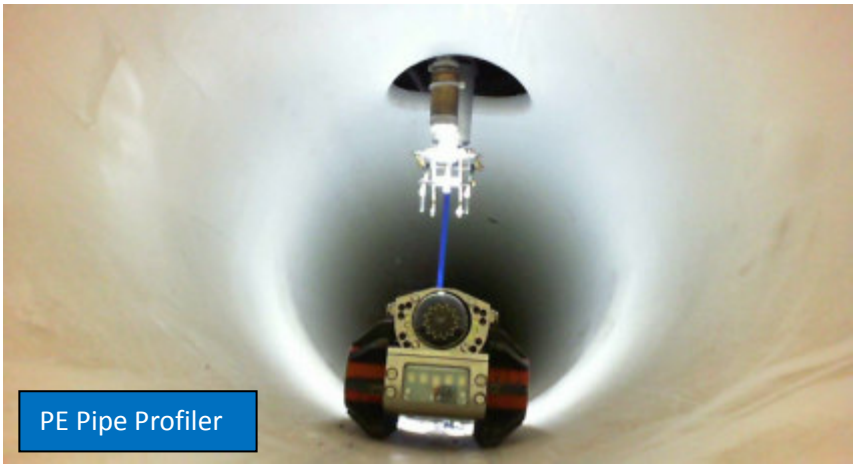
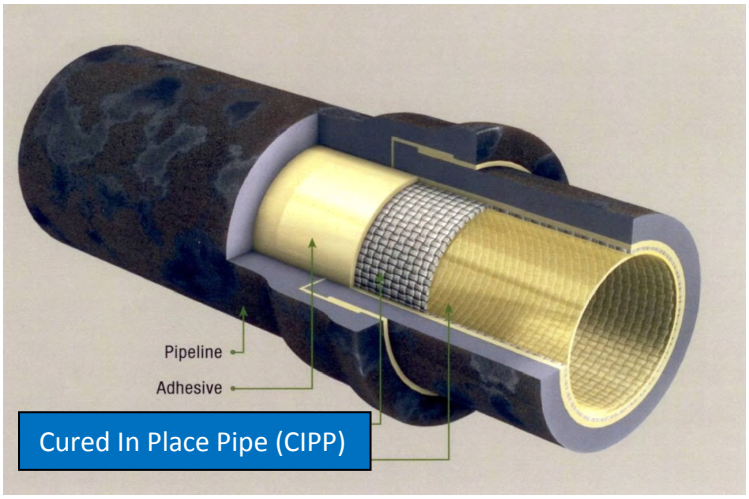
nationalgrid

Innovation Annual Report

Innovation Funding Incentive for Sustainable Development (IFI/SD) I **Gas Distribution**

Air Driven Water Extraction Unit


PE Pipe Profiler



Cured In Place Pipe (CIPP)


Optimise Own Energy Use


Bio-SNG Pilot Plant


Biomethane (Adnams)

National Grid House

Warwick Technology Park

Gallows Hill

CV34 6DA

Contents

01 Introduction from John Pettigrew

Welcome to the fourth report presenting the Gas Distribution Innovation Programme delivered under the Innovation Funding Incentive for Sustainable Development.

Our current Innovation Strategy compliments our Company vision and strategy by promoting technological advances and developing knowledge to provide a safe, secure, reliable network and long-term value for consumers.

During 2011/12 we continued to address our priorities and challenges and have presented specific project highlights under three main headings within this report:

- Asset and energy management
- Engineering technologies and techniques to improve operational performance
- Environmental and Climate Change

Our portfolio has a balance of potential benefit outcomes and has a positive NPV of potential benefits overall. Examples of the value gained from completed projects are shared on page 9 and demonstrate value to our consumers.

In the four years since IFI commenced, we have commissioned a total of 83 innovation projects. Forty percent of projects commissioned to date have secured funding via collaborative partnerships with various other organisations. The projects covered a wide spectrum of gas distribution activities with predominately short to medium term delivery horizons and at various stages in the innovation project lifecycle. We have continued our commitment to facilitating bio-gas in our network working with Adnams Bio energy to produce a consistent quality of biogas and installed remote monitoring equipment for energy calculation supported by Ofgem.

Innovation is at the heart of our plans now and for the future. Our RIIO-GD1 Innovation Strategy takes the foundations from the last four years experience of gas R&D through IFI and moves us forward to help find new solutions to our future challenges ahead.

I look forward to Gas Distribution developing into a more innovative organisation to help improve our performance and deliver exceptional services to customers further. We are also looking at improving collaborations with both our supply chain partners and other network operators, for example working with the Energy Innovation Centre (EIC), to help small and medium size enterprises work more effectively with the gas networks.

This report provides details of each active project currently in the portfolio totalling £5.7m of investment into research and development. I hope that you find this report to be a useful insight into the value of innovation from National Grid Gas Distribution.

J. Pettigrew.

John Pettigrew - Chief Operating Officer for Gas Distribution & Metering

02 About National Grid and Gas Distribution

National Grid UK owns and operates the Gas Transmission system throughout Great Britain and, through its low pressure Gas Distribution business, distributes gas in the heart of England to approximately eleven million businesses, schools and homes. National Grid owns and operates the high voltage electricity transmission system in England and Wales and operates the Scottish high voltage system.

Gas Distribution UK

Gas Distribution UK segment comprises four of the eight regional gas distribution networks in Great Britain. The networks comprises of approximately 190,000 kilometers of gas distribution pipelines and transports gas on behalf of 25 active gas shippers from the gas national transmission system to around 10.8 million consumers. We also manage the national gas emergency contact centre service for all the gas distribution networks and for other transporters in the UK.

03 Overview of the IFI Programme and 2011/12 Highlights

Introduction

Historically, we have driven efficiencies in our organisation as a direct result of our innovative activities, which includes taking a lead industry role on a number of collaborative projects.

The challenge we set ourselves was to utilise the IFI/SD to support future delivery and culturally re-energise technical research and development in our organisation. Without the focus on IFI there was a danger that research associated with the provision of safe, reliable and secure networks would have significantly declined as it did following privatisation during the early 90's. It has been a long journey to re-establish research and development as a valuable core business process.

Our Role in Industry Innovation

We have used innovation successfully to support our ambition on leading the exploration of the role of gas in the energy pathways for a low carbon future as well as facilitating renewable gas into the network through biogas demonstration plants. During the first few years of IFI we led 6 out of 9 jointly GDN commissioned projects. We have shared our experience and now collaborate on a total of 17 joint GDN projects, typically leveraging benefits on a 2:1 ratio. In addition, we are the only company who has collaborated with GERG (the European Gas Research Group), gaining valuable knowledge through a network of European experts.

We have continued to build a strong working relationship with GL Noble Denton, suppliers of our R&D consultancy services, for 50% proportion of our portfolio. During 2012 we will be devising our sourcing strategy for the retender of our R&D suppliers going forward in preparation for RIIO.

In partnership with Adnams Bioenergy we created the first purpose-built biomethane to grid plant in the UK, which will generate enough energy to heat 235 family homes per year, or run an average family car for 4 million miles. In the future the facility will produce enough renewable gas to power the Adnams brewery and run its fleet of lorries, while still leaving up to 60 per cent of the output for injection into our East of England network.

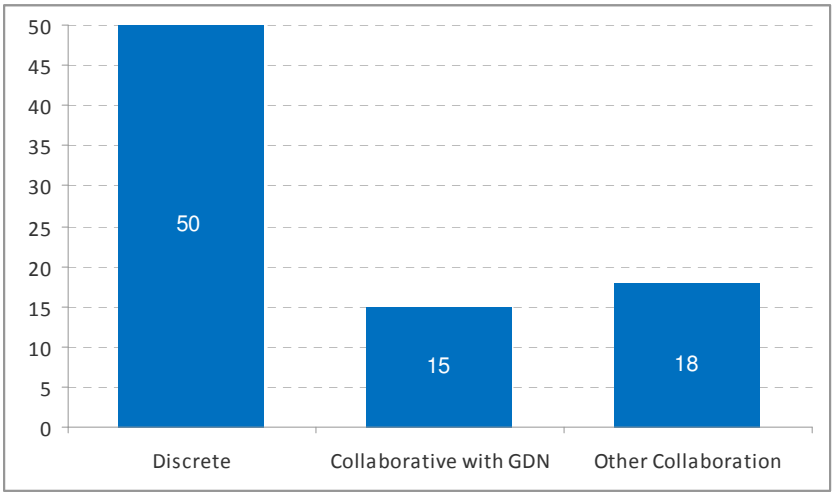
We have also used innovation successfully in our core work delivery processes through the development and implementation of keyhole technology. Keyhole reduces excavations and the volume of reinstatement, thereby reducing traffic congestion, especially in London, and has provided an alternative solution to the Olympic project challenges.

IFI Projects Activity

In the four years since IFI commenced, we have commissioned a total of 83 innovation projects. Approximately 40% of projects commissioned to date have secured funding via collaborative partnership with various other organisations. The projects covered a wide spectrum of gas distribution activities with predominately short to medium term delivery horizons and at various stages in the innovation project lifecycle.

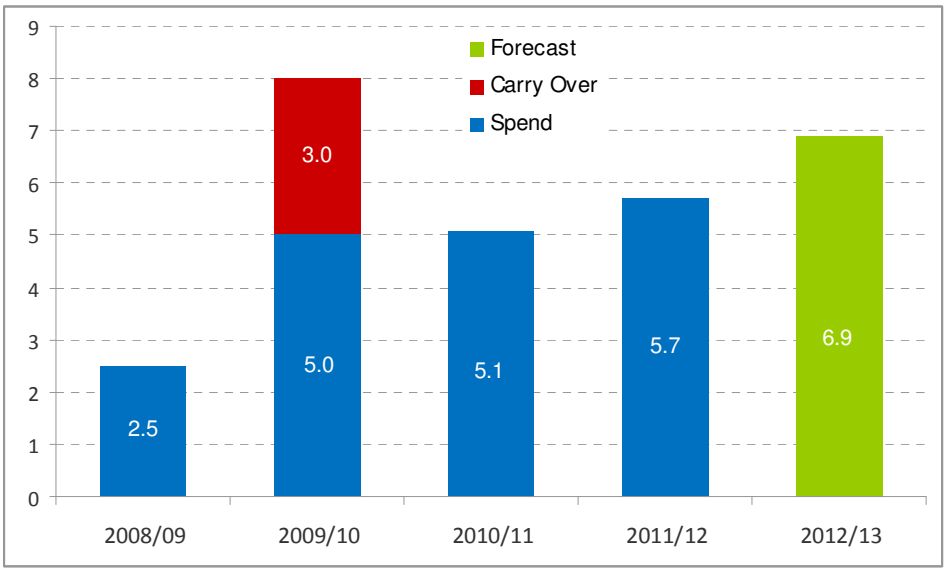
- Number of IFI projects commissioned between 2008/09 and 2011/12:

Figure 3.1 - IFI projects commissioned 2008/9-2011/12 (number)



- Total expenditure over the four years of £18.3m , breakdown as follows:

Figure 3.2 - Expenditure (£m)

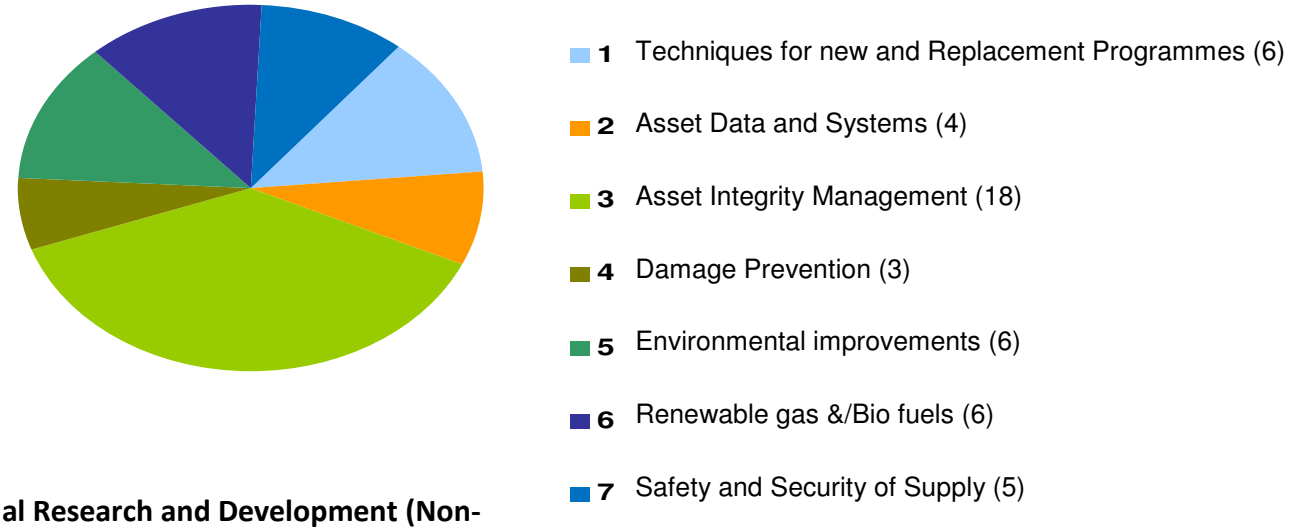


The establishment of IFI in 2008/09 meant we had to start to build a new culture of Innovation within our business. Our approach to innovation is continuing to evolve and we are starting to see a steady increase in the IFI expenditure, with associated benefits.

The following highlights the broad range of challenges that currently make up our 2011/12 innovation portfolio, which are all at different phases of development and technical maturity.

- Challenges within our 2011/12 innovation portfolio:

Figure 3.3 - Challenges within our Innovation portfolio



Internal Research and Development (Non-

Although IFI has been an excellent incentive to re-energise our Research and Development (R&D) activities, we have also continued to fund Innovation directly from our business. We have completed a number of small scale field trials throughout our network, to test various new tools and techniques, to aid efficiency in replacement and repair activities. We have also used our own resources to make improvements to our network analysis, planning tools and connection processes to accommodate biogas connections in the future.

Our intent is to continue to fund innovation from directly within our business as well as utilise the innovation funding opportunity available under RIIO-GD1 in the future.

Current Internal Capabilities

We have a dedicated innovation team that manages the strategy, funding, governance and regulatory reporting, and compliance with the Good Practice Guide for IFI funded projects.

Whilst the small central innovation team coordinates innovative activities, responsibility for sanctioning and prioritising these projects is shared with the Distribution Innovation Governance Group (DIGG), which is attended by representatives from all our directorates. This has served us well as the specialist knowledge, learning and output is retained within the responsible line management departments, whilst the innovation team maintains accountability for the strategic alignment of outputs and goals.

In order to increase focus on the delivery of projects more work will be done to raise awareness of the programme, and build the capability for implementation, in order to realise the potential associated benefits.

Completed Innovation Projects

The following are examples of completed Innovation Funding Incentive (IFI) projects, the benefits of which have been factored into our plan:

- Impact of Future Energy Systems on Energy Networks – Beywatch (IFI3): This work provided knowledge that has been used to help develop a strategy for energy supply and the optimum development of future energy networks. Results have been used to inform the national debate on energy network futures and has been presented to both Ofgem and the Department of Energy and Climate Change (DECC). The energy model has been used to model a variety of future energy scenarios, decade by decade, and help identify issues and opportunities to enhance network development.

- Maximising The Benefits of Keyhole Excavation (IFI11): Further advancements in keyhole technology have led to the development of the beam drilling method. This is the biggest change in 30 years in the procedure for attaching fittings to 4" to 48" live metallic mains, and excavations have been reduced to one sixth of the size of conventional excavation.

- Demonstration Trial for On-site Energy Savings (IFI45): Trialled new energy saving devices on three of our office sites with a resultant 10% reduction in electricity use. Reduction was achieved with an associated saving of 115 tonnes of carbon dioxide.

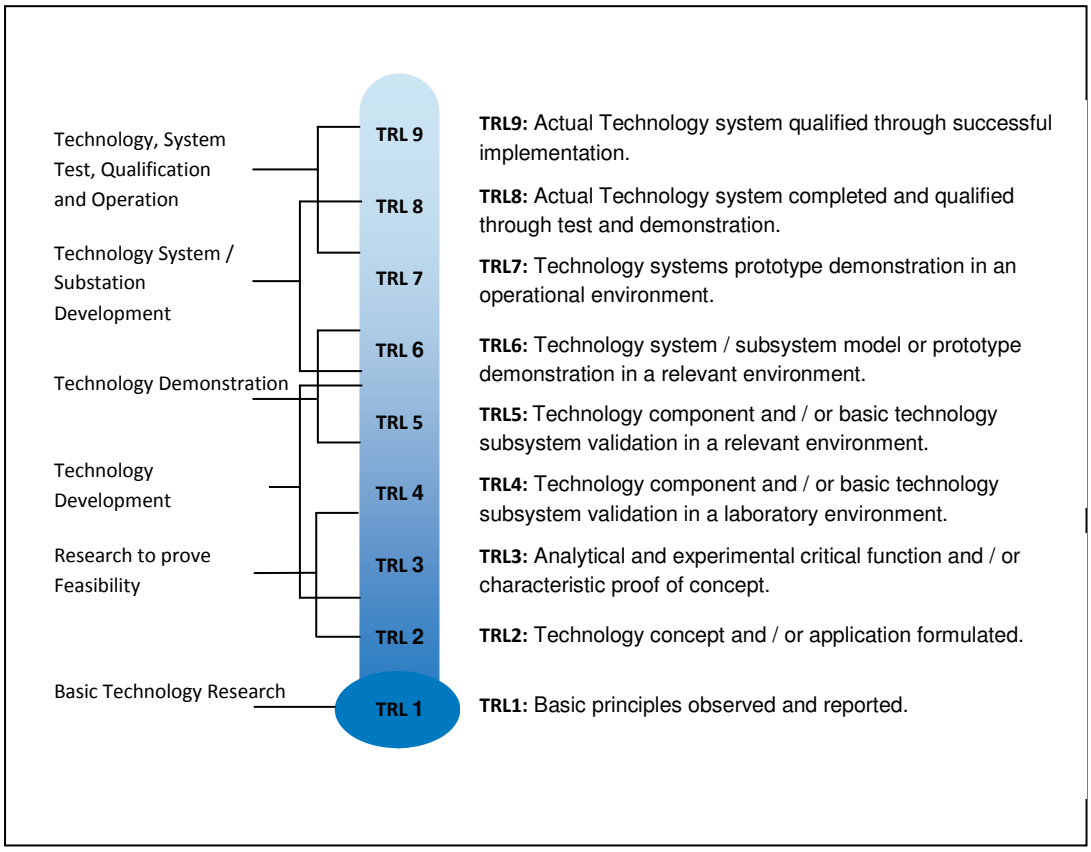
- Human Factors in Gas Operations (IFI49): The knowledge associated with the implications of human factors in decision-making was reviewed within the maintenance functions, within Operations, to inform the Gas Distribution Front Office (GDFO) design.

- Work Scheduling and Mobile Solution in the Field (IFI56): The innovative integration of work scheduling software 'CLICK' and mobile solution 'SYCLO' has improved the operation and maintenance of the network by ensuring both labour, and plant and equipment resources are optimised.

04 Programme Highlights

As part of this report Gas Distribution would like to highlight the broad range of challenges that currently make up our innovation portfolio all at different phases of development and technical maturity. The projects highlighted in the following pages provide the differences between the TRL's and illustrate National Grid's approach to maintaining a balanced portfolio.

Technology Readiness Level (TRL) is a widely used model to demonstrate where a project is within the innovation life cycle.



The TRL indicates how close a technology is to becoming both technically and commercially viable and can be seen above. Level 1 relates to research with no obvious purpose more commonly known as "Blue Sky Research" and Level 9 on the TRL scale indicates products/information readily available with no development required. Currently Gas Distribution innovation activities have been focussed between TRL's 2 and 8. This range ensures that Gas Distribution balances both tactical and strategic projects within its portfolio but also ensures that the innovation money is being used for innovation activities and not purchasing existing solutions.

Our aim is to balance our portfolio to improve efficiency, improve asset and energy management, and support improvements in all aspects of the environment. We also aim to continually increase project collaboration into the future. The projects highlighted in the following pages provide the differences between the TRL's and illustrate National Grid's approach to maintaining a balanced portfolio.

