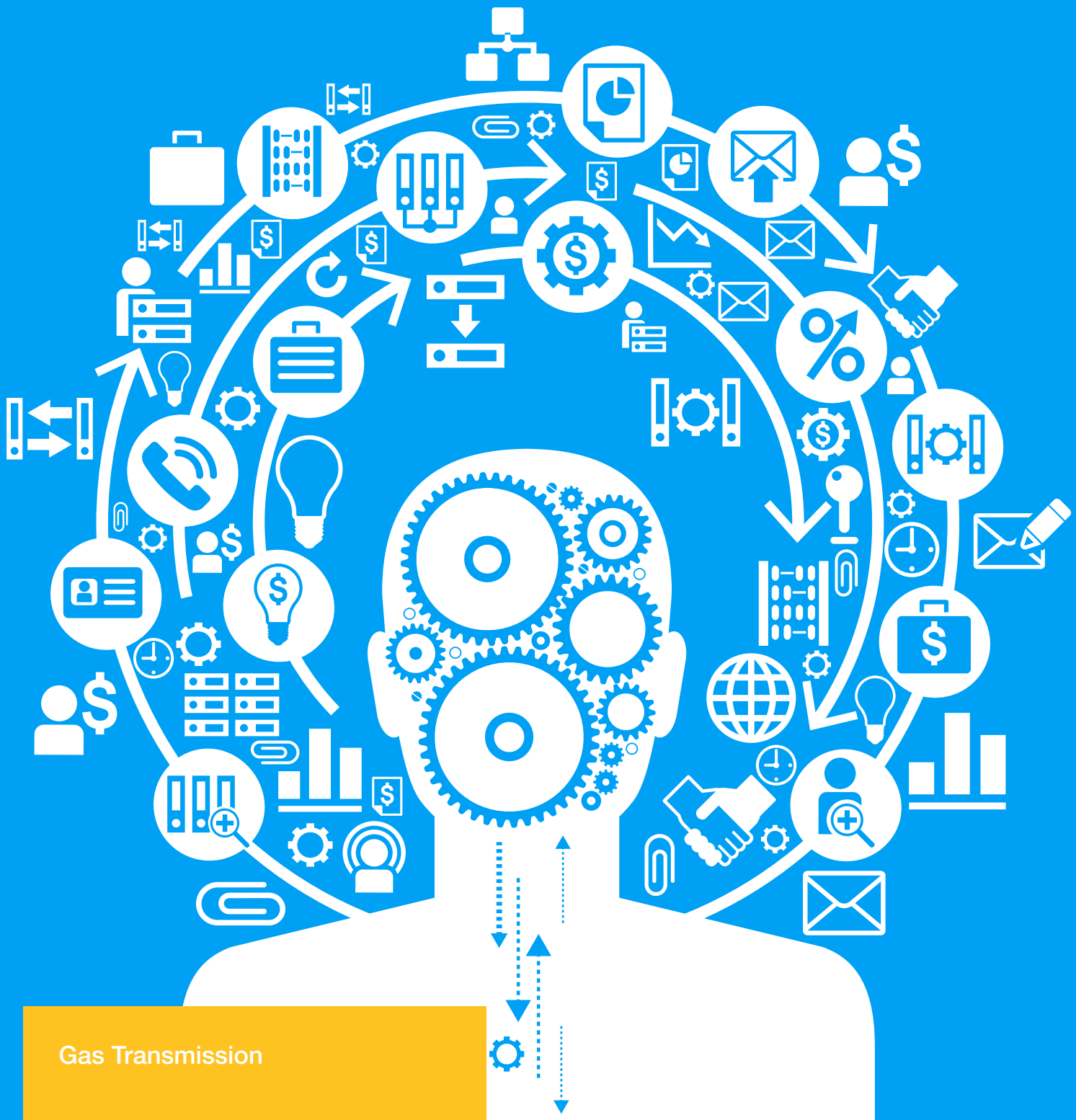
Annual summary

nationalgrid

Network Innovation Allowance

2013/14



Gas Transmission

Contents

Introduction

2013/14 has been an exciting and rewarding year for Gas Transmission innovation. We have built upon the Innovation Funding Incentive successes, transitioning a number of projects over into NIA, and we have developed many new ideas into NIA proposals.

