Gas Transmission

Embedding innovation value

Mid-term report 2017

nationalgrid

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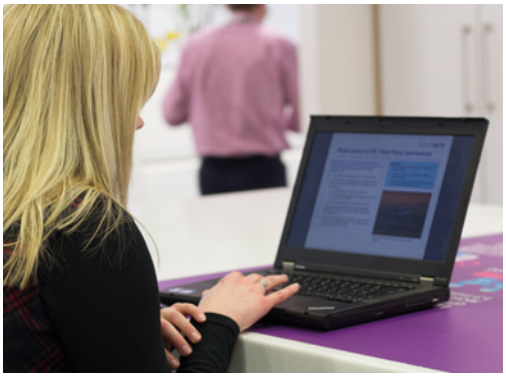
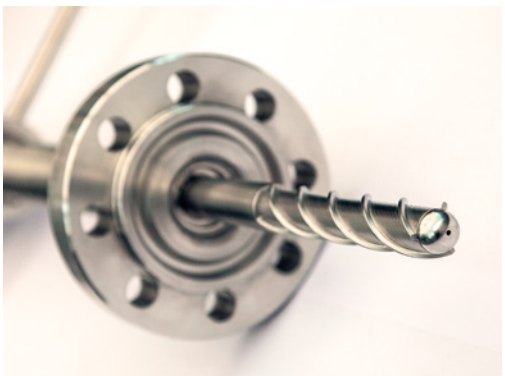




Welcome to our innovation value mid-term report

Successful innovation takes drive, passion and commitment. Over the past four years, National Grid Gas Transmission (NGGT) has developed a strong portfolio of new ideas and demonstrated solid project management in delivery. A key area of focus for the past 12 months has been on the implementation of new learning and project outputs. This critical step is by no means without its challenges, but essential if our customers are to benefit from our innovation output.

"We are committed to delivering real value to our customers through our forward-thinking innovation"

Pauline Walsh,
Director,
Gas Transmission Owner,
National Grid

Value tracking is an important part of our approach to managing the innovation portfolio. Within such a portfolio there is a balance of risk and therefore always some element of failure. Where concepts are not showing success or promise, we look to 'fail fast', testing the limits of what can be achieved but at the lowest cost. Many of our projects include stage gates and interim reports to give structure to this approach.

The capabilities of our innovation team have expanded to match the shifting requirements of the portfolio. Value tracking, for example, is now owned by a dedicated member of the team. This ensures that the requirements for capturing data, developing a library of case studies and assurance have a level of importance alongside stakeholder engagement and project management.

The combination of input from the innovation team and our project leads has been critical in transforming qualitative benefits into quantitative value statements. Our innovation project leads who successfully manage projects through to business as usual are recognised through the National Grid "appreciate" scheme.

We are looking to go further. As we move into the second half of the RIIO period, many more innovation projects will be implemented alongside major works on the National Transmission System (NTS). With future benefits from the portfolio projected in the region of £100m, we will be enhancing our value-tracking tools and focussing on solutions to enable our successful innovation work to be embedded into business as usual.

We have engaged PwC to provide independent advice on some of the data contained in the innovation value mid-term report. This has generated some extremely useful guidance which we will use as part of our broader commitment to continuous improvement on innovation portfolio management and value tracking.

Our ambition is to build on the positive outcomes captured in this report by delivering maximum value to customers. Through our innovations, we will create a safe, efficient and reliable gas transmission network into the future.

Pauline Walsh
Director, Gas Transmission Owner,
National Grid

Investment in innovation that benefits our customers

Five key areas
Our portfolio of NIA projects is split into five key themes as shown here:

Safety
Sustain world-class levels of safety and seek innovative solutions to reduce the risk on our network.

Sustainability
Embed sustainability into our network to reduce our environmental impact and make the most of the resources we use.

Strategic
Deliver value for our stakeholders and seek opportunities to deliver a safe and efficient service across our operations now and into the future.

Customer and commercial
Understand the needs and priorities of our customers to provide exceptional service.

Reliability and operability
Drive improvements in asset health across our network to ensure the network can operate reliably and flexibly to deliver the best possible services.