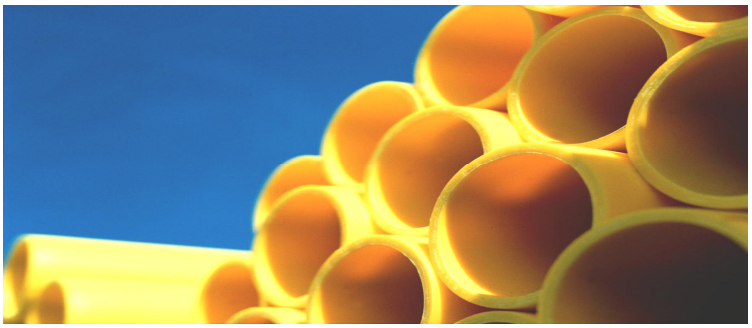
Asset and Energy Management

Asset and energy management remains a key focus area, with our primary objective being to optimise the balance between risk, cost and performance over the lifecycle of our assets. We need to make sure we know where our assets are, what we want from them, get the best value from them, and be confident they are safe and reliable for our customers.

There are a number of common challenges in relation to asset and energy management which are reflected in our portfolio. Such challenges include reviewing and improving our current asset strategies, developing our investment plans for targeted replacement and reinforcement of our assets, and developing our network in order to ensure optimised performance.

The examples below illustrate some of the work in progress within our current portfolio:

IFI: 63 – PE Asset Life Research (TRL 6)



Polyethylene (PE) pipes have been installed within UK gas distribution since the late 1960s, and the long term integrity of this asset has been proven. However, it has now been determined necessary to undertake fundamental research to confirm continued use, in order to provide assurance in its performance up to and beyond the nominal 50 years life in situ.

The scope and principal objectives of this project include developing methodologies, techniques and decision support tools that establish the current condition of the existing PE network, identifying potential threats to the integrity of PE pipes and joints, assessing the residual life of the PE network, and identifying possible strategies and policies for targeted replacement.

During 2011/12 a large number of samples of early PE pipes and fittings have been gathered from the field and rigorous testing has been undertaken. This will enable statistical data assessment and modelling to take place. As of July 2011 Scotia Gas Networks have also joined the project as collaborative partners.

IFI: 77 – Asset Health Modelling (TRL 3)

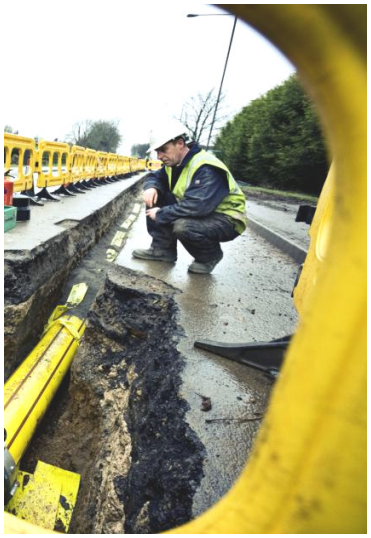
IFI 77 will develop a tailored solution for National Grid Gas to accommodate Asset Health and corporate Risk Methodologies, through use of a Condition Based Risk Management (CBRM) system.

The CBRM methodology is based on building the definition of both current and future condition and performance, and quantifying risk by using asset information, engineering knowledge, and practical experience of the assets.

The CBRM tool will allow the future Health Index (HI) and Probability of Failure (POF) of assets to be simulated and assessed, allow investment decisions to be prioritised, and will support all future RIIO-GD regulatory submissions.

IFI: 82 – Distribution Pipeline Risk Management (TRL 2)

The GDNs are subject to mains replacement policy which states that all metallic distribution gas mains within 30 metres of property are replaced by 2032. The overall cost of this programme is in excess of £10 billion.



During 2011 the HSE proposed that the methodology for identifying and managing risk associated with metallic mains should change to a 3 tier approach (≤8", 9"=17", >18" diameter). This proposed approach will be new for the gas distribution industry within the UK.

IFI 82 is a joint collaboration project with the UK GDNs, with an objective to review and develop the current methodology to ensure that it is robust for future effective management of the risks associated with distribution pipes below 7bar, in line with HSE requirements.

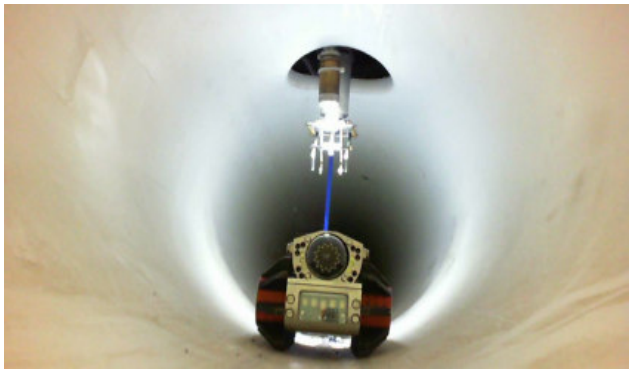
Engineering Technologies and Techniques to improve Safety and Operational Efficiencies

The trial of new technologies and techniques to support operational efficiencies and challenges within the field remains a key focus within our portfolio. We have continued our drive for operational efficiency with aims to further improve the safety of our field force, minimise disruption to the public, and ultimately provide greater value to our customers.

The examples below illustrate some of the work in progress within our current portfolio:

IFI: 46 – Internal Joint Profiling System for PE Pipes (TRL 7)

IFI 46 aims to develop an internal measurement profile tool with a launch and retrieve system capable of producing accurate profile of internal PE butt and electrofusion joints (within defined parameters) that can be compared against a set of standard acceptable joint profiles to establish fitness for purpose. This will enable National Grid to demonstrate the robustness, both internally within National Grid and externally to the HSE, of in-service PE joints and pipe.



This is a collaboratively funded project between National Grid and Synthotech, who is a leading supplier of practical engineering solutions for gas and utilities industries worldwide, and is committing around 30% of the total project cost. The success of the feasibility and development work during stages 1 to 3 has meant that the project has progressed to field trial demonstrations in 2011/12.

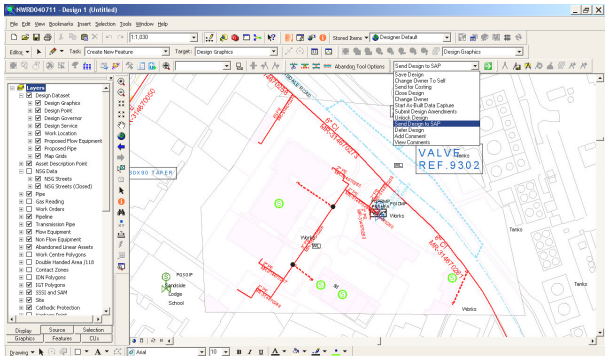
IFI: 80 – Air Driven Water Extraction Unit (TRL 7)

Water extraction units are currently used operationally to extract water from siphon pots during routine maintenance, and to extract water from mains and services in response to water ingress incidents. However, due to inefficiencies in the water extraction units currently used, an alternative solution is required to provide longer term sustainability and reduced operating and maintenance costs.

IFI 80 aims to complete a robust, wide-scale demonstration trial to prove the long term sustainability of the new-design air driven water extraction units. By having more robust water extraction units available it is anticipated that reduced incident costs will be achieved, as well as reduced maintenance costs associated with the operation of the equipment.

IFI: 90 – Network Design Improvements (ArcFM) (TRL 6)

During 2011/12 work was carried out to enhance our network design tool, ArcFM Designer Classic. The objective being to deliver a graphical design tool integrated into core SAP that will replace the manual production of paper graphical designs, thereby improving the control and integrity of asset designs, validation of designs, design amendments, work issuing to the field, and as laid records data capture.



The technology development involved defining business requirements and system design work to enable the integration of National Grid's core asset systems, to improve design efficiency and improve asset records management.

Environmental and Climate Change

National Grid Gas Distribution remains committed to minimising our business Carbon Footprint emissions, specifically the reduction of leakage from our above ground assets and pipelines. In our 2011/12 portfolio we have continued research and development activities to address reducing our carbon emissions, promote energy savings, and improve environmental performance, whilst exploring opportunities for diverse fuel sources.

Renewable gas has the potential to make significant contribution to renewable energy targets while also providing diversity and security of supply and is one of National Grid's top priorities. Following the government announcement of the Renewable Heat Incentive (RHI), Gas Distribution has continued to build momentum with biomethane plant developers.

There are currently several projects in preliminary stages that are expected to proceed to implementation over the next year, as well as anticipated continued growth in the new distributed gas connections. In

addition, National Grid is investigating the use of mixed waste to generate bio-Synthetic Natural Gas using thermal gasification, as this has the potential to open up much larger quantities of biomass resources for conversion to renewable gas.

The examples below illustrate some of the work in progress within our current portfolio:

IFI: 4 – Optimise Own Energy Use (TRL 6)

IFI 4 addresses the issue of National Grid's own energy use, within the Gas Distribution business sector, for operational Pressure Reducing Installations and Offtakes. It aims to evaluate different sources of energy and identify how National Grid's own energy use can be reduced and optimised, for instance using alternative renewable sources, without impacting on the functionality of the business.

The project aims to gather information surrounding major energy uses within the business, evaluate options for potential reduction of energy use, and demonstrate new and/or renewable energy technologies that will result in lowering the environmental impact of the business.

The success of the feasibility, proof of concept, and detailed design, during stages 1 to 3, has resulted in the project being able to proceed to the installation and commissioning stage. Successful implementation will see a number of environmental benefits, including a significant reduction in carbon emissions, and more effective and efficient use of energy leading to considerable energy savings.

IFI: 47 – Alternative Sources/Scenarios for Bio-methane Injection (TRL 6)

IFI 47, to construct the connection facility for the UK's first purpose built "Bio methane to Grid" (BTG) facility, is substantially complete.

The connection facility at the Adnams Brewery in Suffolk was officially launched in October 2010 and will take gas produced from food and brewery waste to be injected into the Intermediate pressure (IP) network.

This now stands ready for full commissioning when bio methane of consistent quality is produced in sufficient volume, following forthcoming changes to the biogas upgrade system.

IFI: 69 – Capacity Enhancements Using Compression (TRL 3)

Currently, when a potential biomethane producer contacts a GDN to investigate the possibility of connecting to the nearest point on a GDN network, in a substantial number of cases, there is insufficient capacity in the local network to accept the proposed flow rate of biomethane for 365 days per year. This is because the local demand on the network is likely to be lower than the output of the biomethane plant, particularly in the summer period and during the night when there is less demand.

A potential solution has been proposed by Northern Gas Networks (NGN), involving the installation of a compressor at a local Pressure Reduction Station (PRS) to pump gas up into a higher pressure tier, thereby increasing access to gas demand in other parts of the network. A desktop feasibility study has already been carried out on behalf of NGN and the project is now being taken to the next stage.

IFI: 70 – Development of Packaged Solution for Bio-methane Injection (TRL 4)

National Grid has also taken an initiative to reduce grid injection costs and to speed up the connection process for renewable gas by running a competitive tender process for the design and build of an integrated instrumentation and control skid unit, under IFI 70. This skid will be trialled at the Stockport "Bio methane to Grid" (BTG) site.

This fit for purpose packaged solution will offer a unit that can be deployed for the majority of requested bio-methane connections in the future. This will help incentivise bio methane producers to connect to the network, which will in turn help National Grid to work towards the renewable gas targets set out by DECC.

Collaboration

Throughout 2011/12 we have continued to raise awareness of the innovation incentives with our stakeholders both internally and externally, in order to leverage benefits from collaborative opportunities.

In addition to collaboration with other GDNs, Gas Transmission, and network operators, we have continued to maintain relationships with numerous research organisations. Membership and involvement in these groups enables not only the opportunity to generate more innovative ideas with a wider group, but also allows for the sharing of knowledge and information to the benefit of the wider energy industry.

Collaboration with the European Gas Research Group (GERG), under IFI 52, is a cooperation of European Gas Networks. This offers leverage by collaborating in joint research projects directed to increase integrity and safety of gas distribution systems. Currently we have 4 live projects with GDF Suez and KIWA. The total value of projects which were undertaken in 2011/12 was £750k, providing National Grid with a leverage ratio of 4:1, based on the total National Grid project contribution.

Collaboration with the Pipeline Research Council International (PRCI), undertakes jointly funded pipeline research. This covers many aspects from construction through to structural integrity, with benefits to National Grid being around assessment, prevention and mitigation of integrity threats, such as mechanical damage and external corrosion. The total value of projects which were undertaken in 2011 was $9.4m, providing National Grid with access to relevant research outputs for our membership

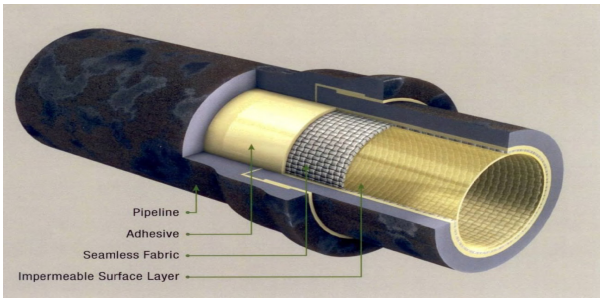
National Grid Gas also collaborates with the European Pipeline Research Group (EPRG). EPRG is an association of European pipe manufacturers and gas transmission companies, and undertakes a wide range of research, directed to increase integrity and safety of gas transmission pipelines. The National Grid R&D leverage ratio of 15:1, and sharing knowledge on best practice and incidents, are the main benefits of this collaboration.

In 2011, we also joined the Pipeline Industry Research Club (PIRC) which undertakes jointly funded pipeline research, to mitigate issues and risks associated with PE pipes. The group conducts collaborative PE research on behalf of participating organisations thereby providing economies of scale and avoiding duplication of cost and effort.

The examples below illustrate some of the collaborative projects in progress within our current portfolio:

IFI: 71 – Cured In Place Pipe (TRL 3)

Cured in Place Pipe (CIPP) is a trenchless rehabilitation technique used to repair existing pipelines. A thermosetting resin is inverted into the host pipe using a flexible tube, which produces a tough pipe lining once the resin has been cured by the use of heat or UV light.



CIPP is a much cheaper alternative to replacement with PE, as liners can be inserted approximately 150m from the point of access, with little to no excavation involved. Through use of this technology National Grid aims to reduce the risk of our iron mains and deliver customer benefit through our existing mains replacement programme, with leverage of benefits through a collaboration partnership with the UK GDNs, and suppliers, the Water Research Council (WRC), who have extensive knowledge in this field and its application to the water industry.

IFI: 79 – Bio-SNG Pilot Plant Design and Demonstration (TRL 3)

National Grid has in recent years promoted the upgrading of biogas from anaerobic digestion for injection into the gas network as a vector for renewable energy. Having successfully supported others in demonstrating the feasibility of this process National Grid now plans to promote the injection of biomethane derived from thermochemical processes for the same purpose.

In collaboration with Progressive Energy Limited (PEL) and Advanced Plasma Power (APP), National Grid has partnered to design and build a pilot plant that demonstrates the production of Bio-SNG from biogenic waste. The project also aims to confirm the techno-economic feasibility of bio-SNG from syngas derived from waste at scale. Stage 1 of the project will involve proof of concept for the production of Bio-SNG from solid recovered fuels (SRF), which will be conducted by means of a demonstration facility at the existing APP Gasplasma® plant facility in Swindon.

Both APP and PEL have extensive industry experience, with APP having committed significant research into development of the technology. Successful completion of the project will aim to establish the UK as a leader in the production of renewable gas to grid.

5 Finance Overview & Benefits

This section of the report gives the financial information associated with the 2011/12 programme as agreed within the IFI/SD Good Practice Guide (GPG).

In year 4 there are 48 live projects moving through the research, development and demonstrations phase with the total spend of £5.7m, utilising 76% of the gas allowance. 18 new projects started and 30 continued from year 3, and 3 projects completed.

Potential benefits are assessed on a project by project basis against the GPG benefit criteria and reassessed at each stage gate to ensure consumer value. Overall portfolio benefits total £788,131 positive NPV overall.

Anticipated benefits are documented against each project in Appendix 1 and are achieved by:

- Reduced Direct Costs e.g. through reduced planned capital expenditure, maintenance expenditure or efficient operations.
- Avoided Costs e.g. deferred investment, reduced failures, establishing conditions of equipment to feed capital or maintenance plans and improved ratings.
- Enhanced Risk Management e.g. understanding the application of new technology and minimising the impact of our networks on the environment.
- Strategic Knowledge e.g. working with others to address sustainability in the energy industry, maintaining awareness of new technology in the industry.

Revenue	**£1512.00m**
IFI Allowance	**£ 7.56m**
IFI Carry over	**£0**
External Expenditure	**£ 4.93m**
Internal Expenditure	**£ 0.78m**
Total Expenditure	**£ 5.71m**
Anticipated IFI Allowance (For 2012_13)	**£ 8.26m**
Number of Active Projects	**48**

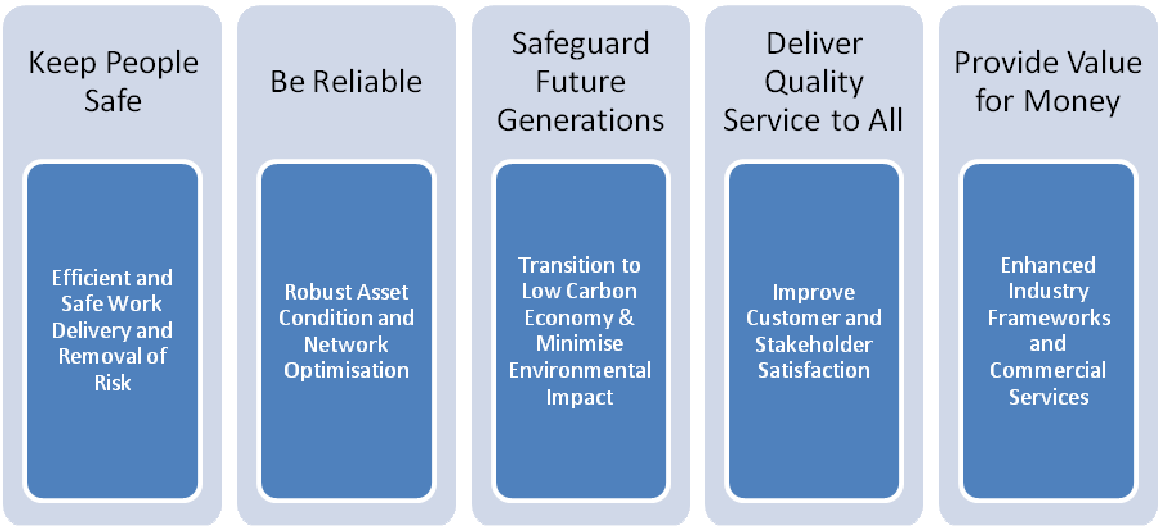
06 Looking Forward

As we move into the final year of IFI we will be preparing for RIIO and understanding how we can transition the existing programme into the new period and maximise the opportunity of the Innovation Stimulus Fund.

Innovation Strategy under RIIO

We have delivered our Innovation Strategy and presented as part of the RIIO-GD1 submission in April 2012. Within the Strategy we have considered our key priorities and developed 5 innovation themes which more specifically describe the areas we are seeking to explore.

The following diagram outlines our 5 innovation themes, linked to our priority outputs:



The following describes each of our innovation themes in turn and the business challenges that we want to address:

- **Efficient and Safe Work Delivery and Removal of Risk** – To deliver our new mains replacement programme based on a risk removed approach, as opposed to length of iron main abandoned, and the need to progress the development of improved mains replacement technology and techniques, to minimise risk to be more efficient, safe and less disruption to the public.
- **Asset Condition and Network Optimisation** – We need to ensure that our assets are resilient and can adapt to the consequences of climate change. We have also identified a number of specific challenges associated with major cities, particularly London, in terms of consequences of incidents and congestion.
- **Transition to Low Carbon Economy & Minimise Environmental Impact** – The changing energy landscape and the need for us to transition to a low carbon economy means we need to continue to

focus on reducing our impact on the environment and the minimisation of our Business Carbon Footprint emissions.