The NIA portfolio centres on our six strategic themes: safety, reliability, environment, strategic, customer and connections. Particular successes this year have been in areas such as investigating alternative materials, green and renewable energy solutions and intelligent assessment of asset health condition.

We have developed collaboration projects with other network licensees and other gas transmission operators globally. We have also focussed on developing strong relationships with a number of SMEs, which has allowed us to act quickly in the development of novel ideas and run the portfolio efficiently and effectively. We have in addition prioritised our internal engagement activities and a particular success this year is the number and diversity of technical teams now leading projects and participating in the NIA.

Our ambition for the second year of NIA is to build upon these foundations, maximising the opportunity of the NIA to drive value for our customers.

John Pettigrew
Executive Director

Network Innovation Allowance

The National Grid Gas Transmission NIA expenditure for 2013/14 was **£3.0m**

The National Grid Gas Transmission total NIA expenditure for 2013/14 was £3.0m across 52 NIA projects and NIC bid preparation. There were 47 gas transmission led NIA projects plus three collaborations with gas distribution led projects and two with electricity transmission. National Grid Gas Transmission submitted one bid for the 2013 NIC, Variable Envelope Compressor Optimisation (VECTOR), which was unsuccessful at the final stage.

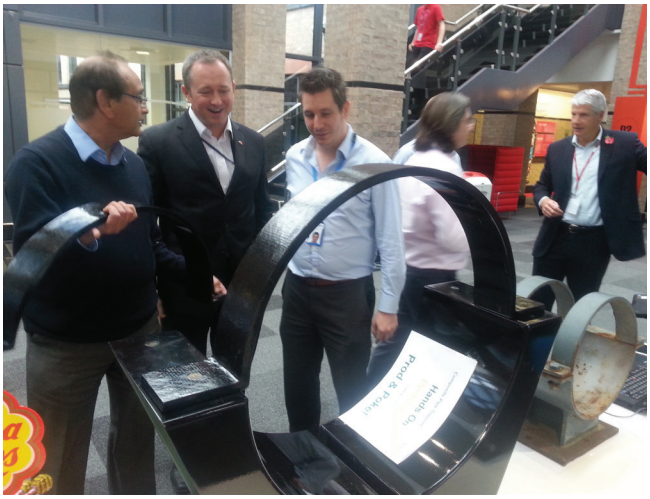
Our innovation strategy set out to build on three core elements:

- **Identification and prioritisation of research areas**
- **Harnessing internal innovation capabilities**
- **Collaboration with external parties.**

Work this year has seen significant progress in all three areas. Our RIIO-T1 priority research areas are currently new pipeline build, compressors (emissions and new build), asset health, and network flexibility modelling. Projects initiated in this areas include Compressor Balance of Plant Environmental Study, Feasibility Study for Alternative Pipeline Materials, Investigation into the use of Constrained Layer Damping and Ramp Rate Study System.

We have seen increased internal engagement from our technical teams for sponsorship and leadership of NIA projects. The NIA portfolio is managed through a central team allowing our project leaders to focus on technical aspects of the projects.

We have also engaged in a number of internal dissemination events designed to encourage greater participation in the NIA, including events through the Newnet network for new starters to the company, “brown bag lunches” and developing a communications strategy for publishing innovation news on the National Grid infonet.



We have worked with over **20 partners** and suppliers

We now work with a diverse range of partners and suppliers from SMEs (e.g. Premtech, MACAW, Oxford Computer Consultants), large engineering consultancies (DNV GL) and universities (Manchester, Leeds and Warwick). We have also collaborated with other licensed operators and gas transmission operators globally.

We have engaged with industry through project presentations at events hosted by IGEM and the Pipelines Industries Guild. National Grid Gas Transmission also participated in the LCNF in 2013. We have looked to meet with potential new external partners on an ongoing basis, arranging discussions each month. For our 2014 NIC bid submission we published specific themes on Nationalgrid.com to encourage third parties to submit ideas, in addition to ideas of their own.

