Low Pressure Operational Business Plan

Innovation Annexe

Scotia Gas Networks
in partnership with Mutual Energy

Scotia Gas Networks

mutualenergy

Innovation is a new way of doing something that adds value to our customers and our business and it is now very much at the core of everything that we do.

Introduction

For us, innovation is a new way of doing something that adds value to our business and our customers. It can take many forms, from process improvements to the invention of new engineering techniques, products or services.

We have established constructive relationships with key gas industry suppliers, companies and academic institutions across the energy sector. Since 2008 we have commissioned around 150 projects to build a strong, well-balanced portfolio of projects that has allowed us to advance industry knowledge, technology, competition, products and services, and develop new ways of working.

Our projects are designed to deliver outcomes, not just outputs. We have a proven track record of embedding innovation into business-as-usual reflected in the cost efficiencies generated through successful innovation rollout, such as our 'Keyhole' combined core and vac technology, or through successful demonstration of enabling technology, such as the first ever GB biomethane-to-gas grid injection point in Didcot, Oxfordshire.

We are confident that there is significant opportunity for technology transfer from our current portfolio to any network we operate in NI. Moreover, we believe our resource, commitment and approach to innovation will allow us to develop a dynamic innovation strategy specific to NI, whilst continuing to lead the way in addressing the challenges faced by the UK energy sector as a whole.

Current innovation strategy – high cost areas, sustainability, enabling technologies

Our innovation strategy is aligned to the following desired outcomes:

- improve the way in which we work to be more efficient, more customer focussed, less disruptive whilst carrying out roadworks 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; and
- support long-term utilisation of the gas network by supporting the development of hybrid technologies.

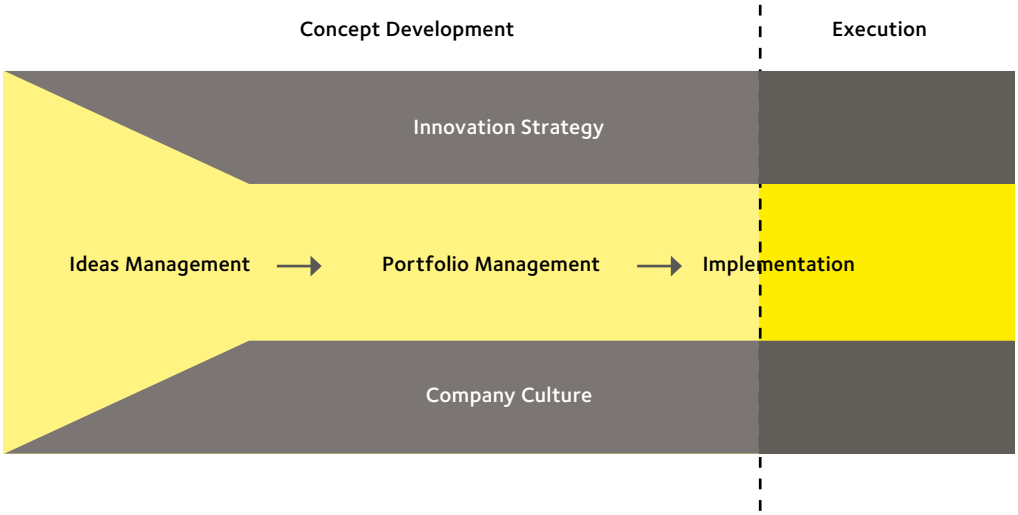
Innovation process

We adopt a proactive and reactive approach to innovation. We operate a suggestions scheme, called 'Ignite' 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 receive between 30 and 50 suggestions a month and one of our most recent has been to use QR codes on our signs and barriers so that smart phone users can interact with us and find the information they need about the business.

We are also proactive in seeking new innovations by scanning for opportunity by way of our industrywatch regime, through our external memberships which give greater access to SMEs and probably most successfully by tendering the industry challenges to our ever increasing array of project partners.

We have a dedicated Public Affairs and Policy Manager to ensure we focus on emerging trends in and outside of the energy sector within the UK, EU and worldwide markets – and through our participation in industry working groups , we are able to contribute to key debates.