Innovation is a key driver of the RIIO framework and vital to bringing benefits to our customers. The Network Innovation Allowance (NIA) and Network Innovation Competition (NIC) frameworks have driven innovation throughout the industry. The challenge now is to implement the outputs across our business.

The purpose of this report is to reflect on our performance in delivering value from innovation, highlight output from key innovation projects that have been embedded into our business and identify areas where we will focus on improvements as we move into the second half of the RIIO-T1 price control.

Now in our fourth year of the price control, our innovation portfolio comprises a diverse range of projects funded through the NIA framework, alongside two funded through the NIC.

Our investment under NIA since 2013/14 has been £10.4 million across 110 projects registered on the smarter networks portal. We have secured an additional £10.5 million in funding under NIC for our Gas Robotic Agile Inspection Device (GRAID) and Customer Low Cost Connection (CLoCC) projects.

Our projects are managed by our engineers and subject matter experts from across the Gas Transmission business. Their ownership – from project initiation through to embedding new technology and learning – is supported by the core innovation team.

Working for gas network customers

Innovation in numbers

£10.4m
total NIA portfolio spend
13/14: £3m
14/15: £4m
15/16: £3.4m

£100m
forecast innovation benefits

10
value case studies completed to date

Our internal innovation structure in 2013 was a dispersed model with individual centres of innovation and governance. This model was successful in generating a strong pipeline of project ideas, with a high level of internal stakeholder engagement.

However, having recognised the importance of innovation at the core of the NGGT business and the RIIO framework, we migrated to a model centrally coordinated by our regulation function. This centralised innovation function directly reports to our Gas Transmission Investment Committee on a quarterly basis. Delegated authority for sanctioning is provided to the Gas Transmission Innovation Governance Group (GTIGG) which is responsible for ensuring innovation projects are robust, compliant with NIA governance and aligned to our strategic goals. Clarity across the innovation process has allowed for a coordinated approach to our innovation investment to date and remains a vital part of our innovation strategy moving forward.

Collaboration is key to success in innovation, and the sharing of new knowledge is vital to deliver benefits to gas network customers. We have worked with more than 60 individual small and medium-sized enterprises, engineering consultancies and academia and through the Gas Innovation Governance Group we promote knowledge transfer between network operators. The success of the portfolio has been recognised when we were shortlisted for a Utility Week Award for our work on Building Information Modelling and our Award of Merit in the National Grid Chairman's awards for Composite Transition Pieces.

This internal innovation model and focus on collaboration has supported a NIA portfolio spend of more than £10m and comprises 110 projects. The projected benefits, assuming each project is successful and implemented, is over £100m. To date we have realised £6.9m across the 10 case studies presented in this report. This success has been possible through a flexible approach and continuous learning. As part of this report at mid term, we were keen to further understand our performance and opportunities to improve, and in September 2016 we launched our first innovation stakeholder survey, targeting our project leads and external partners and suppliers.

Our team behind innovation:
L-R Peter Amos, Feona Weekes-James, Tom Neal, Tamsin Kashap, Quentin Mabbutt, Alison Dineley

Innovation stakeholder survey

Average score

3.6

out of 5 across all measures

80%

of respondents either likely or very likely to get involved in an innovation project in the future

For a broad view of our performance in cultivating and delivering innovation, we wanted to engage with our stakeholders to understand how they thought we had performed.

In September 2016, we asked more than 100 of our external innovation partners and internal project leads to complete a survey to help us understand our innovation performance and where we can improve. We had excellent uptake, with responses from 43% of our contacts, of which 29 were external and 18 internal stakeholders. The survey included questions on all aspects of the innovation project lifecycle, from idea generation through to implementation of project output. On average, across all measures, we scored 3.6 out of 5 – a good performance across our innovation activities to date.

The support provided by our centralised innovation function consisting of the RIIO and GTO teams, scored the highest with an average 4.2 out of 5, representing a strong innovation function in place. Also scoring high, at 4.0 out of 5, was the perception of our openness to new ideas.

Scoring the lowest in our survey, with a score of 2.5 out of 5, was "transitioning projects into business as usual". This reflects the challenges we have encountered in overcoming barriers to implementation of successful innovation projects. It is a key theme of this report.