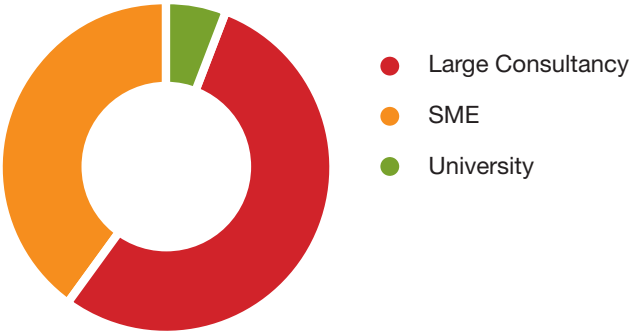
DNV·GL

Oxford Computer Consultants
Original, robust and flexible IT solutions

Premtech
ENGINEERING EXCELLENCE

MACAW
ENGINEERING

Fig 1 Project spend by supplier type



Innovation strategy

The gas transmission innovation strategy centres on **six key themes** and our 2013/14 portfolio has been managed to ensure the NIA is balanced across these themes:

Safety
Within the safety theme, topics include safe working practices, third party interference and infrastructure. We have a number of new projects associated with asset condition assessment (including guided long wave ultrasonic inspection techniques for sleeved crossings and manual phased array for small offtake weld inspection), and we have developed intelligent methods for maintenance with the pipeline risk ranking model.

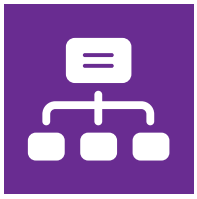
Reliability
For value driven innovation, the reliability theme is crucial. This encompasses topics such as optimising asset management, gas quality, capacity and capability.
A wide variety of new projects have been initiated in this area. Examples include SCT pipeline inspection, which is the development of a novel over ground pipeline inspection tool, a metering simulator, and projects to use novel composite designs and materials (composite pipe supports and removable composite transition pieces).

Environment
The environmental theme centres on reducing emissions from gas transmission operations, and in particular ensuring compliance with the European Industrial Emissions Directive. A significant project in this area is Compressor Balance of Plant. Balance of plant is the wide range of ancillary equipment in addition to the gas compressor machinery train and this project looks to develop a software tool that will allow comparison of a range of candidate technology options for various balance of plant asset groups.

Fig 2 Project spend by theme

Connections
The connections theme centres around facilitating access to the National Transmission System (NTS). We have initiated a project to develop a ramp rate study system to interface with our network modelling tool, which is called 'Simone'. This will assist in the provision of ramp rates to our directly connected customers on the NTS.

Customer satisfaction/commercial
Within this theme we have ongoing work on demand forecasting and initiated a new project, the Network Investment Stakeholder tool. The tool will enable our stakeholders to visualise investments that National Grid is proposing on the network and select a number of approved pre-run studies that contain different supply and demand scenarios and network configurations.



Strategic
Within our strategic theme we have continued participation in external research groups such as PRCI and EPRG which offer high leverage across a range of research topics, in particular pipeline safety and materials. We also have our longer term research (feasibility study for alternative pipeline materials and construction methods) and our Cooperative Awards in Science and Engineering (CASE) with the University of Manchester.

Significant new learning

BIM (Business Information Modelling)

Project partner - Premtech

One of our key projects for the year was BIM (Business Information Modelling).

BIM is a process that involves the generation and management of intelligent 3D digital representations of the physical and functional characteristics of assets. Put simply, BIM is the process of pegging data to 3D models. The aim of the project was to develop and trial an intelligent 3D modelling process within an existing construction project. Within this project:

Within this project:

- The trial of smarter surveying techniques, such as laser scanning was proven to reduce the ambiguity of site records and requests for information and reduce the time required at the outset of a project. Laser scanning involves the collation of millions of points of data that provide a true 'as is' status of the site; also known as 'point-clouds'. By overlaying photographs onto the point-cloud, this enables measurements to be taken from the photographs, reducing the repeat visits to a potentially hazardous site environment.
- 4D modelling (linking the construction programme to the model) added substantial benefits from a construction design and management (CDM) perspective. 4D modeling forces the designer to consider the build sequence and the "soft clashes", i.e. the open excavations, plant movements and working areas.
- Linking together material cost data (5D modeling) and carbon data to 3D models meant that engineers could make economic and environmental decisions earlier rather than using the back ended commercial and sustainable practices.