- **Improve Customer and Stakeholder Satisfaction** – During RIIO-GD1 we need to consider more innovative ways to improve the service we deliver to customers such as the challenge to minimise supply loses and getting customers' supply restored as quickly as possible**.**

- **Enhanced Industry Frameworks and Commercial Services** – We need to consider innovative commercial and regulatory frameworks to help us best manage future uncertanties such as volumes of biomethane connections to our networks. We will also look to develop innovative approaches to solving problems of theft of gas, encourage new capacity products, and utilise smart data and new charging methodologies.

Transition from IFI to the new Innovation Stimulus Fund

These IFI projects align to deliver value to customers under RIIO-GD1. We have not assumed any significant benefits from these initiatives at this stage, as they may not prove technologically viable or economic to deploy. We are hopeful that some will prove successful for implementation to underpin delivery of our plan and help us to deliver our efficiency targets.

- Optimise Own Energy Use (IFI4): The new technologies on trial offer improved environmental, integrity and cost effective performance over water bath heaters. Current water bath heater replacement systems (modular boilers with heat exchangers) do however require contingency arrangements, in the form of backup modular boilers and heat exchanger, and need to be maintained and notably require an electricity supply. If these trials are successful then efficiencies can be made on alternative replacement technologies.

- Better Load Analysis & Demand Modelling – Feasibility (IFI19): The principle benefit from this work at this stage will be knowledge that may ultimately lead to the production and replacement of the current published demand algorithms that will be appropriate for implementation. Better identification of demand requirements into the future could lead to better targeted and timely reinforcement and replacement planning of the networks and better understanding of peak condition.

- Alternative Sources/Scenarios for Bio-methane Injection (IFI47): Develop knowledge of best industry practice on the injection of biomethane into the grid in the UK for the pressure tiers identified. This project should also identify any on-going barriers that may prevent biogas being injected and reaching its full potential.

- Asset Health Modelling (IFI76): Condition Based Risk Management (CBRM) is essentially a process that is based on utilising asset information and assessment of risk to support policy and strategic decisions. The CBRM tool will allow the future Health Index (HI) and Probability of Failure (POF) of assets to be simulated and assessed. This will allow the effort of replacement, refurbishment or changes of maintenance regimes to be modelled resulting in the recalculation of the POF, Consequence of Failure (COF) and Risk.

Delivery Risk and Mitigation

We have identified a number of risks associated with successful delivery of our Innovation Strategy. The risks are listed below with our proposed approach to minimise and/or mitigate those exogenous risks:

- Supply chain partner response to future energy challenges – we will make every effort to encourage suppliers into dialogue on future challenges, specifically seek to understand their views on energy challenges. We will ensure that the fully understand the supplier market and develop relationships with a wide range of suppliers, to encourage innovative solutions.

- Financial stability of suppliers to support the long term innovation programmes – We will ensure that our Supply Chain Management (SCM) approach is robust and continually review our supplier contracting arrangements and provide commercial support to suppliers.

- Multiple collaboration partners leading to delays in delivering projects – we will ensure that the collaboration contracts are clear in their scope and timescales for delivery.

- Slow to respond to the need to change – we will respond to stakeholder feedback and review our internal governance processes to minimise delays in delivering innovative projects.

- Failure to share learning and best practice – we will establish best practice forum and fully utilise our best practice engineers to ensure the benefits of innovation are realised.

Our approach to Network Innovation Competition

The Network Innovation Competition (NIC) offers National Grid the opportunity to bid for project funding to support the low carbon economy and meet environmental targets. The Future Network Team will be evaluating potential larger scale projects during 2012/13 and understanding which collaborative partnerships we need to develop to prepare for the bidding process.

Example projects are:

- Optimisation of Gas / Electric Smart Grids – demonstrate optimisation of gas and electricity networks through dynamic fuel switching to manage heating in the most efficient and economic way. Our work will identify the appropriate appliances for differing parts of the residential market. Where appropriate we will make use of dual fuel boiler technology currently being reviewed under our IFI programme. We aim to pilot the technology to demonstrate the optimisation of heating (dynamic switching) to balance energy demands, minimise heating costs and reduce Carbon emissions. Smart energy systems and controls will be tested as part of the study to evidence the potential benefits of smart metering and integration of existing energy grids. The scale and cost of such a trial is dependant upon scale of the pilot and we aim to discuss the planning of such a trial with our partners in due course.

- Gasification / Bio-SNG Production & Distribution – We aim to reduce the technology risks perceived in the process of converting waste material in to grid quality gas. This project aims to carry out a technical demonstration of end-to-end process integration of advanced gasification / bio-SNG production technologies on a commercial scale for gas grid injection. This has the potential to provide a platform for future investment in a fleet of large-scale waste to energy facilities, with a view to substantially de-carbonising future UK gas supplies.

Future Approach to Innovation

During the RIIO-GD1 period we will build on our current approach to innovation. The innovation team will manage a portfolio of projects, yet each discrete project will be delivered by a dedicated project manager in the relevant business area.

We will make a step change in efforts to generate innovative ideas and will also develop a new capability, within our Future Distribution Networks team, to construct bids associated with the Network Innovation Competition (NIC).

We will ensure that we develop a culture of innovation in all of our activities. We will also ensure that we have a strong framework to ensure the value of our innovation programme is aligned to our business plan objectives, the benefits are tracked and monitored and risks mitigated.

07 Innovation Project Reports Contents Page

Project Reference & Title:

Appendix 1: Project Reports

Appendix 1

(IFI4) Optimise Own Energy Use (PRIs)

Year: 2011/12

Project Description	The project targets the energy used by National Grid in non-vehicular applications, aiming to reduce and optimise the energy used to establish company-wide best practice for operational Pressure Reducing Installations and Offtakes.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£139,582.00	£60,034.00	£22,657.00	
External	£660,829.00	£545,511.00	£164,373.00	£3,143,303.31
Materials	£709,576.00	£208,011.00	£182,983.00	
Total	£1,509,987.00	£813,556.00	£370,013.00	

Status	
Draft	
Draft	24/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Good Alignment. Viable alternative forms of pre-heat with measured energy savings of lower carbon emissions.
☐ **2 Eradicating Fuel Poverty**	
☑ **3 Promoting Energy Savings**	Major Alignment. More effective and efficient use of energy will lead to energy savings and reduced emissions.
☑ **4 Safe, Reliable Network**	Minor alignment. Moving away from traditional water bath heater solutions for pre-heating should lower the risk of supply failure as water bath heaters are essential assets in ensuring security of gas supply to consumers. Faults occurring due to corrosion that pose risks of fire / injury at the PRI and loss of gas supply downstream will be eradicated with these new technologies.
☑ **5 Protecting the Environment**	Minor alignment. Moving away from traditional water bath heater solutions for pre-heating will improve environmental performance as there will be no need to use or dispose of large quantities of potentially hazardous glycol or non-glycol solutions.
Technological area / issue addressed by project	Viable alternative heating solutions that will reduce own energy use for pre-heat conditions that either: - optimise the energy use only as and when required - use another method of pre-heating that is sustainable and environmentally friendly

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	21	2	19

Expected benefits of project	To reduce energy consumption at National Grid gas operational sites and offices. Improved environmental and performance of water bath heaters. Current Water Bath Heater replacement systems (modular boilers with heat exchangers) require contingency arrangements in the form of backup modular boilers and heat exchanger. These also need to be maintained and notably require an electricity supply.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	20 yrs	50%	-£484,784

Potential for achieving expected benefits	Despite challenges experienced during Stage 3 understanding the requirements and complexities regarding installation and commissioning activities at NGG sites, this project is still on target to deliver the benefits envisaged.
Project Progress	Stage 3 of the project commenced which focused on installing and commissioning 3-off novel gas preheating units for the winter heating season. The successful completion of Stage 3 will enable the performance of the novel preheating units to be monitored and assessed during Stage 4 of the project to determine whether they are better than the existing gas preheating technologies installed on site. Completion of the civil works at all three sites, ordering and delivery of the fuel gas skids for the three pre-heating units at all three sites and electrical and instrumentation installation has been completed.
Collab' Partners	
Provider(s)	GL Noble Denton, Bruest, CWT

(IFI7) Risk-Based Automatic Handling Of Plant Enquiries

Year: 2011/12

Project Description

This project aims to produce an intelligent web based enquiry system, incorporating damage prevention management procedures and automated responses, for individuals proposing to carry out third party work in the vicinity of National Grid buried assets.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£67,242.00	£188,523.00	£0.00	
External	£163,115.00	£147,315.00	£216,360.00	£1,246,389.00
Materials	£0.00	£0.00	£0.00	
Total	£230,357.00	£335,838.00	£216,360.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	The proposed system will determine the appropriate response to enquiries based on querying the asset data directly and through applying an expert system rules-based approach. This intelligent web based enquiry system, incorporating damage prevention management procedures and automated responses, for individuals proposing to carry out third party work in the vicinity of National Grid buried assets resulting in - Less damage to assets. - Reduced consequential loss of supply or service. - Reduced safety risk for those working in or near underground assets. - Reduced safety risk to members of the general public. Resulting in - Reduced direct, third party damage and societal costs. - Improved health and safety. - Reduced congestion.
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

- o Delivery of an automated response system to third parties for National Grid's buried assets
- o Development of expert system rules based on risk and assets involved
- o Response will be provide with MAPS detailing the assets at risk via Web-based portal

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	13	-3	16

Expected benefits of project

Improve standards of customer service efficiency & consistency in responding to plant enquiries
The system is designed to mitigate risks of third party damage. Known areas of critical supply and impact on vulnerable customers can be defined and monitored for high risk works.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	6 yrs	75%	-£381,020

Potential for achieving expected benefits

The stage included extended internal trials, the aim being to test the feasibility of the new functionality and also to gather additional feedback from expert users. The trial has provided additional confidence that the benefits of the project can be delivered.

Project Progress

The trial with third parties was successful and delivered usability, efficiency and safety improvements via improved rule and responses updates and also location functionality which improved the efficiency and accuracy of the system.

Collab' Partners National Grid Transmission

Provider(s) GL Noble Denton, Hammonds

(IFI10) Easy Flow Stop Systems

Year: 2011/12

Project Description	The primary objectives are to verify and demonstrate the use of stoppling flow stop equipment on PE pipes.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£8,256.00	£3,114.00	£249.00	
External	£29,428.00	£12,540.00	£22,120.00	£339,497.00
Materials	£0.00	£0.00	£0.00	
Total	£37,684.00	£15,654.00	£22,369.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good Alignment. Will enable a flow stop solution that will be cost effective and avoid the need for expensive cut-out operations.
☑ **5 Protecting the Environment**	Good alignment. Will reduce excavation sizes and thus materials to landfill. Output will enable the ability to reuse same location to carry out same type of flow stop operation in the future. Minimises disruption to members of the public through reduced excavation footprint.
Technological area / issue addressed by project	o Validation and verification that the Stopple equipment and launch platforms are fit for purpose for use within the UK.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	19	-3	22

Expected benefits of project	Reduced excavation footprint reduces potential for interference damage to other buried apparatus. This will reduce materials to landfill and minimise the disruption to members of the public.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	5 yrs	50%	£149,308

Potential for achieving expected benefits	The proposed benefits are still in line with expectations.
Project Progress	During 2011/12 review and validation of two preferred stopple equipments on 63mm & 250mm and 315mm and 355mm PE80 (SDR11 &17.6) mains at pressures up to 7 & 2 Bar took place respectively. This will verify whether the Stopple equipment and launch platforms are fit for purpose for use within the UK. Design and construction of the test rigs has commenced in preparations for 2012 trials.
Collab' Partners	Pipeline Maintenance Centre, National Grid Transmission
Provider(s)	GL Noble Denton

(IFI16) Alternative Inspection Techniques

Year: 2011/12

Project Description	To develop an alternative inspection technique for OLI4 pipelines that cannot be pigged due to difficult circumstances.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,590.00	£2,386.00	£0.00	
External	£10,000.00	£15,205.00	£0.00	£98,890.00
Materials	£0.00	£0.00	£0.00	
Total	£11,590.00	£17,591.00	£0.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	This project will provide a technique for inspecting non piggable pipelines on the >7bar network, and thus operators can mitigate the risk of an incident occurring by understanding fully the condition of its pipeline assets.
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project

o The limitations of above ground survey techniques currently employed as part of the OLI/4 process have been identified.
o The shortcomings of above ground techniques to provide information related to coating damage and CP potentials in difficult to inspect areas
o Inspect areas, such as hard surface and sleeved and unsleeved crossings, have been identified.
o Techniques that may be able to provide data from hard to inspect areas have been identified for site trials to be undertaken within Stage 2 of this project.
o The limitations of LRUT for measuring metal loss features that may compromise the integrity of high pressure pipelines have been identified.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	14	-5	19

Expected benefits of project

- Incidents concerning the failure of <7 bar pipelines tend to be catastrophic events. Where such pipelines are located by significant populated areas any such failure expose the risk to staff and the general public.
- The new tool will minimise costs for inspecting difficult to inspect areas. The increased understanding of the condition of the asset in these difficult to inspect areas should allow GDNs to take appropriate remedial measures quickly to prevent a major pipeline failure. This will allow pipelines to be operated to the maximum safe level.
- Incidents concerning the failure of <7 bar pipelines tend to be catastrophic events. Where such pipelines are located by significant populated areas any such failure expose the risk to staff and the general public.
- The main financial benefit to accrue from this project is primarily avoiding costs of unexpected failures and subsequent cost penalties due to failure to supply. To calculate an accurate value directly related to this risk is difficult to quantify as there are probably no historic incidents to compare against.

The notional value of a potential pipeline failure and penalty due to failure to deliver is taken as £1m. This is a conservative estimate that includes costs associated with repair, recommissioning if the failure occurred on a critical pipeline, loss of gas supplies, compensation, and responding to subsequent regulatory action should an incident occur.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	20 yrs	50%	-£59,675

(IFI16) Alternative Inspection Techniques

Year: 2011/12

Potential for achieving expected benefits	Stage 2 delivered a number of technical benefits that may be codified within the GDN policy. These will assist in managing the risk of unpiggable pipelines and therefore the cost avoidance benefit associated with the project should remain as the value proposed was a very conservative estimate. Stage 3 delivered a knowledge benefit concerning the MTM and NoPig techniques. The GDNs see merit in these techniques but both require some development work to be undertaken to make them applicable to the distribution networks. As this is currently being progressed by other companies a watching brief will be maintained, awaiting further developments.
Project Progress	The report reviews emerging technologies for above ground surveys, including reviewing the MTM (Magnetic Tomography Method) technique,. The report recommends: 1.The OLI/4 document should be modified, during subsequent revisions, to make specific reference to the four stages identified in the ECDA and ECCDA processes i.e. pre-assessment, indirect inspection, direct examination and post-assessment. 2.That further trials be conducted with the magnetic tomography method (MTM) to validate the claims of the vendors and to assess the full capabilities and limitations of the system. 3. That a watching brief be conducted to monitor future developments of the NoPig system with a view to performing field trials in the future. The Project Steering Group has agreed that no further work be undertaken on this project. The key recommendations to be considered from the output of this work are: 1.Keep a watching brief concerning the NGGT MTM project and the GERG NoPig project. The visibility of these projects to the Project Steering Group is currently low; GL Noble Denton will keep the project participants informed of developments. 2. If the ongoing MTM and NoPig developments are found not to meet the requirements of the GDNs, then a collaborative expression of interest to the market will be considered in the future. 3. The consensus is to incorporate the knowledge from this project into a set of shared industry documents. However this will require GNCF approval due to the different version of the policy and procedure documents that each GDN currently has. 4. The output of this project should be presented at GNCF, not only to seek agreement on Item 3 above, but to propose a GNCF sub-group specifically focused on >7 bar high pressure pipelines. The group should have membership representatives from all GDNs, and potentially NGGT, with the remit of covering policies, procedures and potential future IFI projects.
Collab' Partners	NGN, SGN, WWU
Provider(s)	GL Noble Denton

(IFI18) Injection of Biomethane into the Gas Network

Year: 2011/12

Project Description

The key objective is to demonstrate the safe injection of biomethane into the UK gas grid, with the overall aim of establishing the overall feasibility of small scale "green gas" additions to the National Grid Gas Distribution network.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£30,530.00	£1,526.00	£0.00	
External	£600.00	£33,036.00	£25,672.00	£627,275.59
Materials	£8,288.00	£22,106.00	£0.00	
Total	£39,418.00	£56,668.00	£25,672.00	

Status	
Draft	
Draft	24/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Injection of bio-methane into the gas network provides the only large scale, non-disruptive & economic solution for decarbonising heat in the UK.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	National Grid have established that up to 50% of residential gas demand can be met with renewable gas and therefore this represents a potentially significant source of fuel that will enhance energy/security of supply within the UK.
☑ **5 Protecting the Environment**	Biogas promises to deliver substantial environmental benefits. This project should demonstrate the injection of this gas into the gas distribution network enabling it to be used in the most efficient way and thus delivering the greatest environmental benefit. By demonstrating the technology in the UK's regime and addressing any resulting barriers, and will lead the way for stimulation of many other biogas injection projects and the associated environmental benefits that they will bring.

Technological area / issue addressed by project

o The potential study has shown that the UK has material volumes of biogas potential that justify further investigation into its feasibility and demonstration for grid injection in the UK.

o Technical feasibility has been confirmed and shown that biomethane can be safely injected into the gas network, but work has illustrated that a number of technical, regulatory and financial challenges remain.

o A conceptual engineering design for a biogas injection plant has been produced.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	11	2	9

Expected benefits of project

- National Grid will develop knowledge of best industry practice on the injection of biomethane into the grid in the UK. This will include fully understanding any safety or environmental risks and how they can be effectively mitigated to protect the consumer and the network.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	20 yrs	25%	-£862,755

Potential for achieving expected benefits

The new project with Adnams and the development of a Standard for biogas in pipelines continues to demonstrate National Grid's support to renewable gas applications. The outcome of these studies will support the growth of the UK biomethane industry and the technology enablement which will hopefully stimulate further growth in the number of biomethane-to-grid projects.

Project Progress

This project provides a test bed for biogas and biomethane gas quality measurements and a programme of work has been developed to undertake detailed measurements of trace components in the biomethane and establish compliance with GS(M)R and other Network Entry Agreements. Although the practical analysis work has not begun during 2011 -12, plans have been made to undertake a series of tests to confirm the performance of the clean-up facility and gain a greater understanding of the potential concentration of trace components.

To extend the potential interest in biogas to smaller-scale producers, National Grid has initiated development of a Standard for Biogas in Pipelines. Here the aim relates to highlighting options for

(IFI18) Injection of Biomethane into the Gas Network

Year: 2011/12

clusters of biogas sources to 'feed' one clean-up facility, and through development of an IGEM-supported Standard for the pipeline will widen the potential for biogas and biomethane technology applications. A draft document is being prepared and will be approved through normal IGEM technical panel endorsement.

Collab' Partners		**Provider(s)**	GL Noble Denton, Hammonds, Mouchel, United Utilities

(IFI19) Better Load Analysis & Demand Modelling (Feasibility)

Year: 2011/12

Project Description	Develop a new and novel demand estimation model that can be practically utilised within <7bar analysis modelling.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£42,143.00	£38,130.00	£108,053.00	
External	£366,106.00	£341,574.00	£230,000.00	£2,136,980.89
Materials	£1,946.00	£82,258.00	£0.00	
Total	£410,195.00	£461,962.00	£338,053.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	A better understanding of demand profiles will: o facilitate better pressure management of the system and consequent improvements in control of leakage o provide a baseline for the understanding of current demand patterns against which the impact of new gas technologies and energy uses may be assessed.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	A better understanding of demand profiles will allow the peak demand requirements to be better understood. This will lead to a more economic and efficient design of the system to meet those peak demands and better understanding of off-peak demand will facilitate greater security and flexibility in carrying out maintenance activities.
☑ **5 Protecting the Environment**	A better understanding of demand profiles will facilitate better pressure management of the system and a consequent improvement in the control of leakage.