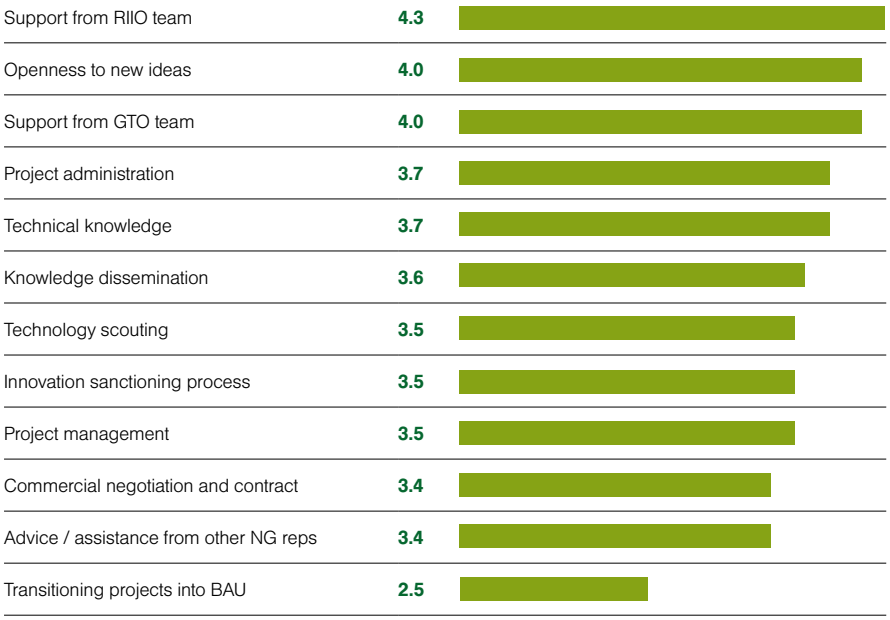
"Sign-on by everyone in National Grid so the transition from innovation to putting it into practice is easier"

Keith McGrath, Premtech

"Always there to help, removing blockers to get projects off the ground"

Neil Dawson, NGGT

The graph shows the survey results across all measures, scored out of 5:



“We are building a more open relationship with NGGT and there was a real buzz at the recent innovation drop-in session”

Scott Haslam,
NM Group

“It is imperative that the full requirements to embed innovation projects into business as usual activities are fully understood at commencement of the project”

Chris Barron,
Aqua Consultants

There were a number of words that featured strongly in the feedback we received:

Survey comments

When reflecting on working with NGGT innovation, our respondents were very positive about the experience, with more than 80% of them either likely or very likely to get involved in an innovation project in the future. More than 70% have found us easier to work with than other partners. Securing good relationships with our stakeholders is a key driver to successful innovation and these results demonstrate our commitment to facilitating collaborative innovation with our partners.

Looking to the future, the focus will be firmly on implementing successful outputs from the innovation portfolio. With just 23% of respondents scoring us good or very good at transitioning projects into business as usual, this is a priority for us. The projects from the first few years of the NIA scheme have helped us identify blockers. Particular problems include procedural changes, amendments to specifications and work procedures, and procurement and contractual challenges when suppliers or products are unusual. Often these challenges can be overcome but do introduce significant delays. It became clear early on that checks to identify implementation actions early, at the point of sanctioning, would be very beneficial. However, there are still a number of improvements to be made in this area.

With 77% of respondents scoring us good or very good on knowledge dissemination, this is something we intend to continue to prioritise. From our own innovation drop-in sessions for NGGT staff, to industry conferences and sharing learning through the Gas Innovation Governance Group, we will continue to look for new opportunities in this area.

Value in action

"Our regulatory framework has driven a strong innovation culture which has resulted in significant value for network customers to date and provides significant prospects for the future"

Chris Bennett,
Director of UK Regulation

Transitioning successful innovation projects into business as usual allows their full potential to be realised. In this section, we focus on 10 key projects whose results are now being applied for the benefit of our customers and Gas Transmission business.

This section provides a snapshot of our most mature projects in their implementation journey. These case studies set out why there was a need for innovation, what the impact without change would have been and, ultimately, the solution that was implemented. The value from these projects has either been realised or is underpinned by committed investment.