Figure 1 – Innovation process



We have a dedicated and established innovation team. Their role is to manage ideas and opportunities, both from internal and external sources, co-ordinate their evaluation, prioritise and convert them into value propositions (projects) that align with our innovation strategy. Upon completion of projects, the team supports the implementation and execution of any new techniques, products or services within the business.

Conversion of projects into business-as-usual is essential. It takes time to develop a culture where innovation is embraced at every level of the business. To support this we have an Innovation Board which is engaged in delivering innovation throughout SGN and provides overall Executive level control and guidance. The Board:

- decides on innovation areas to pursue that may significantly reduce our operating costs or promote effective working and management of risk
- spreads innovation throughout the Company
- supports evaluation of ideas and suggestions
- ensures innovation projects are being properly progressed
- ensures any 'best practice' is spread across SGN as standard practice
- removes any blockages or barriers to implementation; and
- supports implementation and tracking of initiative effectiveness

The Innovation Board meets on a bi-monthly basis to review progress against the budget and plan, support major deliverables and provide input to risk and issue management. Particular importance is placed on managing the key dependencies between the different business streams to minimise potential delays.

History and capability – funding, opportunity, spend etc

Innovation is a key element of the Ofgem RIIO (Revenue = Incentives + Innovation + Outputs) model for price control; introduced in to the GB gas distribution market from 1 April 2013. One of the unique regulatory aspects was the introduction of the Network Innovation Allowance (NIA) and the Network Innovation Competition (NIC) for all network licensees, funded under the RIIO framework.

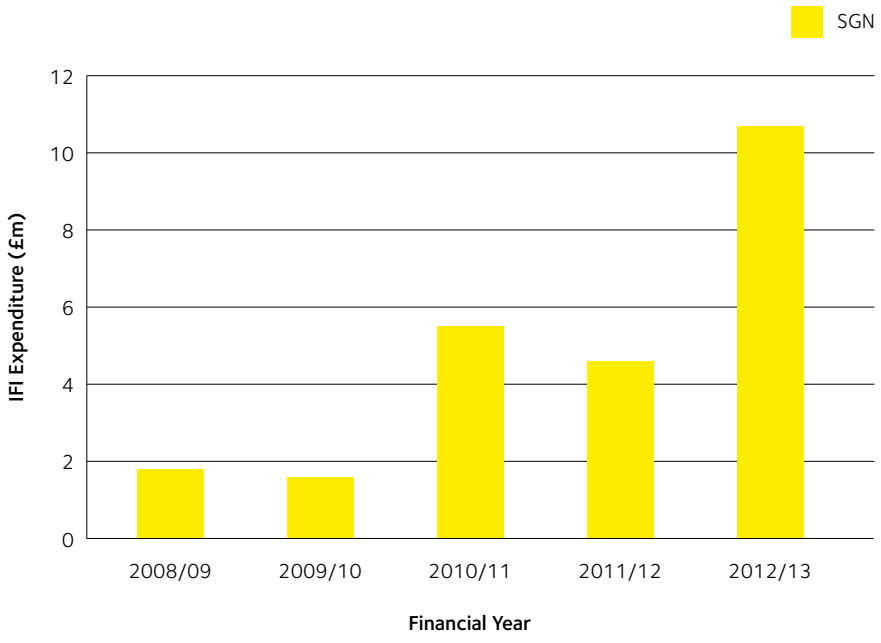
The NIA funds smaller innovation projects that will deliver benefits to customers as part of a RIIO-network licensee's price control settlement and also funds the preparation of submissions to the NIC.

The NIC is an annual competition to fund selected flagship innovative projects that would deliver low carbon and environmental benefits to customers.

The purpose of these funding mechanisms is to provide a consistent level of funding to network licensees to allow them to carry out research, development and demonstration projects that, when at an early stage, yield uncertain commercial returns.

We have steadily increased our innovation activity to around 0.5% of revenue year-on-year. As illustrated below, it has taken time to build our relationships and project portfolio.

Figure 2 – Innovation Funding Incentive annual expenditure



We already have around 40 new projects registered with Ofgem this year, and are the industry leader in the size and scale of gas distribution innovation projects in GB. Along with the other gas distribution networks, we publish all of our NIA-funded projects via the 'Smarter Networks' portal (http://www.smarternetworks.org).

