31st July 2010

Innovation Funding Incentive For Sustainable Development Annual Report 2009/2010

Gas Distribution

nationalgrid

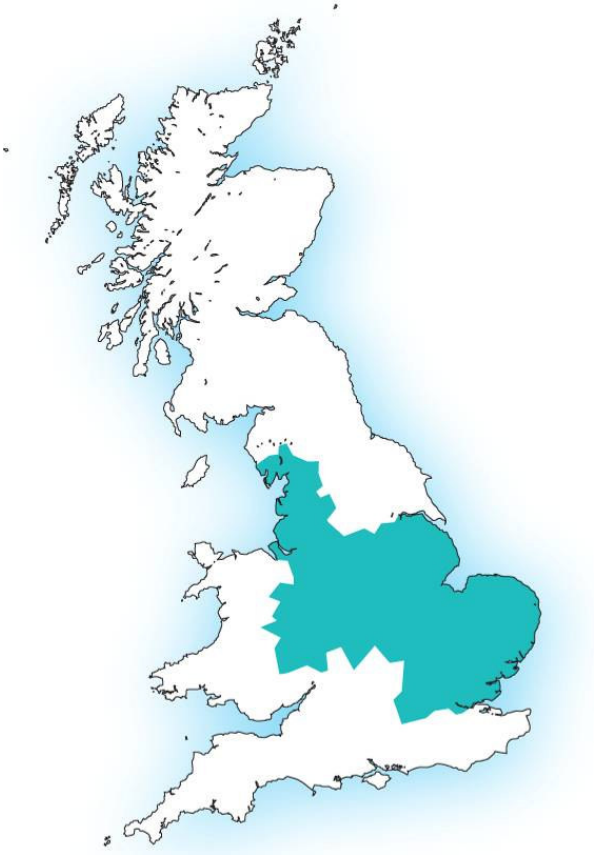
THE POWER OF ACTION

Document Content

This document has been designed in order to comply with the Gas Distribution IFI/SD Good Practice Guide (GPG - issued December 2008) and the contents of this document are listed below.

About National Grid and Gas Distribution

National Grid is an international Electricity and Gas Infrastructure Company and one of the largest investor-owned energy companies in the world. We play a vital role in providing energy to millions of customers across Great Britain in a safe, efficient and reliable manner. We are committed to safeguarding the environment for future generations and providing all our customers with the highest standards of service.



Gas Distribution

Gas Distribution owns and operates four of the UK's eight gas distribution networks. It consists of 132,000km of gas pipelines operating a various pressures up to 38 bar with approximately 13,000 pressure reduction sites, including district governors. GD distributes gas on behalf of the shipper and suppliers to 10.8 million UK domestic, commercial and industrial consumers.

Gas Distribution continues the objective of improving the safety and reliability of the network by replacing metallic mains with plastic each year. During 2009_10 over 2000 kilometres were replaced.

Introduction by Mark Fairbairn, Executive Director, Gas Distribution

Welcome to the second report presenting the Gas Distribution Innovation Programme delivered under the Innovation Funding Incentive for Sustainable Development (IFI/SD). This incentive agreed with Ofgem as part of the 5 year Gas Distribution Price Control Review has re-energised innovation within National Grid Gas.

Our Innovation Strategy has remained unchanged from year one and compliments our Company vision and strategy to being an innovative leader in energy management and to safeguard our global environment. Gas Distribution addresses specific areas to improve business performance as follows:

1) Improve asset and energy management;
2) Focus on new technology and innovative techniques to support operational efficiency and challenges;
3) Support improvements in all aspects of the environment.

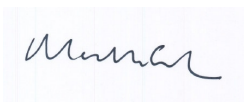
Following a further year of embedding this incentive within our business, the benefits from the first year's programme are starting to be reflected in new approaches to existing problems and increasing knowledge to take us into the future. Broadly speaking we have invested 80% of the gas allowance utilising the first year carry over value of £3.3m and a further £4.7m to total £8m in 2009/10.

In the 2008/09 report I outlined some of our global environmental and economic challenges such as our carbon reductions by 2050 which are still relevant today. Gas Distribution has remained focused on developing and promoting the environmental benefits associated with renewable gas. We have completed further research to enhance our understanding of anaerobic digestion and worked hard to impart the output with key stakeholders, Government and the broader energy industry.

We have also been transforming our front office systems completing the feasibility, proof of concept and design phases to deliver a new work scheduling and mobile solution to our maintenance and emergency processes which will improve customer performance and asset data capture and more details are contained within this report.

I hope you find this second report a useful insight into the value of IFI_SD from a National Grid Gas Distribution perspective and that the report illustrates our commitment to the future Gas network.

Mark Fairbairn



Executive Director, Distribution.

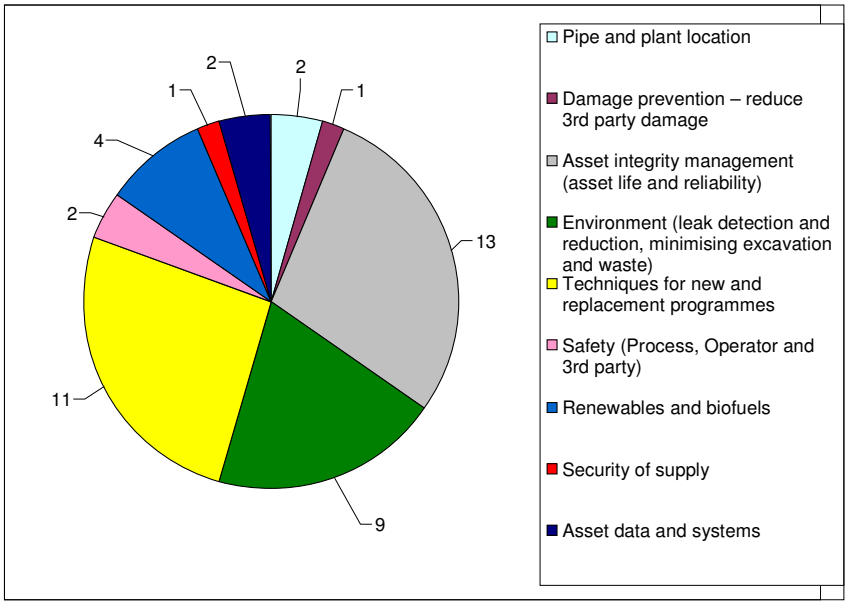
Overview of 2009/2010 programme

In the second year we have continued to:

- Work to our Innovation Strategy for National Grid Gas Distribution in line with our company strategy
- Grow the portfolio of projects from year 1 and continue to review and move existing projects through their various stage gates to ensure projects meet the intended objectives
- Raise awareness of the incentive with all our stakeholders both internally and externally
- Improve our processes and systems to manage the programme more effectively.

Our Innovation Strategy states we will promote technological advances and develop knowledge to provide a safe, efficient and reliable network, to deliver value to our customers and safeguard our environment. Our aim is to balance our portfolio to improve operational efficiency, improve asset and energy management and support the environment always aligning to one or more of the 5 sustainable themes.

There are 45 projects detailed in this report where expenditure has been incurred in 2009_10. This pie chart shows more detail of the areas of focus within our portfolio.



We have clear governance and visibility of our plans at Executive and Global level. We have adopted a stage gate approach to project management that ensures decisions are made to proceed or close a project, reviewed against the potential benefit delivery.

Wherever practicable we have continued to collaborate with other organisations who share common objectives and issues. We have 4 joint projects with fellow members of the European Gas Research Group (GERG) both fostering relationships and leveraging Euro430k worth of research for Euro84k commitment.

The joint GDN research sub group facilitated by the ENA (Energy Networks Association), have worked together to ensure the right mechanisms are in place for successful collaboration and found common ground to allow collaborative working whilst maintaining individual competitiveness. A joint industry Collaborative R&D Strategy has been developed and 3 projects are continuing.

IFI serves us well for the immediate innovation programme however the need to sponsor large scale demonstration projects to prove new technology will work on a real network will mean that the IFI is not enough. To demonstrate the benefit of these longer term projects may be challenge in pure financial terms (e.g. where the benefit is carbon reduction) and we will engage with Ofgem to discuss change.

Innovation Focus Areas

As explained earlier our portfolio is balanced over three areas (focus on new technology and innovative techniques to support improvements to asset and energy management, operational efficiency and supporting improvements in all aspects of the environment) with alignment to the 5 sustainable themes. Here are some highlights from the existing programme of work.

Asset and Energy Management

Risk Based Automatic Handling of Plant Enquiries

National Grid process around 1500 postal queries a week in relation to third party work in the vicinity of buried pipes, overhead and buried electrical cables. An integrated expert system is being trialled internally, replacing a number of legacy systems and processes that use a set of rules to determine the appropriate response depending on the assessed level of risk involved in the third party work. This has improved the efficiency with which the queries are handled resulting in an improved customer experience. It has also significantly improved safety by reducing the margin for error by ensuring that all of the relevant Plant Protection rules are followed in a consistent manner whilst providing precise location details and maps to the enquirer. This is a joint project with National Grid Transmission.

Development of the Corrosion Camera

A large amount of National Grid's above ground installations, pressure reduction stations and above ground crossings have some form of cladding that has to be removed to allow the pipework to be inspected and then subsequently replaced. In the case of above ground crossings scaffolding is constructed to allow this to take place, causing major disruption to the rail and road networks. The camera aims to solve this by using an infrared camera to detect corrosion through the layers of cladding, thus reducing those impacts on the road and rail networks and removing the need to replace the cladding every time an inspection takes place. Laboratory testing proved that the project was feasible and field trials will continue.

Engineering Technologies and Techniques to improve Safety and Operational Efficiencies

The safety of our operational workforce, reducing traffic congestion, reducing excavations / volume of reinstatement and improve the customer experience remains at the forefront of our innovation programme to continue our drive for operational efficiency. This allows works to be completed more efficiently and provide value to customers. We need to make sure we are able to locate our assets efficiently, know what we want from them, operate them efficiently, make the right asset investment decisions and be confident that the assets are safe.

There are common challenges across the gas industry such as the availability of techniques for the repair and the management of larger diameter pipes to minimise customer supply disruption. Research and development of flow stopping solutions and squeeze off techniques will help us meet these challenges.

Flowstopping

Flow stopping continues to be a key focus, particularly for PE at the larger diameters. Following feasibility work during 2009/10, field trials have been successfully completed to allow for flow stopping of low pressure PE mains up to 630mm. The system significantly reduces excavation requirements, thereby reducing the probability of damage to other buried apparatus. It also reduces landfill waste and imported materials and therefore meets our requirements for sustainability to the environment. Additionally pipe stresses are minimized.

Pipe Handler

In contrast to current technologies the Pipe Handler attaches to a standard excavating machine, it grips the PE Pipe in position and inserts it into the larger diameter metallic pipe. It is totally controlled by the excavator operator, eliminating the need for any person to enter the excavated trench. The Pipe Handler can push at speeds of up to 10 metres per minute and can handle long sections of PE Pipe, reducing the amount of excavations that take place thus minimising hazards and hold ups for road users and pedestrians.

Work Scheduling and Mobile Solution in the Field

The objective of the Gas Distribution Front Office Programme is to use the opportunity afforded by the requirement to replace some 70 independent IS systems many of which are reaching the end of their supportable life, to introduce one enhanced system based on SAP.

Existing work scheduling software 'CLICK' and mobile solution 'SYCLO' were selected as best of breed stand alone systems. The technical and innovative element of the programme that qualifies under IFI is the enhancements of these systems and the unique way in which they have been integrated into the core asset repository systems (SAP), smart travel and mapping solutions.

Customer performance is improved with optimised scheduling, optimal travel routes, customer communications, ability to reschedule for customer and improved capturing of customer feedback.

Onsite asset data capture is increased and data quality and storage is improved, thereby allowing more information to be analysed and utilised to determine future maintenance regimes and replacement policies.

These technologies will improve the operation and maintenance of the network by ensuring both labour, plant and equipment resources are optimised.

Pre populated forms and intuitive user interfaces will help to improve site survey, risk assessment and data capture and previous job and site history will be available for view from site.

Environmental and Climate change

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

Bio Methane

Renewable gas has the potential to make a significant contribution to renewable energy targets while also providing diversity and security of supply and is one of National Grid's top Distribution priorities. We are progressing two projects and we plan for both to be commissioned before the end of March 2011. Such projects are designed to facilitate the injection of gas from sustainable sources into our existing gas distribution networks, allowing it to be delivered to customers to heat their homes and businesses

One of these projects is in Manchester which will inject biomethane from waste water treatment into the MP network. Our project in Suffolk will take gas produced from food and brewery waste which when processed via a cryogenic clean up process will be injected into our IP network.