Technological area / issue addressed by project

o Statistical techniques for the development of improved demand models have been specified.

o The proof of concept models developed based on these techniques using available data indicates an increase in accuracy of the demand models over those currently in use and a general reduction in demand being modelled.

o The requirements for the flow data required to develop working demand models have been specified.

o The new Network Analysis model will take into account new factors such as socioeconomic data, cunsumer behaviour and current thermal effeciencies including appliance effeciency.

o Provision of initial winter data for Customer demand profiles to be developed and understood at later stages in the project.

o Whole network data will also be collected to enable the testing of the theroretical flow against the actual demand conditions experienced across the winter.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	19	5	14

Expected benefits of project

The principle benefit from this work at this stage will be knowledge that may ultimately lead to the production and replacement of the current published demand algorithms which will be appropriate for implementation.

A small scale test will also be undertaken to also validate any research received. Better identification of demand requirements into the future could lead to better targeted and timely reinforcement and replacement planning of the networks and better understanding of peak condition.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	10 yrs	50%	-£353,217

(IFI19) Better Load Analysis & Demand Modelling (Feasibility)

Year: 2011/12

Potential for achieving expected benefits	Confidence in the potential to achieve benefits from this work is at an acceptable level. The next stage of the project will inform the potential benefits and their achievability in more detail.
Project Progress	Collection of flow data for domestic and non-domestic sites over the coldest period of the winter and into the summer has allowed further development of the demand models to take place. A number of virtual and real networks were analysed with encouraging results. The variable diversity module has been prototyped and has achieved convergence of diversity correction on a small real network. This has shown the theoretical feasibility of the technique only at this stage. High level recording and analysis of as-is/to be business processes was undertaken - The review considered the existing processes surrounding demand model estimation and also outlined the key areas which would need to be addressed and developed in future project stages.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI21) Improvements to the MRPS Model

Year: 2011/12

Project Description	The key objective of the project is to develop improvements to the MRPS model to efficiently identify mains that are likely to leak and therefore reduce the risk of fire/explosion from any potential escape, to enhance safety to gas employees and the general public whilst also complying with HSE legislation.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£9,327.00	£6,536.00	£8,624.00	
External	£81,016.00	£99,842.00	£49,000.00	£776,499.00
Materials	£0.00	£0.00	£0.00	
Total	£90,343.00	£106,378.00	£57,624.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	This project will investigate possible enhancements to the methodology including the consideration of age as a factor with the cast iron model , and the inclusion of corrosion information in the spun cast model to take account of fissure corrosion. The project will also examine the impact of any changes in terms of risk profile and the potential to increase the rate of reduction of risk and leakage from current levels. The work proposed within this proposal has been costed over a 5 year period.
☑ **5 Protecting the Environment**	The ability of MRPS to identify mains before they leak will have a direct impact on the level of methane emissions from the UK distribution system. In addition, more efficient planning of mains replacement has a direct impact on road closures and traffic congestion
Technological area / issue addressed by project	o Research into the correlation or link between the age of pit cast mains and fracture rate o Research into the correlation or link between corrosion and fracture rate o Demonstration of cast iron and spun cast profile factors in live MRPS model. o Feasibility of profile factors for multi-occupancy buildings o Development & testing of profile factor for the update of the >12" model o Continued update of all profile factors within the MRPS model to accurate profile risk and prioritise remediation

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	20	-4	24

Expected benefits of project	- The knowledge used to analyse the data and produce improvements to MRPS will be communicated in detail to the industry participants. This understanding will assist GDN's in defending the model robustly when challenged by the HSE. - Any improvement in the way in which mains are prioritised for replacement will affect the UK incident level. This has a direct impact on improving safety but is very difficult to quantify. - The ability of MRPS to identify mains before they leak will have a direct impact on the level of methane emissions from the UK distribution system. In addition, more efficient planning of mains replacement has a direct impact on road closures and traffic congestion. - The MRPS is model is used to effectively replace those pipes with a higher degree of risk. By doing so, the GDN can allocate expenditure accordingly and avoid significant cost if a minor or major incident occurs. - The application of a credible methodology for identifying mains at risk will contribute to mitigation measure for any potential litigation arising from fatalities linked to incidents.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	5 yrs	25%	-£621,489

Potential for achieving expected benefits	MRPS has been endorsed by HSE as a method to allow for prioritisation of mains replacement that effectively reduces the risk of incident. However MRPS must be continuously developed using the most recently available data to ensure that the models reflect recent leakage activity. This project enables each Gas Distribution Network to demonstrate compliance with safety legislation in this respect.

(IFI21) Improvements to the MRPS Model

Year: 2011/12

	Stage 4 of this project has successfully provided an updated set of coefficients for MRPS based on augmented data and has established which of the changes investigated will improve the accuracy of the software. Furthermore, work carried out under stage 4.1 provided the GDNs with valuable information to support them in demonstrating the effectiveness and continued improvement of MRPS.. The GDNs remain committed to the ongoing development and improvements to the MRPS model.
Project Progress	As a result of the higher levels of detail and quality within the data collected by each Gas Distribution Network (GDN); stage 4 achieved greater accuracy and more meaningful analyses ,which allowed more significant coefficients to be calculated for the mains fracture factor, gas ingress factor, and ductile iron scaling factor. The GDNs jointly concluded that adopting a 10 year drop off (with equal weighting for all fractures) for the mains fracture factor would provide an improved measure of the level of fractures actually occurring. Additionally, the calculated Cast Iron GIF coefficients were recommended for MRPS inclusion. The Ductile Iron analysis provided useful knowledge surrounding the relative risk between joint leaks and corrosion failures. The GDNs jointly agreed that further investigations are required before incorporating the revised DI coefficients to better understand the behavior of the relative risks. The investigation into the effect of previous corrosion on future fractures relevant to Cast and Spun Iron was significantly useful in understanding the compounding effect previous corrosion has on future fractures. This investigation concluded that Cast and Spun Iron experienced an increased future fracture rate when they endured corrosion failures in previous years. It was recommended that a scaling factor is added to the Cast Iron Risk model to increase the risk score of a main where there have been previous corrosions. Trend analysis of data from all UK networks for 2010 and their comparison with data from 2008 and 2009 has shown that, in general, there is no obvious trend in failures, Gas in Buildings or incidents which would suggest increasing levels of deterioration. Additionally, a change control during this stage implemented work packages that assisted the GDNs in the development of a business case for MRPS to inform the Price Control Review (PCR).
Collab' Partners	NGN, SGN, WWU
Provider(s)	GL Noble Denton

(IFI24) European Pipeline Research Group (EPRG)

Year: 2011/12

Project Description

EPRG is a cooperation of European pipe manufacturers and gas transmission companies. EPRG undertakes a wide range of research directed to increase integrity and safety of gas transmission pipelines.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£34,489.00	£6,910.00	£0.00	
External	£45,359.00	£26,053.00	£0.00	£785,384.00
Materials	£0.00	£0.00	£0.00	
Total	£79,848.00	£32,963.00	£0.00	

Status

Draft

Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Jointly funded pipeline research to mitigate issue and risks associated with the high pressure network. The group also provides opportunities for sharing information on best practice and incidents with other pipeline operators.
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

o (EPRG 124) DWTT Round Robin
o (EPRG 127) Reliability Based Analysis
o (EPRG 129) Hostile environmental effects on residual mechanical resistance of damaged pipes
o (EPRG 130) DWTT Testing philosophy
o (EPRG 134b) Development of tests for assessment of long term resistance to adhesion loss in 3-layer polyolefin external pipeline coatings
o (EPRG 137) Assessment of delayed failure under constant pressure
o (EPRG 138) Clarification of European view towards inline pipe standards ISO3183/2007 and EN 10208-2
o (EPRG 139) Hostile environmental effects on residual mechanical resistance of damaged pipes supplementary tests
o (EPRG 141) Discrimination for mill features using MLF pigs for baseline inspections- Phase 1
o (EPRG 142) Model of ultimate limit state design to predict combined loading capacity of line pipes
o (EPRG 143) Extension of FFP and puncture resistance criteria to X80
o (EPRG 144) Revision of EPRG guidelines on weld defect acceptance criteria
o (EPRG 145) Assessment of bending wrinkles
o (EPRG 146) Development of a reliable model for evaluating the ductile fracture propagation resistance for high grade steel pipelines
o (EPRG 147a) Development of an improved model for the burst strength of dent-gouge damage under sustained internal pressure loading Phase 2 part 1 Modelling
o (EPRG 147b) Development of an improved model for the burst strength of dent-gouge damage under sustained internal pressure loading – Phase 2 part 2 Experimental
o (EPRG 148) Investigation of automated ultrasonic testing concept for longitudinally SAW pipe and coupling control
o (EPRG 149) HIC Assessment of low alloy steel line pipe for sour service application Phase 2
o (EPRG 150) HIC Assessment of low alloy steel line pipe for sour service application Phase 3
o (EPRG 151) Assessment of sensitivity to hostile environments of damaged pipe, under cathodic protection and internal pressure
o (EPRG 152) The effect of toughness on the integrity of HFI pipe seam welds

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	11	-5	16

Expected benefits of project

- Improved system integrity knowledge, Improved corrosion protection, reduced 3rd party incidents leading to less supply disruptions. Networking opportunity with other pipeline operators, sharing information and best practice. It is very difficult to articulate the proposed benefits of these high level benefits until the output of each individual project is known.

(IFI24) European Pipeline Research Group (EPRG)

Year: 2011/12

- Prevention of incidents will also mean the prevention of the loss of gas to atmosphere. It is extremely difficult to quantify a value of the amount of gas saved from the proposed EPRG projects if all were implemented.
- The primary benefit from this programme is collaboration on projects that will help to maintain the integrity of the high pressure pipelines, via developed assessment, risk and prevention tools and techniques that mitigate the integrity threats on the high pressure pipeline network and thus reduce the overall risk.

Assuming the probability of a high pressure pipeline failure is approx 1 in 20 years. If the cost of the incident is assumed to be £10m, then the annual avoided cost year is £500k.

If the work from EPRG reduces this risk by 10%, then the annual avoided cost is £455k, giving a reduction of avoided cost of £45k per year. The current formula period has two years to run therefore the total avoided cost will equate to £90k.
- Significant research leverage benefits. The total value of projects being undertaken is 445,000 Euros in 2009 and about 300,000 Euros in 2010, which provides National Grid with a leverage ratio of 15:1, based on the total National Grid membership cost of 19,684 euros in 2009.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	2 yrs	25%	-£58,912

Potential for achieving expected benefits

This programme of work has potential for achieving the expected benefits for National Grid due the collaborative nature of the projects. The R&D leverage ratio of 15:1 and the shared knowledge on best practice and incidents are the main benefits and a consistency between the Distribution and Transmission businesses.

Project Progress

Meetings of the EPRG Corrosion, Materials and Design Committee were attended. A large number of projects are currently ongoing in; assessing damaged pipelines, welding, strain based design, high strength steels, and fracture propagation. A number of these projects may have implications for NGG (e.g. mechanized welding techniques).

The knowledge has been distributed to NGG via workshops and reports. As part of these discussions, the documented procedures that are currently applied to gas transmission and distribution operations in the UK were reviewed to establish how to incorporate any knowledge gained from recent/ongoing EPRG projects.

A review of strain based design was also conducted to establish how the technique could be used by NGGD. This will have applications for areas where pipe could be susceptible to ground movement.

Collab' Partners

BP Exploration Operating Co. Ltd. (United Kingdom
Corinth Pipeworks S.A. (Greece)
Corus Tubes - Energy (United Kingdom)
ENI G& P (Italy)
E.ON Ruhrgas AG (Germany)
Europipe GmbH (Germany)
Fluxys n.v. (Belgium)
Gaz de France (France)
N.V. Nederlandse Gasunie (The Netherlands)
Salzgitter Mannesmann Großrohr GmbH (Germany)
Salzgitter Mannesmann Line Pipe GmbH (Germany)
Shell Global Solutions International B.V. (The Netherlands)
SNAM Rete Gas S.p.A.n (Italy)
TENARIS DALMINE SPA (Italy)
Total E & P (France)
RAUTARUUKKI OYJ (Finland)
Vallourec & Mannesmann France (France)

Provider(s) GL Noble Denton, EPRG

(IFI25) PRCI Research Collaboration

Year: 2011/12

Project Description	The main focus for National Grid is assessment, prevention and migration of integrity threats, such as mechanical damage and external corrosion.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£15,162.00	£16,307.00	£0.00	
External	£46,755.00	£53,841.00	£0.00	£6,000,000.00
Materials	£0.00	£0.00	£0.00	
Total	£61,917.00	£70,148.00	£0.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Main focus for National Grid Distribution is assessment, prevention and migration of integrity threats such as mechanical damage and external corrosion. Jointly funded pipeline research/ sharing information on best practice / incidents.
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project

The 2008 PRCI research program consisted of Member contributions of $7 million. The 2008 program included:

o Mechanical damage - detection, characterization, and management to address third party damage and geo-technical events.
o Design and construction (pipelines)
o Integrity management - research into corrosion and environmental cracking to enhance safety and reduce the potential for incident.
o Compressor and pump stations - air emissions and fuel requirements.
o Measurement - metering accuracy, reliability and cost-effectiveness.
o Underground storage - storage facility integrity and operational flexibility.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Minor	11	-4	15

Expected benefits of project

- Improved system integrity knowledge, Improved corrosion protection, reduced 3rd party incidents leading to less supply disruptions. Networking opportunity with other pipeline operators, sharing information and best practice. It is very difficult to articulate the proposed benefits of these high level benefits until the output of each individual project is known.

- Prevention of incidents will also mean the prevention of the loss of gas to atmosphere. It is extremely difficult to quantify a value of the amount of gas saved from the proposed EPRG projects if all were implemented.

- The primary benefit from this programme is collaboration on projects that will help to maintain the integrity of the high pressure pipelines, via developed assessment, risk and prevention tools and techniques that mitigate the integrity threats on the high pressure pipeline network and thus reduce the overall risk.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	2 yrs	25%	£17,770

Potential for achieving expected benefits

PRCI comprises US and worldwide pipeline operators and, working together, undertake projects to provide excellent leverage for the National Grid membership. The membership also provides the benefits of networking opportunities to discuss incidents, share best practice and work together to identify emerging threats and opportunities.

(IFI25) PRCI Research Collaboration

Year: 2011/12

	PRCI's value proposition is: 'Formal cost / benefit studies of member participation show a consistently positive ratio of 4:1 to 7:1 from reduced costs of operations and maintenance, inspection, materials, design, construction and testing'. National Grid Transmission and National Grid Gas Distribution use their combined annual contribution of $176k to support the PRCI programme with a value over $8.7 million providing excellent leverage.
Project Progress	PRCI aims to conduct a collaboratively-funded research & development programme that enables energy pipeline companies around the world to provide safe, reliable, environmentally compatible, cost-efficient service to meet customer energy requirements. PRCI addresses areas of common interest concerning corrosion, design, materials and construction, operations and integrity, compressors and measurement. The membership of PRCI is shared between Gas Transmission and Gas Distribution. PRCI comprises US worldwide pipeline operators and, working together, undertake projects to provide excellent leverage for the National Grid membership. The membership also provides networking opportunities to discuss incidents and share best practice.
Collab' Partners	National Grid Transmission, and 34 other member companies with energy pipeline interests via PRCI (23 based in the USA; 5 European; 5 Canadian; 1 South American; 1 Middle-Eastern)

Provider(s) PRCI

(IFI26) The Effect of Thermal Lagging on Fiscal Metering Temperature Measurement

Year: 2011/12

Project Description

To determine if existing non lagged high pressure metering installations provide a representative temperature measurement for the purposes of fiscal flow measurement, including impact on thermowell installation performance.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£4,121.00	£14,833.00	£47,720.00	
External	£40,326.00	£130,259.00	£91,395.00	£489,055.18
Materials	£0.00	£98,922.00	£26,352.00	
Total	£44,447.00	£244,014.00	£165,467.00	

Status

Draft

Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Mitigation against the pass on costs to customers if the lagging of high pressure metering tubes work has to proceed.
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

o Validate and demonstrate the need for not having thermal lagging on meter tubes and its impact upon accurate tempeture measurement
o dentify any alternative techniques for accurate temperature measurement & methods of installation with subsequent tests
o Challenge the established engineering rationale regarding thermal lagging on meter tubes
o Challenge the established engineering rationale regarding thermowell design and configuration.
o Challenge the established engineering rationale regarding surface mounted measurement technqiues.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Minor	10	2	8

Expected benefits of project

Knowledge on thermal lagging future option requirements. The project could provide an efficiency for annual maintenance activities and Gas Industry reputation enhanced through improved metering accuracy.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	2 yrs	25%	£529,802

Potential for achieving expected benefits

The benefits remain unchanged - improved methods of temperature measurement and determining the requirement for lagging on meter tubes. Lagging is a safety issue because water can get trapped beneath it and cause corrosion of the pipework.

Project Progress

Work has continued on building the test equipment. A significant part of the hardware has been designed and ordered including: test spool pieces (at three sizes), novel temperature sensors, and chilling & heating equipment. A test enclosure has also been designed.

As part of increased safety protocols, safety calculations have been performed in preparation for flow centre testing.

The testing has been arranged at the flow centre for Autumn 2012. This will allow an opportunity for the computational field dynamics to be proven.

Collab' Partners

Provider(s) GL Noble Denton

(IFI27) High Pressure Metering Uncertainty Calculation Tool

Year: 2011/12

Project Description	Tool to calculate metering uncertainty clearly defining the Maximum Permissible Bias (MPB) & Maximum Permissible Error (MPE) of the system.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£0.00	£1,952.00	£6,098.00	
External	£0.00	£7,150.00	£0.00	£100,931.00
Materials	£0.00	£0.00	£0.00	
Total	£0.00	£9,102.00	£6,098.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Minor alignment to avoid wasted journeys due the wrong expertise sent to site to investigate meter related alarms and to investigate which contributor is at fault followed by sourcing suitable spare.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The alignment to this theme relates to the "reliable" aspects. National Grid needs to demonstrate that its methodology and approach for accurate metering systems is robust and reliable so that any additional costs are not passed onto shippers and subsequently consumers. The proposed approach should also provide a method whereby the major contributors of bias and uncertainty lie thereby providing a more robust and traceable investigation for conformity against the specification. This should also lead to intelligent and targeted investment where necessary.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Determine the feasibility and proposed development of the OrifUncE tool to assess uncertainty and errors for orifice plate metering systems. o Outline principles for MPE and MPB established for wider industry review and use. o Validation of data to determine the estimation of errors and uncertainties from the secondary instrumentation. o Inclusion of the uncertainty of the temperature measurement in the calculation of the pipe and orifice diameter o Inclusion of uncertainty in the diameter of the drain hole (if present) o Inclusion of fixed viscosity and isentropic index values as well as calculated values used by the Omni flow computers and calculate the impact on the uncertainty and error the flow. o Incorporation of the secondary instrumentation validation results and separate out uncertainties from errors. o Inclusion of an overall sensitivity and error to the inputs.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	10	-3	13

Expected benefits of project	To determine a tool that will calculate the Maximum Permissible Bias (MPB) and Maximum Permissible Error (MPE) terms within the high pressure metering system. This would facilitate the tool being used to verify that HP metering systems meet the requirements set out by the regulator and will provide Industry reputational benefits via improved metering accuracy.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	10 yrs	50%	£100,559

Potential for achieving expected benefits	The project has a high probability of realising expected benefits.
Project Progress	The metering tool for calculating meter uncertainty and error (according to international guidelines) will cover orifice plate meters, turbine meters and ultrasonic meters. The Orifice plate tool has been completed and is currently under review by a third party. The Turbine meter tool has been drafted

(IFI27) High Pressure Metering Uncertainty Calculation Tool

Year: 2011/12

	and will be completed in 2012. As the Ultrasonic tool is similar in some ways to the Turbine tool, it will be developed following feedback on the Turbine tool. The tools are scheduled for completion in 2012, and following delivery the tools could then be adopted for use by National Grid in drawing up metering contracts. National Grid Transmission agreed to collaborate on the project during the current stage. In order to share costs equally Gas Transmission have funded the work undertaken in 2011/12 to balance out the costs incurred by Gas Distribution in previous years. The planned work in 2012/13 will be equally funded.

