are the second largest gas distribution company in GB.

Formed in June 2005, we are owned by three shareholders - SSE plc (50%), Borealis Infrastructure Europe (UK) Limited (25%), which is indirectly wholly owned by OMERS Administration Corporation and OTPPB Investments (UK) Limited (25%), which is owned by Ontario Teachers' Pension Plan Board.

By actively engaging with and helping our customers, our environment and our communities, and by demonstrating the highest standards of safety, reliability and efficiency, we aim to become GB's leading gas network operator.

Our people take pride in making a real difference, continuously improving and innovating. We are committed to delivering excellent customer service in all areas of our business.

We have, with our project partners, won 10 industry awards for our innovation projects since the start of 2013

A clear vision

Our innovation activity is stimulated by a clear vision: to add value to our customers and our business.

To achieve this strategic vision, we have set out an innovation strategy to do a number of things:

- Improve the way in which we work to be more efficient, more customer focussed, less disruptive whilst carrying out streetworks and reduce our carbon footprint
- Support entry into the network from renewable sources of gas and support the low carbon economy
- Open up competition in gas markets through widening the range of gas quality that can be distributed
- Support integration of hybrid renewable technology into the gas distribution network

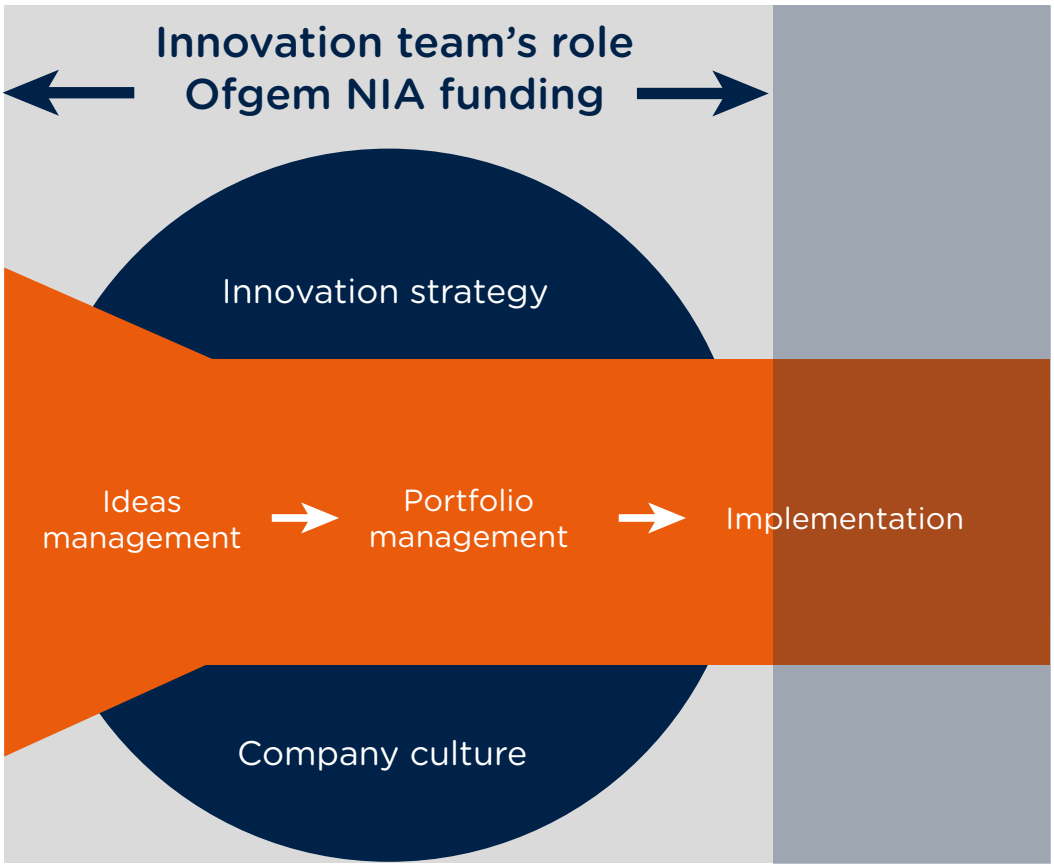
Innovation process

To support this strategy we adopt both a proactive and reactive approach.

We run a suggestions scheme, called Ignite (ignitescheme@sgn.co.uk), for our staff and increasingly for our project partners, suppliers and anyone else who wishes to make a suggestion, offer a new product or share an idea.

We are proactive in seeking new innovations, through our industry watch regime, our external memberships with greater access to SMEs, and most successfully through tendering the industry issues to our ever increasing array of project partners.

We also have a dedicated Public Affairs and Policy Manager to ensure we have a focus on emerging trends in and out of the energy sector within GB, European Union (EU) and worldwide markets. Our senior managers receive regular updates and through our participation in and contribution to key industry working groups where we are able to contribute to key debates.



We have a dedicated and established innovation team whose role is to manage these ideas and opportunities, both from internal and external sources, co-ordinate their evaluation, prioritise and convert into value propositions (projects) that align with our innovation strategy.

Upon completion of these funded projects, the team support the implementation and execution of these new techniques, products or services within the business. Conversion of successful projects into business as usual is essential. It takes time to develop a culture where innovation is embraced at every level of the business.

In support of this we have an innovation board. The Innovation Board are engaged in delivering innovation throughout the business and provides the overall executive level control and guidance.

It's vital that our business embraces innovation and always looks for ways to improve how we do things in order to continually evolve.

The story so far

On 1 April 2013 we set out to achieve this vision with the launch of the NIA and we have accomplished a number of specific outcomes:

Our innovation team

We've created a team which ensures we have the right skills and expertise in place to support our innovation goals.

The number of SMEs and academic institutions we've engaged with over the last year has increased from 10 to 50.

Growth in the number of SMEs active in this sector and other associated sectors.

Our overall innovation portfolio, including potential new projects has increased from less than 40 in 2012 to over 250.

We've achieved this by focusing on building strong relationships with gas industry suppliers and widened our engagement with other industries and new project partners.