Pre-Heating

Feasibility and proof of concept work to improve the efficiency, reliability, and environmental impact of pre heating at pressure reduction stations has shown promising results.
The work has been split into 3 areas of focus namely on reducing and/or removing the need for pre heat, replacing antifreeze with corrosion inhibitors and finding alternatives to ageing water bath boiler technologies. The success of the feasibility work during 2009/10 has meant that all three projects are progressing to developing field trials in 2010/11.

Finance Overview & Benefits of Programme

This section of the report gives the financial information associated with the 2009/10 programme.

	£m
Revenue	1418
IFI Allowance	7.1
IFI carry over	3.3
External Expenditure	6.9
Internal Expenditure	1.1
Total Expenditure	8.0
Anticipated IFI allowance (for 2010_11)	0

Number of Active Projects	45

Following on from Year 1 where 30 live projects commenced (total spend of £2.5m), the programme has now extended to 45 live projects moving through the research, development and demonstration phases (R, D&D). Ten projects are either complete or in the post investment appraisal phase. Benefits of the completed projects have mainly been asset management knowledge acquisition and cost avoidance.

Potential benefits are assessed on an individual project basis against the GPG benefit criteria and reassessed at each stage gate. This has delivered a balanced programme providing a potential positive NPV overall.

Benefits are achieved by:

- Direct Cost e.g. through reduced planned capital expenditure, maintenance expenditure or efficient operations;
- Avoided Cost e.g. deferred investment, reduced failures, establishing conditions of equipment to feed capital or maintenance plans and improved ratings
- Managing risk 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

The potential benefits outlines from the 2009/10 programme will mainly be knowledge acquisition and direct future costs savings. Typical benefits are estimated based on implementation of innovation for a 5 to 10 year period dependant on project and estimated implementation timescales. These benefits will be factored into future business plans for Gas Distribution and will be reviewed as projects progress through to implementation. The programme also delivers non financial benefits such in safety, environment, reputational and customer benefits.

As mentioned last year, internal resources supporting projects increase as projects move through the technology readiness levels. Nine of our projects have exceeded the 15% cap and we have concerns that the 15% cap on each project will constrain our involvement and technical input in future stages. A good example of this is where we clearly demonstrate leadership in the future of renewable gas and need our people to influence the Industry going forward. A more flexible approach is required to match the internal resources to the needs of the individual projects.

Looking Forward

Our Innovation Strategy continues to 2010/11 and the programme will continue to meet our 3 objectives and align to the sustainable themes. Our aim is maximise the benefits from the current portfolio, plan for successful implementation and look for further opportunities to collaborate thus leveraging spend. We expect to utilise the full IFI_SD allowance in 2010/11 on planned existing and new work proposals.

We will continue to influence manufacturers to ensure industry investment in new products is aligned with our longer term and strategic needs.

We will continue to seek to influence governments and regulatory bodies on the forward energy agenda incorporating knowledge gained through innovation – leading in demonstration of renewable gas to the gas distribution networks.

In addition to our biogas based projects we are seeking to pioneer in the UK a process for the removal of carbon from natural gas to create a hydrogen enriched gas (HENG) that will give rise to reduced emissions when burned compared to natural gas. We plan to complete a conceptual design this year and are exploring opportunities for collaborative funding to take this through to detailed design and ultimately the construction of a demonstration plant.

Appendix 1 45 Innovation Project Reports Contents page

Project Reference & Title:

IFI2 Impacts Of Flooding On Gas Pipeline And AGI's
IFI3 Impact of Future Energy Systems on Energy Networks (Beywatch)
IFI4 Optimise Own Energy Use
IFI5 Reduction in Methane Losses
IFI7 Risk-Based Automatic Handling Of Plant Enquiries
IFI8 Large Diameter LP PE Flowstop
IFI9 Cleaning of Gas Mains & Recovery of Gas
IFI11 Maximising The Benefits Of Keyhole Excavation
IFI12 Improved Apparatus Detection, Mapping & Protection Feasibility
IFI14 Maximising the Environmental Benefits of CBEM2 Prototype
IFI15 London Decentralised Energy Network
IFI16 Alternative Inspection Techniques
IFI18 Injection of Biomethane into the Gas Network
IFI19 Better Load Analysis & Demand Modelling (Feasibility)
IFI21 Improvements to the MRPS Model
IFI24 EPRG Research Collaboration
IFI25 PRCI Research Collaboration
IFI26 The Effect of Thermal Lagging on Fiscal Metering Temperature Measurement
IFI27 High Pressure Metering Uncertainty Calculation Tool
IFI29 Waterbath heating
IFI32 Carbon Accounting for Pipeline Installation/Rehabilitation
IFI33 Gas Alliance Group Excavation Protection System
IFI34 Development of a Corrosion Camera
IFI35 Large Diameter PE Pipe Handler 250-355mm
IFI36 PE Glue Repairs
IFI37 Road Plates
IFI38 Service Cut-offs from Inside Dwellings
IFI39 Utopia Flowstop
IFI40 AGI Condition Monitoring
IFI42 Gas Decarbonisation
IFI43 High Pressure Temporary Repairs
IFI44 Preheat Reduction at AGI's
IFI45 Demonstration trial for on site energy savings
IFI46 Internal Joint Profiling System for PE Pipes
IFI47 Alternative Sources/Scenarios for Bio-Methane Injection
IFI48 Flow Measurement Device for Flow Stop and Network Modelling
IFI49 Human Factors in Gas Operations
IFI50 Proximity Effects of Squeeze Off on PE Pipe Joints
IFI51 New Materials for Gas Distribution
IFI52 GERG research collaboration
IFI53 New Methods for Commissioning/Decommissioning Mains
IFI54 Development of new rapid service cut off technique
IFI55 Operations Efficiencies and Integrity Challenges
IFI56 Work Scheduling and Mobile solution in the field
IFI57 Calculation of Zones of Influence

Appendix 1

(IFI2) Impacts Of Flooding On Gas Pipeline And AGIs

Year: 2009/10

Project Description	To identify the sections of UK high pressure Gas Distribution system and Above Ground Installations that are at risk of flooding and develop a risk assessment process so that suitable preventative actions and mitigating measures can be implemented where these are shown to be reasonably practicable.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£12,022.00	£7,641.00	£6,378.00	£246,436.00
External	£113,500.00	£74,050.00	£23,425.00	
Materials	£0.00	£9,420.00	£0.00	
Total	£125,522.00	£91,111.00	£29,803.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Reduce and mitigate the likelihood of failure of pipelines and AGIs from flooding pipeline failure could lead to the release and ignition of high pressure gas, failure on AGIs could result in loss of supply incidents with consequential safety implications.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	Development of a risk assessment process to identify high pressure pipelines and installations at risk from flooding utilising data supplied by the British Geographical Society and the Environment Agency to identify pipelines at risk from flooding not previously undertaken within the gas industry.

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

Expected benefits of project

Increased knowledge of the flooding risks to National Grid's Gas Distribution strategic assets (above 7 Bar pipelines and above ground installations).

Reduce the likelihood of failure of pipelines and AGIs from flooding pipeline failure could lead to the release and ignition of high pressure gas, failure on AGIs could result in loss of supply incidents with consequential safety implications.

Mitigate the loss of gas to atmosphere due to likelihood of failure from flooding.

Reduce the likelihood of loss of supply incidents due to flooding installations or buoyancy overstressing high pressure pipelines. Based on cost of remediation for pipeline in Yorkshire (£500k) that was raised to the surface as a result of flooding, assume an event of this nature could occur once every 5 years if sufficient remedial measures are not taken.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	5 yrs	50%	-£45,596

Potential for achieving expected benefits	Building on the success of last year the project is on track to deliver the expected benefits.
Project Progress	Using data from the Environment Agency (EA) and British Geological Survey (BGS) the number and length of NGG strategic assets at risk of flooding have been determined. This involved all Gas Distribution high pressure pipelines, above 7 bar Above Ground Installations (AGIs), high and low pressure storage sites. Technical report has been delivered summarising research methods and

(IFI2) Impacts Of Flooding On Gas Pipeline And AGIs

Year: 2009/10

	results. Risk ranking procedures have been developed for both pipelines and AGIs. All at risk pipelines and AGIs have been risk ranked and assets with highest risk identified. Risk assessment procedures have been developed for both pipelines and AGIs, which will allow NGG to assess all high risk assets identified. The risk assessment procedures have been piloted on five pipelines and five AGIs. During the trials, the risk assessment procedures have been modified and improved. All research, risk assessment processes and results have been documented in technical reports.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI3) Impact of Future Energy Systems on Energy Networks (Beywatch)

Year: 2009/10

Project Description

Design guidelines for future energy networks need to be enhanced to take account of the increasing use of new and renewable energy systems. This project will provide the data that will be used to optimise the design/sizing guidelines of future energy networks.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£17,385.00	£7,690.00	£0.00	£3,617,250.00
External	£132,060.00	£91,090.00	£41,850.00	
Materials	£0.00	£0.00	£0.00	
Total	£149,445.00	£98,780.00	£41,850.00	

Status	
	Draft
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	The project will use energy modelling & field trial data to drive network analysis models for large scale energy networks. The network modelling will examine the impact of future usage patterns of energy networks will be affected by the increasing application of new and renewable energy systems such as: o New/future distributed environmental technologies on power distribution networks o Local renewable technology (solar, PV's, DCHP etc) o New energy efficient home appliances/energy systems o Smart metering o Energy suppliers' demand-side management models The work will propose solutions for future energy grid operation & infrastructure design.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The future usage patterns of energy networks will be affected by the increasing application of new and renewable energy systems. The project will use energy modelling & field trial data to drive network analysis models for large scale energy networks. The network modelling will examine the impact of: o New/future distributed environmental technologies on power distribution networks o Local renewable technology (solar, PV's, DCHP etc) o New energy efficient home appliances/energy systems o Smart metering o Energy suppliers' demand-side management models The work will propose solutions for future energy grid operation & infrastructure design.
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project

o Development of a flexible energy model design approach that can be adapted to fit a variety of energy scenarios and provide hourly demand profiles for both gas and electricity.
o Definition of 30 year energy scenarios for application to the energy model
o Production of a detailed SynerGEE gas distribution model for a sample network (large town)

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	13	-5	18

Expected benefits of project

To understand the impact of new and renewable energy systems on energy supply in order to optimise the design of future energy network infrastructure. The new model will enable optimised design/sizing of future energy network infrastructure to take account of changing energy load requirements. The project should allow optimum design of future network infrastructure to take account of the impact of renewable energy systems.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	10 yrs	50%	£1,382,744

(IFI3) Impact of Future Energy Systems on Energy Networks (Beywatch)

Year: 2009/10

Potential for achieving expected benefits	The project remains on track with the initial work focusing on development of scenario and simulation / network models. With both these areas developed the subsequent stage of work will centre of developing results for analysis. The results from the network modeling are expected to further an understanding of the impact of new and renewable energy systems on energy networks over the next 30 years from plausible changes in energy usage. In particular, this will show the potential constraints on the electricity and gas networks and guide designers to optimise the design and development of those systems over the coming years. This information will enable National Grid to provide further information to support energy policy development beyond 2020 and help the business plan effectively for future investments required in optimising the efficient and economic operation of its networks. To facilitate this aspiration a wide business level stakeholder review meeting is planning to gain initial feedback on results and analysis undertaken to date and to identify other areas of the business that could benefit from using the simulation models developed.
Project Progress	Stage 1 of the project was designed to carry out a feasibility study of the base modeling assumptions including the definition of building types, population sizes and energy systems for analysis within the forecast models. The stage also included the definition of 10 year interval scenarios from 2010 to 2040 and the acquisition of sample data for modeling a medium scale town. These objectives were met as planned during the 2009 timescales. Detailed energy scenarios based on current policy and research have been developed to enable future a view of energy profiles. Stage 2 of the project covers full development of simulation models for building demand changes and the application of scenario driven demand changes. The aim of the work is to primarily identify the impact on demand profiles from the introduction of new/future distributed environmental technologies on the sampled electricity and gas networks. A detailed Energy Model has been developed which is structured around to allow a dynamic simulation of the network loads. The model takes into consideration the key technology changes expected over the next 30 years. The models have been verified and the outputs fed into a network simulation tool covering both gas and electric systems.
Collab' Partners	Telefonica (Spain) EDF (Electricite de France - France) Synlexis Solutions (Greece) GL UK (UK) Gorenje DD (Slovenia) Fagor (Spain) Keletron (Greece) University of Palermo (Italy) Sigma Research (France)

Provider(s) GL Noble Denton

(IFI4) Optimise Own Energy Use (PRIs)

Year: 2009/10

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	£39,693.00	£10,385.00	£28,746.00	£1,796,727.00
External	£219,750.00	£125,900.00	£305,433.00	
Materials	£54,020.00	£0.00	£1,012,800.00	
Total	£313,463.00	£136,285.00	£1,346,979.00	

Status

Draft

Draft	27/06/2010
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	3	18

Expected benefits of project

To reduce energy consumption at National Grid gas operational sites and offices. Improved environmental and performance of water bath heaters. The new technologies offer improved environmental, integrity and cost effective performance over 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%	-£975,947

Potential for achieving expected benefits

Building on the success of last year the project is on track to deliver the expected benefits.