Projects such as our Building Information Modelling (BIM) tool have a Project Eligibility Assessment (PEA) benefit figure based on the number of investment schemes the tool can be used on within this price control period. Three schemes have already benefited from BIM and are therefore classed as achieved. Other projects have realised savings over a limited time period up to the point of reporting; this value will continue to grow year on year. We recognise it is a challenge to develop a replicable methodology to report on innovation value across all projects and often the benefits are realised in a different manner than initially forecast. We have engaged PwC to provide independent advice on some of the data used in each of these 10 case studies shown below:

Project title	PEA cost	PEA benefits	Benefits realised	Benefit progress
Impact protection slabs	£32k	Safety – cost avoidance	£471k	PEA: Safety; Realised: £471k
Vent stack design	£180k	£250k	£84k	PEA: £250k; Realised: 84k
Safety in pig trap seals	£42k	£90k	£30k	PEA: £90k; Realised: £30k
A greener generation of air compressors	£175k	£50k	£217k	PEA: £50k; Realised: £217k
Customer ramp rate studies	£58k	£142k	£60k	PEA: £142k; Realised: £60k
BIM at Feeder 9	£202k	£1m	£885k	PEA: £1m; Realised: £885k
BIM at Bacton BIM at Peterborough & Huntingdon	£490k	£28m	£3.7m	PEA: £28m; Realised: £3.7m
Hot tap buried sample probe	£610k	£310k	£1.3m	PEA: £310k; Realised: £1.3m
Improving CP data with MiniLog	£20k	£186k	£144k	PEA: £186k; Realised: £144k
Value case studies total	**£1.8m**	**£30m**	**£6.9m**	
NIA portfolio total (2013-16)	£10.4m	£100m	£6.9m	PEA: £100m; Realised: £6.9m

All PEA costs and PEA benefits are nominal and for NGGT only and have been taken from the Project Eligibility Assessment (PEA). The documents can be found at: www.smarternetworks.org

Impact protection slabs

Safety

Project:
NIA_NGGT0007 Risk Assessment Methodologies for Pipelines and AGI's

PEA cost: £32k

Duration: 1 year

Supplier: DNV GL

PEA benefits: Safety – cost avoidance

Benefits realised: £471k

Background

Impact protection slabs are used as additional safeguards against pipeline damage from mechanical plant and equipment. These slabs are installed above the pipeline and are typically buried more than 1m below the surface. They are designed to protect buried pipes from construction and agricultural machinery digging or dredging.

What's new?

Conventionally, reinforced concrete has been the material of choice for impact protection slabs. However, NIA funding has been used to research and develop the use of polyethylene (PE) slabs as an innovative alternative. They are especially useful in shallow ditch-crossing situations and give machine operators early visual warning of the presence of the pipeline.

PE impact protection slabs are made from Ultra High Molecular Weight Polyethylene (UHMWPE). An initial order was placed and the first installations have been taking place in East Anglia.

The benefits

- Installation is quicker
- Installation is safer
- Lower installation costs
- No risk of corrosion of the concrete reinforcement
- No risk of interference to the pipeline cathodic protection
- No risk of pipe damage if the slab sinks or is pushed onto the pipe.

Financial savings

Financial savings from using PE slabs are associated with both capital savings from the purchase of the slab and the significantly lower installation costs, compared to a concrete slab. The purchase and installation of 159 PE slabs to date has realised total savings of £471k. It is anticipated that future savings will be significant as the rollout programme continues nationally.

Carbon savings:

Concrete

1.69 tCO_2

PE slabs

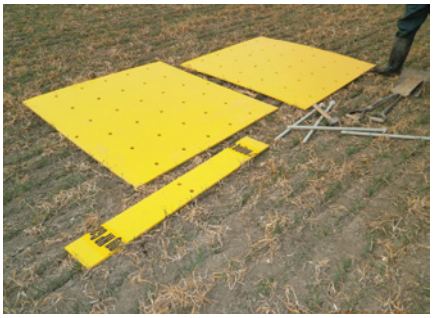
0.95 tCO_2

44% less

for 3x5m coverage

£471k

total savings for installations to date



Vent stack design

Safety

Project:
Project: NIA_NGGT0023
Development of AGI Safe

PEA cost: £180k

Duration: 2 years 6 months

Supplier: DNV GL

PEA benefits: £250k

Benefits realised: £84k

£84k
reduced land purchase cost

Background
The AGI Safe is a software package developed to perform quantitative risk assessments on a range of above-ground high-pressure gas installations, including compressor sites, pressure reduction stations and offtakes. The tool is used to assess modifications to existing installations and for new builds. The continuous management and improvement of safety risk involves the development of new tools and techniques, which in themselves impact on the risk profile of a site. The AGI Safe tool has been developed to allow the user to consider changes to site layout or additional safety features in a quick and flexible manner.

What's new?
The enhanced functionality developed by the project includes five key aspects:

- Modelling of pipework in pits
- Creation of a module to model onsite emergency shutdown procedures
- Provision for modelling 'L' shaped pipework areas and long, thin sections of pipework
- Automatic generation of escalation matrices for thermal radiation
- Provision for a user-defined assessment that can take into account local wind patterns.

The benefits
The AGI Safe tool was used to assess new vent stack designs for Peterborough compressor station. The tool was used to calculate the land required for compliance to safety zones in a number of venting scenarios. The original specification detailed that a radiation contour of 1.58kW/m^2 would apply. However, both the existing perimeter fence and boundaries of land needed by NGGT were outside this contour.

The team then assessed the required zones through the use of the AGI Safe tool, with the new enhanced capability on modelling thermal radiation distances. Based on this assessment, a deviation was agreed against the NGGT specification. This has resulted in reduced land purchase while still protecting site staff and the general public from site operations and the unlikely event of a gas release from the vent stacks of an ignition.

Financial savings
The purchase of an additional 2.37 acres which was required for compliance with the 1.58kW/m2 contour would have incurred a cost of £84k and would have been subject to landowner consent. Further assessment established that applying the original radiation contour at Huntingdon Compressor Station would also require additional land purchase, so it can be seen that without the AGI Safe tool, existing methods could give rise to numerous instances of costly land purchase for future projects.

Safety in pig trap closures

Safety

Project:
NIA_NGGT0027 Pig Trap Door Seals

PEA cost: £42k

Duration: 11 months

Supplier: Premtech

PEA benefits: £90k

Benefits realised: £30k

Background
The NTS contains 208 pig traps, all holding a volume of gas at line pressure. A failure in the pig trap door seals releases gas into the atmosphere, requiring NGGT to isolate the pig trap to stop emissions while carrying out repairs. Nine failures in the five years from 2008 to 2013 represented an upward trend in door seal failure.

The cause of this upward trend was not fully understood. A previous project looking at improving the overall integrity of pig trap enclosures set the groundwork for this investigation into whether the pig trap elastomer seals were fit for purpose.

What's new?
The project identified the cause and impact of each failure with a detailed explanation, greatly improving our understanding of how best to manage and maintain pig trap seals. The investigation also pinpointed key recommendations for avoiding future failures, including improvements to the level of training provided to operations staff and updates to maintenance procedures for pig trap door seals.

The benefits
A new pig trap maintenance training package has been developed and successfully implemented in the business.

All pipeline and compressor mechanical technicians now complete a standalone Pig Trap Door Seals training module. The module has been embedded into several existing courses including Pigging Operations and Maintenance, and National Grid's Engineer Training Programme. Additional pig traps have been installed at National Grid's Training Academy at Eakring to provide participants with a practical, hands-on experience.

These modules are available for other gas networks to use and National Grid Gas Distribution (NGGD) has also implemented it within its business, with four training sessions held to date. Feedback has also been very positive so far. For example, Glynn Barber, Technical Training Manager, NGGD, said "Providing this hands-on training better equips our employees to maintain and monitor pig trap door seals, reducing the likelihood of failures and improving safety conditions."

In addition to expanding our expertise, changes have also been made to the way we maintain and report pig trap closure conditions. Work procedures and specifications have been updated to facilitate the inspection of pig trap closures and capture detailed information about the condition of the door seal. These new methods of reporting enable defects to be identified and, where necessary, repaired at an earlier stage in the process.