IGNITE

Innovating now

The number of external suggestions submitted through our Ignite suggestion scheme has risen from less than 2 to 10 per month on average.

Good ideas can come from many sources. Our popular Ignite suggestion scheme (ignitescheme@sgn.co.uk) allows all our employees and external stakeholders to submit ideas and suggestions. All ideas are welcome and do not need to be fully developed.

Our 2013/14 project portfolio

Facilitating knowledge transfer is one of the key principles of the NIA. It is vital the learning generated is disseminated as effectively as possible to ensure all network licensees (gas and electricity), and therefore customers, benefit from each project.

To support this dissemination, a learning portal has been developed on our behalf and that of the other network licensees. This is a website where external parties can access and gather more details on any of our projects, including progress and closure reports. For further information, please see the Energy Networks Association (ENA) learning portal online: www.smarternetworks.org

All our projects can be found under 'Gas Distribution' – from which there are eight technology research areas which contain the individual innovation projects. These areas were agreed by the GDNs as they all align effectively with each GDN's individual business plans and innovation strategy. The technology research areas are as follows:

- **Distribution mains replacement**
- **Emergency**
- **Repair**
- **Local Transmission System (LTS) and storage**
- **Pressure management, maintenance, electrical and instrumentation**
- **New commercial arrangements**
- **New and renewable gas sources**
- **Other**

The following section provides a brief scope of each individual project commissioned by us during the period 1 April 2013 and 31 March 2014. For each project the benefits have been anticipated and a Technology Readiness Level (TRL) indicator has been used to summarise the progress of the NIA activities in the formula year. We have also included six project snapshots in amongst the summaries, which cover a number of the research areas. These snapshots provide an opportunity to demonstrate the significant new learning and findings taken from each project.

Mains replacement

New learning Project Snapshot

"A strong bond has been built up between the Research and Development (R&D) team at Pipetech and the SGN Innovation team, which has really assisted in moving this project forward in a timely fashion.

The SGN team's engineering capabilities and understanding of technical requirements dovetail with Pipetech's creative thinking to ensure that the optimum product is produced and that training programmes are meaningful."

David Jeavons, Commercial Director, Pipetech Pipeline Technology Ltd.

Pneumatic PE pushing machine

Summary of progress: 5 → 6 → 8

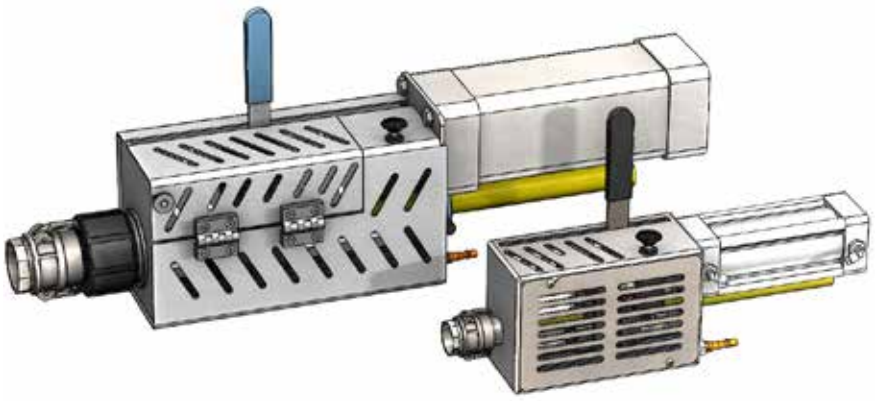
Project reference: NIA_SGN0015
Partnership: SGN and Pipetech Pipeline Technology Ltd
Project start date: August 2013
Research area: Distribution mains replacement

Progress of NIA activity in 2013/14:

In the 1980s a piece of equipment was initially developed to aid service insertion with Polyethylene (PE). The equipment was used in small quantities a number of years ago, but due to limitations with the design it was never developed to cover a broader range of service sizes reducing its use in the field.

The scope of this project is to improve and extend the design of the PE pipe insertion machine to enable PE pipe to be inserted back to the original meter position, to reduce the number of services re-laid to meter boxes and to reduce the number of services requiring copper outlet pipe re-runs.

Pre-production models have been produced and we are working alongside our project partner to agree an approved training package. This project will soon progress to field trial across our network locations, which will ensure maximum value can be taken from the field trial.



In partnership with

Technology Readiness Level (TRL)

TRL	Technology status
1	Basic principles observed and reported
2	Technology concept and/or application formulated
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NIA funding is based on TRL levels 2-8

Description of project	Potential benefits	Summary of progress

Bond and bolt saddle system

When conducting branch drilling operations to connect to or replace sections of metal mains, the full main must be excavated so a drilling saddle can be safely secured to the pipe. Over the years many companies have sought to develop and market new products for drilling on the gas distribution networks. In the past we have utilised managed services and equipment to perform branch drilling operations, particularly on large diameter mains. This project looks to design, develop and test a bespoke adhesive that will form a joint, which eliminates the need for saddles to be plugged off when conducting branch drilling. The solution has the potential to reduce the size of excavations required when completing branch drilling operations, which will in turn bring the time and cost savings that are already being achieved to a much wider range of applications.

- Awareness of a method and product for branch drilling operations that can be used on the low pressure and medium pressure networks across a range of sizes
- Understanding of the time, costs and benefits of the method and product
- Realisation of whether the methodology has the potential to be adapted to suit larger mains diameters

Cured In-Place Pipe (CIPP) Stage 2

The CIPP technique is a method whereby a host pipe is lined with a flexible tube which is impregnated with a thermosetting resin, which produces a tough pipe lining after resin cure. The resin may be cured using various techniques including steam, hot water and ultra violet (UV) light. A range of technical solutions are being considered including non-structural, semi-structural and fully structural, where the latter might be deemed a permanent replacement solution where it does not rely on the host pipe.

