

Gas Innovation Funding Incentive (IFI)

Overview Paper for Ofgem

Executive Summary

This document has been written by ENA on behalf of the four UK Gas Distribution Networks (GDNs) – National Grid, Northern Gas Networks, Scotia Gas Networks and Wales & West Utilities and aims to provide a summary of the gas IFI projects (individual and collaborative) that have been undertaken to date, the lessons that have been learned since the introduction of IFI in 2007 and an outline of the future IFI strategy and potential project themes.

The project summaries have been split into 8 key topic areas:

1. Distributed Gas Injection
2. The Role of Gas in a Low Carbon Future
3. Asset Management
4. Demand Management
5. Reducing Risk for a Safer Network
6. Tools & Techniques
7. Environmental
8. Additional Projects

The GDNs have carried out a considerable amount of work over the past three years to establish a forum and the methods for collaboration and have over this time learnt several important lessons which will further enable collaboration in future. These key learnings include the establishment of collaboration agreements and ensuring the appropriate internal technical support within each GDN.

Innovation Funding Incentive

Following the price control (GDPCR1) proposals from Ofgem in 2007 the GDNs now operate the Innovation Funding Incentive for Sustainable Development (IFI/SD). This scheme is intended to provide funding for projects primarily focused on the technical development of the networks and to deliver value (e.g. financial, quality of supply, environmental, safety) to end customers. GDNs are allowed to spend up to 0.5% annually of their Distribution Network Transportation Activity Revenue on eligible projects. All these projects must align with one of Ofgem's five Sustainable Development Themes, as set out below, to qualify:

1. Managing the transition to a low carbon economy
2. Eradicating fuel poverty and protecting vulnerable customers
3. Promoting energy saving
4. Ensuring a secure and reliable gas and electricity supply
5. Supporting improvement in all aspects of the environment

R&D IFI Subgroup

The ENA R&D IFI Subgroup (reporting into the Gas Network Collaboration Forum of GDN Network Directors) consists of members from the four UK GDNs – National Grid, Northern Gas Networks, Scotia Gas Networks and Wales & West Utilities. The group's key objectives are:

- To receive, consider and manage proposals for collaborative IFI/SD projects
- To determine the successful scoring criteria for projects, in consultation with the Gas Network Collaboration Forum (GNCF) to be reviewed at least once annually.
- To establish specialist project groups to oversee and manage projects that have passed the success criteria, as set out in the IFI/SD Good Practice Guide and agreed with the GNCF
- To oversee the procurement and tendering of work relating to collaborative projects
- To interface with Ofgem and on the management and development of the IFI/SD scheme and keep potential transient areas under review, for example internal cost cap and reporting
- To share and promote good practice
- To monitor R&D developments and understand implications for existing and prospective projects
- To liaise with key stakeholders regarding the IFI/SD, including pro-active communications to raise awareness of the scheme
- To formulate and propose a strategy for future collaboration projects

Project Commissioning

GDNs commission projects in line with the criteria as set out by the industry's Good Practice Guide. During the evaluation of a proposal a GDN decides on whether the project will be commissioned discretely or whether it will be shared with other network operators and thus jointly funded.

The four GDNs have different operating models and business/strategy objectives. At the macro level, there are common objectives shared between the GDNs such as managing pipeline safety and reducing risk, however at the micro level GDNs may have different priorities and so choose to commission projects individually. Therefore, GDNs agreed a broad set of conditions that facilitate collaboration. These are:

- a project carries too much commercial risk for any one GDN to accept;
- where leveraging project costs will deliver the most customer value;
- mandatory requirement to collaborate as set out by the Ofgem or the HSE (i.e. safety);
- the project is delivering a radical change or innovation that would require a significant amendment to the UK's gas legislation or regulatory frameworks;
- a previous price control formula issue where the benefits of a common approach far outweigh individual bespoke solutions;

GDNs may also opt to fund IFI projects discretely especially if:

- the project provides benefits that will improve performance for comparative regulatory targets; or
- a GDN chooses to lead the industry

Collaborative projects between GDNs are commissioned via the GNCF and subsequently managed via the R&D Sub-group. Since the formation of the innovation incentive a total of 9 projects have been commissioned with all GDNs participating with a further 5 projects in scoping and several others at the idea stage being developed.