Reduction in failures
No pig trap door seal failures have been reported on the NTS following the completion of the project – a reflection of the improvements in the competency, governance and reporting of pig trap closures. In financial terms, costs avoided are equivalent to £10,000 per year, assuming three incidents are avoided per year.

£10k
saved per year

0
trap door seal failures since training for pig trap seal maintenance has been rolled out

8.5
tonnes of CO_2e typically saved each time a failure is avoided

A greener generation of air compressors

Sustainability

Project:
NIA_NGGT0037 Compressor Balance of Plant Environmental Study

PEA cost: £175k

Duration: 1 year 7 months

Supplier: SKM Enviros

PEA benefits: £50k (per annum)

Benefits realised: £217k

Whole life savings*:

Reduced emissions

24,640
tonnes of CO_2

Financial savings

£2.4m

*** Assuming a 20-year asset life on four sites**

Background

NGGT operates a wide range of ancillary equipment on its gas compressor station sites in addition to the primary equipment that forms the gas compressor machinery train. This ancillary equipment is generically referred to as Balance of Plant (BoP). In the past, technology was chosen based on the equipment used before and what plant designers agreed was the best choice. This means that, across the NTS, where the age of assets varies significantly there is a considerable variety in the type of equipment installed, although different systems often fulfil the same function and are capable of meeting duty and process safety requirements.

What's new?

The project team developed a software decision support tool which allows a comparison across a range of technology options on equipment such as valve actuators and fuel gas systems. This helps in determining which offers the best environmental cost benefit balance for NGGT and its customers. The tool allows the user to perform qualitative or quantitative assessments against 21 environmental criteria such as air emissions, waste and noise, and six operational criteria such as constructability and maintainability. Alongside the tool, the team also produced a series of best practice guides which compare the environmental cost benefit range of existing technology options.

The benefits

Operations staff were monitoring air compressor energy consumption and wastage data at three gas transmission compressor stations. Instrument air compressors provide the force for the operation of control valves and other tooling on site. Data loggers confirmed the loads from the 200 kW instrument air compressors were not constant.

With unnecessary loading and unloading of the compressors occurring for up to 70% of the time, the operational expenditure of running the three units was in the region of £400k per year. The BoP decision support tool established that variable speed drive (VSD) instrument air compressors are an alternative technology defined as "best available technique". The VSD instrument air compressors deliver a precise mass of air depending on system requirements thereby optimising whole life cost and reducing emissions compared to the alternative technologies.

In addition to the initial three stations, a further air compressor at Alrewas was also identified for replacement. Investment in the VSD instrument air compressors is underway and it is expected that in total across the four sites, running costs will fall by £217k per year. CO_2 emissions will fall by 1,228 tonnes annually and there will be significant savings over the 20-year life of this instrument air system. The case study is only one example of the potential value of the compressor balance of plant tool. We expect to see significant further benefits across the other balance of plant assets as our compressor investment and asset health programmes progress.

Annual savings	Churchover	Wormington	Felindre	Alrewas	Total
Operational savings (£k)	76	48	84	9	217
Carbon savings (tonnes)	449	284	495	4	1232

Award-winning

The project was a winning entry in the first GTO Improvement Award ceremony that took place in November 2016

Customer ramp rate studies

Customer and commercial

Project:
NIA_NGGT0042 Ramp Rate Study System

PEA cost: £58k

Duration: 6 months

Supplier: Oxford Computer Consultants

PEA benefits: £142k

Benefits realised: £60k

100%
ramp rate studies completed in-house rather than outsourced

£60k
over six studies:

25%
time saved per study

Background
When an NGGT customer requests a new connection to the network, we may need a ramp rate study to determine the consequences of bringing it online. New connections to the network can ramp up or down more quickly than the system can handle, leading to abnormal operating conditions and adverse impacts on the safety and security of the NTS. With a ramp rate study, we can model the proposed situation and determine if a particular ramp rate can be safely accommodated by the system.

The initial process relied on complicated and time-consuming interaction between Simone (the network simulation software package), Microsoft Excel spreadsheet and Access tools and sometimes third-party consultants. All ramp rate studies are funded by the customer. Those carried out internally by NGGT took three months on average to complete and cost £25k to £35k. Studies outsourced to a third-party consultant due to limited internal resources typically took longer to complete and cost £30k to £40k.