Project Progress

During 09/10 the Powerperfector technology has been taken forward under IFI 45 and this project should be referred to. IFI 4 has focused on pre heating for AGI and specifically the new technologies. Technology review and comparison work to assess the potential cost and environmental benefit of alternative AGI gas preheating technologies. Overview study aimed at reviewing options for gas preheating. Two technologies selected for field trial. During 09/10 monitoring equipment requirements have been finalised for current site operation (benchmarking and baseline test work for future comparison of cost and environmental benefits. Each site having specific needs to meet the necessary process monitoring to quantify the current efficiency of the gas preheating equipment. Design and G17 approval for site monitoring equipment is under development for each site. Equipment type, specification and location has been investigated needs to comply with safety and operational requirements of the above ground installations.

(IFI4) Optimise Own Energy Use (PRIs)

Year: 2009/10

A HAZID study has been done on selected technologies to ensure applicability for use of the equipment on gas sites from a safety and operability viewpoint. Pipeline Stress Analysis (PSA) programme of work initiated at selected sites for field trial of the new preheat technologies to ensure that new technologies do not introduce undue stresses that may compromise the long-term operation of the selected sites. Pressure Systems Safety Requirements (PSSR) studies to support introduction of new preheat technologies to selected sites. Compliance with appropriate HSE codes for safe introduction of new technologies.

New technology plan and design work to comply with gas industry standard G17 for mechanical, civil, electrical and instrumentation requirements underway.

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

(IFI5) Reduction in Methane Losses

Year: 2009/10

Project Description	Understand where major natural gas losses from the gas distribution network originate (include both controlled emission from venting operations and fugitive emissions with special focus on above ground installations) with the aim to develop strategies, methods and tools to reduce the amount lost from the system.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£12,844.00	£10,177.00	£13,270.00	£387,241.00
External	£105,200.00	£79,950.00	£104,000.00	
Materials	£11,800.00	£50,000.00	£0.00	
Total	£129,844.00	£140,127.00	£117,270.00	

Status	
Draft	
Draft	06/07/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reducing the methane lost from Gas Distribution assets will assist in lowering National Grid's carbon footprint.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The technology will aid in the efficient identification of methane lost from Gas Distribution assets, which remedied quickly will reduce the risk of a potential incident and loss of supply.
☐ **5 Protecting the Environment**	

Technological area / issue addressed by project	o the development of methods to identify leakage in an optimum and effective manner. o a review of technologies to capture and re-use vented gas. o the quantification of environmental benefits achievable through the adoption of the developments. o the evaluation of the performance of the initial leakage decision tool.

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

Expected benefits of project	Reduced methane loss leading to reduced safety risk for National Grid staff during normal operational & maintenance activities. Reduced methane loss leading to reduced environmental impact. Reducing the loss of methane from the system will lead to less shrinkage gas purchased.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	0 yrs	50%	-£184,397

Potential for achieving expected benefits	The potential for being able to reduce methane leakage from National Grid Gas Distribution sites using new technologies has been explored. Additionally a number of potential options for flaring or capturing gas that is vented during maintenance operations have been identified.
Project Progress	Successful laboratory evaluation of the laser methane detector, and combined application of the laser methane detector and infrared camera (from Stage 1) in laboratory. Visualisation of leakage and gas plumes from standard lab flow rig demonstrating proof-of-concept of the technique. Application of the combination detection approach at over twenty National Grid Gas Distribution Sites, leakage observed and evaluated in a semi-quantitative approach. Leakage observed from several types of fitting/equipment at above ground installations, including pig traps, valves, flanges, filter housings and process vents. Conceptual design of equipment for capture of vented gas, focusing on different scales of vented gas from process equipment and maintenance activities. Gas inventories assessed and potential for environmental saving calculated. Continuous gas capture and single event processes considered. Assessment of flaring option shows significant reduction of greenhouse gas emissions for a range of maintenance activities. Flaring of gas during maintenance activities on intermediate pressure mains

(IFI5) Reduction in Methane Losses

Year: 2009/10

	shown to be a suitable alternative to venting with significant potential environmental benefit. Outline environmental and cost benefit analysis indicates potential from reducing emissions.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI7) Risk-Based Automatic Handling Of Plant Enquiries

Year: 2009/10

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	£36,325.00	£7,368.00	£0.00	£298,167.00
External	£139,418.00	£65,150.00	£26,025.00	
Materials	£14,656.00	£2,400.00	£6,825.00	
Total	£190,399.00	£74,918.00	£32,850.00	

Status

Draft

Draft	27/06/2010
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

- Delivery of an automated response system to third parties for National Grid's buried assets
- Development of expert system rules based on risk and assets involved
- 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
2011	5 yrs	50%	£54,539

Potential for achieving expected benefits

The extended internal trial has given additional confidence in the reliability of the system and that the system provides an appropriate response to all of the different enquiry types. The extended trial has confirmed that the project should proceed to the next stage, an external trial, and that the expected benefits of the project will be realised.

Project Progress

Identification of business rules required to fully replace the legacy systemsn and functional requirements to further develop the trial system produced in stage 1, to provide a replacement system for the legacy systems.

(IFI7) Risk-Based Automatic Handling Of Plant Enquiries

Year: 2009/10

	Development of the trial system, training materials and support to demonstrate the feasibility of replacing the legacy systems detailed above. Collection of feedback from the trial participants, and production of an End of Trial Report. Successful completion of an internal trial providing rigorous evaluation of the system and thorough proof of concept ahead of an external trial later in 2010.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI8) Large Diameter LP PE Flowstop

Year: 2009/10

Project Description	To find an alternative solution to isolating large diameter LP PE pipe other than via the use of line valves hence avoiding large numbers of end users being isolated from supply or using squeeze off equipment to minimise excavation lengths.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£6,863.00	£18,335.00	£0.00	£172,134.00
External	£10,300.00	£46,575.00	£12,637.00	
Materials	£0.00	£77,424.00	£0.00	
Total	£17,163.00	£142,334.00	£12,637.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☑ **2 Eradicating Fuel Poverty**	This project will provide alternative solution to isolating 630mm diameter LP PE pipe other than via the use of line valves as this can cause large number of end users to be isolated requiring huge manpower resources to initially isolate and then subsequently purge and relight. This is not only time and resource consuming, but also costly and creates poor perception with end users and contractual compensation issues where end users have been isolated for more than 24 hours, but more importantly by minimising the numbers affected by such isolation will also minimise the potential number of vulnerable customers affected.
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	This project will provide alternative solution to isolating 630mm diameter LP PE pipe other than via the use of line valves as this can cause large number of end users to be isolated requiring huge manpower resources to initially isolate and then subsequently purge and relight.
☑ **5 Protecting the Environment**	The project will reduce the excavation footprint for 355mm to 500mm diameter pipes and also eliminate the potential of damaging other buried plant and reduce environmental impact associated with imported and waste materials.
Technological area / issue addressed by project	o Flowstop capability for 630mm LP PE Pipework o Reduced or removed pipework stress imposed by squeeze off operations on PE pipes o Re-use pipe flowstop methodology o Reduced or removed slow-crack growth o Reduced excavation size - Reduce sterile PE pipe

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

Expected benefits of project	Reduced size excavation for flow stopping activities for PE systems. In addition this will result reduced environmental impact associated with imported and waste material and less potential disruption in the public highway. This will also assist in eliminating the potential of interference damage to buried plant.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2009	36 yrs	75%	£569,019

Potential for achieving expected benefits	Building on the success of last year the project is on track to deliver the expected benefits.
Project Progress	A new 630mm diameter PE test rig was designed, manufactured and delivered to the test site. Testing of the flow stop equipment using the test rig was found to be satisfactory following some minor modifications to the compressor arrangements. In addition video footage was undertaken for the primary and secondary bags insertions to provide validation on dynamic and static flow parameters. Operational Field trials have been carried out to validate the flow-stop equipment and ensure that the equipment is meeting the performance specification required for flow-stopping equipment. Provision of an alternative low pressure (up to 75mbar) flow-stopping technique for large diameter

(IFI8) Large Diameter LP PE Flowstop

Year: 2009/10

PE pipe from 355mm up to and including 500mm diameter successfully demonstrated.

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

(IFI9) Cleaning of Gas Mains & Recovery of Gas

Year: 2009/10

Project Description	To develop a new vacuum-based method to clean gas mains while minimising venting. Application of LP & MP mains up to and including 24" diameter.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£5,283.00	£4,305.00	£4,831.00	£133,619.00
External	£21,300.00	£46,160.00	£29,490.00	
Materials	£19,750.00	£0.00	£2,500.00	
Total	£46,333.00	£50,465.00	£36,821.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in the amount of gas purged during flowstopping activities which see this reintroduced back into the system rather than venting to the atmosphere.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The removal of dust and debris will aid the efficiency of certain flowstop operations, but more importantly it also can affect gas flow due to blockage of the pipes and filters within appliances and other control assets.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Development of a small-scale pump and filter system for the removal of debris from mains o Capture of gas whilst maintaining the upstream and downstream supply o Modular format design to allow the developed technology to integrate with equipment from various manufacturers o 3"- 24" diameter pipe application and up to 2bar gauge

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

Expected benefits of project	Reduction in the amount of gas purged to air during flowstopping activities, all gas to be recaptured into the system without affecting gas pressures. The ability to clean mains internally under no gas conditions will facilitate the deployment of flowstop technologies reducing the risk of bag failure by reducing or removing let by.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	10 yrs	50%	£1,039,952

Potential for achieving expected benefits	Completion of the feasibility stage has confirmed the conceptual design is technical and theoretically viable and has provided evidence to demonstrate that if used on the gas network no effect on supply pressures and flows will be seen. The potential for success is good although testing of the prototype vacuum pump needs to be carried out to determine viability of the product.
Project Progress	A review of technologies and equipment available. The effect on the surrounding network was modelled to investigate impact on pressure regimes and also upstream and downstream pressures. The critical element of the feasibility stage was to determine the methodology and performance requirements for the creation of flows sufficient to lift mains debris without the effecting surrounding pressure supplies. Evaluation of industry equipment to facilitate the next stage for development of a prototype.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI11) Maximising The Benefits Of Keyhole Excavation

Year: 2009/10

Project Description

Investigation, design, development and testing of specialised tooling to enable greater exploitation of keyhole technology by increasing the activities that can be completed.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£52,483.00	£47,993.00	£0.00	£715,512.00
External	£232,293.00	£176,550.00	£55,106.00	
Materials	£121,262.00	£29,825.00	£0.00	
Total	£406,038.00	£254,368.00	£55,106.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	Normal excavation & reinstatement activities a number of vehicles are involved in transporting materials, this will be significantly reduced as the excavated core is used as part of the reinstatement. This should assist in reducing the company's carbon foot print.
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	The ability to relay services from keyhole aids in the delivery of high quality performance which the system is designed for. This will enable repair and maintenance activities to be performed in shortest possible time keeping disruption to an absolute minimum especially in built up urban areas.
☑ 5 Protecting the Environment	The need for large excavations are avoided as the activities will be undertaken via an 18" core excavation instead.

Technological area / issue addressed by project

- o New and novel method for preparation of PE pipe
- o Development of new technique for sawing & drilling of metallic mains for Keyhole excavations
- o Development of a range of prototype tools for use in keyhole activities for use in the UK and possible Europe
- o A new method for service isolation using fixotropic fluid
- o Challenge the customer perception and industry norm that requires an operative in the confines of excavation to complete operational pipeline activities.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	23	1	22

Expected benefits of project

Large excavations are minimised as the activities will be undertaken via an 18" core excavation leading to a reduction in reinstatement materials and waste. In addition, compared with conventional techniques, fewer vehicles are required for transporting materials thereby reducing the carbon footprint.