- A worldwide review of deployed systems in both water and gas sectors
- Proposed performance specifications and a best practice guide for deployment by GDNs
- Framework method of assessing the relative risk of deployed systems

Description of project

Cured In-Place Pipe (CIPP) Stage 2 (continued)

The project's focus is to demonstrate 'fitness of purpose' of CIPP lining technologies, focusing on iron mains of 8" diameter and above operating up to 2 bar pressure. The project will develop performance specifications and proposed best practice suitable for GB gas distribution deployment aligned to commercial and safety regulation regimes.

e-Pipe – Trial internal lining assessment and development of small diameter pipelines

The scope of the project is to further develop the e-pipe system – an internal pipe coating system which extends the asset's lifetime, currently in use in water systems, and adapt it for the gas distribution system. The intention is to allow internal risers inside high rise buildings to be coated internally.

The project will ascertain what resin developments are needed, what equipment designs need to be altered and what procedural processes need to be implemented. The development of the e-pipe product will be in iterative process based on the results of trial work.

Potential benefits

- Substantially improves the cost of the replacement of a gas riser
- Significantly increases the operational life of the asset
- Avoids major construction work on site, therefore minimising customer disruption

Summary of progress

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NIA funding is based on TRL levels 2-8

Description of project | Potential benefits | Summary of progress

Fracture Monitoring Using Acoustics

Under the Health and Safety Executive's (HSE) current 30/30 programme, funded by Ofgem, all cast iron mains within 30m of a property and must be replaced within the next 30 years. GDNs have to prioritise the mains which need to be replaced. A number of these mains are in highly populated areas and although they don't have known leakage issues, they still need to be replaced under the above requirement.

This project seeks to use a system designed by Syrinix to use acoustic technology to pre-determine locations to monitor metallic gas mains remotely and inform the respective GDNs of major leaks for immediate reaction.

- Ability to monitor large metallic LP pipelines over a variety of distances, ground conditions and locations for the first time
- Review and modification of pipeline replacement schedules and practices
- Ability to defer replacement of ageing mains either short term or indefinitely due to accurate monitoring

4 → 8 | 4

Gas Eco (GECO) Gas Pump

When decommissioning and abandoning gas mains and gas holders, gas is currently vented into the atmosphere. The environmental impact of this is substantial with natural gas being 21 times more harmful to the environment than carbon dioxide.

This project is to further develop an intrinsically safe gas pump, which will enable piped gas that would normally have been vented to atmosphere during decommissioning activities, to be recompressed and injected back into the gas network.

- Removal of environmental emissions associated with venting of gas mains
- Economic benefits of removal of gas loss quantifiable against the cost of gas
- Reducing potential for emergency calls, due to increased public confidence

6 → 8 | 6

Description of project	Potential benefits	Summary of progress

Microstop

Traditionally, risers in multi-occupancy dwellings are installed internally and failures can result in time off gas for multiple customers.

Microstop is a new innovative technique for flow stopping (diverting the flow gas around a section of pipework requiring maintenance or replacement while maintaining the flow downstream) on a network riser.

- A review of the manufacturer's specification, and its suitability to the GB gas industry
- Completion of extensive field trials to test the equipment in a variety of different scenarios
- Improved speed of operation and reduction in customer interruption time
- Resolve aesthetic issues with other live transfer techniques
- Maintain gas supplies whilst replacing below-ground riser section
- Reduce the amount of materials required to carry out riser replacement

Investment prioritisation in distribution systems

This project will consider investment planning and prioritisation of mains replacement within the gas distribution network, taking into consideration the approaches adopted by the UK water industry for water distribution networks.

Investment planning is the development of plans to deliver stable or improving levels of service to customers at appropriate levels of expenditure and efficient allocation of resources. These plans are justified

- Steer the future of investment planning practice for the gas sector
- Improve efficiency and effectiveness of mains replacement schemes
- Gain knowledge and experience of tried and tested approaches for investment planning based on service failure risk

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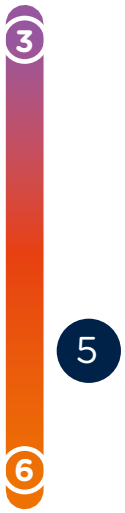
NIA funding is based on TRL levels 2-8

Description of project	Potential benefits	Summary of progress
Investment prioritisation in distribution systems (continued) to the regulators on the basis of current and future risk of service failure. Prioritisation of mains replacement is based on the implementation of investment plans to provide the required levels of service at least cost over the long-term.		
Polyethylene (PE) asset life research PE pipes, laid over the past 40 years, now constitute around 60% of the gas distribution supply networks. While confidence remains high for the long term integrity of PE pipe materials, it has to be recognised some parts of the installed network are now approaching their 50 year design life. This project will collect and analyse samples of pipes and joints across the network from a variety of locations, covering a range of polymers and installation ages and qualify the long-term service performance of these assets.	• Providing a scheme for ranking and managing risks to PE distribution networks • Demonstrate to regulatory authorities and other stakeholders that the control of PE assets is being maintained • Devising condition assessment methods for PE pipes and fittings • Develop best practice for managing the on-going and future integrity of ageing PE assets in a safe and planned manner	
Synthotech service relay initiative The scope of this project is to investigate and develop the capabilities of insertion of both live (1") and dead (¾") services with a corrugated dual wall liner that can easily be inserted from meter to main, around sharp bends without compromising the design life of the material.	• Significant cost reduction in the replacement of a service • Enables replacement of a service that is not otherwise possible • Replacement of a service to the existing position therefore avoiding pipe work re-runs • Reduction in average interruption time by 30% • Environmental impact reduced through a reduction in excavations	

Emergency

New learning Project Snapshot

“This completely new approach to leak location will enable rapid and accurate leak detection, minimising disruption, cost and ultimately providing increased safety to customers.”

Kevin Rackley, Technical Services and Support Manager, Crowcon Detection Instruments Ltd.