Collab' Partners	National Grid Transmission	**Provider(s)**	GL Noble Denton

(IFI28) Hazard & Risk Assessment Tools for Major Gas Installations

Year: 2011/12

Project Description	Research and development of two Software tools for hazard and risk assessment of Major Hazard, Gas Installations

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£5,512.00	£3,254.00	£9,680.00	
External	£54,450.00	£37,332.00	£55,000.00	£500,000.00
Materials	£0.00	£48.00	£0.00	
Total	£59,962.00	£40,634.00	£64,680.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Supports National Grid in assessing the risks from its above 7 bar pipeline system and ensuring that expenditure is appropriately allocated.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Ensure National Grid Gas Distribution is using appropriate and up to date risk assessment methodologies that can be justified to HSE when assessing the risks from its high pressure pipeline assets. o Enhanced Software tools for hazard and risk assessment of Major Hazard Gas Installations

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	20	-3	23

Expected benefits of project

- Improves National Grid's understanding of pipeline risks
- Safety management through application of the models developed through this project
- The full cost of this project will collaborative partners is approximately £500k. National Grid's commitment to this is £135k. This provides a National Grid leverage ratio of 3.7:1 and individually GD's ratio will be 7.4:1.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	20 yrs	50%	-£36,050

Potential for achieving expected benefits

High potential that the benefits will be realised. Collaboration reduces costs significantly and enhances the likelihood of success. Implementation of the benefits from the PIPESAFE collaboration and related studies have been demonstrated.

Project Progress

During this period, a new version of the PIPESAFE package (for hazard and risk assessments of gas transmission pipelines) was delivered through the PIPESAFE collaboration, including the integration of a methodology for risk assessments of low toughness pipelines, revised gas composition values reflecting changes in the UK gas supplies and a facility to take account of ground movement in risk assessments.

Good progress continues to be made with the joint industry collaborations. This included the ongoing ESM (Effectiveness of Safety-improving Measures) project, which is concerned with measuring and improving the effectiveness of safety measures for pipelines; in particular due to external interference. Part A of the project (including full scale experiments with excavating machinery) was concluded and an interim report with recommendations prepared. This work identified human factors as a key area for further study and so a questionnaire was developed to obtain information on human factors, as input to the next stage of the project. The questionnaire has been issued to construction firms across Europe and North America and the results are being analysed to improve understanding of the human factors issues that contribute to damage to pipelines.

(IFI28) Hazard & Risk Assessment Tools for Major Gas Installations

Year: 2011/12

Collab' Partners	Collaborative partners for the "ORDER" group include (but are not limited to) GDF SUEZ (France) Gasunie (Netherlands) Enagas (Spain) Energinet.dk (Denmark) & Fluxys (Belgium). "PIPESAFE" group include (but not limited to) National Grid (UK) Energinet.dk (Denmark) Enagas (Spain) Fluxys (Belgium) Gasunie (Netherlands) StatoilHydro (Norway) & TransCanada PipeLines (Canada).	**Provider(s)**	GL Noble Denton

(IFI32) Carbon Accounting for Pipeline Installation/Rehabilitation

Year: 2011/12

Project Description

Address the common interest of water (and gas) utility companies and their suppliers in developing an Embodied or Life Cycle Carbon measure for pipeline installation and rehabilitation techniques, so that quantification can be made in a consistent, robust and auditable manner.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£392.00	£64.00	£0.00	
External	£5,000.00	£1,250.00	£0.00	£40,000.00
Materials	£0.00	£0.00	£0.00	
Total	£5,392.00	£1,314.00	£0.00	

Status

Draft

Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	Allows for the carbon accounting of pipe construction techniques.
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☐ 4 Safe, Reliable Network	
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

The technological areas this project aims to achieve will be the carbon quantification of gas pipeline activities potentailly covering where applicable:

- impact moling;
- pipe ramming;
- guided boring;
- microtunnelling;
- conventional trenching;
- narrow trenching;
- lining with close-fit pipes;
- lining with continuous pipes;
- lining with cured-in-place pipes (i.e. curing at ambient, by hot water, using steam and via UV light);
- lining with discrete pipes;
- lining with pipe segments;
- lining with spirally wound pipes;
- repair by flood grouting; and/or
- repair with cured-in-place patch.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Minor	10	-5	15

Expected benefits of project

A tool that assesses the carbon impact for different construction techniques. Ascertain knowledge as to the level of information required for a specific number of activities, which will then be used on how to apply the methodology to other activities.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	0 yrs	75%	-£26,286

Potential for achieving expected benefits

The extent to which scope 3 emissions within NGG are to be collated is yet to be finalised.

Project Progress

A tool has been developed that enables the user to calculate the emissions associated with pipeline installation and enhanced to enable the modeling of traffic volumes.

The enhanced tool has been delivered.

(IFI32) Carbon Accounting for Pipeline Installation/Rehabilitation

Year: 2011/12

Collab' Partners	OnSite Central Ltd Insituform Technologies Severn Trent Water Prokasro Mechatronik GmbH Bournemouth & West Hampshire Water BKP Berolina GmbH	**Provider(s)**	WRc

(IFI40) AGI Condition Monitoring

Year: 2011/12

Project Description	To review and test condition monitoring techniques for above ground installations (AGIs)

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£792.00	£1,995.00	£5,228.00	
External	£8,598.00	£15,587.00	£29,707.00	£101,883.16
Materials	£0.00	£1,608.00	£0.00	
Total	£9,390.00	£19,190.00	£34,935.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in maintenance taks and deferring of replacement of PRIs or their components
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The system has the potential to allow targeted maintenance to be performed by detecting moisture under insulation to identify areas of potential significant corrosion. This will enable corrective measures to be taken prior to any leakage occurign thus ensuring no loss of supply.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Detecting conditions that would support corrosion under insulation. o Identify areas of insulation that require removal to inspect pipework. o Identify and rectify areas of pipe corrosion prior to failure.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	17	0	17

Expected benefits of project	A system to allow targeted maintenance to be performed by detecting moisture under insulation on AGIs. Improved integrity of the pipelines and vessels mitigating against the potential loss of supply.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	3 yrs	75%	£624,765

Potential for achieving expected benefits	The results of the preliminary field trials indicate that it may be beneficial to extend the trial to attached a number of units onto lagged pipework to enable further close monitoring of the units to be undertaken.
Project Progress	A trial was conducted of seven units fitted to lagged pipework and monitored at intervals during the 11/12. Monitoring will continue until mid-late 2012, as a greater amount of data is needed to draw effective conclusions. However, the trials have so far demonstrated that the units are able to detect moisture (one of the units has detected approximately four droplets). However, further monitoring and analysis is required to establish the link between corrosion under insulation and the moisture detected by the devices. If the devices are shown to be effective (in detecting risk of corrosion), they could be used for condition based monitoring of lagged pipe work on a wider scale.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI42) Gas Decarbonisation

Year: 2011/12

Project Description	Deliver a conceptual design for a plant that would demonstrate a) the technical, economic, regulatory and legal feasibility of decarbonising network gas to give a hydrogen rich gas for introduction into the distribution network.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,355.00	£8,636.00	£0.00	
External	£17,289.00	£40,795.00	£0.00	£102,178.09
Materials	£0.00	£0.00	£0.00	
Total	£18,644.00	£49,431.00	£0.00	

Status	
Draft	
Draft	28/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Decarbonisation of Natural Gas by AHI to produce Hydrogen Enriched Natural Gas (HENG) to demonstrate its potential to reduce carbon dioxide emissions
☐ **2 Eradicating Fuel Poverty**	
☑ **3 Promoting Energy Savings**	The conceptual design would be a further step to towards proving roll-out feasibility and could identify energy savings from the use of HENG as compressor fuel - long term and marginal
☑ **4 Safe, Reliable Network**	Decarbonising the gas supply helps ensure that gas remains a fuel if choice in a low carbon future.
☑ **5 Protecting the Environment**	The project will pave the way for wider application of the technology by demonstrating its successful application and identifying legal and regulatory actions required to permit distribution of gas with a higher hydrogen and lower carbon content

Technological area / issue addressed by project	o Feasibility and Conceptual Design for Gas Decarbonisation Plant using Atlantic Hydrogen's technology o Process design, including block flowcharts and functional diagrams for the main tasks to be handled within the plant and an estimate of space required for the plant; o An overview of the carbon management plan, which will address management of the carbon resulting from the operation of the CarbonSaver plant, including a description of the logistics to collect, store, handle, pick up, and transport the carbon production; o Revised estimates of electrical loads and consumptions of the plant; and

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Significant	13	6	7

Expected benefits of project	Evaluate the potential to support a long term objective to decarbonise network gas and support the ongoing competitiveness of the netwrok. National Grid will develop knowledge of cutting edge technology with the potential to help improve long term security of the gas distribution industry.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	1 yrs	25%	-£98,261

Potential for achieving expected benefits	The knowledge gained to date has fed into another EU (GERG) work stream looking at the economic and efficient ways to transfer energy between gas and electric networks.
Project Progress	An EU (European Gas Research Group GERG)) proposal has been developed and avenues for EU R and D funding explored.
Collab' Partners	
Provider(s)	Atlantic Hydrogen, Multi-Tech, KIWA

(IFI43) High Pressure Temporary Repairs

Year: 2011/12

Project Description	To select, test and approve composite temporary repair solutions for use on National Grid's high pressure gas pipeline network.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£19,961.00	£0.00	£30,858.00	
External	£89,404.00	£0.00	£148,341.00	£493,204.03
Materials	£107,964.00	£0.00	£26,991.00	
Total	£217,329.00	£0.00	£206,190.00	

Status	
Draft	
Draft	28/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☑ **2 Eradicating Fuel Poverty**	Minimising the loss of supply will limit the potential impact upon vulnerable and needy consumers.
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	This type of solution could prevent a severe loss of supply scenario where long lead times are required fot the production of traditional repair fittings.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	Composite repair systems are currently unapproved. Selection, test and approve a composite repair system that could be used on pipeline geometries, such as bends and tees, where existing techniques are unsuitable.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	15	3	12

Expected benefits of project	Identification and appraisal of a temporary high pressure pipeline repair techniques, sufficient to allow an optimum selection for a given repair scenario. Successful qualification test of solution(s) that can be used for emergency repair use or development of bespoke solution.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	1 yrs	25%	£149,255

Potential for achieving expected benefits	On target to deliver benefits.
Project Progress	A comparison of the two industry standards currently used to provide guidance in composite repair qualification and design has been carried out and consideration has been given to each of the two repair systems selected in the previous stage and both have been found to be compliant. Assurance has been gained through the verification work for the composite repair systems on straight pipe sections. However, gaps have been identified in the qualification tests performed by the vendors of both composite repair systems and a test programme has been devised to address these. This has required a slight change in approach which will require some FEA modelling to be undertaken on a number of bend defect scenarios.

Collab' Partners		**Provider(s)**	GL Noble Denton

(IFI44) Preheat Reduction at AGI's

Year: 2011/12

Project Description	To enable gas preheating to be safely reduced or removed at pressure reduction installations (PRIs) through the development of decision support tool containing validated site selection criteria.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£7,083.00	£5,488.00	£36,555.00	
External	£73,240.00	£52,550.00	£78,500.00	£465,634.50
Materials	£0.00	£22,000.00	£129,200.00	
Total	£80,323.00	£80,038.00	£244,255.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in emissions as a result of using less gas for preheat
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☐ **4 Safe, Reliable Network**	
☑ **5 Protecting the Environment**	Reduction in emissions as a result of using less gas for preheat
Technological area / issue addressed by project	o To validate and demonstrate the reduction of energy use from gas heating at PRIs whilst maintaining gas quality and system integrity downstream.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	16	1	15

Expected benefits of project	Validate the proof of concept and evaluate all risks associated with the reduction in pre-heat. The output will also will inform of the potential benefits. The reduction of pre-heating at PRI's could reduce the energy consumption.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	10 yrs	50%	£260,116

Potential for achieving expected benefits	Project benefits were reviewed and could not be achieved due to the inability to remove preheating.
Project Progress	The review of the field trial sites has been completed to ascertain whether it is possible to reduce or remove preheating at these sites. The review took into consideration the materials of construction, pipe backfill, number of stage of pressure cut, proximity of users etc) and has identified 2 sites for possible field trial that could be operated with reduced preheat. Analysis of the operating envelope under which preheat could be turned off completely has not provided a practical solution in terms of the flow/pressure that could be operated and also the proximity of houses at the selected sites.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI46) Internal Joint Profiling System for PE Pipes

Year: 2011/12

Project Description

To demonstrate if the internal weld profile of in-service PE joints (both butt and electrofusion joints) meet gas industry engineering standards; this will be completed by a combination of:
- visual inspection
- reproducing the internal profile to enable comparison against acceptable parameters.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£3,921.00	£5,826.00	£13,517.00	
External	£33,180.00	£16,500.00	£36,590.00	£455,912.00
Materials	£0.00	£5,000.00	£0.00	
Total	£37,101.00	£27,326.00	£50,107.00	

Status

Draft

Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Good alignment as this will provide a methodology of determining the integrity of PE joints (both butt and electrofusion) to be undertaken without the need to undertake multiple excavations
☑ 5 Protecting the Environment	Minor alignment as the use of the new tool will result less excavations compared with current practice.

Technological area / issue addressed by project

To design a profile measurement device linked with a camera within PE pipe systems for measuring internal joints covering:
- LP/MP/IP pressure tiers, initially up to 4bar, but with the potential to increase to 10bar
- All PE pipe diameters from 125mm up to and including 630mm
- The following existing SDR ranges, 11, 17.6 & 21, plus the potential to modify the instrumentation for other SDRs which are currently under development, e.g, 26 & 33 - subject to acceptable entry systems being designed and developed.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	13	1	12

Expected benefits of project

This device could enable more accurate identification of PE plant to other 3rd party excavators to minimise the potential of interference damage. Reduced operational cost and environmental issues for a single excavation and improved decision making on the condition joints by internal visual appearance and accurate measurement of both butt and electrofusion joints.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	11 yrs	75%	£537,468

Potential for achieving expected benefits

Confidence that achieving the benefits remain high.

Project Progress

Further development of the prototype undertaken and calibration of laser system confirmed prior to release for field trial. The launch platform has been successfully used on robotic vehicle gaining confidence that launch and retrieving of the Profiler system will be successful.

Collab' Partners Synthotech Ltd **Provider(s)** Synthotech

(IFI47) Alternative Sources/Scenarios for Bio-methane Injection

Year: 2011/12

Project Description

To demonstrate the safe injection of biomethane into the UK gas grid from biogas sources other than sewage to demonstrate the overall feasibility of small scale "renewable" additions to the National Grid Gas Distribution network for LTS and IP systems.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£15,356.00	£138,357.00	£54,418.00	
External	£160,000.00	£731,500.00	£20,000.00	£1,507,606.61
Materials	-£17,000.00	£372,000.00	£0.00	
Total	£158,356.00	£1,241,857.00	£74,418.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	Strong Alignment Injection of bio-methane into the gas network provides the only large scale, non-disruptive & economic solution for decarbonising heat in the UK.
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Minor Alignment. National Grid have established that up to 50% of residential gas demand can be met with renewable gas and therefore this represents a potentially significant source of fuel that will enhance energy/security of supply within the UK.
☑ 5 Protecting the Environment	Strong Alignment. Biogas promises to deliver substantial environmental benefits. This project should demonstrate the injection of this gas into the gas distribution network enabling it to be used in the most efficient way and thus delivering the greatest environmental benefit.

Technological area / issue addressed by project

Conceptual Design for the IP system to inject bio-methane from Foodstocks and waste
- o Conceptual Design for the LTS system to inject bio-methane from pig slurry
- o Identify the specific gas quality monitoring equipment for each pressure tier compliant with GS(M)R requirements
- o Identify lower cost, fit for purpose, equipment for each pressure tier and the regulatory changes that would be required to implement them

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Significant	14	4	10

Expected benefits of project

Develop knowledge of best industry practice on the injection of biomethane into the grid in the UK for the pressure tiers identified. This project should also identify any on-going barriers that may prevent biogas being injected and reaching its full potential. This information combined with data from the trial is anticipated to enable effective solutions to those barriers, especially economic ones, to be identified.

This project should demonstrate the injection of this gas into the gas distribution network enabling it to be used in the most efficient way and thus delivering the greatest environmental benefit.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	0 yrs	25%	-£1,453,986

Potential for achieving expected benefits

The site has been designed to the appropriate safety standards and kit supplied. Regular management reviews will assess safety levels and adjustments will be made accordingly. HAZOPs of all parts of the site have been completed and each section put through the G17 process.

The site has also received a letter of approval from OFGEM for the use of new measurement equipment at a remote monitoring point in conjunction with the main sites currently approved Gas Quality & Energy measurement equipment. This will assist in developing alternative equipment for acceptance in measurement of energy and further develop economic benefits for future Bio methane Injection Facilities.

Project Progress

This is the UK's first purpose built 'Bio methane to Grid' facility is substantially complete. The connection facility was officially launched in October 2010 and stands ready for full commissioning when bio methane of consistent quality is produced in sufficient volume following forthcoming changes to the biogas upgrade system. In addition to completing the connection facility, and

(IFI47) Alternative Sources/Scenarios for Bio-methane Injection

Year: 2011/12

outside the scope of the IFI funding, Adnams Bio Energy and National Grid have collaborated to create a visitor centre at the site which will provide a regional focal point for education and information about renewable and sustainability. Training requirements for operation and maintenance of the facility will be delivered at the start of full operation.

Remote monitoring equipment for energy calculation has been installed downstream of a commingling point and has been inspected by OFGEM to support formal approval for the use of 'GasPT2' equipment for measurement of calorific value. This methodology and equipment is another feature pioneered by this site to promote and facilitate development of the market.