The workforce will no longer need to enter traditional excavations as the activities will be undertaken from the road or pavement surface thus reducing the potential for injury or working in confined spaces. The ability to relay services from keyhole aids in the delivery of high quality performance and efficiencies thereby minimising disruption to customers and enhancing reputation

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	5 yrs	75%	£1,022,247

Potential for achieving expected benefits

This remains high based on the success of the field trials to date. Where equipment has been purchased as a result of successful trials post investment appraisals will follow.

Project Progress

The purpose of this project is to develop tools, procedures and processes that will greatly increase the number of activities that can be carried out in keyhole excavations, concentrating on activities with a high workload. Long handled tools have been designed and laboratory tested to prove their concept and these have been developed and manufactured in conjunction with a number of key manufacturers.

These tools have been trialled in the field and modified as required to improve operation. A documentation suite has been produced to support the tooling.

(IFI11) Maximising The Benefits Of Keyhole Excavation

Year: 2009/10

Collab' Partners	Steve Vick, Umole, Grange Industries, Omega, Pipetech, ALH	**Provider(s)**	Able Engineering, GL Noble Denton, ALH, Grange Industries, Pipeline Technology Ltd, Steve Vick International Ltd

(IFI12) Improved Apparatus Detection, Mapping & Protection F'bility

Year: 2009/10

Project Description	This project will provide a report on the global position of underground detection and mapping technologies and an evaluation of the opportunities for National Grid to develop techniques for efficient working practice.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£2,329.00	£1,658.00	£1,013.00	£45,000.00
External	£13,625.00	£14,250.00	£12,125.00	
Materials	£0.00	£0.00	£0.00	
Total	£15,954.00	£15,908.00	£13,138.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Improved asset location and records capture
☑ **5 Protecting the Environment**	Improved technology would ultimately lead to a reduction in excavation resulting from the abortive search of plant
Technological area / issue addressed by project	o This project would broadly comprise a technology survey of globally available detection/mapping and data processing products, or any innovative/leading edge research in technologies or methods likely to lead to the development of new products. The output will provide NG with knowledge that allows it to move forward on the basis of the best information currently available.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	4	1	3

Expected benefits of project	This project is a feasibility study and therefore the expected benefit is knowledge in asset location and records capture.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
0	0 yrs	25%	-£45,000

Potential for achieving expected benefits	The knowledge gained proved that technologies and techniques to meet business requirements. Hence the benefits have been achieved
Project Progress	The project has been completed. The project enabled good contacts to be made across the utility industry and partners in the US/UK that ensured a comprehensive and detailed report on global technologies delivered project.
Collab' Partners	
Provider(s)	GL Noble Denton, NYSEARCH

(IFI14) Maximising The Environmental Benefits Of CBEM2 Prototype

Year: 2009/10

Project Description

This project aims to robustly evaluate the unique "CBEM2" (Cement Bound Excavated Material Type 2) vehicle to determine its environmental, and operational benefits, and facilitate wider roll-out of the CBEM2 process to ensure the benefits are maximised for all stakeholders.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£11,190.00	£3,214.00	£46,338.00	£238,244.00
External	£67,602.00	£19,437.00	£67,713.00	
Materials	£9,000.00	£13,750.00	£0.00	
Total	£87,792.00	£36,401.00	£114,051.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	This will reduce National Grid's carbon footprint as it avoids the need to transport excavated material to a specific chosen site as the material will be mixed at the excavation site itself. The project will also remove the need to compact materials on site.
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☐ 4 Safe, Reliable Network	
☑ 5 Protecting the Environment	The CBEM2 vehicle will reuse excavated material on site therefore reducing use of virgin material and disposal. This will also remove the need to send/transport waste spoil to landfill.

Technological area / issue addressed by project

o Fully operational vehicle that processes recycled materials at the site of excavation safely and efficiently.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	16	0	16

Expected benefits of project

The CBEM2 vehicle will reuse excavated material on site therefore reducing use of virgin material and disposal. This will also remove the need to send/transport waste spoil to landfill.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	10 yrs	50%	£437,373

Potential for achieving expected benefits

The current project is on hold pending provision of a site from which to carry out the tests. The expected benefits will be achieved when a field trial is set up and commences. This is anticipated for 2010.

Project Progress

Modifications were identified to the reinstatement vehicle. These were to make the vehicle self-sufficient for remote working, particularly: on-board pump with cyclonic filtration to allow washout water to be recycled and re-used, and on-board high pressure pump for washout of mixer after use (t avoid need for depot-based petrol/HP pump). These modifications have been designed in outline but not yet implemented.

Preliminary work has been undertaken to set up field trials.

Collab' Partners

Provider(s) GL Noble Denton

(IFI15) London Decentralised Energy Network

Year: 2009/10

Project Description

The City of London Surveyors Department has approached National Grid and other Utilities to participate in a project to evaluate the feasibility of further extending and utilising pipe subways in and around the City of London .

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,958.00	£1,941.00	£601.00	£160,000.00
External	£15,000.00	£15,000.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£16,958.00	£16,941.00	£601.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Multi utility use of new, and existing subways. This has the potential to reduce unnecessary excavations for individual utility works.
☐ **2 Eradicating Fuel Poverty**	
☑ **3 Promoting Energy Savings**	Improved efficiency as a result of energy generation from combined heat and power technology, that is coupled with decentralised energy distribution.
☐ **4 Safe, Reliable Network**	
☑ **5 Protecting the Environment**	There are approx 32KM of <=12" and 23KM of >12" metallic mains within the City of London, that will require replacement as part of the 30 year programme. If this conceptual project leads to the rehabilitation and extension of pipe subways for the purpose of energy decentralisation and/or new Utility plant, then there is the opportunity for efficiencies to be gained although it is not possible to quantify the financial benefits at this stage.

Technological area / issue addressed by project

o Evaluate the opportunity to extend the existing pipe subway network to enable the effective distribution of utility networks to City buildings.
o Evaluate the feasibility of an energy company entering into a partnership to deliver a decentralised energy power network to buildings in the City. The evaluation will identify:
- Potential partners to deliver a network,
> feasible locations for a decentralised energy station serving the City
> the cost of delivering a decentralised energy station and network
- Infrastructure to supply City buildings
> potential returns on investment
> business models available for delivering a decentralised energy network
o Identify the opportunities to marry the aspirations to deliver a comprehensive scheme that would combine the components outlined above.
o Outline a project timetable for procuring a partnership through to delivery of a decentralised energy network and pipe subway infrastructure
o Identification of any additional opportunities and business models that would enhance the prospects of delivering the project proposal set out above

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

Expected benefits of project

This project is a feasibility study and therefore benefits cannot be articulated at this stage. The selection of subway routes provides an opportunity to assess/influence the outcome in favour of routes and subway construction that may provide opportunities to reduce the cost and environmental impact of replacing large diameter iron pipes. The location of decentralised energy stations including CHP will have a critical impact on the gas network and being engaged in this study will provide the opportunity to influence outcomes.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
0	0 yrs	25%	-£33,688

Potential for achieving expected benefits

Benefits will be determined during 10/11 and will be dependant on the opportunities afforded by the outcome of the review work.

(IFI15) London Decentralised Energy Network

Year: 2009/10

Project Progress	The City of London Surveyors Department has approached National Grid and other Utilities to participate in a project to evaluate the feasibility of further extending and utilising pipe subways in and around the City of London.		
Collab' Partners	EDF, EON, BT, London Climate Change Agency	**Provider(s)**	City of London

(IFI16) Alternative Inspection Techniques

Year: 2009/10

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	£2,819.00	£1,615.00	£5,767.00	£109,090.00
External	£15,205.00	£8,170.00	£26,100.00	
Materials	£0.00	£0.00	£0.00	
Total	£18,024.00	£9,785.00	£31,867.00	

Status	
Draft	
Draft	27/06/2010
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	Potential to reduce incidents caused by the failure of >7bar pipelines. The increased understanding of the condition of the asset in these difficult to inspect areas should allow network operators to take appropriate remedial measures quickly to prevent a major pipeline failure. This will allow pipelines to be operated to the maximum safe level.

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

Potential for achieving expected benefits	The information generated from Stage 2 of this project will help to determine whether any of the currently available above-ground survey techniques have the capability to locate coating damage in difficult to inspect areas e.g. on pipe work running under hard surfaces (gravel, tarmac and concrete) and on cased and uncased crossings; and are able to benchmark coating damage in terms of its surface area. The practical work currently being conducted under Stage 2 of this project will also help provide information on the relative sensitivity of the Pearson and DCVG techniques; this will help support the use of one or other of these techniques as the preferred option for coating defect location within the OLI/4 document.
Project Progress	Field trials have been conducted using the Pearson and DCVG techniques to compare their sensitivities for coating defect location. The sizing capabilities of the DCVG survey method has been assessed using buried coupons,

(IFI16) Alternative Inspection Techniques

Year: 2009/10

located at test posts, and using pin probes of varying surface area.

The sensitivity of the Electromagnetic Current Attenuation technique, for locating small areas of coating damage that might exist on cased and uncased crossings, has been assessed.

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

(IFI18) Injection of Biomethane into the Gas Network

Year: 2009/10

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	£95,754.00	£52,550.00	£0.00	£1,012,451.00
External	£227,674.00	£117,386.00	£209,277.00	
Materials	£9,810.00	£0.00	£300,000.00	
Total	£333,238.00	£169,936.00	£509,277.00	

Status	
Draft	
Draft	27/06/2010
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

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.

Understand how the development of the biogas market is likely to impact on operations and thus how National Grid will need to develop its operations to accommodate this technology and facilitate the maximum benefit to the end consumer. This project should also identify any on-going barriers that may prevent biogas being injected and reaching its full potential. This project should also 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	20 yrs	25%	-£862,755

Potential for achieving expected benefits

The economical benefit of biomethane injection is still to be evaluated particularly in light of any future incentives, however the technological barriers do not appear insurmountable.

Project Progress

The pre-field analysis has identified the presence of contaminants present in biogas that are not found in UK pipeline gas. The potential risk of these contaminants has been assessed, based on published data, and a minimum gas specification has been developed that the upgrade technologies must achieve. The exemption approved by the HSE will enable non compliant levels of oxygen to

(IFI18) Injection of Biomethane into the Gas Network

Year: 2009/10

be injected into the network; this has avoided the need for the installation of expensive oxygen removal facility. Required monitoring, post comingling to demonstrate GS(M)R compliance has been agreed.
The study by DBFZ highlighted the potential of biomass fermentation to reduce GHG's compared to composting or landfill.

Conceptual design is being used by NGG Construction in developing, with a third party, a detailed design for the gas to grid injection facility. Efficient upgrade technologies and optimised process pathways defined. Agreement reached with demonstration partner and suitable location for demonstration identified. Successful application to Environmental Transformation Fund (ETF) to support the capex required for a demonstration plant.

Pre-field trial analysis carried out at the site to fully characterise the biogas, such that the appropriate biogas upgrading technologies could be identified and optimized to ensure the removal of contaminants and deliver biomethane compliant with the NEA.
Developed a conceptual design of trial equipment and drafted supporting documentation for detailed tender design and build together with indicative pricing and lead times for major elements.
Assessment of biogas upgrading technologies carried out to assess the suitability, efficiency and costs of various commercially available upgrading technologies.
An assessment of potential economic and environmental benefits was carried out by DBFZ with scenarios used to assess impact of different feedstock and the various technologies available.
Liaison with HSE regarding biomethane injection resulted in acceptance of an exemption to allow out of spec. gas into the network where comingling would render the resultant gas GS(M)R compliant

A study reviewed gasification technologies and costs for the delivery of Bio-SNG into the grid.

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

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

Year: 2009/10

Project Description

This scope of work proposes the investigation of new and novel demand estimation techniques for below 7bar networks to ensure that the network analysis/planning process within the Network is carried out with demand levels that are in line with the latest statistical findings and views on:
- appliance behaviour characteristics,
- consumer behaviour characteristics
- impact of changes in weather patterns,
- network flow and pressure relationships from local measurement instruments,
- implication of "variable" demand diversity across networks,
- applicability of pk6 min load, hourly demand and daily demand for all pressure tiers.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£72,404.00	£28,223.00	£50,674.00	£1,377,653.00
External	£201,461.00	£249,800.00	£267,501.00	
Materials	£369,684.00	£5,200.00	£132,706.00	
Total	£643,549.00	£283,223.00	£450,881.00	

Status	
Draft	
Draft	27/06/2010
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	14	6	8

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

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

Year: 2009/10

reinforcement and replacement planning of the networks and better understanding of peak condition.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
0	10 yrs	50%	-£661

Potential for achieving expected benefits	These remain good given data is now being collected to allow the model to be modelled and validated using that data.
Project Progress	Stage 2 comprises the work required up to the end of March 2010 for the setting up and management of an initial period of data collection and included Data Collection Implementation and Management along with Data Collection and Review. Stage 2a was carried out for the installation of flow loggers at domestic properties whilst Stage 2b carried out for the installation of flow loggers at non-domestic properties. Data from the properties being logged has been collated for use in later stages.