Portable ‘gas in ducts’ sample system

Summary of progress: 4 → 5 → 8

Project reference: NIA_SGN0017
Partnership: SGN and Crowcon Detection Instruments Ltd
Project start date: August 2013
Research area: Emergency

Progress of NIA activity in 2013/14:

The safety of our assets and those of third parties are of paramount importance. The use of plastic ducts to protect cabling situated alongside our gas mains is the preferred method for electrical contractors. However, on occasions, due to small leakages in our network and areas of exposure in the duct work, gas ’tracks’ into ducts because the open space inside is the path of least resistance. Gas leakage into ducts poses potential hazards to our operatives and the public at large; individuals could become exposed to large sources of gas trapped in concealed areas, and potentially it could enter neighbouring properties through the service ducts.

The current method of detecting the source of gas in ducts is to lift the duct maintenance covers to vent the gas. This breaks the path of the gas and the direction of the source of the leak can be determined. Once the section of duct with the source of the leak is identified, the only option is to use the process of elimination and dig on the line of the duct dividing the area into sections. This is a costly and time consuming method, and has the potential to cause high levels of disruption to the general public. Therefore a solution which allows gas to be detected from a distance with minimal physical disruption to the ducts is deemed advantageous to both our industry and customers.

Following an extremely productive partnership with Crowcon Detection Instruments Ltd, we have developed and delivered a unique solution for a robust and portable gas detection system. The project involved the design, prototype build, evaluation, enhancements, and final re-evaluation of 10 identical ‘suitcase’ systems which extract, condition and then report the presence of a flammable gas at very low concentrations.

As the detected level of gas increases, the system ‘switches’ the detecting mode to then report and alert the user to a higher gas concentration presence, therefore enabling our engineers to quickly and accurately identify gas problem areas and to instigate rapid corrective actions.

In partnership with CROWCON Detecting Gas Saving Lives

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NIA funding is based on TRL levels 2-8

Description of project | Potential benefits | Summary of progress

Customer self isolation and restoration (stage 2)

When a gas supply failure occurs it is necessary to isolate every customer at the meter before the network can be recommissioned. Studies have been carried out to investigate whether customers could carry out their own isolation and restoration in a protracted supply failure in order to reduce the duration of the incident.

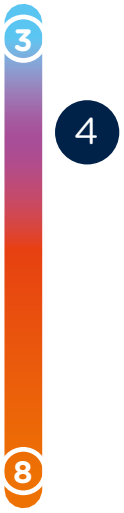
The purpose of this project is to analyse the recommendations provided by the HSE/HSL and modify the model as necessary to ensure the models can be integrated into the working environment of each of the network licensees

- Delivery of a robust safety management procedure that will allow customer self-isolation and restoration during major off-gas incidents
- Engineers can concentrate on works associated with more vulnerable customers'
- Duration of time off gas for customers vastly reduced

Optomole

The purpose of this project is to develop a mobile, optical methane sensing system which GDNs can utilise to quickly and accurately detect the location of natural gas leaks in ducts.

- Substantially improve the gas leak identification process and hence the integrity, safety and reliability of the gas network
- Faster leak location reduces methane (a potent greenhouse gas) emissions to the atmosphere
- Provide reductions in excavation and streetworks
- A technique which can be used with the minimal amount of training in order to give workforce flexibility



Stent bag

Impact damage to a pipeline or a gas main can lead to a significant escape of gas, a loss of supply and incur a significant financial cost, along with large customer impact.

This project specifically aims to provide a solution to this problem by developing an innovative stent bag system that can maintain gas supplies during high volume gas escapes and reduce the potential loss of supply to customers.

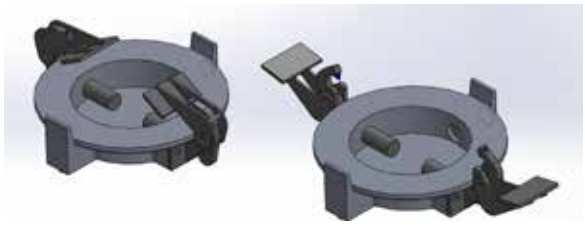
- Maintain gas supplies during high volume gas escapes
- Reduce environmental emissions through escaped gas
- Realise the economic benefits of reduced gas loss

Description of project | Potential benefits | Summary of progress

Tornado max

This project seeks to offer a new and improved piece of equipment which improves and extends the design and functionality of the Tornado air powered vacuum device. This is the removal of small quantities of water from pits and valve chambers, for purging redundant gas pipes and the removal of residual gas trapped in building voids to aid the re occupation of the residents.

- An improved reoccupation time for evacuated residents as a result of gas in properties
- Remove build up of gas from confined spaces in property structures and small quantities of water and grit from valve chambers



7 → 8 (7)

Water extraction reel and Y branch

A not uncommon problem on our networks is water ingress. This is often caused by water entering the gas mains due to third party damage or through small pockets of corrosion on metallic mains. This can lead to a loss of system pressure and a loss of supply to customers, both of which can have cost and safety implications. The scope of this project is to bring to the industry a new and improved piece of equipment to be used in conjunction with current mains camera equipment to detect and remove the water inside the low pressure network.

- Allows water ingress incidents to be dealt with only one excavation
- Faster and more accurate location and extraction of water
- Reduced operation times
- Improved outcomes for customers

3 → 7 (5)

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NIA funding is based on TRL levels 2-8

Repair

New learning

Project Snapshot

“Robotics is an obvious and viable progression for the future of the GB gas industry and aligns with our innovation strategy under RIIO.”

David McLeod, Innovation Delivery Manager, SGN.

Large CISBOT (Cast Iron Joint Sealing Robot)

Project reference: NIA_SGN0019
Partnership: SGN and ULC Robotics
Project start date: August 2013
Research area: Repair

Summary of progress: 4 complete 7

Progress of NIA activity in 2013/14:

We have a significant number of large diameter cast iron mains, many of which are prone to gas leakage. Necessary repairs or replacement can lead to intrusive streetworks, road closures, traffic jams, noise pollution and local disruption.

On 17 October 2013 along with New York-based project partners ULC Robotics, we carried out the first ever live robotic cast iron joint seal in GB. Over the four weeks which followed, the demonstration at Repository Road, Woolwich, South London was very successful. Eighty eight joints along a 24” diameter cast iron main were sealed over 20 days; at an average rate of 4.4 joints a day, all from only two small excavations and a single launch tube. CISBOT encountered no major issues with deployment, driving, and sealing.