The project successfully delivered cost savings of up to 11% compared to the current 2D based design.

Composite pipe supports

Project partner - Capita

On the NTS, all terminals, compressor stations and above ground installations include pipe supports, as do the equivalent assets on the UK's distribution networks. These pipe supports vary in design, with an average cost of £3,500 (600mm steel pipe support only) and consist of a concrete plinth and a steel cradle. The cradle can weigh well in excess of 100kg (134kg at 600mm diameter), creating a manual handling risk and the existing pipe support design and material leads to potential pipe corrosion.

This innovation project looked to investigate a new design of support based on composite materials. We achieved the original objective to research potential solutions for pipe supports relatively quickly. Using a staged approach we have subsequently developed the design through the rigorous National Grid design verification procedures to the production of a working prototype. The composite pipe support prototype has delivered:

Safety – the solution is lighter than expected, allowing for safe manual handling and requirement for mechanical lifting. At 600mm diameter, the composite pipe support has a maximum component weight of 21kg.

Integrity – the composite solution is stronger than existing steel supports and will not present the corrosion issues that are experienced on the existing steel supports.

Cost – initial estimates indicate that unit costs are expected to be 25% less than existing steel supports and further savings from eliminating the need to sacrifice and then construct new concrete plinths during maintenance. Using a composite pipe support negates this procedure.

The prototype has been on trial at the National Grid Eakring training centre.The next phase of work will include finite element analysis (FEA) for all pipe diameters and the installation and evaluation of a composite pipe support within a working environment.

Significant new learning

Semi mechanised hot tap welding

Project partner - Macaw

Current methods used by National Grid to weld thick wall minimum hot tap or stopping off connections to a pipeline can result in extended continuous welding times in excess of 24 hours. This is undesirable from the key aspects of human factors (extended working hours), environmental (increases in atmospheric pollutants) and safety (accidental damage to pipework).

The project has successfully developed and qualified semi-mechanised welding procedures for the welding of longitudinal seam welds on thick wall hot-tap tees. A comprehensive welding and test programme was performed as well as an evaluation of the capability of manual phased array to perform ultrasonic testing (UT) inspection of the longitudinal seams welds of split tee connections.

The main learning points include:
Overall welding times using the gas shielded flux cored arc welding (GSFCAW) process were reduced by approximately 20% related to the arc time recorded during the qualification tests.

Using the semi-mechanised GSFCAW process resulted in a reduction in the number of welders required from 5 to 3. There is a cost saving directly related to this reduction in labour required, in addition to the predicted increase in productivity.

In terms of health and safety, there are specific hazards; fumes/gases and trapping hazards, associated with the semi-mechanised GSFCAW process, that must be considered before implementation on site. These would be addressed by the use of appropriate method statements and risk assessments on site.

The T/SP/P/9 National Grid specification will now be revised to accommodate the application of the GSFCAW semi-mechanised longitudinal seam welding process.