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

(IFI21) Improvements to the MRPS Model

Year: 2009/10

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	£6,146.00	£4,092.00	£16,763.00	£600,700.00
External	£48,290.00	£41,000.00	£99,000.00	
Materials	£0.00	£0.00	£0.00	
Total	£54,436.00	£45,092.00	£115,763.00	

Status

Draft

Draft	27/06/2010
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

- Research into the correlation or link between the age of pit cast mains and fracture rate
- Research into the correlation or link between corrosion and fracture rate
- Demonstration of cast iron and spun cast profile factors in live MRPS model.
- Feasibility of profile factors for multi-occupancy buildings
- Development & testing of profile factor for the update of the >12" model
- 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%	-£233,456

(IFI21) Improvements to the MRPS Model

Year: 2009/10

Potential for achieving expected benefits	The main benefit of the project has been to confirm that the distribution system, in terms of leaks, gas in buildings and incidents, is stable and not showing signs of significant deterioration, thus the current version of MRPS is adequately modeling the current risk. The further work on spun cast mains has shown that the model could potentially be improved by the inclusion of corrosion data but this needs to be confirmed with further analysis in 2010. Work completed this year has also confirmed that it is appropriate to have and maintain two separate models for above and below 12" CI mains. The application <12" model to >12" mains produces a significantly different risk factor profile and therefore should not be applied.
Project Progress	Analysis of historic data determines that the metallic distribution system appears to be stable in terms of leaks, gas in buildings and incidents and does not show signs of significant deterioration. Initial observations from the report "Investigation into the Effect of Previous Corrosions on the Fracture Rate of Spun Cast Distribution Mains" have concluded that previous corrosion activity on spun cast mains is likely to increase the likelihood of future fracture activity by an average of around 30%. The report has raised issues about the data upon which the analysis was based and the National Replacement Forum suggested that is prudent to repeat the analysis with more recent data in 2010 before a decision is taken as to whether the MRPS models for Pit and Spun Cast are updated. Examination of the Applicability of the <=12" CI MRPS Model to >12" CI Mains concluded that the present <=12" MRPS model is not a suitable substitute for the >12" model as both the correlation of scores and correlation of ranks are too dissimilar.
Collab' Partners	NGN, SGN, WWU
Provider(s)	GL Noble Denton

(IFI24) European Pipeline Research Group (EPRG)

Year: 2009/10

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	£3,003.00	£1,138.00	£0.00	£785,384.00
External	£15,273.00	£6,950.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£18,276.00	£8,088.00	£0.00	

Status	
Draft	
Draft	27/06/2010
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	13	-4	17

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: 2009/10

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
2011	0 yrs	25%	£1,416

Potential for achieving expected benefits

This programme of work has potential for achieving the expected benefits 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 our Distribution and Transmission businesses.

Project Progress

There are 20 current projects progressing during 2009. Two papers have been produced in 2009 recommended revisions of the EPRG Tier 2 Guidelines for the assessment of defects in transmission pipeline girth welds and ductile crack arrest in gas transmission pipelines.

A Joint Technical Meeting (EPRG/PRCI/APIA) was held in Milan in May 2009 to exchange and review the results of research undertaken by the three research organisations.

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) EPRG, GL Noble Denton

(IFI25) PRCI Research Collaboration

Year: 2009/10

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	£6,148.00	£10,485.00	£0.00	£6,000,000.00
External	£48,159.00	£41,882.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£54,307.00	£52,367.00	£0.00	

Status	
Draft	
Draft	27/06/2010
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	6	-5	11

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. Significant research leverage benefits.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2010	0 yrs	25%	-£42,882

Potential for achieving expected benefits

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 the benefits of networking opportunities to discuss incidents and share best practice.

Project Progress

The projects selected and voted jointly for by National Grid Distribution and Transmission in the 2009 ballot were:

- o DP-3-2 Influence of Human Factors on Pipeline Damage Prevention
- o ROW-3 Conceptual Pipeline Integrity & Security Management
- o ALT-1-1 CO2 Transmission and Storage - Research Plan Development
- o EC-3-8 Determination of a Recommended Upper Limit to Cathodic Protection for FBE Coatings
- o EC-5-4 Above Ground Surveys For Difficult to Assess Areas
- o EC-5-5 ECDA in Dynamic Stray Current Areas

(IFI25) PRCI Research Collaboration

Year: 2009/10

- CPS-5-5 Synthetic vs. Standard Oils for Gas Turbines
- CPS-5-6 Method & Procedure to Remaining Life Assessment of Combustion Turbine Disks
- MEAS-5-12 Extended Low Flow Range Metering
- MEAS-5-11 Performance Verification of Perforated Plate Flow Conditioners Installed Upstream of Multipath Ultrasonic Meters
- MEAS-5-14 Performance of Dirty or Worn Flow Conditioners
- MEAS-5-7 High Pressure Differential Pressure Calibration
- CPS-5-1 Improve Part-Load Fuel Efficiency of Solar DLN Units
- EC-1-2 Detailed Procedures for Comparing Successive ILI Runs to Establish Corrosion Growth
- EC-1-7 Evaluation of the Current Understanding of External MIC and Gap Analysis

The projects selected and voted for by National Grid in the 2010 ballot were:

- IC-1-4 Integrity Issues for CO2 Pipeline Transport Including Corrosion, Cracking, and Rupture
- EC-3-11 Performance of Above Ground Coating Evaluation Survey Method
- MATH-5-1 Guidelines to Address Pipe Material and Construction Quality Issues in Response to

Current Concerns

- EC-4-3 Improved Pipeline Reliability by Using In-Ditch Verification Data to Measure ILI Uncertainty and Applying Correction Factors
- EC-2-3 Develop Leak/Rupture Boundary for Corrosion in Low Toughness Pipe
- MD-4-8 Assessment of Delayed Failure for Mechanical Damage Under Constant Pressure
- NDE-2-5 Base Resource Document for Unpiggable Pipelines
- MEAS-6-5 Effect of Upstream Piping Configurations on Ultrasonic Meter Bias
- MD-4-3 Improved Model for Predicting the Burst Pressure of Dent + Gouge Damage

The following National Grid supported projects were launched this year by PRCI:

- MD-4-2 Full-Scale Demonstration of the Interaction of Dents with Localized Corrosion Defects
- MD-4-1 Full-Scale Experimental Validation of Mechanical Damage Assessment Models
- MD-4-4 Improved Model for Predicting the Time/Cycle Dependent Behavior of Dent + Gouge Damage
- EC-4-2 ILI Tool Error Calibration Based on In-the-Ditch Measurements with Related Uncertainty

Recently issued reports included:

- Development of a Model for Predicting the Severity of Pipeline Damage Identified by In-Line Inspection (MD-2-2; PR-218-063511-B)
- Pipeline Integrity Management for Ground Movement Hazards (ENV-1)
- Stress Corrosion Cracking in Areas of Local Deformation (SCC 2-5; PR-186-063516)
- The Assessment of Corrosion Damage in Pipelines Subjected to Cyclic Pressure Loading (PR-273-0323)
- The Remaining Strength of Corroded Low Toughness Pipe (PR-273-0323)
- Transformation of Shallow to Deep Cracks, Environmental Effects (PR-261-02142)
- Assessment of the Use of Geosynthetic Fabrics to Reduce the Soil Load on Buried Pipelines (PR-268-03111)
- Augmenting MFL Tools with Sensors that Assess Coating Condition (EC-3-1)
- Enhanced Model & Practice Guidelines for Horizontal Direct Drilling (PR-227-03110)
- Fracture Initiation Criteria for High-Strength Steel Line Pipe (Phase I Report) (MAT-4-4)
- Using Strain Based Design in Conjunction with API RP 1111 (API-1-1)
- Effectiveness of Current ROW Monitoring Processes (ROW-2-1)
- Guidelines for Reliability-Based Pipeline Integrity Methods – Phase II (EC-1-3)
- Investigate Fundamentals and Performance Improvements of Current In-Line Inspection
- Technologies for Mechanical Damage Detection - Phase II (MD-1-2)
- Practical Guidelines for Internal Corrosion Threat in Dry Natural Gas Pipelines (IC-1-1/IC-1-2)
- A Review of Methods for Assessing the Remaining Strength of Corroded Pipelines (PR-273-0323)
- Assessment of Long-term Integrity of Wrinkled Pipeline Segments (ENV-3)
- Guidelines for Reliability-Based Pipeline Integrity Methods – Phase II (EC-1-3)
- Measuring the effectiveness of Current ROW Monitoring Techniques/Practices (ROW-2-1)
- Stress Corrosion Cracking in Areas of Local Deformation (SCC-2-5)
- Corrosion Assessment Guidance for High Strength Steels (PR-273-0323)
- Investigate Fundamentals and Performance Improvements of Current In-line Inspection Technologies for Mechanical Damage Inspection (MD-1-2)
- Leak vs. Rupture Boundary for Low Toughness/Ductility Pipe (EC-2-3)
- Using Strain-Based Design in Conjunction with API RP 1111 Including Appendix A Guidance Document (API-1-1)

PRCI addresses areas of common interest concerning corrosion, design, materials and construction, operations and integrity, compressors and measurement.

(IFI25) PRCI Research Collaboration

Year: 2009/10

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.

Areas of particular interest are improved methods for assessing the remaining strength of corrosion damage, understanding in-line inspection performance, methods for comparing successive in-line inspection runs, pipeline damage prevention methods, unpiggable pipeline and the work on the mechanical damage model.

Collab' Partners	National Grid Transmission	**Provider(s)**	PRCI

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

Year: 2009/10

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	£4,760.00	£1,568.00	£9,883.00	£134,861.00
External	£20,150.00	£8,650.00	£89,850.00	
Materials	£0.00	£0.00	£0.00	
Total	£24,910.00	£10,218.00	£99,733.00	

Status: Draft

Draft	27/06/2010
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	3	7

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
2012	2 yrs	25%	£443,383

Potential for achieving expected benefits: All the theoretical indications to date provide improved understanding of the thermal lagging measurement requirements. The experimental measurements proposed will enable these predictions to be tested in future.

Project Progress: Recent computational fluid dynamics (CFD) calculations carried out have been a success and has provided details of the appropriate experimental work to compare the theoretical calculations against actual measurements under controlled conditions. Further work on policies and applicable standards/guidance.

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

(IFI27) High Pressure Metering Uncertainty Calculation Tool

Year: 2009/10

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	£5,112.00	£1,292.00	£0.00	£65,704.00
External	£21,250.00	£19,500.00	£18,550.00	
Materials	£0.00	£0.00	£0.00	
Total	£26,362.00	£20,792.00	£18,550.00	

Status	
Draft	
Draft	27/06/2010
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	11	3	8

Expected benefits of project	Feasible proof of concept for a tool that will calculate the Maximum Permissible Bias (MPB) and Maximum Permissible Error (MPE) terms of a high pressure metering system. Effective and targeted maintenance when inspections are necessary to investigate errors. Industry reputation enhanced through improved metering accuracy.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	10 yrs	50%	£154,302

Potential for achieving expected benefits	The project has a high probability of realising expected benefits.
Project Progress	The report and Tool which details uncertainty, error and maximum permissible error calculations for orifice plate meters and a finite difference technique has been developed, tested and now under review.

(IFI27) High Pressure Metering Uncertainty Calculation Tool

Year: 2009/10

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

Summer 2010

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(IFI29) Water Bath Heater Corrosion Inhibitor Trial

Year: 2009/10

Project Description	Trial a new water and corrosion-inhibitor (Multitreat BNS) mix to replace existing anti-freeze solution (ethylene glycol).