We have led the way on robotic technology in GB, thanks to the trail-blazing partnership which has been developed with ULC Robotics. Furthermore, both parties have fully engaged with the other Network Licensees (who all attended the site trial) and we have ensured that learning has been appropriately disseminated as part of our commitment to maximise the benefits of trenchless technology.

The benefits:

- Proved this injection technique is more effective than external injection
- Monitors the flow and pressure sensors and the effects of the wicking around the joint can be visibly observed
- Robotic technology can greatly reduce inconvenience to the public and road users
- Makes work on the streets less visible to customers
- Decreases the amount of excavations required compared with other joint repair methods
- It minimises environmental impact
- Provides reliable information on asset conditions

In partnership with SGN (Your gas. Our network.) and ULC (Pipeline Robotics Energy Services Research and Development)

New learning Project Snapshot

"We have found SGN to be incredibly forward thinking and proactive in their attitude towards research. During negotiations, SGN has adapted their systems and contract requirements to help meet the challenges faced by micro SMEs."

Nick Ryan, Technical Director, Steer Energy Solutions.

Seeker particles

Project reference: NIA_SGN0012
Partnership: SGN and Steer Energy Solutions Ltd
Project start date: September 2013
Research area: Repair

Summary of progress: 2 complete 3

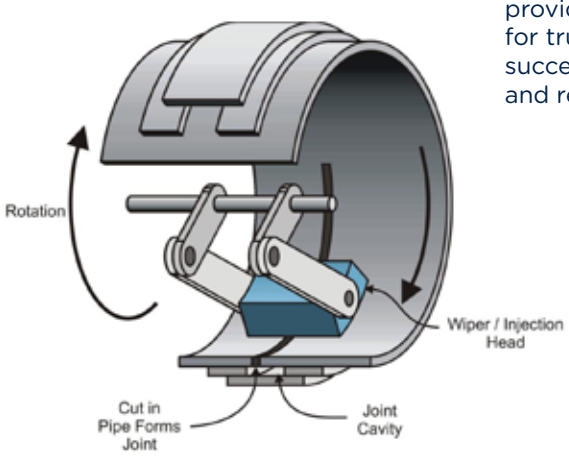
Progress of NIA activity in 2013/14:

There are a number of contributory factors to our direct carbon footprint; however, approximately 95% is from natural gas leakage. The majority of leakage is from lead yarn and mechanical joints within low pressure distribution networks.

In 2013/14, funded by the NIA, we commissioned a project in partnership with Steer Energy Solutions. This project involved a theoretical analysis to see if the saltation technique for particle sealing, successfully used in medium pressure gas leaks, would be adaptable for use in low pressure distribution networks. The outcome of the analysis was the pressures in low pressure systems are not sufficient to enable the particles to reach the top of the pipe and penetrate the leak site.

However, the study successfully identified three further cutting edge, innovative concepts which we are excited to be progressing with Steer Energy in 2014/15. These are; NIA_SGN0050 - Seeker Particles (Stage 2) which involves a liquid sealant being deployed from within the gas pipe directly onto the joint, NIA_SGN0056 - Aerosol Sealant – Stage 1A – Initial development which uses tiny flocculants of sealant transported in aerosol form, and NIA_SGN0057 - Gas polymerisation – Proof of concept which takes advantage of chemicals which are transported with the gas and react with the unique conditions found at leak points to create a gas tight seal.

We are fully supportive of work being carried out by SMEs and we aim to provide them with the freedom to carry out the blue sky research required for true innovation. The successful completion of these projects and their successors will enable the potential to significantly reduce our emergency and repair expenditure as leakage from joints could be eliminated.



In partnership with

Technology Readiness Level (TRL)

TRL	Technology status
1	Basic principles observed and reported
2	Technology concept and/or application formulated
3	Analytical and experimental critical function and/or characteristic proof of concept
4	Technology/part of technology validation in a laboratory environment
5	Technology/part of technology validation in working environment
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NIA funding is based on TRL levels 2-8

Description of project	Potential benefits	Summary of progress
Cast iron fitness for purpose (CIFFP) All the GDNs are investigating various techniques to assess the condition of Cast Iron (CI) pipes including coupon removal for localised metallurgy, internal pipe inspections (inner/outer wall corrosion, hairline cracks and induced strain) localised NDT (ultrasonic and magnetic flux for corrosion and pitting) and basic internal camera inspections. However, none of the projects make any quantitative assessment based on the individual outputs i.e. remaining life of the complete pipe section or current factor of safety with measured defects. This project is aimed to undertake an in-depth review and assessment of technologies and methodologies which provide intelligence on the fitness-for-purpose of CI pipe	• Evidence of national and global work on cast iron test assessments • Substantive and reliable data has been sourced on CI failure data • A suitable range of techniques which enables pipes of greater or lesser risk score or other risk factors can be assessed • Technically acceptable, cost-effective and practical decision support methodologies have been identified	
Internal stress corrosion cracking (ISCC) assessment work High pressure pipelines which were previously used to transport manufactured gas (e.g. town gas or reformer gas) can be subject to Internal Stress Corrosion Cracking (ISCC). There is currently no practicable industry guidelines for identifying whether a pipeline has the potential to contain ISCC and to assess the significance of any cracking found. This project will assess the extent of the threat of ISCC to the pipelines owned and operated by the participating GDNs, which will enable the requirements and benefits of further research to be confirmed.	• To identify whether a pipeline has the potential to contain ISCC • Provides information on the different types of manufactured gas, and which areas manufacture what type of gas in GB	

Description of project	Potential benefits	Summary of progress

Self amalgamating tape (stage 2)

We have an estimated 188,000 network risers within multi-occupancy buildings. There is a high inherent risk of major incident with this asset group. The majority of network risers are constructed of materials and fittings which are subject to deterioration and ultimately failure.

The aim of this project is to evaluate a solution to repairing screwed joints with a self-amalgamating tape.