The group engages with third parties, both companies and research organisations, through ENA and individual GDNs and use their monthly meetings to establish relationships with these parties and to evaluate any potential project ideas.

Project Summaries

As previously stated, all GDNs have commissioned numerous projects over the past three years, both individually and collaboratively. To provide an overview and key achievements the innovation areas have been split into eight key themes outlined below which contains detail of some of the main projects carried out.

Distributed Gas Injection

The injection of bio-methane is still an emerging market place and two perspectives can be outlined:

1. In the short term the number of bio-gas injection points is likely to increase given that the renewable heat incentive (RHI) has been agreed. Whilst work is in progress to modularise or package bio-methane connections, future innovations will probably be in the incremental form of improving the current technologies and on different configurations that will enable the capital investment costs to be reduced for end users to adopt.
2. In the medium term, there are still a number of unknowns that warrant further research. Research on how bio-methane gas impacts upon assets on the network and also how it will impact upon the wider society given that it will be potentially sourced from sewage and animal farms, where the impact to human health increases from microbial perspective.

Two key demonstration projects have been carried out in this area – SGN's Didcot and NGG's Adnam's, with further research being carried out by all the GDNs into 2011/12 to reduce the barriers to entry (both in terms of costs and gas quality requirements) in this vital arena alongside the work done by the ENA Distributed Gas working group and the upcoming Ofgem industry group.

SGN's Didcot project demonstrates a UK first for receiving bio derived gas into the existing gas network, to develop the gas scrubbing technology employed, its interaction with the requirement to bring bio methane to GSMR standards (upgrade of gas), to develop the technology and equipment to monitor the gas quality of bio methane and the flows of bio methane into the gas network (monitoring and control) and develop the regulatory regime in support of bio methane injection to the gas network.

Role of Gas in a Low Carbon Future

The Energy Networks Association Gas Futures Group (GFG) identified the need to develop long ranging scenarios specific to the gas industry within the Great Britain and undertook the project with Redpoint collaboratively between all GDNs, National Grid Transmission and Inexus. The outputs of the scenario work allowed the ENA GFG and individual project contributors to understand the challenges and opportunities within the GB Gas Distribution market out to 2050. The project outputs have provided valuable information that informs the GFG of further work that would be of benefit in RIIO T1 & RIIO GD1 Price Control Review preparations. The GFG are currently exploring the options of a second project into 2011/12 focusing on domestic heating and the role of gas.

The NGG and European collaborative project "Project Beywatch", initiated in 2007, aimed to further the understanding of the impact of new and renewable energy systems on energy supply in order to model the design of potential future energy network infrastructures.

Asset Management

Asset Management projects focus on delivering new processes and techniques that can prolong the longevity or maximise the performance of deployed assets connected to the gas network.

The GDN collaborative DANINT project aims to develop and trial engineering software for data management of Gas Composition, CV and volume data in compliance with 'The Gas Calculation of Thermal Energy Regulations'. If this solution is approved by Ofgem there will be two solutions available for Operators to use which will require less maintenance and site visits than that the Model 500, and will also enhance the viability of injecting other gas sources.

The PE Asset life project by NGG and SGN aims to develop methodologies, techniques and decision support tools that establish the current condition of the existing PE (polyethylene) network, identify and quantify potential threats to the integrity of PE pipes and joints and assess the residual life of the PE network. WWU and NGN are currently considering joining the collaboration for this project.

SGN have commissioned the Dust Removal project which will facilitate a trial of utilising reverse cyclone technology on the filtration element already fitted to the inlet of a district governor. The aim of the trial is to improve the integrity of the network by removing the dust from the system and allowing the network to operate with increased capacity and at lower pressures.

The NGN Storage Strategy Review project will review storage requirements and identify alternative methods of meeting demand whilst addressing environmental issues. The reduction in fixed storage assets will remove the requirement to access structures and work at heights, remove discharge and leakage issues, remove major hazard sites, many in residential / urban locations and will reduce maintenance requirements.

Leakage of natural gas from cast-iron pipes, particularly from joints, has been evident in older gas distribution systems throughout the world and so a number of projects have been initiated in this area. SGN's Gas Leakage Reduction project aims to identify cost effective, new to SGN, technologies and practices that reduce leakage and emissions of natural gas from specified joint types within the SGN MP & LP distribution systems. The NGN Leakage management PMAC project has the potential to reduce average system pressure and thus to reduce leakage including undetectable leakage. It will also provide efficiency benefits in reduced travel to sites and provide additional assurance over the accuracy of data included in leakage calculations.