In November 2013, we were awarded both of our NIC entries, securing some £9m of the total £15m awarded. The projects are summarised below:

- approximately £7m funding for 'Robotics' project. This innovative and world-leading project has the potential to allow extensive work to be carried out on the gas network without the associated disruptive road works. Its objective is to develop new robotic technologies which operate inside the live gas main which can remotely repair leaking joints and support our pipe fracture risk management process through enhanced inspection of our larger diameter pipes.

- approximately £2m funding for 'Opening up the gas market' project. The objective of this project is to demonstrate that gas which meets the European Association for the Streamlining of Energy Exchange-gas (EASEE Gas) specification but sits outside the characteristics of gas specified within the GB Gas Safety (Management) Regulations (GS(M)R) 1996 can be distributed and utilised safely and efficiently in GB. For this demonstration, we have a unique opportunity to utilise one of our discrete, isolated networks which we operate in remote parts of Scotland.

By opening the market to new sources of gas, this project, could reduce the cost of gas for customers by reducing the requirement for expensive processing and improve security of supply.

Existing projects – snapshots, transferability, evidence of implementation

In the pages that follow we have selected some projects that give a snapshot of the breadth of our approach to innovation and that we believe have relevance for the gas industry in NI.

Transferable projects snapshot

1 Leading the way in biomethane to grid

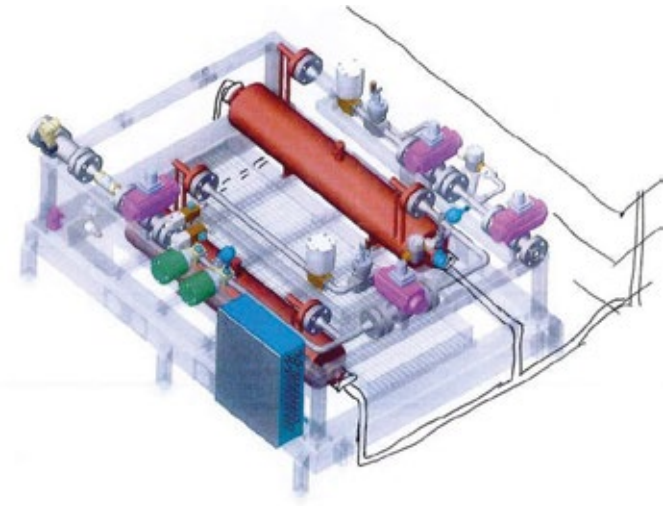
Not only were we involved in the UK's first Biomethane demonstration project at Didcot Sewage Works, near Oxfordshire, we were also instrumental in developing and installing the UK's first commercial 'biogas to grid' project at Poundbury estate near Dorchester. In both projects our essential and award-winning contribution related to cleaning the biogas, the quality monitoring of the produced biomethane, developing the network entry equipment and creating the functional design specifications to ensure the necessary monitoring, control and communication between the various installations. Building on these successes we now have 12 projects at various stages of commercial approval or technical discussion, with four expected to be injecting biomethane this year.

In addition to the technical issues we have resolved, we have identified a number of other challenges associated with biomethane 'gas to grid' injection:

- particularly for agriculturally-based digestors, it can be difficult to find connection points that are in close proximity to the plant and that operate with sufficient pressure and flow to allow the injection of the biomethane
- there can be planning constraints associated with building anaerobic digester facilities close to suitable network systems; and
- the additional cost of the propane required to bring the biomethane up to UK gas specifications.

These challenges can make 'gas to grid' projects uneconomic against the relative costs of using biogas to generate electricity. To dispense with the cost of propane for enrichment we carried out a feasibility study to look at the possibility of blending – or co-mingling – the biomethane with gas from the grid. We are now using innovation funding to construct an injection facility at a grid connection point with the necessary pressure and flow parameters to meet the dilution ratios required to protect the downstream network. The project is technically challenging and has involved rewriting engineering specifications on several fronts. Once complete the facility will have five loading bays with capacity to inject some 3,600 m^3/hr of biomethane into our network.