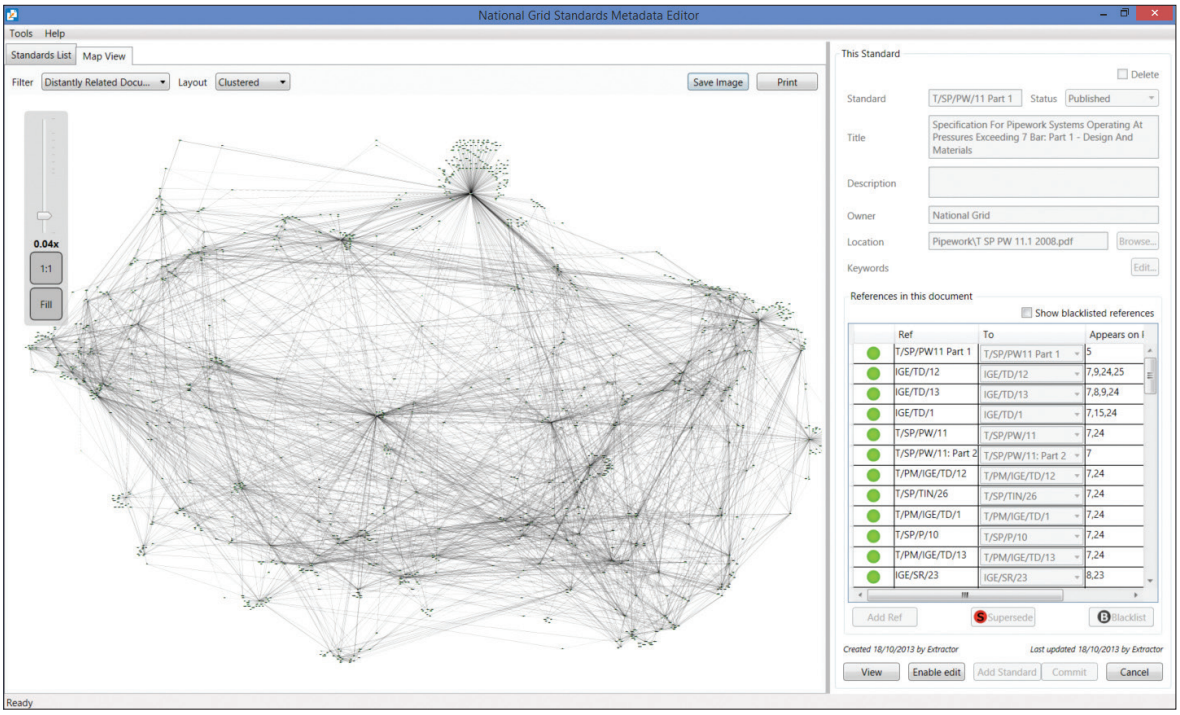
Standards Mapping Tool

Project partner - Oxford Computer Consultants

Gas Transmission Asset Management is responsible for the update and maintenance of the standards suite comprising approximately 540 documents. These documents provide the safety, legislative and operational framework for the National Transmission System (NTS).

The majority of the standards make reference to other standards or legislation, however it was identified that there was no functionality to make it possible to determine these inter-relationships. This meant potential inconsistencies or gaps within the standards suite.

The development of the Standards Mapping Tool has produced a solution which will improve consistency of document referencing, thereby ensuring a fully rounded overview of inter-relationships and common mappings between documents.



Project information

The 2013/14 NIA portfolio consisted of **52 projects**

NIA_NGGT0001	Alternatives to venting
NIA_NGGT0002	Development of AC OHL Survey System and Evaluation of ER Probes
NIA_NGGT0003	PRCI - Pipeline Research Council International
NIA_NGGT0004	Development of a Risk Based Asset Management Tool
NIA_NGGT0005	European Pipeline Research Group (EPRG)
NIA_NGGT0006	Turbine and USM Uncertainty and Error Analysis Tool
NIA_NGGT0007	Risk Assessment Methodologies for Pipelines & AGIs
NIA_NGGT0008	Development of a novel mitigation method for high frequency main pipework vibration
NIA_NGGT0009	Removable Composite Transition Pieces (CTP)
NIA_NGGT0010	Backup DC Drive Electronic Starter
NIA_NGGT0011	Composite Pipe Supports
NIA_NGGT0012	Development of new design vent silencer
NIA_NGGT0013	Evaluation of Inspection Techniques for Sleeved Crossings
NIA_NGGT0014	Daily Gas Demand Forecasting
NIA_NGGT0015	The Need for Pressure De-rating Prior to In-Service Welding
NIA_NGGT0016	Pipeline Risk Ranking Phase II
NIA_NGGT0017	Heat in the Soil Form - Assessment of Heat In Soil Caused by Buried Infrastructure
NIA_NGGT0018	Optimisation of Severe Winter Strategy for Pipeline Isolation Valves
NIA_NGGT0019	Toughness of Fittings
NIA_NGGT0020	Variable envelope compressors
NIA_NGGT0021	Epoxy Sleeves in Place of Heavy Wall Pipe
NIA_NGGT0023	Development of AGI safe
NIA_NGGT0024	BIM (Building Information Modelling)
NIA_NGGT0025	Architectural Design of Compressor Site
NIA_NGGT0026	Study to Determine Stress Concentration Factors (SCF) for Alternative Design on Branch Connections
NIA_NGGT0027	Pig Trap Door Seals
NIA_NGGT0028	P9 semi mechanised hot tap welding
NIA_NGGT0029	Assessment of Hydrophobic Treatment for Gas Compressor Air Intake Values & Screens
NIA_NGGT0031	Direct Preheat Replacement Package (DRPP)