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,624.00	£0.00	£2,026.00	£24,370.00
External	£850.00	£0.00	£15,850.00	
Materials	£4,020.00	£0.00	£0.00	
Total	£6,494.00	£0.00	£17,876.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☑ **3 Promoting Energy Savings**	The new solution is a better heat conductor than ethylene glycol and hence will improve the heating efficiency of the water bath heater.
☑ **4 Safe, Reliable Network**	Water bath heaters are essential assets in ensuring security of gas supply to consumers. Faults occurring due to corrosion pose risks of fire / injury at the PRI and loss of gas supply downstream. This solution is more effective at preventing corrosion thereby leading to a safer and more reliable network
☑ **5 Protecting the Environment**	Any leakage and disposal of Multitreat BNS will be more environmentally friendly than the toxic and acidic glycol solution.
Technological area / issue addressed by project	o Heater operates through one full year with new solution without any signs of freezing o Inhibitor chemical does not degrade and remains non-corrosive throughout the duration of the trial without the need for frequent 'dosing' o No visible/ measurable corrosion on the 'corrosion rack' within the heater.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Radical	Medium	20	-6	26

Expected benefits of project	Validation of supplier's claims and understanding of the new solution. Reduction in the level of corrosion on HP gas tubes within water bath heaters. More environmentally friendly solution and more efficient potential solutions.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2012	2 yrs	75%	£82,850

Potential for achieving expected benefits	Confidence is high that projected benefits will be achieved.
Project Progress	Two field trials in progress. On both installations the working heaters were filled with corrosion inhibited 'soft' water. Both operational heaters survived coldest winter for many years without any indication of content freezing.
Collab' Partners	
Provider(s)	B&V Water Treatment

(IFI32) Carbon Accounting for Pipeline Installation/Rehabilitation

Year: 2009/10

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	£2,137.00	£0.00	£0.00	£20,137.00
External	£18,000.00	£0.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£20,137.00	£0.00	£0.00	

Status

Draft	
Draft	27/06/2010
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	-2	12

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
	0 yrs	25%	-£20,000

Potential for achieving expected benefits The outputs are being reviewed within National Grid across various lines of business. The specific nature of the implementation of the tool and techniques will be reviewed during 10/11.

Project Progress In collaboration with the Water Research Centre and individual Water Companies the output of this project has addressed the common interest of utility companies and their suppliers in developing an Embodied or Life Cycle Carbon measure for pipeline installation and rehabilitation techniques.

(IFI32) Carbon Accounting for Pipeline Installation/Rehabilitation

Year: 2009/10

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

(IFI33) Gas Alliance Group Excavation Protection System

Year: 2009/10

Project Description	Collaboratively develop a utilities sector, industry leading standard temporary fencing solution.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£9,099.00	£391.00	£10,693.00	£287,000.00
External	£103,662.00	£0.00	£0.00	
Materials	£0.00	£0.00	£63,838.00	
Total	£112,761.00	£391.00	£74,531.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Use of recyclable materials and eficient manufacturing techniques
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Reduction in injuries caused to members of the public and employees as a result of tripping over barriers and barriers that were not resistant to impact
☑ **5 Protecting the Environment**	Use of recycled materials
Technological area / issue addressed by project	o Development or redesign of an excavation barrier to BS standards to make it stronger, more robust and less obstructive to members of the public whilst enhancing its recyclable qualities.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Minor	19	-4	23

Expected benefits of project	Reduction in the number of incidents through slips, trips and falls, to members of the public & workforce. Reduction in our Carbon Footprint through the use of increased recycled and recyclable products.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	1 yrs	50%	-£45,603

Potential for achieving expected benefits	The confidence for achieving success is high. The project is at an advanced manufacturing stage with prototypes capable of field trial due in May 2010.
Project Progress	The barrier design has been completed to reduce public injuries and increased use of recycled materials. Successful collaboration from companies providing both resources and funds.
Collab' Partners	AMEC, Balfour Beatty, Skanska, MorganEst
Provider(s)	Balfour Beatty

(IFI34) Development of a Corrosion Camera

Year: 2009/10

Project Description	To develop a tool that detects and measures metallic corrosion remotely and where necessary through field coatings and insulation.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£2,840.00	£0.00	£4,160.00	£180,000.00
External	£22,500.00	£0.00	£40,000.00	
Materials	£0.00	£0.00	£0.00	
Total	£25,340.00	£0.00	£44,160.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ **1 Low Carbon Economy**	
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Improvement to the maintenance inspection regime for some 730 pressure reduction installations and 1000 above ground crossings to identify corrosion qucikly and efficiently to reduce risk for staff and the general public.
☑ **5 Protecting the Environment**	Reduction in waste and minimising use of products used for cleaning, recoating.
Technological area / issue addressed by project	o Development of thermography technology for portable use in the field o Detection of defects via multipul layers of cladding o Assessment and evaluation of defect using enhanced software (development of algorithms)

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Minor	19	-7	26

Expected benefits of project	Enable more efficient routine maintenance. Avoids the need to dispose of cladding to landfill which is non bio-degradable. Prevent the removal of cladding and scaffolding required on site. Collaborative leverage ratio 4:1

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	10 yrs	50%	£58,686

Potential for achieving expected benefits	The potential for achieving success is good since the prototype has been extensively tested during stage 1, and it has been confirmed that the technology is able to identify and indicate corrosion severity under certain conditions. However further development is required in order to confirm the technology operating parameters. The prototype also requires further development, specifically ergonomically, to ensure it is sufficiently portable for use in an operational environment
Project Progress	Laboratory testing of suitable equipment identified active thermography can determine corrosion under a variety of coatings. This laboratory testing also identified suitable technology and a prototype which is being trialled.
Collab' Partners	**Provider(s)** NYSEARCH

(IFI35) Large Diameter PE Pipe Handler 250-355mm

Year: 2009/10

Project Description	To provide a safe and cost effective means for inserting long lengths pf PE pipe as part of National Grid's 30/30 mains replacement work on large diameter MP mains.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£15,384.00	£0.00	£0.00	£168,084.00
External	£45,242.00	£0.00	£0.00	
Materials	£107,458.00	£0.00	£0.00	
Total	£168,084.00	£0.00	£0.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduced number of excavations leads to reduced fuel consumption by excavators
☐ **2 Eradicating Fuel Poverty**	
☑ **3 Promoting Energy Savings**	Reduced number of excavations leads to reduced fuel consumption by excavators
☐ **4 Safe, Reliable Network**	
☑ **5 Protecting the Environment**	This new Large Diameter PE mains insertions method reduces the number of excavations arising from mains insertion by at least 50%
Technological area / issue addressed by project	o The need for a concrete plinth to mount the pipe pusher is eliminated o The moving of the pipe will be carried out by the Pipe Handler o Increased insertion lengths thus reduced numbers of excavations o Improved safety as no operatives needed in the trench or near the winching bond o Full control of pipe insertion is outside the trench from a control box within the digger cab

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	17	1	16

Expected benefits of project	Improved process safety as staff will not be required in enter the trench or go near the winching bond during operations as the work is solely undertaken by the equipment. The new technique will significantly reduce the need to excavate during mains replacement activities.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	7 yrs	25%	£440,873

Potential for achieving expected benefits	The benefits are being realised. A post investment appraisal will follow.
Project Progress	Pipe Handler have been delivered which can handle long sections of PE pipe, reducing the amount of excavations and minimising disruption to customers. Training and operating instructions in progress.
Collab' Partners	
Provider(s)	Steve Vick International Ltd

(IFI36) PE Glue Repairs

Year: 2009/10

Project Description	To provide an alternative repair solution to full cut out or mains replacement when glue is used in conjunction with bridging strips and encapsulation.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£29,013.00	£0.00	£25,965.00	£554,030.00
External	£152,680.00	£0.00	£206,421.00	
Materials	£51,638.00	£0.00	£88,313.00	
Total	£233,331.00	£0.00	£320,699.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	A reduction in excavation to enable joint repair regeneration.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Improved utilisation of the asset, less cut outs and unnecessary tappings
☑ **5 Protecting the Environment**	Reduction in imported materials and waste to lndfill
Technological area / issue addressed by project	o Materials science analysis of chemical structure for both PE and adhesive to develop preperation and bonding requirements o Develop and refine the existing technology for PE adhesives so as to develop a fit for purpose product o Develop an application method for the glue o Develop and create a bridging strip that will maintain the joint strength when put into axial pull loading or vibration o Create a gas tight seal to protect against future leakage sing Polyform

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	13	4	9

Expected benefits of project

Significant knowledge will transfer to the business that the adoption of a glue based repair technique can be applied for operational use including its limitations and possible alternative applications.

This new project could provide an alternative repair solution to avoid the need to cut-out. This will improve the process in completing repairs allowing the immediate reconditioning of leaking or poor quality PE joints, and also ensuring the integrity of the asset is maintained. Less materials used for the excavation process will result in less spoil to recycle and less used materials to transport to landfill.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	25 yrs	50%	-£171,092

Potential for achieving expected benefits

This programme of work has potential for achieving the expected benefits based on work to date.

Project Progress

Development and testing the glue which included: Reviewing the technical specification of the glue formulation, performing laboratory trials to confirm theory of technical specification, final formulation of the glue, performing adhesive tests on PE pipe to determine the required test sample dimensions.

Assemble rigs for testing which included the construction of the following rigs: impact test rig, short term deflection test rig, hydraulic test pump machine, tacograph checking system. Commenced PE80 sample tests.

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

(IFI37) Road Plates

Year: 2009/10

Project Description

This project seeks to support the development of an existing patented interlocking system for trenches up to 1m width and hole openings 2m*1m used without mechanical lifting aids to enable road works to be undertaken without interrupting the flow of traffic.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£28,699.00	£0.00	£10,957.00	£375,268.00
External	£197,676.00	£0.00	£48,127.00	
Materials	£19,766.00	£0.00	£70,043.00	
Total	£246,141.00	£0.00	£129,127.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ 1 Low Carbon Economy	Reduction in traffic congestion
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Reduced risk of injury to members of the public and damage to assets.
☑ 5 Protecting the Environment	Reduced vehicle emissions from stationary traffic

Technological area / issue addressed by project

o Structural analysis to extend range
o Skid resistance of materials
o Product design to account for road cambers and avoidance of injury to members of the public or employees

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

Expected benefits of project

Current road plates used within the business require the re-application of a non-slip coat every 6 months. Ramps are also required to hold these in place at site which also requires heavy lifting equipment. Potential improvement to reputation in the greater London area.

The black top asphalt used as part of the Tarmac ramps that hold the current road plates installed at present cannot be easily recycled. As the new road plates will avoid the need for ramps this will avoid the need for any used Tarmac to be sent to landfill and thus avoid landfill tax. which is approximately £30 per tonne at present. Avoid the need to divert or manage traffic through the affected area thus improving traffic management..

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	10 yrs	50%	-£143,057

Potential for achieving expected benefits

The project is on track to achieve the original planned benefits.

Project Progress

A proof of concept stage (1) was completed. Stage 2 of the project involved conducting a series of cyclic and static tests via a third party testing laboratory. On completion the results from these tests were used to develop a mathematical model for predicting product lifespan based on a number of variables, and a report delivered detailing the tests undertaken, issues experienced, the test results, mathematical model and the recommended product life spans.