As the facility is remote from potential producers, to get the biomethane to the injection point, we are developing a 'virtual pipeline' concept that will see road tankers filled with biomethane travel from the producers' sites to the injection facility, where the biomethane will be introduced to the gas network. Our first producer is signed up and others are in discussions to use the facility. We firmly believe 'gas to grid' projects represent an example of innovation that is directly transferable to NI and could make a significant contribution to creating a sustainable future for the gas industry.



2 Transferable projects snapshot – turbo expander

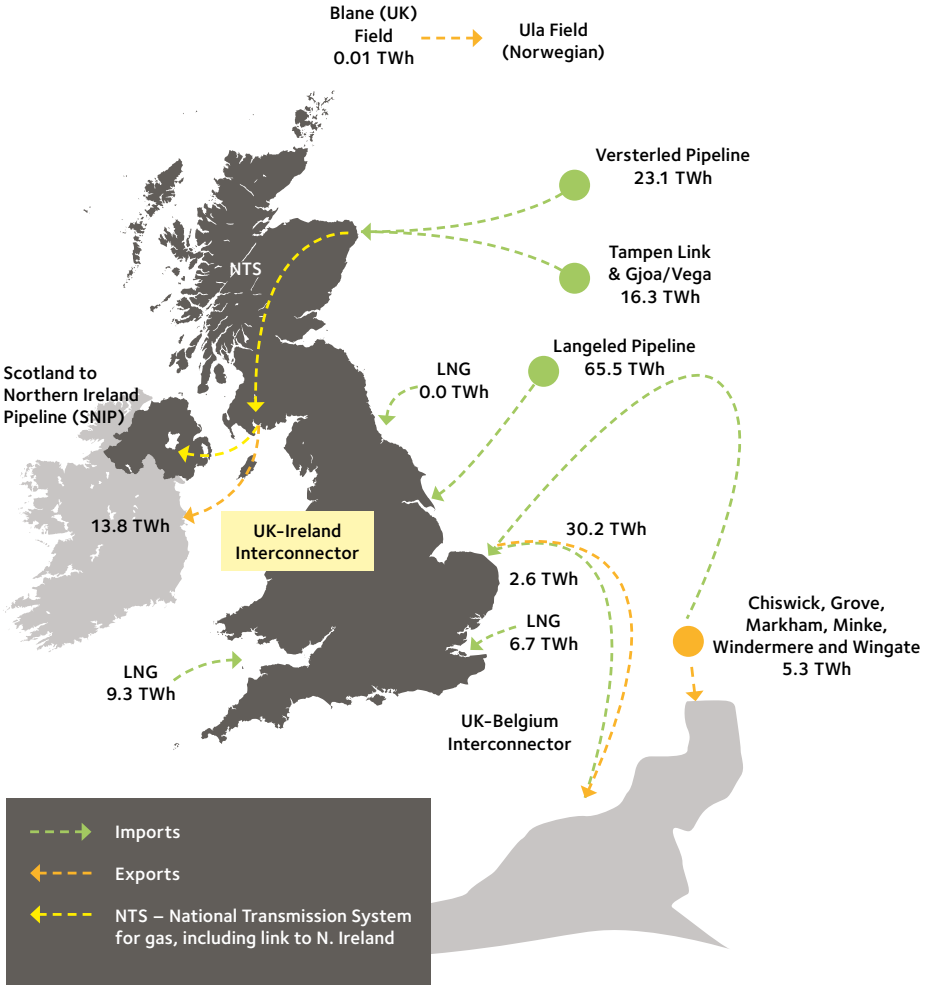
Pressure reduction installations are a normal feature of operating a gas network and the reduction in pressure affords the opportunity for energy harvesting (on a small or large scale).

At an existing pressure reduction site next to our St Mary Cray in south east London, we have built and now operate a 4.4MW turbo expander. While reducing the gas pressure the plant generates enough electrical power for around 5,000 homes and will be able to supply electricity for our office making the building carbon neutral. We have also installed a combined heat and power plant that will provide pre heat for the turbo expander and enough electricity for a further 2,000 homes.