Demand Management

Load Research & Demand Management (NGG)

National Grid has commissioned work to determine whether the current principles of managing peak demand, based upon assumptions developed in the late 1980s, are still valid for use in the 21st century. These assumptions are also critical from a planning perspective as they underpin how future modifications to the network are specified, designed and then deployed.

Reducing Risk for Safer Networks

Clearly the removal of risk and ensuring a safer network is a key priority for the GDNs and so a number of projects have been commissioned, both individually and collaboratively, in this area. For this reason this section has been split to show the range of individual projects.

Intervals (GDN Collaborative – NGG lead GDN)

The output has been endorsed by the HSE in November 2010 stating that the results will provide a significant improvement in how corrosion management will be undertaken going forward. However, whilst the output has moved the GDNs away from a cost based approach to a risk orientated one, this change may actually reduce inspection frequencies. The indicative average of an inspection is between £70 and £100k, and therefore GDNs may need to increase significantly the allowable spend for this activity to ensure that the risk is maintained in line ALARP principles.

The above example shows how costs can increase. The benefit of having R&D to underpin business practice will not only demonstrate that the risk is being managed appropriately based on up to date knowledge but more importantly, if supported by the HSE it proves invaluable independent justification/credence behind any plans submitted.

MRPS/Pipesafe (GDN Collaborative – NGG lead GDN)

The output from these projects demonstrates how GDNs manage and maintain the risk prioritisation tools that determine when high pressure pipelines, mains and services need remedial action or even replaced. This allows operators to predict trends and undertake further research to understand the potential risks associated with them, so that pre-emptive action can be deployed to mitigate the risk as low as possible.

Proximity Effects of Squeeze off Operations (NGG)

This project will provide new industry knowledge concerning the stresses involved on PE pipelines during squeeze off operations. This project may require the industry to change current practices concerning squeezing off pipes. This may increase operational costs as it may take longer to undertake routine operations as alternative forms of flow-stopping such as bagging off are undertaken instead, or other additional safety precautions are imposed.

Data Validation Project (WWU)

This project was undertaken to understand and establish the level of risk > 7 bar AGI's and their components present to WWU ensuring that the end consumer supplied by WWU has a safe and secure supply. This project has allowed WWU to improve its understanding of how condition affects the reliability, level of safety, the environmental impact of a failure and asset due to poor condition, customer interruptions and the financial impact of a failure attributed to condition.

Application of a Condition Based Risk Model (WWU)

Wales & West Utilities has embarked on an industry leading approach to develop a single Condition Based Risk Model (CBRM) to encompass the Health Index of each of its pressure reduction installations and > 7 bar distribution mains assets, the probability of failure associated with these assets and the Consequences of each of these assets if they were to fail. The expected benefits of this project will be used to provide a foundation to WWU's short term and long term replacement strategy.

MODUS Mobile Data Uploading System (NGN)

Modus will provide rapid reliable reporting, to record and confirm that site circumstances satisfy all safety, statutory or regulatory requirements. This will provide efficiencies in maintenance processes by proving remote supervision capabilities.

Virtual testing Platform for Emergency Scenarios (NGN)

The development and creation of a virtual tool for emergency testing would result in a database of scenarios and locations that could allow virtual, real time interaction by multiple participants. The end result would be a bespoke, unique and totally portable testing mechanism, as the tool would be based on a leading edge computer software platform. This will increase the operational safety of employees, but also of the responding agencies to an incident and to the public at large and improve testing of emergency plans through table top exercises without the need for engineers to experience actual incidents.

Tools & Techniques

Like R&D programmes previous to IFI, a proportion of the portfolio is focussed on developing new tools and techniques. These projects often will deliver efficiency savings that broadly fall into two categories:

- Tangible tools/techniques for physical use in the field
- Intangible tools/techniques for day to day processes (i.e. decision support tools / procedural processes etc).

Keyhole (NGG)

Key projects for National Grid are the expected delivery of Keyhole technology that was substituted from the USA. New manual tools were developed so that the technique and processes could be adapted for use in the UK. The main benefits expected from this project will be a significant reduction in excavation costs, less materials going to landfill and less time and costs surrounding street works.