- Demonstrate onsite suitability as a temporary repair technique
- Demonstrate repair longevity or otherwise
- Increase in productivity
- Avoid high cost associated with riser replacement

5 → 6 → 8

Small pressure pot

As of August 2013, we had 3,583km of iron mains greater than 8" in diameter (tier 2 and 3). Many of these ageing joints are now starting to leak.

The most common method of remediating these joints is to excavate around the joint, drill into the cavity and inject sealant using a hand powered gun. This method is effective for tier 1 mains (8" and below) but for larger diameters more than one injection point is required to ensure the full circumference of the joint is sealed which requires larger excavations, making this method incompatible with keyhole activities.

This project aimed to develop a portable mini pressure pot capable of injecting sealant at an adequate pressure to require only one injection point to successfully seal tier 2 and 3 mains thus complementing keyhole excavation.

- Cost-effective solution for sealing joints
- Compatibility with keyhole activities and therefore reduced excavation
- Minimised stakeholder disruption

4 → 8 complete

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NIA funding is based on TRL levels 2-8

Description of project

Potential benefits

Summary of progress

SynthoTrax I-Seal robot (technical feasibility study)

The scope of this project is to carry out a feasibility study to investigate the technical potential to develop a robotic system which can remotely travel to, locate and seal leaking joints from a single live access point.

- Understand the feasibility of inserting a robot into a gas main to perform a technical operation
- Manage risk associated with leaking tier 3 (18-48") mains
- Investigate the differences between robotic technologies and classical sealing methods i.e. main spray, encapsulation etc

2 → 3 complete

LTS & storage

Description of project	Potential benefits	Summary of progress

Diurnal storage (phase 2)

To understand factors which influence the storage requirements, aiding a GDN to make efficient investments or flex bookings and demonstrate regulatory compliance.

This project is for the development of an application decisions will provide a better analysis tool for determining storage requirements.

- Improved understanding of the factors that influence the storage requirements
- Better network planning performance and by improving the information available to system operation
- Enables more efficient and accurate use of diurnal storage

Beyond visual line of sight aerial inspection vehicle

The scope of this 18 month programme by VTOL Technologies is to develop a Remotely Piloted Aerial System (RPAS) Beyond Visual Line of Sight (BVLOS) specification which is endorsed by the Civil Aviation Authority (CAA) and which can then be used to develop a RPAS BVLOS system (not part of this project).

- Allows for future use of Remotely Piloted Aerial System to relay asset integrity within remote locations
- A specification(s), confirmed by the CAA which is one step towards developing a RPAS BVLOS for which CAA approval can be secured

Technology Readiness Level (TRL)

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Pressure management, maintenance, electrical and instrumentation

New learning Project Snapshot

“This project has produced equipment that has been deployed and proven that it is possible to map >95% of the internal surface of an Orpheus regulator module.”

Ian Moore, Business Development Manager, James Fisher NDT.

Corrosion mapping system for buried Orpheus regulators

Project reference: NIA_SGN0005
Partnership: SGN and James Fisher Nuclear Ltd
Project start date: January 2013 (Commenced under IFI)
Research area: Pressure management, maintenance, electrical and instrumentation

Summary of progress: 2 complete 4

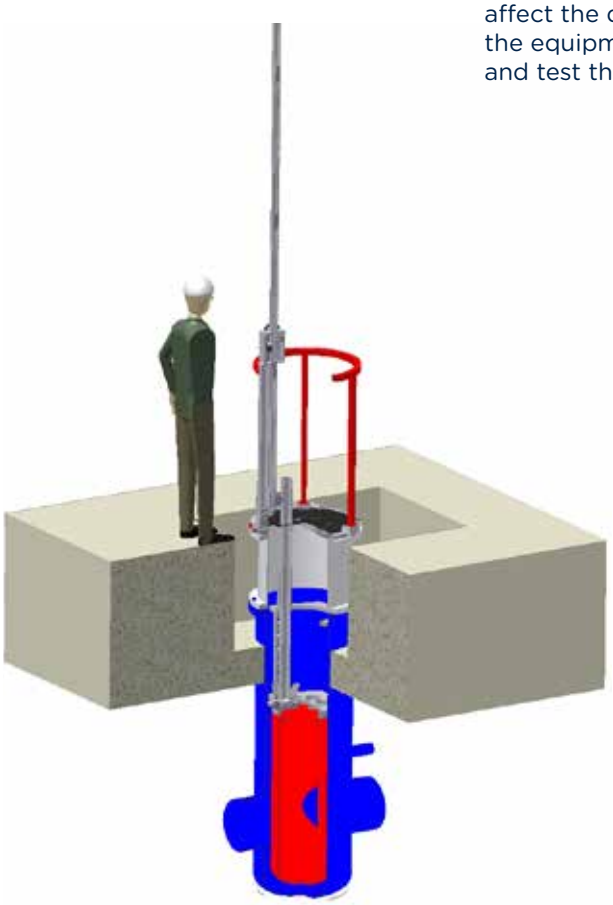
Progress of NIA activity in 2013/14:

From January 2013 to March 2014, we’ve been working with our project partner James Fisher Nuclear Ltd. The aim has been to minimise the completion time and the operational activities associated with the maintenance of buried Orpheus regulators where cathodic protection (CP) has not been applied or has failed. In such cases, a detailed ultrasonic inspection should be carried out at a frequency not exceeding six years.

The development of the equipment through the trialling phases, with associated redesign and rework, was considerable but managed to take the equipment to the point where a set of full, replicable and reliable scans were obtained.

After the four trial runs and numerous design improvements to the equipment, full data scans of the internal surfaces indicate the entire internal surface can be scanned within three working days.

It is recommended a future stage project is required, as there are still some key risks associated with the current unknowns regarding Orpheus module installation and variations in ‘as installed’ configuration. The equipment is dependent on some key dimensions so any variance in these could adversely affect the deployment system. Further design work could be useful to reduce the equipment’s sensitivity to dimensional variance and improve the data set and test the equipment for durability prior to carrying out field trials.