3 Transferable projects snapshot – opening up the gas market

The UK is now a net importer of gas, with prices and access to supply increasingly dependent on international markets. This can make UK gas prices subject to volatility. While alternative supplies of natural gas are available, for example Liquefied Natural Gas (LNG) from America or new sources of gas such as shale gas, coal-bed methane, biomethane and hydrogen, they have different gas compositions, most of which are outside the prescribed UK specifications. They therefore require some form of additional processing before they can be used in the UK, which ultimately leads to increased costs for customers.

Figure 3 – UK import and export of gas Q1 2013



We operate a number of discrete, isolated networks in remote parts of Scotland. Our opening the gas market project will use one of these Scottish Independent Undertakings (SIUs) to test the introduction and use of gas that has a different specification to that of the rest of the UK. By opening the market to new sources of gas, this project could reduce the cost of gas for customers by removing the requirement for expensive processing and improve security of supply.

It could also open the way for decentralised networks to be constructed in remote areas that might be supplied by unconventional gases such as biomethane, coal-bed methane or shale gas. A successful demonstration could provide the justification to simplify and make less expensive the process and technology required to clean such gases for entry to the transmission or distribution system.

4 Transferable projects snapshot – testing Orpheus regulators

To maintain the integrity of buried regulator modules, they require Cathodic Protection (CP) and to have that CP monitored. Where CP has not been applied or has failed, a detailed ultrasonic inspection should be carried out at least once every six years. Conventional non destructive testing can take about three weeks and requires the unit to be excavated, grit blasted clean, inspected and assessed for corrosion, prior to being repaired (if necessary) and repainted. All of this can disrupt network operation and inconvenience customers.

We have been progressing an inspection technique that requires no excavations or grit blasting and can carry out internal long range NDT inspection of affected Orpheus modules. We expect the Orpheus Valve/Filter Corrosion Mapping project to be completed this year and bring:

- a considerable cost reduction against the current method
- reduce the test completion time from three weeks to a maximum of five days
- reduce inconvenience to customers
- eliminate excavations, bringing environmental savings and reduce waste to land fill
- 95% corrosion scanning of Orpheus 10 governors.

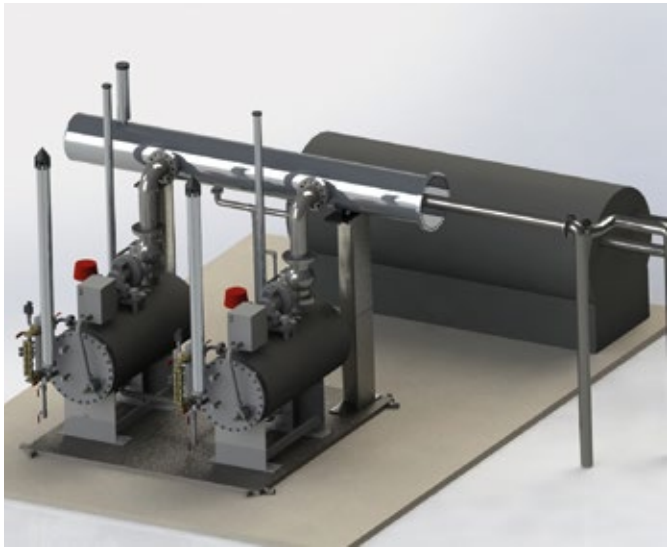
5 Transferable projects snapshot – introducing core and vac

Picking up on an idea from another GDN, our Innovation Team in conjunction with Operational colleagues developed a technique for small hole or keyhole working that allows mains repairs to be made without anyone having to get in the hole. The process involves cutting a circular hole core in the road, extracting the surface 'core' and excavating the ground below using an 'air pick' and a vacuum excavator. When the repair is made the excavated material is returned and the original core is replaced and sealed into place. Our particular innovation was to bring the different bits of equipment together in one vehicle and it has significantly reduced the time required and the disruption associated with conventional repair techniques, achieving in an afternoon what might previously have taken days.

We have worked hard demonstrating the benefits of the technique to roads authorities and have backed up our claims with independent testing. While some authorities are still to approve its use, we have been sufficiently encouraged by the results of our trials, to begin looking at developing new forms of keyhole tools and pipe bending techniques, through which we can extend its application to other forms of activity such as new connections or pipe installation.