Collab' Partners

Provider(s) GL Noble Denton

(IFI38) Service Cut-offs from Inside Dwellings

Year: 2009/10

Project Description	Utilising advanced sealant products and methods, to enable live service cutoffs under no gas conditions from inside the house. This will avoid any external excavation.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£1,830.00	£0.00	£0.00	£12,830.00
External	£7,500.00	£0.00	£0.00	
Materials	£3,500.00	£0.00	£0.00	
Total	£12,830.00	£0.00	£0.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in construction works at customer properties.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Improving performance in meeting obligations for cutting off services.
☑ **5 Protecting the Environment**	Reduction in waste/landfill as excavations are reduced.
Technological area / issue addressed by project	o No gas operation at meter combined with sealant injection.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Medium	6	3	3

Expected benefits of project	This initial stage is to validate the proof of concept which will inform of potential future benefits.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
	0 yrs	25%	-£12,200

Potential for achieving expected benefits	The concept provided has a high degree of success in achieving its objectives and should move forward to development.
Project Progress	Technical information was reviewed for the conceptual idea and current development progress. A Review of the technical specifications and standards were carried out to determine what performance testing may be required for external acceptance.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI39) Utopia Flowstop

Year: 2009/10

Project Description	To develop and implement within NG the Utopia flow stop system that utilises advanced bag technologies via a single hole to deliver flow stop, bypass and mains pressure and thereby changing working practices that have been in place for over 30 years.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£2,725.00	£0.00	£0.00	£19,125.00
External	£11,500.00	£0.00	£0.00	
Materials	£4,900.00	£0.00	£0.00	
Total	£19,125.00	£0.00	£0.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	A reduction in excavation reduces the need for vehicles and plant on site and in the quarries
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☐ **4 Safe, Reliable Network**	
☑ **5 Protecting the Environment**	A reduction in excavation reduces the enviromental footprint
Technological area / issue addressed by project	o Safe and reliable gas flow stopping in mains using advanced bag technology and single bag operation

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

Expected benefits of project	This initial stage is to validate the proof of concept which will inform of the potential future benefits.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
0	0 yrs	25%	-£18,200

Potential for achieving expected benefits	Following the proof of concept stage benefits can be articulated.
Project Progress	Completed a review of current specifications to determine performance testing and risk evaluation requirements. Some key issues need to be investigated before proceeding.
Collab' Partners	**Provider(s)** GL Noble Denton

(IFI40) AGI Condition Monitoring

Year: 2009/10

Project Description	To review the available technologies and techniques for condition monitoring of above ground installations (AGIs)

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£3,938.00	£0.00	£0.00	£35,088.00
External	£31,150.00	£0.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£35,088.00	£0.00	£0.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in maintenance taks and deferring of replacement of AGI's
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Investment where it is identified as essential is targetted to higher risk installations rather than based on existing criteria such as age.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	7	4	3

Expected benefits of project	This initial stage of this project is to validate the proof of concept which will inform of the potential future benefits.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
	1 yrs	25%	-£33,855

Potential for achieving expected benefits	This first phase of this project has delivered satisfactory results.
Project Progress	Proof of concept report has identified key areas for further investigations into available condition monitoring techniques.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI42) Gas Decarbonisation

Year: 2009/10

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	£6,660.00	£0.00	£270.00	£70,930.00
External	£28,798.00	£0.00	£35,202.00	
Materials	£0.00	£0.00	£0.00	
Total	£35,458.00	£0.00	£35,472.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Decarbonisation of Natural Gas by AHI to produce Hydrogen Enriched Natural Gas (HENG) has been the subject of a feasibility study (IFI 42). This demonstrated 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 network. 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
2010	1 yrs	25%	-£69,101

Potential for achieving expected benefits	The technology is feasible but further work needs to be carried out on conceptual design with a specific site. This will form part of the next stage.
Project Progress	Feasibility report delivered.
Collab' Partners	
Provider(s)	Atlantic Hydrogen

(IFI43) High Pressure Temporary Repairs

Year: 2009/10

Project Description	Review the options currently available for the temporary external repair of high pressure pipelines, in particular those that can be applied to bends and other non-straight features of pipelines.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£3,414.00	£0.00	£0.00	£33,300.00
External	£27,975.00	£0.00	£1,911.00	
Materials	£0.00	£0.00	£0.00	
Total	£31,389.00	£0.00	£1,911.00	

Status	
Draft	
Draft	27/06/2010
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	

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	7	2	5

Expected benefits of project	This initial stage is to assess and validate techniques or technologies that could deliver a solution that would significant reduce the loss of scenario identified in the project solution. The output will also inform the business of the potential benefts (including cost avoidance) any techniques identified.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
	1 yrs	25%	-£33,300

Potential for achieving expected benefits	Encouraging start to this project which provides the basis for advancement to the next stage (field trialling / testing). Next phase should ascertain whether composite tapes would enable temporary (or permanent) repairs in all circumstances.
Project Progress	A review and appraisal of pipeline repair techniques that are currently available has been carried out. It assesses their suitability for use on bends and other features with reference to pipeline material and size, pipeline configuration, pipeline location, type of defect and pipeline operating characteristics, and determines which are suitable as an off-the-shelf temporary repair solution.
Collab' Partners	**Provider(s)** GL Noble Denton

(IFI44) Preheat Reduction at AGI's

Year: 2009/10

Project Description	Reduce energy use from gas heating at PRIs whilst maintaining gas quality and system integrity downstream

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£4,071.00	£0.00	£0.00	£36,041.00
External	£31,970.00	£0.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£36,041.00	£0.00	£0.00	

Status	
	Draft
Draft	27/06/2010
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	

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	6	2	4

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
	1 yrs	25%	-£35,520

Potential for achieving expected benefits	Confidence is high that projected benefits will be achieved and the field trials during 2010/11 Winter will provide more information to determine actual benefits.
Project Progress	This first stage of the project has confirmed that there should be potential to reduce the number of heating systems on AGI's where certain criteria is met. Field trial sites will be established to continue through the next phase.
Collab' Partners	
Provider(s)	GL Noble Denton

(IFI45) Demonstration Trial for On-site Energy Savings

Year: 2009/10

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 offices, gas holder operational sites and potentially other building/site infrastructure..

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£12,931.00	£0.00	£4,779.00	£178,710.00
External	£51,975.00	£0.00	£22,275.00	
Materials	£86,750.00	£0.00	£0.00	
Total	£151,656.00	£0.00	£27,054.00	

Status	
Draft	
Draft	08/07/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Strong Alignment. Measured energy savings of lower carbon emissions and application of the decision tool to establish a targeted, on-going programme of improvements to the energy use at National Grid sites.
☐ **2 Eradicating Fuel Poverty**	
☑ **3 Promoting Energy Savings**	Strong Alignment. Energy savings lead to reduced emissions by an estimated 15%. The powerPerfector device has the potential to save over 2,000,000 kg of CO2 per year if installed on all Gas Distribution Sites.
☐ **4 Safe, Reliable Network**	
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Demonstration of the available technology for safe and reliable use on National Site sites o Voltage Optimisation system. This reduces waste or redundant power as sites will only consume the actual power that they require o Technology will mitigate against harmonics and spikes in supply

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Medium	16	0	16

Expected benefits of project	Knowledge transferred to National Grid concerning the suitable of use for UK Gas Distribution sites. Energy savings demonstrated at Case Study sites - good options for roll-out across other sites within National Grid.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2010	10 yrs	90%	£20,543

Potential for achieving expected benefits	Preliminary indications suggest that energy use at the sites has been realized through the installation of the powerPerfector units. The extent of the saving will be quantified at the end of the 3-month monitoring phase. Other sites being assessed for potential further roll-out of voltage optimization technology (powerPerfector or alternatives).
Project Progress	Site surveys completed to identify powerPerfector unit size and location to be determined. Installation completed with minimal issues at the three sites. No issues with regard to the initial performance of the powerPerfector units. Monitoring of electricity consumption at sites underway to enable quantification of the environmental benefit and provide data to support the cost benefit calculations.
Collab' Partners	**Provider(s)** GL Noble Denton

(IFI46) Internal Joint Profiling System for PE Pipes

Year: 2009/10

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	£17,559.00	£0.00	£9,423.00	£255,332.00
External	£101,250.00	£0.00	£38,000.00	
Materials	£81,000.00	£0.00	£8,100.00	
Total	£199,809.00	£0.00	£55,523.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

- ☐ **1 Low Carbon Economy**
- ☐ **2 Eradicating Fuel Poverty**
- ☐ **3 Promoting Energy Savings**
- ☐ **4 Safe, Reliable Network**
- ☐ **5 Protecting the Environment**

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		13	6	7

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
	10 yrs	50%	£431,400

Potential for achieving expected benefits

Good due to the high quality feasibility report and given the general nature of the project is to integrate existing proven technologies from other markets.

Project Progress

A feasibility study has been completed against predetermined broad deliverables as outlined below:

- o CCTV Cameras and scanning equipment available
- o Measurement system
- o Access launch and retrieval fittings across the range of pipe sizes in use
- o Glanding system
- o Propulsion system
- o Interface & Control system

At least one solution deliverable was identified for each of the above sections. With the completion of the feasibility (end Nov 09) the project has now moved to solution delivery. Ongoing work is now being undertaken in the measurement and propulsion systems. Looking at further miniaturisation of the system.

(IFI46) Internal Joint Profiling System for PE Pipes

Year: 2009/10

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

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

Year: 2009/10

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	£8,325.00	£0.00	£0.00	£55,500.00
External	£24,650.00	£0.00	£22,525.00	
Materials	£0.00	£0.00	£0.00	
Total	£32,975.00	£0.00	£22,525.00	

Status: Draft

Draft	27/06/2010
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. The benefits at this stage cannot be quantified but will be during the course of the project and also from the output from IFI:18.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
	0 yrs	25%	-£55,000

Potential for achieving expected benefits: The feasibility report has been delivered, and has enabled the technologies to be progressed into design/prototype at selected sites.

Project Progress: A feasibility and conceptual design study into the necessary equipment required for bio-methane injection on IP and LTS systems has been delivered.

Collab' Partners: | **Provider(s):** Mouchel

(IFI48) Flow Measurement Device for Flow Stop and Network Modelling

Year: 2009/10

Project Description To provide a simple, accurate measurement of Gas Flow in the main to be stopped to confirm: Flow Direction, Flow Rate, Pressure etc

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£907.00	£0.00	£0.00	£12,507.00
External	£7,600.00	£0.00	£0.00	
Materials	£4,000.00	£0.00	£0.00	
Total	£12,507.00	£0.00	£0.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Improved control of cut out operations, improved knowledge of the actual flow in the gas distribution system to compare with network modelling predictions and hence improve modelling accuracy
☐ 5 Protecting the Environment	
Technological area / issue addressed by project	

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	11	0	11

Expected benefits of project

The proof of concept will inform of the potential benefits. Measurement of Gas Flow rate and Direction will confirm Network Analysis predictions prior to Bag Stop and other Flow Stop Operations as well as providing a useful tool for network modelling validation.

Much of the existing equipment cannot be utilized at High Flow Rates and the device will confirm actual site conditions which will help to avoid incidents associated with failure of Flow Stop equipment due to high flow conditions..

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
0	0 yrs	25%	-£12,900

Potential for achieving expected benefits This first phase of this project has delivered satisfactory results.

Project Progress Undertook a review of existing technologies and capability in the market place for flow measurement devices to cover natural gas with pressures up to 7 bar and completed external acceptance criteria.

Collab' Partners

Provider(s) GL Noble Denton

(IFI49) Human Factors in Gas Operations

Year: 2009/10

Project Description

Understand the factors that influence decisions by people at all reporting levels in carrying out their work which contributes to the causal sequence of accidents in gas operations, so that a coherent safety management strategy can be developed.

The first stage of this work is to undertake a review of current systems so as to provide feedback to the leadership of the organisation on the effectiveness of current systems, as reflected in the assumptions and beliefs held by employees at all levels in the maintenance group.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£6,733.00	£0.00	£0.00	£74,962.00
External	£68,229.00	£0.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£74,962.00	£0.00	£0.00	

Status

Draft

Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☐ 1 Low Carbon Economy	
☐ 2 Eradicating Fuel Poverty	
☐ 3 Promoting Energy Savings	
☑ 4 Safe, Reliable Network	Strong alignment. Nationa Grid has reviewed the arrangements for process and occupational safety management and is taking a number of actions to re-invigorate its focus on safety. National Grid has identified that it does not currently have sufficient information about the human factors that are most relevant to its operations to inform a coherent strategy to achieve the unparalleled safety performance that is sought.
☐ 5 Protecting the Environment	

Technological area / issue addressed by project

Objective analysis of the primary factors that are currently influencing behaviours of NGG personnel whose work contributes to process and occupational safety performance.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Substitution	Significant	18	4	14

Expected benefits of project

The project will enable knowledge about the role of human factors in decision making to be transferred through National Grid Gas. This project demonstrates a strong commitment to continuous improvements in process and occupational safety performance.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
0	0 yrs	25%	-£75,729

Potential for achieving expected benefits

The outputs have been reviewed within Operations maintenance and used to inform the new front office system design. The benefit of this human factor knowledge will transferred through Gas Distribution.

Project Progress

Stage 1 has been completed. The purpose of this stage was for National Grid to better understand how "systems drive behaviour" given the nature of it's workforce and operating environment. Interviews were held with a cross section of maintenance staff and the results were used to inform the design of the new front office systems.

Collab' Partners

Provider(s) PBRune

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

Year: 2009/10

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	£17,751.00	£0.00	£4,336.00	
External	£102,991.00	£0.00	£78,535.00	£209,013.00
Materials	£2,800.00	£0.00	£2,600.00	
Total	£123,542.00	£0.00	£85,471.00	

Status

Draft

Draft	27/06/2010
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	3	16

Expected benefits of project

This project will provide essential knowledge and understanding via validated finite element analysis 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.

There could be an environment benefit by not releasing natural gas into the environment.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	5 yrs	25%	£287,412

Potential for achieving expected benefits

Likelihood of success remains high. Guidance on the minimum acceptable squeeze-off distance will be derived from the FE analysis results for the four PE pipe types. This guidance will be used to derive acceptable limits for minimum separation distances between the squeeze-off location and the joints.