Collab' Partners	Adnams	**Provider(s)**	Mouchel, Willows, Various

(IFI50) Proximity Effects of Squeeze Off upon PE Pipe Joints

Year: 2011/12

Project Description	To understand the loads imposed upon PE Pipes when they are squeezed off and to use this information to better understand the requirements for separation distances between squeeze off equipment and joints.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£517.00	£8,278.00	£6,633.00	
External	£5,614.00	£63,227.00	£37,689.00	£250,345.66
Materials	£0.00	£525.00	£0.00	
Total	£6,131.00	£72,030.00	£44,322.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good Alignment. Project will mitigate against the risk of joint/fittings failures during squeeze-off operations and this maintaining supplies to customers.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Using validated finite element analysis of PE pipes to explore sensitivity of joint/fitting proximity to squeeze-off equipment o Explore Proximity issues when soil restraints is present o Explore Proximity issues when joints contain defects o To undertake basic testing of samples of PE material that have been subjected to Squeeze-Off to verify the Post Squeeze-Off Yield Strength

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	19	1	18

Expected benefits of project	This project will provide essential knowledge and understanding via validated FEA regarding the loads imposed during PE squeeze-off operations. This informed position will then determine whether any modifications are required to its working practices to ensure that their PE pipes are safe and also maintain supplies during flowstop operations.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	5 yrs	75%	£941,371

Potential for achieving expected benefits	This project is on target to deliver the proposed benefits.
Project Progress	The stresses obtained from FE modelling of squeeze-off on 4 PE pipe types were compared with the limiting stresses to identify acceptable distances between the squeeze-off tool and pipe joints/fittings. This provided interim guidance on squeeze off separation distances. However, it was also identified that end conditions/restraints and other conditions affect stresses in ways which were not covered by the FE modelling. Therefore it was agreed that stage 4 would include strain gauge measurements during live squeeze-off to help quantify these stresses. Stage 4 was initiated in October 2011 and aims to carry out strain gauge measurements on six different live squeeze-off jobs.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI51) New Materials for Gas Distribution

Year: 2011/12

Project Description	Determine the feasibility of applying specific novel materials to gas distribution that will overcome the construction difficulties associated with reinforcement and replacement of mains in and around London, so that National Grid can design and construct the mains replacement programme from 2013.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£9,493.00	£14,702.00	£0.00	
External	£121,138.00	£234,964.00	£0.00	£614,966.27
Materials	£0.00	-£9,200.00	£0.00	
Total	£130,631.00	£240,466.00	£0.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Strong alignment. Currently there is no practical pipe material to meet the requirements of the London Strategy replacement programme for future years.
☑ **5 Protecting the Environment**	Strong alignment. In the absence of any innovative material and faced with no alternative, steel would have to be used typically by non trenchless techniques. This would cause major traffic congestion, additional excavation and waste materials
Technological area / issue addressed by project	Large diameter pipes other than PE/ST that meet Gas Industry standards and procedures of up to 7bar operation o Risk assessments for laying such pipes in close proximity to buildings o Ability to connect to existing gas distribution systems o Ability to connect new offtakes in PE/ST o simplified table or matrix specifying building proximity distances associated with PE material by SDRs and PE pipe generation, pressure range host pipe material and jointing method.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Significant	25	2	23

Expected benefits of project	Develop an alternative to steel and provide environmental benefits by reducing excavations and waste materials in urban areas. This supports our London strategy.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	18 yrs	50%	£403,239

Potential for achieving expected benefits	The ability to utilise large diameter PE mains in urban locations has been realised. Further work is necessary to assess the true nature of damage caused to large diameter PE by excavation equipment. It is likely that to extend further the use of large dia PE without the need to undertake site specific quality risk assessments can only be achieved by undertaking this damage assessment work and/or review the repair methodology for large dia mains.
Project Progress	Using damage history from smaller diameter mains and using theoretical modelling , a screening methodology has been developed to assess the societal risk posed by large diameter PE mains in close proximity to multiple occupancy and building containing vulnerable people and a table of proximities developed for use of large diameter PE in urban areas. Implementation is deferred pending the proposed impact testing work on large diameter PE to further validate and refine the model.
Collab' Partners	
Provider(s)	PB Rune, GL Noble Denton

(IFI52) European Gas Research Group (GERG) 2009/10 - 2010/11

Year: 2011/12

Project Description

GERG is a cooperation of European Gas Utilities. Its members undertake a wide range of research directed to increase integrity and safety of gas distribution systems. National Grid is an active partner within the Distributions stream of GERG and seeks to gain significant leverage by collaborating in joint research projects.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£9,677.00	£2,476.00	£0.00	
External	£85,247.00	£6,706.00	£0.00	£750,000.00
Materials	£0.00	£0.00	£0.00	
Total	£94,924.00	£9,182.00	£0.00	

Status

Draft

Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	Minor alignment. Development of best of breed methane emission methodologies.
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Good Alignment,. Jointly funded research/ sharing information on best practice NDT of joints and Gas in Soils.
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

- Non destructive testing using field made joints
  - o The dynamics of gas tracking in soils
  - o Bench marking of methane emission methodologies
  - o Evaluation of nano technologies in gas distribution systems
  - o Reducing gas losses as a result of operation of the system
  - o Innovative testing of PE to define the tendency for slow crack growth

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	7	-2	9

Expected benefits of project

Improved knowledge in all project areas. NDT technologies have influenced the PE asset life project IFI63 in terms of the techniques utilised.

Significant research leverage benefits. The total value of projects proposed during the life of the listed projects is approximately £750,000 which provides National Grid with a leverage of approx 3.5 to 1.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	0 yrs	25%	-£94,924

Potential for achieving expected benefits

Expected benefits for NDT Inspection Technologies to be delivered during Q2 2012. Results due to be presented at the Plastic Pipes Conference in Barcelona in Sept 2012

Examining the Potential of application of Mirco-Electro Mechanical systems (MEMS) in GD systems Whilst the potential has been recognized the specific application favoured by GERG members will not be progressed by NGG

Other GERG projects in progress the expected benefits remain on track.

Project Progress

Gas Migration in Soils
Phase 2 has started and is focused on the design/ development of field trial sites to enable the theory to be tested.

NDT Inspection Techniques
Butt fusion testing has been completed at GERG member labs.
The majority of the saddle tests have also been completed.

(IFI52) European Gas Research Group (GERG) 2009/10 - 2010/11

Year: 2011/12

	Examining the Potential of application of Mirco-Electro Mechanical systems (MEMS) in GD systems A feasibility study has been completed that examines the use of MEMS in gas distribution Methods to reduce or prevent the free Gas Outflow during operational GD activities To undertake a global review of methods used.

Collab' Partners	KIWA, GDF SUEZ	**Provider(s)**	GDF Suez, GERG, KIWA

(IFI53) New Methods for Commissioning/Decommissioning Low Pressure Mains

Year: 2011/12

Project Description	To develop, verify and validate a new procedure for the commissioning and de-commissioning of Low Pressure Mains 250mm – 355mm in diameter

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£2,615.00	£2,511.00	£0.00	
External	£17,638.00	£17,638.00	£0.00	£79,285.57
Materials	£0.00	£1,105.00	£0.00	
Total	£20,253.00	£21,254.00	£0.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Minimising the delay to consumers during the reconnection process.
☑ **5 Protecting the Environment**	Reduce PE waste and avoid sending this to landfill.

Technological area / issue addressed by project	o The methodology can be adopted in all flow stopping operations within the size/pressure range specified o Verify whether temporary or permanent end restraint is required on live low-pressure, metallic gas mains using the new design of end cap from AVK Ltd. o Verify and validate the de-commissioning procedure using a two bag operation on LP metallic mains 7" – 12" diameter. o Verify that the Pipe Equipment Test End is suitable for use as the test piece on the end of the 250mm - 355mm PE100 SDR21 LP main during pressure testing of the main. o Verify and validate proposed commissioning procedure developed through a number of field trials for PE100 SDR21 LP mains 250mm - 355mm in diameter.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	9	-3	12

Expected benefits of project	Development of a new restraint system. The new methods will reduce waste of PE materials that would otherwise go to landfill.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	1 yrs	75%	£7,368

Potential for achieving expected benefits	Benefits can be realised by reducing the number of bags used within the decommissioning & commissioning process from 4 bags to 2 bags requiring smaller excavations and reduced site effort by operational staff. The previous methodology when commissioning the new pipeline required the use of squeeze off on the PE main to make the tie in connection. The revised technique eliminates the need for squeeze off during commissioning which increases the performance of the team and elimination of potential stresses imposed on the PE main by the application of the squeeze off equipment.
Project Progress	Successfully completed six field trials to verify and validate the new decommissioning / commissioning procedure on low pressure metallic mains 7" to 12" diameter.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI57) Calculation of Zones of Influence

Year: 2011/12

Project Description	To enhance existing zones of influence functionality so as to improve the efficiency and accuracy of the annual leakage return and economic assessment of leakage reduction projects.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£6,971.00	£12,567.00	£0.00	
External	£53,898.00	£79,574.00	£0.00	£194,089.57
Materials	£0.00	£0.00	£0.00	
Total	£60,869.00	£92,141.00	£0.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Minor Alignment. The output will facilitate reductions in leakage from subsequent projects i.e. allowing additional analysis to be undertaken to establish the effectiveness of MEG treatment which could then lead to remedial techniques to be deployed or other options to be sought.
☑ **5 Protecting the Environment**	Good alignment. Improved zones of influence calculation enables improved reporting and improved design of pressure management solutions.
Technological area / issue addressed by project	o Network analysis modelling software innovation bespoke to National Grid o Enhance our ability to report on the effectiveness of our leakage reduction strategy o Enhance our ability to design future leakage reduction proposals. o Identification of bio-methane sites to automatically calculate oxygen levels on the network for planning purposes o Ensure network analysis tools are in a position to easily enhanced in the future as the bio-methane market increases

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	17	-2	19

Expected benefits of project	Improved understanding of the impact on our networks of biomethane and modelling of leakage scenarios. This will then enable the creation of strategies and the deployment of solutions that will reduce our leakage in future years.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	1 yrs	50%	£878,282

Potential for achieving expected benefits	The demonstration version has shown that all the key benefits of this project will be achieved.
Project Progress	Successful delivery and testing of functionality within our core network analysis tool that allows users to easily identify where live and potential bio-methane sites have been added to the network model. The enhancements improved the efficiency, robustness and speed of response to a customer enquiry and removed the potential for error. The introduction of warnings regarding the recommended maximum values for a Gas Component reduces the chance of a user entering incorrect values, and the potential for an incorrect answer being provided to a customer. The purpose of this stage was to develop functionality to enable users to have the flexibility to generate the required average pressures more efficiently.
Collab' Partners	**Provider(s)** GL Noble Denton

(IFI58) Study into the Future Impacts on Calorific Value

Year: 2011/12

Project Description

To review and assess the future impacts and issues surrounding the injections of non-natural gases.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£2,412.00	£2,723.00	£0.00	
External	£15,500.00	£15,500.00	£0.00	£39,940.00
Materials	£1,495.00	£1,495.00	£0.00	
Total	£19,407.00	£19,718.00	£0.00	

Status

Draft

Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Ensuring the CV of gas is maintained within the agreed limits for all future imputs.
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

o Knowledge of key issues affecting the calorific value of gas in future years to mitigate the risk of accepting noncompliant gas and subsequent prosecution or financial penalty by Ofgem or HSE.
o Identify alternative carrier gas of lower cost and unrestricted supply and demonstrate their suitability to Ofgem.
o Identify low cost alternative to the Danalyzer suitable for installation at low volume network entry points

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Low	13	1	12

Expected benefits of project

Knowledge of key issues affecting the calorific value of gas in future years

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	1 yrs	25%	£188,007

Potential for achieving expected benefits

Project is on track to deliver the benefits

Project Progress

This stage of the project had 3 objectives:
> Evaluate the feasibility of using a cheaper alternative
> Carry out a market review of alternative instruments to the Danalyzer and review capabilities of each.
> Assess the range of gases that could feasibly enter the network, e.g. biogas, and assess the potential impact on the performance of the Danalyzer and hence accuracy of the determined CV.

It has now been established that an alternative to Helium as a carrier gas is possible and demonstrated no loss of performance. A market review of alternative CV instruments has been carried out and the capabilities of each have been reviewed and compared. The range of gases that could feasibly enter the network, were assessed in terms of the potential impact on the performance and hence accuracy of the determined CV. The output of this report informs of the potential impact of injecting non compliant gas into the network. This will also enable operators on site, for example, gas to grid facilities to quickly identify unexpected results on their instruments.

Collab' Partners

Provider(s) GL Noble Denton

(IFI60) Development of Pump Wier Tank Method for Multi-holder Sites

Year: 2011/12

Project Description	Design and trial of pump wier tank method for methane extraction at multi-gasholder sites.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£423.00	£8,766.00	£0.00	
External	£3,685.00	£125,115.00	£0.00	£140,061.98
Materials	£0.00	£0.00	£0.00	
Total	£4,108.00	£133,881.00	£0.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Water in gas holder tank contains certain amount of methane. As tank water is discharged into the sewer, methane can release from the water and build up in confined space. This can potentially lead to explosion and may impact upon the holder being operation as and when required in order to meet gas demand.
☑ **5 Protecting the Environment**	Local sewer undertakers have updated the Discharge Consents by prescribing limits of methane concentration in the water discharged at gas holder sites. This solution will assit National Grid in complying with these statutory regulations. In NG's corporate risk register, non-compliance with discharge consent scores 41.
Technological area / issue addressed by project	o Development of a pumped weir system for multi-holder sites o Utilisation of the last chamber of the site interceptor pit to house the submersible pump o Submersible pump operated by level switch

Innovation Type	**SD Rating**	**Benefits Rating**	**Residual Risk**	**Overall Score**
Incremental	Medium	18	1	17

Expected benefits of project	This project will test whether the weir tank solution can be modified so that it can be deployed for multi-holders sites.

Adoption (Year)	**Duration of Benefits**	**Prob' of Success**	**Project NPV**
2012	1 yrs	75%	£1,527,751

Potential for achieving expected benefits	Project completed.
Project Progress	Stage 3 provided technical briefing material for operational use of the Weir Pump installations in preparation for implementation. This consisted simple E&I description of pump and its usage, maintenance requirements, site operation and failure alarm indication response
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI63) PE Asset Life Reseach

Year: 2011/12

Project Description	To develop methodologies, techniques and decision support tools that establish the current condition of the existing PE network, identifies potential threats to the integrity of PE pipes and joints, assesses the residual life of the PE network and identifies possible strategies and policies for targeted replacement.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£26,566.00	£23,622.00	£33,520.00	
External	£217,766.00	£366,302.00	£135,710.00	£823,473.59
Materials	£12,987.00	£7,000.00	£0.00	
Total	£257,319.00	£396,924.00	£169,230.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Strong alignment. The avoidance of wholesale PE replacement in future years based on design life of 50years. The work is expected to allow asset life to be extended for many decades thereby avoiding major construction activity.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Strong alignment. The principal objectives of this work are to provide tools and methodologies to allow condition assessment and risk management of PE mains and service assets to be undertaken. This may lead to targeted replacement where risk dictates.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Introduction and development of novel retrieval methods for small PE samples (slivers & coupons). o Development of chemical and physical characterisation methods of determining condition assessment and residual life prediction from small samples. o Introducing new test methods to qualify the long term service performance of recovered sections of pipes and joints. o Developing a PE materials database and software tools for predicting the residual life of PE systems.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Significant	26	2	24

Expected benefits of project	New test methods for PE integrity and life that may be used to provide improved tests to specify new PE products. Understanding the risks posed by the PE asset to at least the same level of confidence as is currently the case for metallic mains.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	10 yrs	50%	£922,400

Potential for achieving expected benefits	Expected benefits are on track to be delivered.
Project Progress	A large number of samples of early PE pipes and fittings have been gathered from the field and testing completed. Scotia Gas Networks have joined the project
Collab' Partners	SGN
Provider(s)	MACAW

(IFI66) Orifice Plate Deformation

Year: 2011/12

Project Description	To recommend a reliable and accurate method for assessing orifice plate deformation at typical National Grid Gas Distribution operating conditions.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£3,294.00	£1,293.00	£0.00	
External	£10,917.00	£10,917.00	£0.00	£26,421.32
Materials	£0.00	£0.00	£0.00	
Total	£14,211.00	£12,210.00	£0.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good alignment. This work will validate whether the current concepts built on 1947 data, assumptions and mathematics are robust and fit for purpose leading to accurate and reliable assessment of both plastic and permanent deformation, conformance to ISO standards and suitable billing for gas transport revenue.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Survey of existing technical literature to establish current status of orifice plate deformation calculation. o Establish the causes of the differences between the Jeplast routine within HPMIS and elsewhere. o Use computational fluid dynamics (CFD) to calculate the actual load distribution on the orifice plate. o Use finite element analysis (FEA) to calculate the behaviour of the orifice plate under the load distribution calculated from the CFD. o Repeat the CFD and FEA calculations for a range of plate sizes, beta ratios, seal and mounting types. o Recommend a method of calculating orifice plate deformation that can be implemented by National Grid Gas Distribution in IFI:27 and elsewhere.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	10	4	6

Expected benefits of project	The main benefit of this work will be ascertaining crucical knowledge in determining whether the current assessment tools are robust and fit for purpose.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	0 yrs	25%	-£26,421

Potential for achieving expected benefits	The expected benefits are on target for delivery.
Project Progress	Stage 1 has been completed which included a survey of the existing technical literature available and established the gaps and inconsistencies in orifice plate deformation calculations. A matrix of orifice-plate types has been defined which will form the basis of the detailed calculations in stage 2 of this project. Future stages will develop a calculation method using a combination of finite element analysis and computational flow dynamics for calculating flow errors and orifice plate deformation.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI67) Pipeline Industry Research Club [PIRC]

Year: 2011/12

Project Description	Assessment, prevention and investigation of PE threats and opportunities via collaborative research.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£4,548.00	£1,291.00	£1,760.00	
External	£10,000.00	£5,833.00	£10,000.00	£170,000.00
Materials	£0.00	£0.00	£0.00	
Total	£14,548.00	£7,124.00	£11,760.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	PIRC undertakes jointly funded pipeline research to mitigate issues and risks associated with PE pipes. The group also provides opportunities for sharing information on best practice and incidents with other 8 other Water Companies
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project

Year 1:
o Butt Fusion Welding using forced-cooling to reduce welding cycles by up to one third without sacrificing quality, in collaboration with equipment manufacturers, thereby providing very real cost savings to the Industry.
o Coil Straightener a modular unit which can be attached to a coil trailer straightening and re-rounding coiled pipe in the process. The major benefits would be significant improvement in both joint quality and safety for relatively low cost.
o Rehabilitation Guidance a critical assessment of various rehabilitation techniques, including Rolldown, Swagelining and Polyflex, with practical guidance and advice to minimize avoidable risks.
o NDT of fusion joints - establishment of specific pass/failure criteria for the welds by correlation of NDT results obtained from the field with mechanical testing where appropriate, ultimately providing reliable reassurance.
5) Large Diameter EF Couplers (>630mm) Various jointing issues (including Reversion of pipe ends) are exaggerated in larger diameter fittings. Exova conduct approval testing and analysis to prevent problems occurring in the field.

Year 2:
In Year 2 the following projects will progress/continue:
o Harnessing Standards to Optimise Procurement
o Microwave NDT of PE BF and EF Joints
o Butt Fusion Welding of PE
o Lifetime of Electrofusion Fittings
o Coil Straightener
o Condition Assessment of Large Diameter Iron Trunk Mains
o New Technology Awareness

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	13	-7	20

Expected benefits of project

Improved system integrity.

The primary benefit from this programme is collaboration on projects that will help to maintain the integrity of PE pipes and demonstrate to the HSE and other stakeholders that National Grid is actively engaged at an Industry level.

Significant research leverage benefits.

(IFI67) Pipeline Industry Research Club [PIRC]

Year: 2011/12

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	8 yrs	25%	£37,094

Potential for achieving expected benefits	Benefits as stated. This remains high based on the successful work delivered to date.
Project Progress	Butt Fusion Welding - using forced-cooling to reduce welding cycles Work to date has shown that both internal and external cooling, when combined, can reduce the joint cooling time by 50% for PE pipes with a wall thickness of 30mm. The next stage will be to look at external cooling only and evaluation of the long term integrity of the resultant joint. Coil Pipe Straightener - a modular unit which can be attached to a coil trailer straightening and re-rounding Coiled pipe in the process. Redesigned unit undergoing field trials in the Water Industry. NDT of fusion joints. A number of field trials and site audits have taken place within the Water Industry. This has assisted with refined of the specific pass/failure criteria following destructive testing of welds.
Collab' Partners	United Utilities, Thames Water, Severn Trent Water, Yorkshire Water, Veolia Water, Northern Ireland Water, South West Water, Bristol Water, Sutton and East Surrey Water & Northumbrian Water. .
Provider(s)	EXOVA Polymer

(IFI68) Model Maintenance Improvements

Year: 2011/12

Project Description	To develop enhancements and efficiency improvements to the model maintenance applications that are used to model and analyse gas distribution systems with the aim to enable better integration with the business systems proposed under the GDFO programme.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£6,515.00	£4,715.00	£12,933.00	
External	£54,621.00	£31,500.00	£73,484.00	£266,952.02
Materials	£0.00	£0.00	£0.00	
Total	£61,136.00	£36,215.00	£86,417.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☑ **2 Eradicating Fuel Poverty**	Good Alignment. The network analysis models are used to make operational and strategic decisions for the business, the swifter updates will remove the potential disparity between the models and reality removing the probability of loss of supply and thus protecting venerable customers.
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good Alignment. The network analysis models are used to make operational and strategic decisions for the business, the swifter updates will remove the potential disparity between the models and reality removing the probability of loss of supply and ensuring that these models align to reality.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o New GBNA/LINAS Compare & Update functionality o Develop a prototype that provides the ability to independently process pipe attribute changes o Develop a prototype that provide the ability to 'drag and drop' node numbers o New Pipe Attributes Supplied From GIS o New update functionality for the underlying GBNA network files to hold the PON/Asset ID. o New Update the underlying GBNA network files to hold the unique GIS Node IDs. o Prototype Export to ArcFM Designer

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	11	2	9

Expected benefits of project	The proposed enhancements will greatly reduce the manual effort required to maintain and update models, which in turn will reduce the potential for errors occurring in the network models. Therefore there will be an expected increase in both efficient working and quality of the network models.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	3 yrs	50%	£683,504

Potential for achieving expected benefits	The benefits are on track to be delivered.
Project Progress	The key developments were efficiencies to the model maintenance process and further developments and automation of model extracts.
Collab' Partners	**Provider(s)** GL Noble Denton

(IFI69) Capacity Enhancements Using Compression

Year: 2011/12

Project Description

To demonstrate the feasibility of the use of compression to pump gas into higher pressure tiers at times of low demand, and hence to maximise the capacity for biomethane injection into the gas networks

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£23,238.00	£0.00	£11,000.00	
External	£87,500.00	£0.00	£72,500.00	£405,590.00
Materials	£0.00	£0.00	£0.00	
Total	£110,738.00	£0.00	£83,500.00	

Status

Draft

Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	Successful integration of compression into the gas network at strategic locations will enable GDNs to accept biomethane into their networks at many more locations than at present, as capacity is often constrained by the lack of year-round local demand
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	The introduction of biomethane at a multiplicity of locations will provide additional resilience for gas networks, and also facilitate the long-term continued use of all gas networks
☑ 5 Protecting the Environment	The additional quantities of biomethane injection that will be facilitated by the development of intra-network compression will reduce the proportion of fossil gas in the gas network and hence reduce greenhouse gas emissions from gas utilisation

Technological area / issue addressed by project

- Confirm, by means of simulation model, the steady-state and transient operating characteristics of a compressor installed at a PRS to pump gas from one pressure tier to a higher tier.
- Quantify operational constraints, gas flow metrics, site and equipment pressure settings, safe operating envelopes, consequences of breaching limits
- Review and quantify plant performance characteristics, reaction times, and start-up/shut-down reliabilities
- Derive site or network-specific sensitivities to clarify key considerations when designing explicit site requirements
- Define the technical, commercial and regulatory requirements for a field trial project.
- Injection biomethane into a higher pressure tier using compression

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Significant	13	-3	16

Expected benefits of project

The output will provide significant knowledge benefits by firstly developing and testing of the Simulation Model and then subsequently via the design and testing from the field trial installation.