In partnership with SGN (Your gas. Our network.) and jf nuclear

New learning Project Snapshot

"Participating in the NIA-led project allowed Abriox to demonstrate the advantages of our new OSPREY® Pressure validator. SGN supported Abriox during the pilot trial and provided expert advice and opinion enabling Abriox to successfully refine and launch the product to market."

Richard Williams, Sales Manager, Abriox.

Osprey pressure validator

Summary of progress 7 complete 8

Project reference: NIA_SGN0021
Partnership: SGN and Abriox
Project start date: September 2013
Research area: Pressure management, maintenance, electrical and instrumentation

Progress of NIA activity in 2013/14:

Network validation based on a comprehensive knowledge of pressures across our networks is fundamental to all of our reinforcement, replacement and pressure management design and asset investment. Historically, accurate validation has been recorded through data loggers, located at key locations across our distribution networks with our engineers visiting these sites annually to download pressure data.

In September 2013 we commissioned a project to field trial a remote, wireless, intrinsically safe, Global Positioning System (GPS) enabled data logger, the Osprey Pressure Validator in a trial which sought to remove the manual handover processes. The field trial realised the technological and economic benefits of the removal of this process previously associated with logger downloads, as well as indicating benefits associated with poor pressure investigations and pressure management.

Following the trial, the use of Osprey loggers has been continued as 'business as usual' utilising the technological benefits on a day-to-day basis. Furthermore, in partnership with Abriox, we are looking at how remote units can be used in other aspects of the network to further push network integrity and optimal pressure management.

The benefits:

- Remote pressure data logger removes the current manual handover process
- Removal of lost logger assets through inbuilt GPS location system
- Instantaneous alerting of poor pressures mitigates potential loss of supply
- Greater accuracy in network validation allows for:
  - optimised pressure management - thus reducing leakage and environmental emissions
  - optimised mains replacement
  - reduced levels of mains reinforcement – resulting in less customer disruption

In partnership with

SGN Your gas. Our network.

ABRIOX

Technology Readiness Level (TRL)

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NIA funding is based on TRL levels 2-8

Description of project	Potential benefits	Summary of progress
Acoustic communications in gas mains We have a large number of leased telephone lines which are used to communicate with remote electronic equipment to monitor and control low pressure networks. These systems allow network pressures to be run at the safest minimum low pressure to ensure security of supply to the customer, whilst minimising gas leakage. Leased lines suffer from system disconnections and line faults, which often results in the loss of over extended periods of monitoring and control facilities with the consequence of higher network pressures and increased leakage. This project is concerned with developing an alternative communication method to interconnect pressure monitoring and control equipment.	• Understanding the acoustic characteristics of a typical low pressure gas network • Identifying the capability of the acoustic technique in a gas environment to provide a reliable communication medium • Highlights the requirements of equipment to receive and transmit acoustic signals • Produces and disseminates learning to other GDNs	2 2 3
Novel pressure reduction station (stage 1) We have a high percentage of below 7 bar pressure reduction stations that are over 30 years old and operate in harsh environmental conditions across our Scotland and Southern licence network areas. Many of these regulators are currently being scoped for replacement on the basis of safely and security of supply. Considerable energy is currently lost in network pressure reduction, in an ideal design this energy would be recoverable and noise pollution reduced. There is potential for significant improvement in the design of replacement pressure reduction stations. As a result, this project aims to investigate a radically novel pressure reduction station design. for significant improvement in the design of replacement pressure reduction stations. As a result, this project aims to investigate a radically novel pressure reduction station design.	• Review of current global technologies for energy recovery, pressure control and energy storage which can meet the elements of the complete performance specification • Analyses potential devices, sizing, performance and economic factors • Determines the most advantageous device(s) to be integrated in new pressure reduction system design	2 2 3

Description of project | Potential benefits | Summary of progress

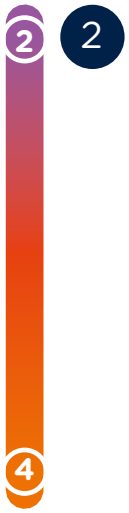
Oscillating energy harvester (phase 2)

We have a large number of low energy battery powered pressure data loggers and profile systems used for the monitoring and control of our low pressure networks in order to maintain security of gas supply while minimising gas leakage.

The battery life of this equipment is limited and involves regular replacement. Occasionally premature battery failure causes additional unscheduled visits and the loss of this essential equipment, resulting in elevated network pressures.

This project is concerned with developing a solution to extend battery life by providing a local low energy source to power data logger and profile equipment. The technique to be investigated is the Oscillating Energy Harvester, which generates electrical energy by recovering the kinetic energy in the gas flow.

- Environmentally-sound method of supplying low energy systems
- Production of reliable electrical power within a range of network assets for pressure and flow conditions
- Highlights the capabilities of the electronic interfacing circuits to regulate, control and store sufficient electrical energy to power data logger and profile control equipment



Starline/Marwin valve bolt replacement

Across many of our Pressure Reduction Installations (PRI) in Scotland, Starline/Marwin ball valves have been used in purge and vent lines.

We have found some of the bolts on these valves are suffering from corrosion and therefore in need of replacement.

For this project we are working in partnership with DNV GL to design, produce and test a prototype for a full bolt replacement solution which could potentially be used to replace badly corroded bolts on 1" Starline/Marwin valves while they remain pressurised (at pressures greater than 7 bar).

- Avoidance of stream isolation
- Minimises the impact and loss of supply to the network
- Reducing the effect on customers
- Substantial improvements to asset life

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NIA funding is based on TRL levels 2-8

New and renewable gas sources

Description of project	Potential benefits	Summary of progress

Unconventional gases within the onshore gas networks

There are currently no standards available for the gas collection pipelines for biogas and for injection of biomethane into the gas distribution network. In addition, there is currently no guidance document for the onshore shale gas industry. This feasibility study intends to address these gaps in standards and relevant documentation.