Project Progress

A validated FE model had been developed for predicting stresses in a single pipe diameter and material. To validate the FE method over a range of PE pipes, 3 additional pipe types were identified. It was proposed that FE analyses be conducted in a similar manner to that in the first phase and validated by conducting full scale squeeze-off tests.

The following work has also been completed:
o 3-D FE analyses of the squeeze-off process for 3 selected pipes has been completed
o Full scale squeeze off tests for three PE pipe types, were successfully completed at the end of 2009.

Collab' Partners

Provider(s) GL Noble Denton

(IFI51) New Materials for Gas Distribution

Year: 2009/10

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 NG 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	£12,253.00	£0.00	£34,249.00	£418,237.00
External	£167,940.00	£0.00	£194,595.00	
Materials	£9,200.00	£0.00	£0.00	
Total	£189,393.00	£0.00	£228,844.00	

Status	
Draft	
Draft	06/07/2010
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 from 2013-2031
☑ **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	Developing an alternative to steel and provide environmental benefits by reducing excavation and waste materials. especially in urban areas.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2013	18 yrs	25%	£595,965

Potential for achieving expected benefits	In order to meet the requirements for large diameter replacement in urban areas, particularly London, it is necessary to pursue the work in pushing the boundaries of PE utilisation. In this context revisiting the Industry proximity distances and pipe stress safety factors provides the best chance of success in delivering a solution to meet the objectives of this project.
Project Progress	Feasibility report delivered. A detailed technical scoring matrix developed in the study compared PE against novel materials. The key conclusions of the report has identified that In order to meet the requirements for large diameter replacement in urban areas, particularly London, it is necessary to pursue the work in pushing the boundaries of PE utilisation. In this context revisiting the Industry proximity distances and pipe stress safety factors in stage 2 provides the best chance of success in delivering a solution to meet the objectives of this project.

Collab' Partners		**Provider(s)**	PBRune

(IFI52) European Gas Research Group (GERG) 2009/10

Year: 2009/10

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	£7,226.00	£0.00	£0.00	£75,577.00
External	£67,629.00	£0.00	£0.00	
Materials	£722.00	£0.00	£0.00	
Total	£75,577.00	£0.00	£0.00	

Status

Draft

Draft	06/07/2010
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

Adoption of knowledge ascertained via the output of sponsored projects that can be quickly implemented into the business as q efficiently as possible.

For 2009/10:

- Non destructive testing using field made joints
- The dynamics of gas tracking in soils
- Bench marking of methane emission methodologies

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	13	-2	15

Expected benefits of project

Improved knowledge in all project areas. Specifically the methane emissions may lead to changes to the way shrinkage calculations are carried out. NDT technologies may lead to improvements in materials and/or field procedures, and gas dispersion may lead to changes in the MRPS model.

Significant research leverage benefits. The total value of projects proposed during 2009/10 is approximately £376,000 which provides National Grid will an 4:4 to 1 leverage ratio. The NPV for the work contained within the 2009/10 will improve once the projects progress to the development stages and the benefits identified.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
	0 yrs	25%	-£84,175

Potential for achieving expected benefits

Projects are ongoing in particular the NDT technologies are encouraging and chances of success are good due to the collaborative approach to this work.

Project Progress

Gas Migration in soils. Kick off meeting held.

NDT techniques
Delivery of an updated 2007 report on Non-Destructive Examination Technologies of PE joints, published by Kiwa Gas Technology. One technique was recommended for further evaluation

NDT Samples
Delivery of over 50 samples from the UK to Kiwa

(IFI52) European Gas Research Group (GERG) 2009/10

Year: 2009/10

	Methane Emissions Responses to questionnaires being evaluated.
Collab' Partners	KIWA, GDF SUEZ
Provider(s)	GL Noble Denton, KIWA, Gaz De Suez

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

Year: 2009/10

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	£4,071.00	£0.00	£3,959.00	£75,991.00
External	£21,945.00	£0.00	£30,670.00	
Materials	£9,172.00	£0.00	£6,174.00	
Total	£35,188.00	£0.00	£40,803.00	

Status

Draft

Draft	27/06/2010
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	2 yrs	50%	-£16,924

Potential for achieving expected benefits Initial work on this project seems favourable.

Project Progress Completed the work associated with the following packages of work. Completed procurement activities and off site field trials.

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

(IFI54) Development of New Rapid Service Cut-off Technique

Year: 2009/10

Project Description	Facilitation of the removal of elbows and tee type mains to service connections under no blow conditions.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£4,519.00	£0.00	£2,644.00	£65,120.00
External	£20,500.00	£0.00	£27,457.00	
Materials	£0.00	£0.00	£10,000.00	
Total	£25,019.00	£0.00	£40,101.00	

Status	
Draft	
Draft	08/07/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Removal of uncontrolled gas emissions to atmosphere resulting from service cut off operations.
☐ **2 Eradicating Fuel Poverty**	
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	The new service isolator will reduce the risk of gas in building by allowing the faster repair to be undertaken. Internally, the removal of the denso-cut procedure will reduce the risk to staff from asphyxiation.
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o the introduction of a sealant into a domestic service pipe for the purpose of isolation / cutting under no gas conditions and in a similar / quicker time to the 'denso cut' method o fast, safe and effective live / dead checks of capped services o injection of anaerobic sealant into screwed joints.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	21	-2	23

Expected benefits of project	Removal of gas emissions to atmosphere resulting from service cut off operations and more efficient gas repairs.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2011	10 yrs	75%	£2,137,123

Potential for achieving expected benefits	The initial prototype has been modified into version 2 to address the minor issues. This version requires testing to prove the modifications and this will be done as soon as practically possible. Confidence is high that the modifications will fully address the issues and following the next site trials it is anticipated that the project can progress to the demonstration phase.
Project Progress	First Prototype completed and field trials carried out. Field trial report completed indicating acceptance by field force and speed and safety of new process / design however 2 minor areas of concern were highlighted and second prototype produced to further improve product to trial 2010_11.

Collab' Partners	Steve Vick	**Provider(s)**	Steve Vick International Ltd

(IFI55) Operational & Integrity Challenges (Small Projects) 2009/10

Year: 2009/10

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	£6,200.00	£0.00	£0.00	£63,862.00
External	£57,662.00	£0.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£63,862.00	£0.00	£0.00	

Status	
Draft	
Draft	27/06/2010
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 o Evaluation and Validation of the Synthotech Service Isolator to determine the full innovation potential that can be exploited

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	6	2	4

Expected benefits of project	Adoption of knowledge via an independent appraisal that will determine whether an innovation opportunity can be quickly developed and thus implemented into the business as efficiently as possible. The knowledge gained will also enable the efficient development of project scopes should any one of the small projects need to be developed into a more substantial project. A number of projects will investigate how to reduce safety risks as part of the day-to-day operations. These cannot be articulated at this stage due to the early stage in the respective project life cycle. A number of projects will investigate how to resolve current operational and technical issues that will avoid alternative options. These cannot be articulated at this stage due to the early stage in the respective project life cycle.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2010	0 yrs	25%	-£61,886

Potential for achieving expected benefits	The outputs from the moling project have established that there are no identifiable alternative launch systems for small diameter impact moling systems that provide an alternative to the use of insulating PPE to mitigate against the hazard associated with a cable strike during launch and receiving operations. Other global manufacturers may be considered. The PE Riser project identified additional testing/evaluation of the proposed PE riser fittings to ensure its fitness for purpose and also against additional engineering considerations required to ensure performance and structural/pressure integrity over the proposed service life of the product. The Repair Tape evaluation has confirmed that current repair tapes are not appropriate but may be temporarily useful.
Project Progress	Delivery of Feasibility Report regarding the distribution of National Grid and third party asset location data to National Grid field staff on USB devices. Identification of implementation phasing to deliver

(IFI55) Operational & Integrity Challenges (Small Projects) 2009/10

Year: 2009/10

"quick wins" without large scale hardware procurement.

Delivery of a report reviewing launch system and protective clothing and equipment options of using impact moles. Delivery of a report evaluating PE risers Engineering Data received for new design of PE Riser fittings from the supplier. Specifications were evaluated, and some aspects were identified which are not covered in exiting specification. Report on evaluation submitted detailing the test data, evaluation against specification, and recommendations for further evaluation of the system to gain more confidence in its long-term integrity.

Delivery of a report evaluating Mains Stoppers. Workshop Testing Complete with failures of the flexible stopper under test and field trials completed. Global evaluation of repair tapes.

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

(IFI56) Work Scheduling and Mobile Solution in the Field

Year: 2009/10

Project Description	To support Gas Distribution in delivering a state of the art work scheduling and mobile solution to the Maintenance and Emergency processes.

	Expenditure for Current FY	Expenditure for Prev' FY	Expenditure for Next FY	Total Project Costs
Internal	£504,380.00	£0.00	£0.00	£3,362,536.00
External	£2,858,156.00	£0.00	£0.00	
Materials	£0.00	£0.00	£0.00	
Total	£3,362,536.00	£0.00	£0.00	

Status	
Draft	
Draft	27/06/2010
Final	
Approved	

Alignment with IFI/SD

☑ **1 Low Carbon Economy**	Reduction in travel times for field force and supervisors. Minimises abortive visits
☑ **2 Eradicating Fuel Poverty**	Vulnerable customer information will be held in core systems and made available to the field force as necessary eg incidents
☐ **3 Promoting Energy Savings**	
☑ **4 Safe, Reliable Network**	Reduction of multiple sources of data records, Improved data capture and accuracy, Reduced computer to human handoffs and interfaces, Improved information at 'front line' - contact centre and field Streamlined, consistent processes with reduced manual processing, Improved management information. By having increased visibility of previous we can make better informed decisions. A consolidated Contact Centre organisation will give greater flexibility to deal with large-scale incidents. Increasing our channels of communication makes it easier for our customers to raise safety concerns. Through more resilient technology we can reduce the risk of business continuity failures
☐ **5 Protecting the Environment**	
Technological area / issue addressed by project	o Integration of asset IS systems o Configuration and enhancement of best of breed software and hardware systems

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Significant	Significant	24	3	21

Expected benefits of project	Achieve a transparant real time single view of work across locations, capabilities and assets. Focus available resources on critical assets, SLAs for emergencies improved and improved MI. Avoidance of inappropriate maintenance activities. Improved asset reliability through RCM. Reduction in travel. Improved lif cycle costs to identify optimum replacement frequencies. The overall programme delivers reduced fleet costs from street level routing, Improved utilisation of plant and equipment, lower maintenance costs, removal of back office admin costs, decrease in level of field supervision, increased levels of lone working, increased MI, better use of dircet labour eg for reinstatement. The work scheduling and mobile solution components are key enablers to deliver the field force benefits in Maintenance and Emergency described below in combination with the functionality and equipment delivered by the with main programme.

Adoption (Year)	Duration of Benefits	Prob' of Success	Project NPV
2010	10 yrs	75%	£1

Potential for achieving expected benefits	The Gas Distribution Front Office (GDFO) team has undertaken a detailed and in depth analysis of business benefits. The GDFO steering group have signed onto the benefits. On the assumption that the system passes successful testing during the summer of 2010, then there is confidence that benefits will be achieved at implementation.
Project Progress	Detailed feasibility, business requirements and design undertaken. This phase reviewed best of breed packages, evaluated and established customization, enhancement and integration needs.

(IFI56) Work Scheduling and Mobile Solution in the Field

Year: 2009/10

	Integration and assembly build into core asset repository system		
Collab' Partners		**Provider(s)**	Cyclo, Click, SAP

(IFI57) Calculation of Zones of Influence

Year: 2009/10

Project Description	To enhance existing zones of influence functionality in GBNA/LINAS 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	£5,253.00	£0.00	£9,898.00	£106,151.00
External	£35,828.00	£0.00	£55,172.00	
Materials	£0.00	£0.00	£0.00	
Total	£41,081.00	£0.00	£65,070.00	

Status	
Draft	
Draft	08/07/2010
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.

Innovation Type	SD Rating	Benefits Rating	Residual Risk	Overall Score
Incremental	Medium	14	2	12

Expected benefits of project	Improved understanding of the impact on our networks upon 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
2010	1 yrs	50%	£487,199

Potential for achieving expected benefits	The demonstration version have shown that all the key benefits of this project will be achieved.
Project Progress	This phase reviewed best of breed packages, evaluated and established customization, enhancement and integration needs.
Collab' Partners	
Provider(s)	GL Noble Denton