It is estimated that compression could be required in relation to around 40% of potential biomethane injection sites, which would otherwise not connect to the gas network. Additional biomethane injection should enhance the resilience of the gas network, and secure its long-term future in an environment when there will be increasing pressure to reduce the use of fossil gas. It is difficult to quantify the environment benefit here given that installation and injections rates may vary from site to site and it is also difficult to predict the number of connections that may be requested in the future.

By ensuring that the output is codified and adopted into existing connection processes it will allow the funding to parties to respond accordingly within the appropriate standards of service.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	8 yrs	50%	-£363,705

Potential for achieving expected benefits

The project benefits have been reviewed and remain valid. Stage 3 remains appropriate, and anticipates a successful outcome by July 2012.

Project Progress

There have been no significant issues that have arisen, and the main decision points of selection of field trial location, commissioning of the computer modelling of the field trial gas network plus

(IFI69) Capacity Enhancements Using Compression

Year: 2011/12

compressor, compressor selection and selection of subcontractor to undertake the mechanical, electrical and control system design were characterised by logical analysis followed by agreement of the recommended course of action.

We are confident that the robust design of the field trial unit as evidenced by the successful HAZOP study and the thorough work carried out to develop and validate the computer model of the network provides a good platform for moving into phase 3 of the project, the construction and operation of the field trial unit itself.

Achievements:
> Network computer model developed that allows the user to input different demand profiles and computes transient pressures and flows for all nodes. Includes User Guide.
> HAZOP study of field trial installation completed
> Mechanical, electrical, instrumentation and PLC design of field trial installation completed

Collab' Partners	NGN	**Provider(s)**	CNG Services

(IFI70) Development of Packaged Solution for Bio-methane Injection

Year: 2011/12

Project Description

To develop an integrated packaged solution to allow bio-methane producers to connect to the network in the intermediate, medium and high pressure tiers.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£9,301.00	£0.00	£117,731.00	
External	£77,074.00	£0.00	£338,926.00	£877,296.00
Materials	£0.00	£0.00	£330,000.00	
Total	£86,375.00	£0.00	£786,657.00	

Status

Draft

Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Good Alignment. Bio-methane is a renewable energy that cuts the dependency on fossil fuels helping to ensure security of supply for the future whilst using and thus sustaining the existing energy infrastructure.
☑ 5 Protecting the Environment	Strong Alignment. The project forms a fundamental part of National Grid's target to integrate sources of renewable gas into the network, which will thus contribute towards the UK government target of 15% of the UK's energy to be from renewable sources by 2020

Technological area / issue addressed by project

o Greater process integration leading to a more streamlined approach.
o It is possible that new equipment may be incorporated into the packaged solution providing that it meets existing standards, GS(M)R, and National Grid engineering policies.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	9	-1	10

Expected benefits of project

Essential knowledge to modularise the connection and installation process for a bio-methane connection.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	0 yrs	50%	-£840,265

Potential for achieving expected benefits

The continued progression of establishing a framework for biomethane injection facility contracts demonstrates support of renewable gas connections and the focus on removing barriers to entry for customers.

The Stockport project will offer opportunities to demonstrate the efficiencies in delivering the innovation of packaged skid designs to customers.

Project Progress

Three of the four companies that entered into the process have had there designs appraised through the external appraisal process. These three companies have subsequently been entered on to the Bio Methane Injection Facility framework agreement for design/construct and installation.

Work will be offered for tender following completion of the G17 Process. This has resulted in Stage Gate 1 target completion moving into Q1 for 2012/13.

Collab' Partners

Provider(s) GL Noble Denton, Orbital, Technica, Future BioGast

(IFI71) Cured-in-Place and Polyurethane Spray Linings >12"

Year: 2011/12

Project Description	The overall aim is to demonstrate that CIP and PU spray linings are 'fit for purpose' as a permanent repair/rehabilitation technique for gas distribution mains, so supporting future Health and Safety Executive approval for the techniques as an alternative to pipeline replacement. This will include conducting mechanical testing on linings, laboratory and site trials and auditing of installation practicalities, quality assurance and quality control procedures.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£2,829.00	£0.00	£15,763.00	
External	£36,098.00	£0.00	£89,565.00	£261,559.00
Materials	£0.00	£0.00	£0.00	
Total	£38,927.00	£0.00	£105,328.00	

Status	
	Draft
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Strong alignment. Utilisation of thinner wall solutions over PE, that are easier to transport and install
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Strong alignment. Leads to a significant improvement in large diameter replacement
☑ **5 Protecting the Environment**	Strong alignment. Reduction in excavation due to reduced pipe entries and ability to replace longer lengths.
Technological area / issue addressed by project	o Development of lining technologies that are able to withstand pipe fracture and provide a system that enables the carrier pipe to be deemed 'permanently replaced' o Development of liner thickness measurement devices o Development of technologies to transport and/or deliver product in long lengths of buried pipe

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Significant	7	0	7

Expected benefits of project	To validate the proof of concept which will also inform the business of the potential benefits of CIPP solutions.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	0 yrs	25%	-£261,559

Potential for achieving expected benefits	The anticipated knowledge benefits from stage 1 are still on track to be achieved.
Project Progress	Project commenced in January 2012 and is progressing well.
Collab' Partners	NGN, SGN, WWU
Provider(s)	WRc

(IFI72) Operational & Integrity Challenges (Small Projects) 2011/12

Year: 2011/12

Project Description	To facilitate utilisation of innovative tools, techniques and processes across Operations, Coalitions and Alliance work activities that result in safety, efficiency, and environmental improvements

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£21,964.00	£0.00	£0.00	
External	£164,091.00	£0.00	£0.00	£234,853.64
Materials	£48,798.00	£0.00	£0.00	
Total	£234,853.00	£0.00	£0.00	

Status	
Draft	
Draft	24/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good alignment. Improvement in operator safety. Efficient utilisation of tools, techniques and equipment that enhance the operation, replacement and maintenance of the gas network
☑ **5 Protecting the Environment**	Minor alignment. Minimising leakage and waste
Technological area / issue addressed by project	o Technical safety & risk assessments for innovative products o Development of new performance specifications that will deliver new innovative products from the market

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	8	2	6

Expected benefits of project

Adoption of knowledge via an indepentent appraisal that will determine whether an innovation opportunity can be quickly developed and thus implemented into the business as efficiently as possible.

A number of projects will investigate how to reduce safety risks as part of the day-to-day operations, and other projects will investigate how to resolve current operational and technical issues that will avoid alternative options.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	0 yrs	25%	£253,113

Potential for achieving expected benefits

2011/12

1. ANG/CNG Feasibility Options - Unlikely to be able to deliver benefits at present due to the lack of Industry guidance in this area.
2. London MP Replacement Options - Report has confirmed that the weco seals could be removed albeit with some incremental innovation in some areas.
3. LP Bagstop - On track to deliver the 400mm solution.
4. Heat Pump Analysis and Validation - Benefits achieved
5. Dual Heat Feasibility - Benefits delivered.
6. Kevlar Bag Field Trial - Benefits are unlikely to be delivered in the foreseeable future
7. Drilling Migration Project - Benefits on track to deliver during 12/13 with full implementation
8. Mains Breaker 2 - On track to deliver
9. Redesign of the LSI Nose Cone
10. Gouging Damage from Service Pipes - On track to deliver
11. MBW Towbar Drill - On track to deliver
12. Hand Held Vacuum - Benefits will not be delivered
13. Saddle Entry System - On track to deliver system in use in North London area
14. CIPP Analysis - On track to deliver

(IFI72) Operational & Integrity Challenges (Small Projects) 2011/12

Year: 2011/12

Project Progress	2011/12 During 2011/12 15 small projects were approved which support short tem operational and integrity challenges to the network together with some research to support for the future of gas story. The fifteen project updates are as follows: Laser Scanning technology - A trial has been completed. ANG/CNG feasibility options - Feasibility report delivered London MP replacement options - Report delivered that outlines the types of fittings that may be encountered and some recommendations as to how they might be safely removed LP Bagstop Field trials of 400 saddle in progress. Heat pump analysis and validation Report delivered Dual heat feasibility Delivered report. The report identified that manufacturers were already developing technologies in this area. Future IFI work in this area is to be evaluated Kevlar bag field trial The project has identified that single bag has too many legislative barriers to overcome to enable it to be progressed. The project is on hold. Drilling migration project - Drill has been developed and delivered into the business Mains breaker 2 - Trials underway Redesign of the LSI nose cone -Testing has proved successful. Field trial to be progressed during 12/13 Gouging damage from service pipes - Samples are being collected from the field. MBW Towbar drill -Trials underway Hand held vac -The project has identified the effectiveness of the air shovel but the air delivery system is not adequate on the existing fleet of NGG vehicles. Saddle entry system Project has demonstrated that the concept works, field trials completed. CIPP analysis - Samples of CIPP product have been collected
Collab' Partners	
Provider(s)	GL Noble Denton, MBW, Pipeline Technology Ltd, Plasticpipes, Steve Vick, Synthotech

(IFI73) Facilitating the Natural Gas Vehicle Market

Year: 2011/12

Project Description	To support the development of an LTS grid gas filling facility and identify the market opportunities for natural gas vehicles in the UK with particular focus on trucks and other large vehicles

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£13,429.00	£0.00	£0.00	
External	£55,000.00	£0.00	£0.00	£68,429.42
Materials	£0.00	£0.00	£0.00	
Total	£68,429.00	£0.00	£0.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in CO2 emissions
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Improved utilisation of the gas network given the potential to reduce daily load factors
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o First ever high pressure inlet CNG station in UK o Well to wheels and tank to wheels CO2 impact o Detailed and focused market scenario analysis and future utilisation of the gas network

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Minor	8	-1	9

Expected benefits of project	Understanding of the specific business case for individual facilities and the broader analysis of the UK/gas grid potential.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	0 yrs	25%	-£68,429

Potential for achieving expected benefits	All benefits completed within 11/12. Project has been finalised and results communicated with external market bodies of interest.
Project Progress	The project provided a road transport market review and evaluation of current and potential fuel options. The study compared costs and carbon benefits between fuels in order to ascertain viable markets for CNG/LNG/CBiomethane. The study has identified that the current LTS connection process would need to be compatible with timescales required for commercialisation of CNG refuelling stations.

Collab' Partners	Asda	**Provider(s)**	CNG Services

(IFI74) NUAG (London) Asset Location Demonstration

Year: 2011/12

Project Description	To validate the NUAG NRS Portal is fit for purpose to receive asset enquiries and request asset information from other owners including National Grid

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£8,633.00	£0.00	£0.00	
External	£50,000.00	£0.00	£0.00	£600,000.00
Materials	£0.00	£0.00	£0.00	
Total	£58,633.00	£0.00	£0.00	

Status	
Draft	
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Single Portal for all UK asset enquiries that will ensure National Grid and all other asset owners only receive enquiries within their own area of interest and ensuring all relevant enquiries are received, thus reducing the potential risk of damage caused by 3rd Parties or to 3rd Party apparatus.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o receiving and responding to asset enquiries in a timely manner from a 3rd Party portal o obtaining details of all asset owners at a given location for work undertake by National Grid or those working on our behalf o minimising damage to National Grid assets by others - reducing effort/resources to resolve o minimising damage to 3rd party appatatus - reducing claims and effort/resources to reslove

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	18	-9	27

Expected benefits of project	Knowledge that a web-based asset information sharing service, aimed at improving access to asset information and so ensure effective planning and safer execution of works on or near buried assets both in and away from the street The proposed portal will also allow National Grid to request asset information from other utilities participating in the trial.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	8 yrs	75%	£104,348

Potential for achieving expected benefits	Good progress has been made to date and the expectation is the benefits will be realised. Further collaboration has been identified the potential to integrate applications achieving an improved customer experience and process efficiencies.
Project Progress	NUAG NRS Limited web-based national asset record information sharing service (NRS) to improve access and efficiencies to information on buried assets has been delivered, tested and training has been delivered. The trial with the funding organisations has commenced and it is expected all trial participants will be using the system in the next couple of months.
Collab' Partners	UK WIR, Thames Water, SE Water, UK Power Networks, Southern Gas Networks, BT, Technology Strategy Board
Provider(s)	NUAG

(IFI75) Improved Diurnal Storage Requirements Modelling

Year: 2011/12

Project Description	Identify and consider the application of new modelling techniques and methodologies for predicting diurnal storage needs for the Gas Distribution Networks to support both investment and operational planning activities.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£3,466.00	£0.00	£1,906.00	
External	£10,833.00	£0.00	£10,833.00	£65,000.00
Materials	£0.00	£0.00	£0.00	
Total	£14,299.00	£0.00	£12,739.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The key benefit of this research is in improved diurnal storage requirement modelling capability to ensure GDNs are able to make efficient investments or flex bookings to demonstrate regulatory compliance
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Validate whether improved diurnal storage requirement modelling capability will ensure GDNs are able to make efficient investments or flex bookings to demonstrate regulatory compliance.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium			

Expected benefits of project

- The main benefit from the study undertaken in the first stage will be to look at all the drivers for storage requirement and would investigate the most appropriate method for delivering a tool which satisfies agreed requirements:
  - o Whether through development of SSM, or
  - o Through the development of a new tool perhaps linked into 'Forecaster1' technology.

- The main benefit of this proposal is in improved diurnal storage requirement modelling capability to ensure GDNs are able make efficient investments or flex bookings in demonstrating regulatory compliance, i.e. each network has to demonstrate its ability to identify and meet the 1 in 20 storage requirement.
Identification of diurnal storage requirement factors in this feasibility study and the consequent identification and review of possible solutions for development of new tools/techniques in a future IFI project has the potential to deliver better network planning performance, and by improving the information available to System Operation, enable more efficient use of diurnal storage.

A full benefit analysis will be undertaken should the project proceed to further stages beyond the Feasibility Stage proposed.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	0 yrs	25%	-£65,000

Potential for achieving expected benefits	Work is progressing to plan and there is a good expectation of planned benefits being achieved.
Project Progress	The project commenced at the start of and initial workshops has been conducted which covered the existing Modelling approach and high level business requirements and drivers which will be used to evaluate ideas on options for development, and capture feedback on presented solutions options. This will be used as an input to scope the remainder of the project.

(IFI75) Improved Diurnal Storage Requirements Modelling

Year: 2011/12

Collab' Partners	SGN, WWU	**Provider(s)**	GL Noble Denton

(IFI76) Mobile Data Capture Project

Year: 2011/12

Project Description	This project aims to leverage the low cost and flexible platform afforded Smart Phones and bespoke applications to re-engineer the Gas Alliance Field force business processes associated with data collection, communication, compliance and customer service

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£12,032.00	£0.00	£5,718.00	
External	£38,184.00	£0.00	£61,816.00	£267,500.00
Materials	£0.00	£0.00	£0.00	
Total	£50,216.00	£0.00	£67,534.00	

Status	
	Draft
Draft	30/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Strong Alignment. Improvement to process safety via an efficient technological solution to capture data whilst out in the field.
☑ **5 Protecting the Environment**	Minor Alignment. Reduce the amount paper and avoidance of re-visits to site.
Technological area / issue addressed by project	o Development and testing of smartphone application for use in the Gas Distribution industry o Future proofing system cosing to ensure potential integration with bespoke GDFO/SAP systems

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Significant	17	-4	21

Expected benefits of project	Improvements in process safety, data quality and timeliness by removing hand-offs and delays. The use of the smartphone app technology will reduce significantly the paper used in the back office. As data will be captured on site this will also avoid unnecssary revisits to site.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	2 yrs	50%	£203,502

Potential for achieving expected benefits	Confidence remains high that the following benefits will be achieved > Improved Data Assurance – Use of GPS, time and date stamped photographs to assure test and other data now proven > Improved Data Timeliness – ability to complete, transmit and analyse field data in the remote office within 15 minutes of data sending proven > Improved Data Quality – Applications have demonstrated how methodologies reduce input errors > Shaping behaviors – Proved the functionality of the applications enables users to consistently follow correct testing and reporting protocols
Project Progress	The mobile data project has achieved the following: > Field trails of 8 mobile data applications and smart phone technology > Development of procedures, coding structures, definitions and methodologies to facilitate code distribution > Development of commercial agreements with contract partners to enable deployment > 3 applications in final trial – cross business deployment expected May 2012 > 4 further applications being coded in ready for trialling in May 2012 and cross business deployment in June 2012
Collab' Partners	Amec, BBUS, Morgan Sindell, Skanska, Morrisons, Enterprise
Provider(s)	Hyphen

(IFI77) Asset Health Modelling

Year: 2011/12

Project Description	Development of a Condition Based Risk Model that will determine the future health index of NGGD's key assets so that these can be assessed to prioritise investment decisions.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£12,805.00	£0.00	£59,488.00	
External	£142,334.00	£0.00	£338,000.00	£564,873.00
Materials	£0.00	£0.00	£0.00	
Total	£155,139.00	£0.00	£397,488.00	

Status	
Draft	
Draft	30/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good alignment. Understanding of asset condition and criticality, identifying and modelling different interventions to mitigate risk, and prioritise / select optimal expenditure via a condition based risk approach.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Asset management investment decision making, based on actual individual asset condition data. o Simplification of regulatory submission data that is fully auditable and repeatable. o An automated methodical approach to asset management that supplements existing engineering knowledge.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	19	3	16

Expected benefits of project	The tool will review and update data sets for each asset category thus providing understanding as to the condition and deterioration factors that impact upon the performance of key assets and how the risk is determined from these inputs.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	8 yrs	25%	£109,818

Potential for achieving expected benefits	The project benefits have been reviewed and remains valid at this moment in time.
Project Progress	Developed and delivered a tool that has enabled the loading of MP/LP distribution asset type, components, maintenance history and fault data for establishing current and future health/condition.
Collab' Partners	
Provider(s)	EA Technology

(IFI78) Application of Fracture Alert Monitoring

Year: 2011/12

Project Description	To maintain the safety and risk profile associated with cast-iron gas distribution mains via a cost effective innovative monitoring/ detection services as an alternative to full mains replacement.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,733.00	£0.00	£0.00	
External	£22,116.00	£0.00	£0.00	£26,008.00
Materials	£0.00	£0.00	£0.00	
Total	£23,849.00	£0.00	£0.00	

Status	
Draft	
Draft	28/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good alignment. Understanding of asset condition and criticality, identifying fractures to minimise risk.
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project	Ultimately, if the current technology can be adapted, the following may be achieved: o Detecting early stage leaks and planning mitigation works accordingly o Reacting immediately to breaks thus reducing the catastrophic effects o Avoiding the incremental capital and operational costs associated with emergency works o Improving long term asset planning programmes through real data and incorporating optimised operating and capital expenditure o Potentially extending the life of critical assets through real data o Cost effectively managing the risks associated with cast-iron pipelines o Complying with their statutory obligations in terms of safety

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	11	5	6

Expected benefits of project	The feasibility study will determine if acoustic technologies can be applied to Gas demonstrating improved asset condition monitoring.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	0 yrs	25%	-£26,008

Potential for achieving expected benefits	Expected benefits remain on track.
Project Progress	Work on this project commenced in March 2012, starting with the Stage 1 feasibility study which will inform the longer term project going forward. A review of the historical failure mechanisms has also been undertaken.
Collab' Partners	
Provider(s)	Syrinix

(IFI79) Bio-SNG Pilot Plant Design and Demonstration

Year: 2011/12

Project Description

To design and build a pilot plant that demonstrates the production of bio-SNG from biogenic waste.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£18,250.00	£0.00	£39,880.00	
External	£74,907.00	£0.00	£226,593.00	£554,147.00
Materials	£0.00	£0.00	£0.00	
Total	£93,157.00	£0.00	£266,473.00	

Status

Draft

Draft	17/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	The project forms an essential building block in National Grid's 'heat story', by demonstrating that large quantities of renewable gas could be produced from zero / low carbon sources, thereby providing justification for continued retention of the existing gas distribution network into the long term future if/when heating using fossil gas becomes more problematic.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	As bio-SNG would be produced from indigenous waste resources, this would enhance supply security by providing an alternative to fossil gas imports as UKCS gas production declines.
☑ **5 Protecting the Environment**	Thermal gasification is environmentally preferable to the alternatives of incineration or landfill of waste. Production of bio-SNG maximises the efficiency of energy from waste compared with electricity generation and can be applied at relatively small scale, thereby obviating the need for long distance transport of waste. Thermal gasification plants are more acceptable to the public than incineration plant in view of their lower environmental impact on their surroundings (e.g. air quality and visual impact).