For further information on our full project portfolio and to see our project progress reports for the projects listed below please visit **www.nationalgrid.com/innovation** or **www.smarternetworks.org.**

NIA_NGGT0032	Gas Quality Limits in Emergency Situations
NIA_NGGT0033	Hot tap buried sample probe
NIA_NGGT0034	External Contamination Detection & Measurement at Entry Points
NIA_NGGT0036	Standards Mapping Tool (SMT)
NIA_NGGT0037	Compressor Balance of Plant Environmental Study
NIA_NGGT0038	Novel vibration measurement technologies
NIA_NGGT0039	Renewable Power on Remote Installations
NIA_NGGT0040	Metering and Gas Quality Training Simulator
NIA_NGGT0041	On Site Chemical Analysis of Pipeline Materials
NIA_NGGT0042	Ramp Rate Study System
NIA_NGGT0043	MiniLog Stray Current Monitoring Devices for Cathodic Protection Re-Life
NIA_NGGT0044	SCT Pipeline Inspection System
NIA_NGGT0045	Acoustic Emission Measurements in Valve Leakage Detection and Quantification
NIA_NGGT0046	Manual Phased Array for Small Diameter Offtake Weld Inspection
NIA_NGGT0047	Resource and asset re use toolkit
NIA_NGGT0048	Feasibility Study for Alternative Pipeline Materials
NIA_NGGT0049	Investigation into the use of constrained layer damping
NIA_NGGT0050	Network Investment Stakeholder Engagement

National Grid Electricity Transmission Led Projects

NIA_NGET0144	Enhanced Sensor Development (ICASE Award)
NIA_NGET0135	Integrated Electricity and Gas Transmission Network Operating Model (ICASE Award)

National Grid Gas Distribution Led Projects

NIA_NGGD0007	Development of DANINT FWAVC software for New Gas Chromatograph
NIA_NGGD0009	Orifice Plate Deformation
NIA_NGGD0022	Study of Crater Formation Threshold During Gas Leakage on High Pressure Pipes

Get in touch

The Gas Transmission Innovation team welcome ideas both for the NIA and 2015 NIC.

Engaging with our customers and suppliers is key to innovation success.

As we move forward into the second year of the NIA, we are looking to develop the NIA portfolio in line with our innovation strategy and welcome any ideas and suggestions aligned to our themes.

Please get in touch at the following:
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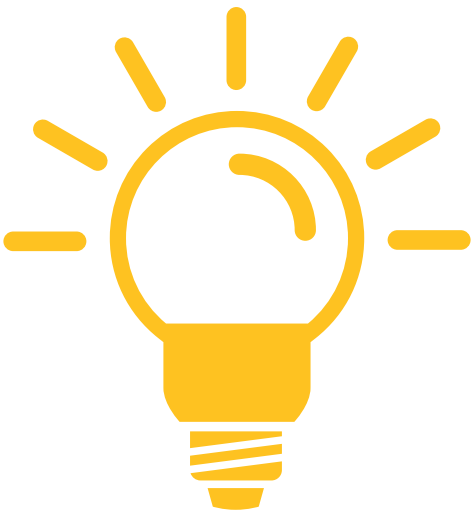

Notes

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