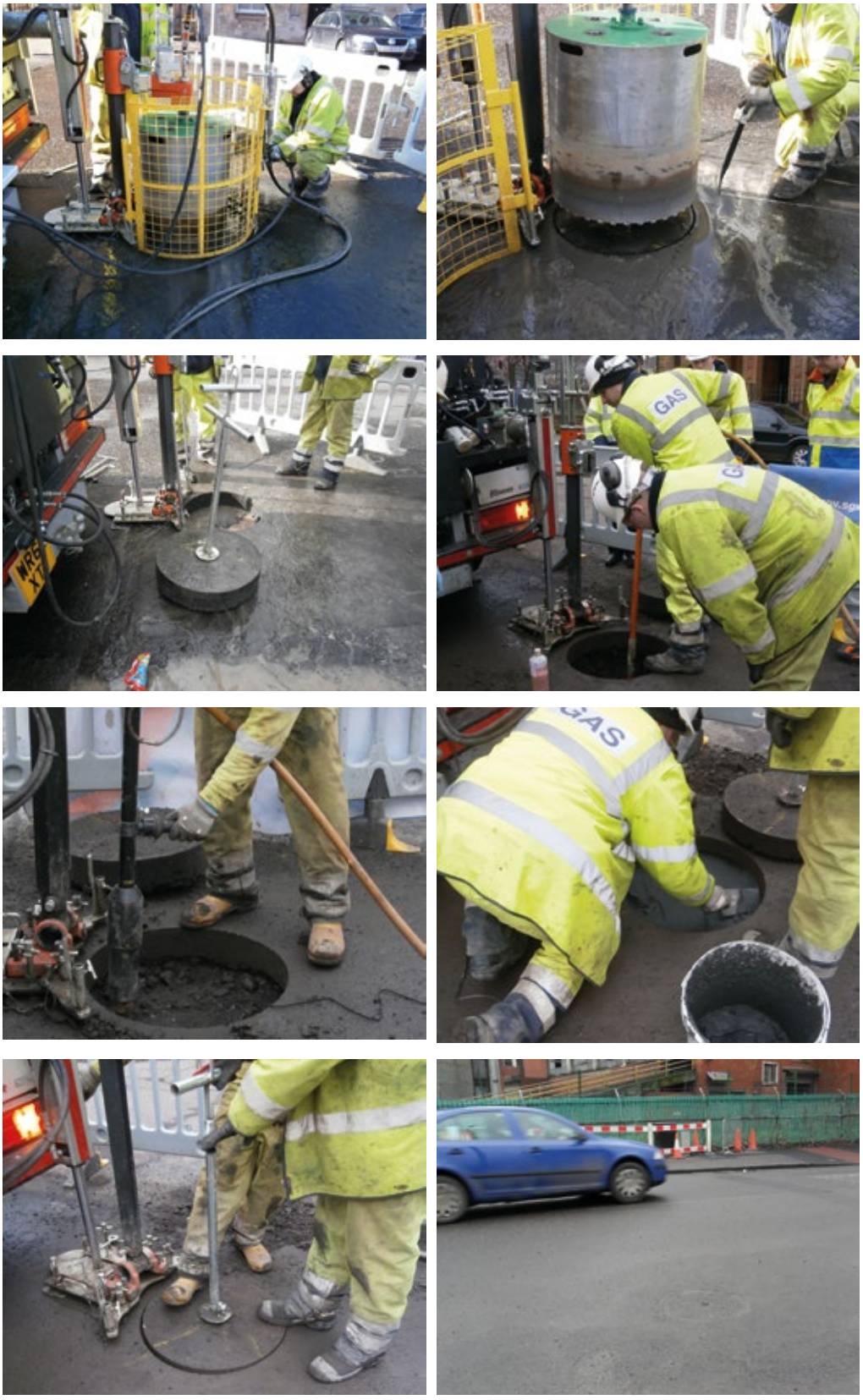
Immersion Tube Preheating Modifications/Field Trials

The Immersion Tube Preheating project supported the technical development of a new concept in gas pre-heating at pressure reduction sites called Immersion Tube Pre-heating and carried out field trials to assess its viability. The project has supported improvements towards the environment as the combination of reduced carbon emissions and reduced energy consumption made the new system more environmentally friendly than traditional pre-heating systems.