Technological area / issue addressed by project

o high-level process design of a pilot bio-SNG plant based on the existing APP Gasplasma® gasification facility, including selection of the catalyst provider for the methanation stage and integration of this process into the overall design.
o High level assessment of waste availability and composition.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	10	4	6

Expected benefits of project

Demonstration of SNG production from biogenic waste would establish the UK as a leader in the production of renewable pipeline quality SNG, with possible future benefits in terms of exports of commercial plants and enhanced employment.

National Grid's participation should enhance our reputation as a leading proponent of the low carbon economy.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	0 yrs	25%	-£533,187

Potential for achieving expected benefits

The project has just commenced but we are confident that the major benefit of the project, namely demonstration of the concept of bio-SNG production from mixed waste, will be achieved.

Project Progress

The Collaboration Agreement between Advanced Plasma Power, Progressive Energy and National Grid was signed at the beginning of March 2012, following detailed discussions between the parties. Progress has been made with detailed planning for phases 1 and 2 of the project, and preliminary discussions have been held with potential catalyst suppliers. APP and PEL have started work on the high-level process design of the demonstration plant.

Collab' Partners

Advanced Plasma Power
Progressive Energy Limited

Provider(s) Advanced Plasma Power

(IFI80) Demonstration of Air Driven Water Extraction Unit

Year: 2011/12

Project Description	Complete a robust wide scale demonstration trial to prove the long term sustainability of an air drive powered design to extract water from gas mains.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£5,290.00	£0.00	£7,382.00	
External	£0.00	£0.00	£0.00	£84,672.00
Materials	£67,500.00	£0.00	£4,500.00	
Total	£72,790.00	£0.00	£11,882.00	

Status	
Draft	
Draft	30/05/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Minor. Reduction in carbon emissions as the utilisation of the vehicle engine to power the unit as opposed to the current need to run both the vehicle and units.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Minor. Increasing the availability of units during the winter period enabling restoration of gas networks in the event of a water ingress incident
☑ **5 Protecting the Environment**	Good. The use of an air drive motor will reduce noise levels from its current 104dB to a more acceptable 75dB. The system will also reduce carbon emissions
Technological area / issue addressed by project	o Evidence of robust testing of the product in different geographical and operational conditions o Demonstration of the systems robust design o Acceptance by the user that the design meets current operating requirements when used during normal works or as part of an incident.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	11	-3	14

Expected benefits of project	Improved design that meets the requirements of Operations and becomes the product of choice thus improving environmental performance.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	10 yrs	75%	-£12,819

Potential for achieving expected benefits	Confidence levels of achieving the objective and benefits set out in the original scope remain high.
Project Progress	To date all units have been manufactured and delivered to the agreed design. A work procedure and training manual have been produced by the manufacturer in compliance with PUWER and are undergoing registration within the National Grid learning and development process. Operational trials are being conducted with positive feedback to date being received from operatives using the equipment

Collab' Partners		**Provider(s)**	D Shuttleworth

(IFI81) Heat Economics Project

Year: 2011/12

Project Description	Identify whether gas ought to be more or less prominent, from an economic point of view, as part of a low Carbon economy than currently envisaged by government

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£26,059.00	£0.00	£11,249.00	
External	£75,000.00	£0.00	£63,914.00	£214,085.00
Materials	£43,131.00	£0.00	£0.00	
Total	£144,190.00	£0.00	£75,163.00	

Status	
Draft	
Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Identifies the scale of biomethane economically viable for gas to gas grid injection by decade and identifies the economic merits of retaining gas in a low Carbon economy. Proposes pathways and key policy milestones to enable a low Carbon UK vision to become a reality.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Identifies the timescales and milestones required to enable a low Carbon pathway to become a reality concerning specifically bio-methane and the assumptions previous made.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o determine the level of heat economically attractive to electrify or deliver from heat networks and the level and implications for gas networks. o determine the level of bio-methane to aim to deliver by decade. o outline the costs for energy in each decade and policies / technologies commercially required

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Significant	12	3	9

Expected benefits of project

Transfer of key knowledge from modelling related to the longevity of network assets - identification of business requirements / needs of 2050 which will support asset depreciation, regulatory submissions and reputation.

The output will inform the dialogue with DECC regarding long term views concerning the delivery of heat in a low carbon economy.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	yrs	50%	-£210,547

Potential for achieving expected benefits

The study is continuing as expected and remains on track for delivering anticipated benefits. The project will enable National Grid to provide an informed response to the recent DECC Heat Strategy, help identify key technologies for further review and provide an enduring platform for evaluation of future technologies within a macro economic outlook.

Project Progress

The review makes use of optimisation software to calculate the least cost mixture of appliances and infrastructure over time in order to reduce UK greenhouse gas emissions by 80% of 1990 levels by 2050.

Work commenced on the project during January 2012 and is on track for completion by June 2012.

During 2011/12 the study focused and delivered the development of the software package to be used within the study. Scenarios were identified for review and progress is being made with finalizing results.

Collab' Partners		**Provider(s)**	Redpoint, AIMMS

(IFI82) Distribution Pipeline Risk Management

Year: 2011/12

Project Description	To review and develop the current methodology to ensure that it is robust for future effective management of the risks associated with distribution pipes below 7bar in line with HSE requirements.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£4,928.00	£0.00	£0.00	
External	£14,000.00	£0.00	£0.00	£65,856.00
Materials	£0.00	£0.00	£0.00	
Total	£18,928.00	£0.00	£0.00	

Status	
	Draft
Draft	28/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Good alignment. The new approach will change the methodology of assessing risk associated with the distribution pipeline network supporting the potential reduction in cost of the current replacement programme.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Validate technical approach options to determine the best methodology for adopting the tier 2 threshold

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	17	0	17

Expected benefits of project	The knowledge used to analyse the data and produce improvements to MRPS will be communicated in detail to the industry participants. This understanding will assist GDN's in providing a robust response to use if required.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2014	0 yrs	25%	-£65,856

Potential for achieving expected benefits	The anticipated output from Stage 1 will be Knowledge.
Project Progress	Project commenced in late March 2012. Stage 1 is validate the technology.
Collab' Partners	NGN, SGN and WWU
Provider(s)	Newcastle University, Jacobs

(IFI83) Gas Quality & Bio Methane Project

Year: 2011/12

Project Description

The aim of the proposed work is to brief the UK gas industry on international and European developments in standardisation in the area of standardisation and energy measurement.
The main objectives will be to:
a) Provide reports and updates on an agreed list of key working groups.
b) Facilitate an agreed position and UK input into the agreed list of key working groups

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£705.00	£0.00	£0.00	
External	£9,000.00	£0.00	£0.00	£21,168.00
Materials	£0.00	£0.00	£0.00	
Total	£9,705.00	£0.00	£0.00	

Status

Draft	
Draft	28/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Strong alignment. Ensure a continued secure and reliable gas supply and standardised gas quality in line with the potential changes European legislation or directive may bring as a result of changes within the UK gas industry based upon decision made at European working groups.
☑ 5 Protecting the Environment	This work will provide the particapating DN's with a routine into and potential influence of the use of Bio methane within thier distribution netwroks.

Technological area / issue addressed by project

o Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition.
o Natural gas - Determination of composition with defined uncertainty by gas chromatography.
o Narural gas – Performance evaluation for on-line analytical systems.
o UK gas quality and the Gas Safety (Management) Regulations.
o European specification or standard for quality of biogas and other non-conventional sources of gas.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	12	-12	24

Expected benefits of project

- Understanding of the following:ISO TC 193/WG 18, which is tasked with revising ISO standard 6976: Natural gas - Calculation of calorific values, density, relative density and Wobbe index from composition.

ISO TC 193/WG15 and WG17, which are tasked with revision of the multiple parts of ISO standard 6974: Natural gas - Determination of composition with defined uncertainty by gas chromatography. In addition, WG15 is tasked with revision of ISO standard 10723: Natural gas – Performance evaluation for on-line analytical systems.

CEN BT WG 197, which is tasked with development of a European Standard for Natural Gas Quality.

DECC: Understand UK government's position on future UK gas quality and the Gas Safety (Management) Regulations.

CEN/TC 234/WG 9, which is developing a European specification or standard for quality of biogas and other non-conventional sources of gas. There is some potential for overlap or indeed conflict with the CEN standard on natural gas quality, and in view of increased interest in biogas there is some merit in securing UK representation.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	1 yrs	25%	-£21,168

(IFI83) Gas Quality & Bio Methane Project

Year: 2011/12

Potential for achieving expected benefits	> Industry has been appraised of the progress and issues surrounding the key standards in two briefing sessions with Gas Quality within the Gas Distribution Networks. An impact assessment on the changes in ISO6976 will also be updated. > Best practice in Europe is being shared during the development of European standards for natural gas and biomethane > In particular biomethane injection in Europe is further advanced than in the UK and this is helping to shape UK view on biomethane specifications in the UK. > Performance evaluation of CVDDs in the UK has advanced significantly in the UK and the methodologies developed have been incorporated into the revised ISO 10723.
Project Progress	> The Gas Distribution Networks have been represented on the review or development of five standards that were agreed as key to the UK gas industry: three international standards that are under review and two European standards that are being developed following Mandates issues to CEN by the EC. > The three ISO standards are concerned with analysis of natural gas and the calculation of key properties from the resulting composition. > ISO 6974 is the natural gas analysis standard under development currently comprises six parts. The first two parts deal with processing of data and have been extensively revised and include methods for determining the uncertainty in compositions. Publication of Parts 1 and 2 is expected soon. Part five deals with the most commonly used CV Determination Device (CVDD) employed in the UK and has been revised to include uncertainty calculations. It will shortly be issued for comment as a Final Draft ISO Standard, the last stage before publication. A new seventh part will also be developed, which will cover micro GCs. These can be used as lower-cost CVDDs and are likely to play a greater role in natural gas in the future. > ISO 6976 is the standard covering calculation of properties of natural gas from composition. It covers calculation of properties such as Calorific Value and Wobbe Index, which are extensively referred to in UK legislation. Calorific Value is critical in calculating energy, which is the basis by which natural gas is traded and the amount of gas conveyed by gas transporters is quantified. The draft standard has been issued for commend as a Committee Draft. ISO have asked the working group charged with revision of ISO 6976 to harmonize this standard with similar US standards. > The two new European standards cover future European natural gas and biomethane specifications.Both are at a relatively early stage of development.

Collab' Partners	NGN, SGN, WWU	**Provider(s)**	Dave Lander Consulting

(IFI84) SR25 Calculator

Year: 2011/12

Project Description	To create an excel spreadsheet calculator tool to allow the calculations in IGEM/SR/25 Edition 2 to be easily and consistently applied and an elexctroic auditable

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,050.00	£0.00	£0.00	
External	£13,400.00	£0.00	£0.00	£31,517.00
Materials	£0.00	£0.00	£0.00	
Total	£14,450.00	£0.00	£0.00	

Status	
Draft	
Draft	24/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Accurate and reliable identification of SR25 requirment at opertional sites and an output aligned to the requirments if IGEM SR25 ed 2 document
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project

o The classification of Natural Gas installation hazardous areas and the requirments to ensure a adequate ventilation for safe opertaion and the location in which they operate.
o The main features of the package include:
o Modules: In addition to the existing modules (Buildings, Vents, Multi-Venting and Gasholders) as the existing tool, a new Outdoors module will be implemented. However, there will be significant differences and additions in the Buildings, Vents and Multi-Venting modules, affecting the underlying methodology and/or the user interface.
o GUI: The Graphical User Interface will remain similar to that of the current tool. However, improvements may be introduced if dictated by ergonomic considerations or more robust implementation of the methodology logic.
o Data files: The calculator makes extensive use of pre-computed results, which are included as tables in the Excel spreadsheet. This approach will be retained but some will be modified and new tables will be added.
o Save/Load facilities: The current facilities of saving the data for a case in a textfile will be retained. If desirable, backwards compatibility will be implemented, so that case files produced with the current version of the tool will be accessible from the new package.
o Output: The current approach of writing the results to pre-existing templates in the spreadsheet, also containing explanatory
diagrams, will be retained.
o On-line help: The existing system of informative messages on the methodology will be retained and possibly augmented with new information,when appropriate.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	13	-4	17

Expected benefits of project

Transfer the use of the SR 25 model to GDN's. Leads to the avoidance of potential lost time accidents and major injury which can be quantified on a GDN specific basis. Ensure compliance with adopted IGEM/SR/25 specification and the avoidance of any associated fines, and mitigate or prevent against minor incidents.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	1 yrs	50%	-£31,517

Potential for achieving expected benefits

1. Consistent and rapid assessment of hazardous area classification of Natural Gas installations throughout UK.

2. Enable safety of the public, employees and plant to be maintained.

(IFI84) SR25 Calculator

Year: 2011/12

	3. Enable efficiencies for the both of the assessment of hazardous areas and the cost of implementing the requirements for safety. Implementation is in the initial phase as this report is compiled but it is envisaged that ALL benefits will be realised.
Project Progress	This project has delivered a software program that allows the GDN's to assess each above ground installation in line with the requirement of SR25 Ed 2. This will ensure a consistent review of above ground installations across the 4 GDN's. During the development of the model/calculator minor issues were identified and addressed but some issues such as calculation the hazardous area of a below ground installation cannot be calculated wit the delivered calculator.

Collab' Partners	NGN, SGN, WWU	**Provider(s)**	IGEM

(IFI85) Customer Self Isolation & Restoration Risk Assessment R&D

Year: 2011/12

Project Description

To develop a risk assessment model that would be included in the gas supply emergency procedures for all DNs, that would determine the optimal approach to take to customer self isolation & restoration.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,171.00	£0.00	£0.00	
External	£12,712.00	£0.00	£0.00	£25,423.00
Materials	£0.00	£0.00	£0.00	
Total	£13,883.00	£0.00	£0.00	

Status

Draft

Draft	20/04/2012
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☑ 2 Eradicating Fuel Poverty	This proposal enables GDNs to focus its resources on vulnerable customers in an incident rather than across the whole customer population
☑ 3 Promoting Energy Savings	By reducing the incident duration, fewer (fuel inefficient) electric heaters will need to be issued, and will be in use for a shorter duration.
☑ 4 Safe, Reliable Network	This proposal will enable the gas network to be restores much quicker than under current arrangements.
☑ 5 Protecting the Environment	By reducing the incident duration, fewer (fuel inefficient) electric heaters will need to be issued, and will be in use for a shorter duration.

Technological area / issue addressed by project

o A risk assessment framework has been developed for use in assessing the optimal approach to customer isolation & restoration. Early indicative figures suggest that the approach has merit, but it is now necessary to develop a robust risk assessment model that can be included in gas supply emergency procedures. This model will then form part of the decision making process during an incident.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium			

Expected benefits of project

- This will deliver a robust risk assessment module which will enable informed decision making on when it is appropriate to use self isolation and restoration.
- Incident casualties will be reduced by shortening the duration of the incident.
- By reducing the incident duration, fewer (fuel inefficient) electric heaters will need to be issued, and will be in use for a shorter duration.
- Supply to the affected customers are restored much quicker and thereby enhancing the performance of the network.
- Reduces impact on society in the affected areas. e.g. Not overloading the electricity grid with subsequent electrical supply failures.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	1 yrs	50%	£34,011

Potential for achieving expected benefits

This work has been completed and the decision support tool developed. The HSE have reviewed the risk assessment and have concluded it is sound although there are some recommendations which will be followed up in due course.

Work is currently ongoing to integrate this decision support tool into industry emergency procedures and to develop the wider customer self isolation & restoration process.

Project Progress

The work was undertaken in two separate phases to enable a feasibility analysis to be carried out initially. This phase consisted of locating and obtaining available data and determining whether it is sufficient to allow the full risk analysis to be undertaken.

The second phase utilised all available information and assumptions to build the models that can be used to generate the required graphs

Event diagrams have been established to enable a model to be built to estimate the predicted

(IFI85) Customer Self Isolation & Restoration Risk Assessment R&D

Year: 2011/12

number of gas safety related fatalities required for graph 1. A methodology for developing graph 2 (predicted number of cold weather related fatalities) has also been developed. The inputs for both graphs have been highlighted to show where the most uncertainty in the data lies.

The development of event diagrams and the availability of associated probabilities has determined that the development of a fully populated model is feasible to enable the two graphs required by SGN to be produced

Collab' Partners	NGN, SGN, WWU	**Provider(s)**	GL Noble Denton

(IFI90) Network Design Improvements (ArcFM)

Year: 2011/12

Project Description	To deliver a graphical design tool integrated into core SAP that will replace the manual production of paper graphical designs and thereby improve the control and integrity of asset designs, validation of designs, design ammendments, work issuing to the field, and as laid records data capture.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£136,691.00	£0.00	£0.00	
External	£579,000.00	£0.00	£0.00	£715,691.22
Materials	£0.00	£0.00	£0.00	
Total	£715,691.00	£0.00	£0.00	

Status	
	Draft
Draft	23/05/2012
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Improved efficiency in mains replacement designs, enhanced consistency, less hand offs reducing the risk of errors, ability to undertake more 'what if' designs that may include security of supply analysis
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Quicker designs held in electronic format o Ability to undertake more easily a set of costed replacement design options analyses to test 'what if' scenarios that could generate a more holistic network solution o Reduction in asset record errors between design, work order issue and as laid data capture as the need for creating/duplicating and replicating designs and plans throughout the end to end process is reduced significantly

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	14	-2	16

Expected benefits of project	- System enhancements. - The program will deliver the following benefits: 1. Efficient designs based on more 'what if' scenarios considering capacity and security of supply 2. Removal of manual handoffs of work designs across business units 3. Reduction in asset data errors. - Improved control and quality of field data capture.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	0 yrs	50%	-£715,691

Potential for achieving expected benefits	The implementation of the system as part of the gas transformation programme which is on track for delivery in 2012/13.
Project Progress	The integration and enhancement of a graphical design tool into core SAP following extensive business engagement to define requirements.
Collab' Partners	**Provider(s)** ESRI, Wipro

nationalgrid

1-3 Strand
London
WC2N 5EH
United Knigdom

Registered in England and
Wales 4031152