EAGLES (NGG)

Project EAGLES has seen the development of a new web based system that will handle plant enquires from third parties. The system will be able to automate responses based upon a set of pre-defined rules and provide these back to the initiators more quickly. It is hoped that this system will not only provide process and cost efficiencies but will also improve safety and our service to customers.

SGN Vac Ex Demonstration Project (SGN)

The aim of the SGN Vac Ex demonstration project is to undertake a trial to assess the commercial and safety benefits of a Vacuum Excavator operating within the networks. The Vac Ex project is designed to introduce working practices and equipment that would help to reduce the number of damages to cable and other underground plant in the highways

PE Flow Stop Evaluation Initiative (SGN)

The PE Flow Stop Evaluation initiative by SGN investigates alternative methods to squeeze-off operations by utilising a mechanical stopple flow-stop system. Anticipated project outputs are for the cost of the new flow stopping techniques to be cheaper and more reliable compared to the existing Squeeze off equipment. The successful deployment of PE stopples or more advanced flow stopping techniques would allow the reduction in excavated ground and provide a contribution to cost reduction.

Environmental

SGN Wall Thickness for PE Pipe Project (SGN)

High Density Polyethylene pipe has been used successfully in the larger diameter ranges since 1989. The progression to thinner walled pipe is a natural progression following a number of years of investment by the supplier in material testing and development.

There are significant economic and environmental advantages of introducing thinner walled PE100 pipes into gas distribution practice. Therefore to take advantage of the opportunity the SGN Wall Thickness for PE Pipe project will involve field trials to test, in relation to pipe integrity, ground loading.

Ecogen CHP Preheat Project (SGN)

Gas needs to be pre-heated at PRSs to overcome the Joules-Thomson effect which occurs as gas expands and which would otherwise cause freezing on the downstream system. New pre-heating systems comprise of a number of gas fired condensing boilers which are modulated to meet variation in heat requirement as the demand varies. Electrical power is required to operate the circulating pumps and control systems. It is expected that Micro generation Technology in the SGN Ecogen CHP Preheat project can demonstrate an overall reduction in electrical consumption from the grid whilst providing the required heat output to meet the site pre-heating needs. CHP provides heat and electrical energy for local use. By displacing the electrical generation from the inefficient grid system there is an overall reduction in CO₂ production.

Further work is also done outside IFI in this area to reduce the environmental impact and efficiency of the GDN businesses both through recycling, reduction of waste to landfill, less excavations and energy efficiency.

Additional Projects

The basis of the SGN Small LNG Production Proof of Concept project is to conduct a proof of concept analysis and feasibility study for the small scale production of Liquefied Natural Gas (LNG) utilising an innovative combination of Turbo Expander technology coupled with LNG manufacturing equipment. Three potential Pressure Reduction Installation (PRI) sites in Scotland will be considered in the analysis.

The NGN Fuel Poor Market Quantification project will provide a comprehensive list of fuel poor off gas households to aid in the decision of potential connections to our network and thus improve access to mains gas to assist the more vulnerable in society. It will provide a more efficient heating regime, previous fuel poor projects have resulted in carbon emissions savings.

The NGG projects in this category cover their international and European collaborations with research organisation such as PRCI, EPRG, GERG and PIRC. These collaborations provide a significant amount of funding leverage, normally in the range of between a 3:1 and 7:1 ratio. These memberships allow National Grid to access a pre-defined portfolio of project which each year it can influence its direction. PRCI and EPRG focus on high pressure pipeline issues whilst GERG and PIRC focus on more general distribution issues and PE pipes respectively.

GDN Collaboration in Future

The GDNs have worked very hard over the past three years to establish a forum and methods for collaboration and have over this time learnt several important lessons which will make collaboration easier in future. The GDNs are also currently in the process of updating their IFI strategy which outlines the key project areas and methods for communicating with third parties, both to raise new project ideas and to communicate the results and outputs. The sections below provide some further detail on these key pieces of work and the next steps for collaborative IFI.

Lessons Learnt & Key Issues

Collaboration agreements

A recognised key learning point from the first three years is that the collaborative approval process needs to be quicker and far more efficient. This process operates with a review of ideas first followed by a formal submission.

The collaboration framework documentation and formal collaboration agreements to support individual projects are currently being finalised and will make future collaboration quicker and easier for the GDNs. Work has also been undertaken by the GDNs to identify and review potential collaborative projects before they are commissioned to ensure that the right arrangements are in place.