In addition to the economic benefits, the project had acquired the improvement in efficiency compared to WBH (50%), the improvement in efficiency compared to MBH (15%), a reduction in installation cost compared to MBH (30%), reductions in failures/ unplanned maintenance (75%) and the elimination of third-party maintenance (100%). This technology will be assessed as part of the design phase for West Transmission.

Figure 4 – Keyhole Excavation Cycle



Innovation Overview

Figure 5 – SGN Innovation Projects with the potential to transfer

We are confident there is significant opportunity for technology transfer from our current (and future) projects that will bring efficiencies to any network we operate in NI. In addition to the snapshots described above there are a number of other projects (for example pay as you go metering apps) that we believe would be relevant in an NI context and they are summarised below.

Project	Objective	Benefit
Alternative Outlet Pipe	Development of alternative copperwork that is made of fire resistant properties and is less value to deter metal theft.	Avoids metal theft and reduces cost of outlet pipework.
Cold Lay Tars	Develop an environmentally friendly cold lay asphalt containing no volatile organic compounds and that are more cost effective.	Possibility that this can be used as a permanent reinstatement method.
Alternative Reinstatement Materials	Develop alternative reinstatement materials and additives that are more environmentally friendly and cost effective.	Possibility that this can be used as a permanent reinstatement method.
Keyhole Mains and Service Moling	Develop a vertical entry moling system to allow installation of new mains and services through keyhole.	Reduction in customer impact.
Keyhole Tooling	Develop keyhole tooling allowing mains and service activities to be done through the keyhole method.	Operatives are able to work from above ground, therefore providing safer means of working.
Hybrid Gas Renewables	To carry out hybrid system demonstration, including generation from renewables.	Develop a technology and techniques that 'green the gas' that is transported and support and maximise the effective ongoing utilisation of the gas.
Integrating Microgeneration to the Gas Grid	Small scale generation of heat and electrical power.	Develop a technology and techniques that 'green the gas' that is transported and support and maximise the effective ongoing utilisation of the gas.
Ground Source Heat Pumps	The use of natural energy to provide heat.	Develop a technology and techniques that 'green the gas' that is transported and support and maximise the effective ongoing utilisation of the gas.
Robotic Pipeline Inspection Methods	Development of robotic platform to perform pipeline inspection.	Aims to improve asset integrity of pipelines.
Business Information Modelling	Involves the generation and management of digital representations of physical and functional characteristics, which can be exchanged or networked to support decision-making of the network.	Can be used to plan, design, construct, operate and maintain the gas infrastructures.
Pay as you go Metering Apps	Customers are able to quickly and electronically add finance to their meter.	Develop a strategy, technology and technique that improve customer engagement.
Reduced Transmission Connection Costs	More cost effective way to lay transmission connections to remote locations.	Opens up supply to potential new customers in remote locations who do not have gas.

Project	Objective	Benefit
Intelligent Carbon Monoxide Detector	Ability to communicate externally using text mobile communications, self checks and reports weekly, reports faults, reports alarms to multiple mobile devices, data server and call centre.	Customer satisfaction and safety is improved.
PE Asset Life Research	Devise condition assessment methods for PE pipe and fittings, determine cost effective mitigation and replacement strategies and develop methodologies to determine residual service life.	Provides strategy for the future of PE.
Zeostore Domestic Thermal Store	This project proposes the design and development of a prototype unit for domestic energy storage.	Efficient means of storing energy when it is plentiful and releasing it as high grade heat whenever it is required.
RCA Records Project	Develop an automated system for updating as-laid records.	More effective means of communication between operations and administration.
Laser Scanning Project	Develop an automated laser scanning system that can communicated with other streetworks operators and automatically calculate material quantities.	Efficient means of communication with operations and other utilities. Saving time and costs.
Domestic Heating Project	To provide a bottom up study on the optimal appliance technology pathways by property type, based on known and emerging heating technology required to meet carbon and renewable targets.	Highlights the impact on consumers and the impact on the gas and electricity distribution networks to 2050.

Award winning robotics

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