- New standards for biogas gathering pipelines and biomethane injection into the gas distribution networks
- Documentation for use within the onshore gas industry and a report relating to the impact of shale gas on the gas distribution networks
- Facilitate the associated financial benefits of introduction of a wider gas market

Other

Description of project	Potential benefits	Summary of progress

Asset health and criticality modelling

Ofgem recognises the significant work carried out by the GDNs to report asset health, criticality, probability of failure and deterioration. However, it was also recognised the framework utilised does not provide consistent results between the GDNs.

This project seeks to provide a new methodology for delivering the requirements for Ofgem reporting. This will involve the use of pioneering research into deterioration models and probability of failure analysis using nationwide data sets.

- Demonstrable models for deriving asset health, criticality, probability of failure and deterioration
- Provides a system that must be readily accessible and easily incorporated into the asset management working activities of all the GDNs

Cotter plate identification and remediation

Up until the early 1950s and particularly during WWII, 'Cotter Plates' were used to re-seal gas mains following a hole being made in the main (whether through operation, accidental or bomb damage). Cotter plates, although fit for purpose at the time have not aged well and as a result more often than not are a cause of leakage.

Unfortunately, due to a lack of historical records from these periods, the locations of these assets are largely unknown.

- Reduction of environmental emissions through leakage
- Operational risk removal through confidence in integrity of remediated Cotter plates

Technology Readiness Level (TRL)

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NIA funding is based on TRL levels 2-8

Description of project	Potential benefits	Summary of progress
Cotter plate identification and remediation (continued) The objective of this project is to first undertake a study to determine the potential location of these plates throughout our network. Future work may then be carried out to investigate the reliability of the method of locating Cotter plates, their condition and develop a cost effective methodology for remediation of the seal failure over external encapsulation.		
Development of DANINT FWAVC software for new gas chromatograph This project seeks to improve the data management of gas composition, calorific value (CV) and volume data in relation to metering errors by reviewing and trialing new software. It will look at a robust method of monitoring CV for the billing process and monitoring metering and gas quality data for detection and reconciliation of errors ensuring there is a reliable gas supply (by being commercially viable) which is in line with Ofgem's sustainable development themes. Importantly full resilience testing including simulations will test various scenarios.	• Improved accuracy of custody transfer metering • Reduction in metering errors • Operational costs avoided by reducing the number of required site visits	

Description of project

Potential benefits

Summary of progress

Immersion tube pre-heating

When gas experiences a deliberate reduction in pressure it expands and as a result it drops in temperature. This is known as the Joule-Thomson effect. Therefore, in order to prevent ice forming inside a pipeline which, in turn, could ultimately lead to a loss of supply, the gas needs to be pre-heated at pressure reduction stations prior to the reduction in pressure.

Conventional pre-heating methods in GB require a choice between age and complexity, using dated, inefficient, water bath heaters (WBH) or complex modular boiler heating systems (MBH).

This project is to develop and trial a pre-heater design which reflects the low lifecycle cost enjoyed by water bath heaters, while achieving modern standards of efficiency associated with condensing boiler pre-heat designs.

- Better thermal efficiencies than the current pre-heaters onsite
- Lower installed capital costs than modular boilers as a replacement option
- Lower operating costs than other systems currently available
- A reduction in fuel usage
- Reductions in carbon emissions
- Improved system reliability and design life as compared with modular boiler pre-heating plants

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NIA funding is based on TRL levels 2-8

Description of project

Potential benefits

Summary of progress

Orifice plate deformation

Orifice plate meters form a substantial part of National Transmission System (NTS). The plates need to satisfy numerous criteria such as flatness, edge squareness, surface finish and any deviation from the standard can lead to metering errors which can cause under registration of mass flow.

This project aims to improve the measurement of volume and energy flow through orifice plate metering systems by ensuring that orifice plate deformation is calculated correctly.

- Improvement in the measurement of volume and energy flow through orifice plate metering systems
- Enables the calculation of orifice plate deformation to be carried out more accurately

Description of project

Potential benefits

Summary of progress

RCA GPS Survey

A large part of our business is based on replacing or laying new mains and associated infrastructure. As such, there is a constant stream of asset and project related data going out and coming back from the field locations where this work is taking place. At present we rely on paper based processes for communicating this information and updating our asset register.

The scope of this project is to work in partnership with hand held device and integrated software suppliers and to support the field trial of a GPS enabled device that will wirelessly exchange project and asset data with the exchange server running geospatially enabled automation software.

- Reliable and consistent communication from a live working environment
- Ease and speed of use in the field
- Time-stamped, location specific data using GPS
- Reduced timescales for projects
- Improved asset data handling through automation

Technology Readiness Level (TRL)

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Looking to the future

We aspire to grow our innovation portfolio and continue to generate significant new learning and implement projects throughout our business. Furthermore, we will continue to share project output and outcomes with other GDNs.

We are committed to driving innovation in pursuit of our customers' vision and embracing Ofgem's principles to work in the most efficient way, ensuring our customers gain best value for our investment. In the coming years, we will continue to deliver projects which have the potential to add value to our customers and our business.

Next steps

Much of our first year has been about building our capacity, making connections and expanding the breadth and depth of our portfolio. For the second year, our focus will be continuing to meet and exceed our innovation goals and achieve our potential. We are focusing our future efforts on four key strategic themes of activity:

A primary focus for us throughout 2014/15, along with delivering the projects presented on the ENA learning portal, will be to progress those completed projects that have provided significant new learning into 'business as usual'. As a minimum at this stage, this will include:

- NIA_SGN0019 - Large CISBOT
- NIA_SGN0022 - Small pressure pot
- NIA_SGN0021 - Osprey pressure validator

New projects

We are always looking for new partners and projects. If you have any ideas or suggestions which you think could have a potential to add value to our business and GB gas customers, please submit this through our Ignite scheme (ignitescheme@sgn.co.uk). Once we receive it we will respond in a timely manner. They don't need to be fully developed – we don't expect you to be manufacturing prototypes!

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 of course the other GDNs for their commitment and hard work throughout the first year of NIA (1 April 2013 to 31 March 2014).

“We are delighted that across the industry innovation is gaining momentum and look forward to building on the successes of the first year of NIA.”


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