Technical Engagement

A key learning point from the MRPS project has been the tremendously positive effect of an engaged steering group comprising of representatives from each GDN.

The evidence from the collaborative portfolio suggests that where a technical group exists that can incorporate a project as part its business will provide a far higher degree of success. If no technical group exists, or the project has been commissioned without a clause confirming that the management of a project will be conducted via a steering group approach then it is likely the project will suffer.

Internal Cap

GDNs believe that the 15% internal cap on IFI spend can have an adverse impact on project management, by requiring unnecessary additional hand-offs with third parties where the GDNs have the capability to undertake the work internally. In addition GDNs have found that this restriction could see increased costs for projects, where they are required to outsource activity, which they could undertake more cost effectively in-house. These additional costs are not efficient or in the best interest of consumers who are essentially funding the scheme.

With this seen as a key issue in IFI project management, GDNs have written to Ofgem asking for the cap to be increased as necessary, with Ofgem approval, on an individual project basis to align with the arrangements for electricity distribution.

Collaborative IFI Strategy out to 2013 and beyond

The GDNs, through the ENA R&D Subgroup, are currently developing their strategy out to 2013 which will mainly include plans for short-term projects but may also cover longer ones fitting into the Network Innovation Allowance criteria which can be developed across the price controls.

Once completed and signed off, this will be shared across the other ENA expert groups of GDN representatives to expand the potential project areas which can then be communicated to third parties to raise potential project ideas through media, websites and meetings with possible suppliers.

Future Project Areas

As part of the strategy, the GDNs have identified two primary and five secondary themes which outline the potential collaborative project areas. The primary themes have been prioritised due to the collaborative nature of the potential project areas included.

Some themes have direct one-to-one mapping with the five Sustainable Development themes outlined in the IFI Good Practice Guide whilst others may items that span two themes or more. Each theme contains requirements across long, medium and short delivery horizons where both strategic and tactical solutions may need to be sought from the wider commercial market, including research councils, professional institutes, European organisations, academic institutions, consultancy firms, industry associations. The intent of this approach is to establish the best value in terms of price from the wider market place.

The primary and secondary themes are outlined below.

Primary Themes

- **Alternative forms of gas supply/utilisation and exploitation of opportunities from emerging technologies in the renewable sector:**
 - ▶ Assist in achieving the 2050 climate change targets for the UK
 - ▶ Resolution of subsequent issues following the biomethane injection demonstration projects and removal of barriers to entry
 - ▶ Alternative forms of networks
 - ▶ Alternative forms of distributed gas (CBM, Shale and Tight Gas)
- **Safety and Risk Reduction:**
 - ▶ Development of risk models
 - ▶ Aging assets and asset life extension
 - ▶ Process safety research
 - ▶ Safety for the general public
 - ▶ Human Factors – consolidation and application of academic models for operational deployment
 - ▶ New tools and techniques for the delivery of new, safe and reliable, uses of gas
 - ▶ Plant Protection / Damage Prevention

Secondary Themes

- **Facilitation to a lower carbon footprint and/or improved environmental performance:**
 - ▶ Energy mix interaction
 - ▶ Environmental Emission Targets
 - ▶ Leakage reduction research
 - ▶ Energy Savings
 - ▶ Non CO2 fleet, assets and plant e.g. gas in vehicles
 - ▶ Recycling of materials and consumables
 - ▶ Demonstration/trials of new environmental products

- **Utilization of new technology for use on gas distribution systems:**
 - ▶ Integration of gas distribution assets
 - ▶ New Devices and equipment Asset location / GPS
 - ▶ Smart and Smarter Networks
 - ▶ Wireless systems
 - ▶ Web-based asset management applications
- **New materials and methods that deliver sustainable performance:**
 - ▶ New Materials
 - ▶ New Tools/Techniques
 - ▶ New Products & Services
 - ▶ New Processes
 - ▶ Replacement strategies for obsolete assets
- **Security of Supply preservation:**
 - ▶ Alternative or new forms of storage
 - ▶ Forecasting
 - ▶ Load Management
 - ▶ Upstream Security of Supply
- **New methods/options that address the needs of the fuel poor:**
 - ▶ Energy Efficiency/Management
 - ▶ New Incentives