What's new?
This project set out to provide a lower-cost service to the customer, improve the level of service provided and improve customer satisfaction.

The project team developed a new methodology for assessing proposed customer ramp rates, incorporating intelligent software algorithms, new methods of analysis and the development of in-house capacity and expertise.

To facilitate wider application of the tool, the developers used open source code. They developed user guides and technical documentation to increase accessibility and encourage uptake of the tool.

The benefits
Implementation of the tool has resulted in a faster turnaround of a ramp rate study for the customer, cutting the average completion time of a ramp rate study from nine weeks to just seven – 25% quicker and saving £10k per study. This has had a significant impact on the cost to customers.

Greater efficiencies have been achieved by applying the methodology to six new studies. All studies are now completed in-house, reducing reliance on third-party consultancies and avoiding the higher costs to customers associated with outsourcing.

Building Information Modelling (BIM)

To date, BIM has delivered £4.6m in cost efficiencies. Our asset health and compressor programme investment for the remainder of RIIO-T1 is circa £750m, presenting significant opportunities to deliver even greater value.

Strategic

Projects:
NIA_NGGT0024 BIM (Building Information Modelling)

PEA cost: £202k

Duration: 10 months

Supplier: Premtech

PEA benefits: £1m

Benefits realised: £885k

Strategic

Projects:
NIA_NGGT0057 Building Information Modelling (BIM) Investigation into Enhanced Techniques

PEA cost: £490k

Duration: 8 months

Supplier: Premtech

PEA benefits: £28m

Benefits realised:

Bacton	£647k
Peterborough and Huntingdon	£3.1m
Total	£3.7m

"BIM is fundamentally changing our project management and delivery practices and we are now evaluating the impact on our asset management techniques"

Paul Lee,
Investment Scheme Manager,
NGGT

Background
Building Information Modelling (BIM) is the process used for pegging cost and carbon data to 3D models throughout the design, construction and maintenance of an asset. Asset owners can store the models and data for reuse on future projects. Advanced spatial survey techniques, in particular laser scanning and photogrammetry, has enhanced the work done by NGGT under BIM.

These techniques provide an accurate "as-is" visual representation of the site. This type of representative survey is crucial in removing ambiguity between conflicting historical records.

What's new?
The objectives of the BIM demonstration were to identify efficiencies and savings in cost, carbon impact, project schedule and operational expenditure. Using BIM, clash detection for both space and time can be undertaken. This is a clear advantage over traditional methods, allowing us to test various construction methods and sequences, proving the site logistics are valid and the construction timeframe is achievable.

Laser scanning was identified as an immediate solution to improve visualisation because of the high accuracy of the returned information, and the reasonable costs and fast generation of the site models. The development of a standard for laser scanning has allowed the technique to be quickly adopted for business-as-usual asset health works such as Feeder 9, Bacton and the Emissions Reduction Programme (ERP), as well as on new innovation projects.

Key advantages in using the BIM technique come through in the early stages of generating and assessing design options, which are often very different from the conventional solutions. The BIM benefits are demonstrated in the following three case studies.

On the construction programme:

BIM at Feeder 9
£885k
saving

BIM at Peterborough & Huntingdon
£3.1m
saving

BIM at Bacton
£647k
saving

BIM at Feeder 9

The benefits
The BIM process was trialled as part of a constructability review for a new gas transmission installation at Goxhill, part of the ongoing works on Feeder 9. The conceptual design for a gas transmission project, which had previously been tendered but not completed, was used to benchmark costs and design deliverables.

A laser scan of the site along with the proposed construction activities and timeline were re-evaluated in real-time through the BIM tool, Navisworks. The process allowed the team to identify and eliminate construction hazards and embed construction process improvements at a very early stage of the works.

The BIM model highlighted problems with the location of an instrument and control building on the far side of the site. This location would require site personnel to cross the site behind a pig trap door to investigate instrumentation trips, and so the building was relocated close to the site entrance. Also, the sequence of work was amended to ensure construction considered working traffic and access. The flexible nature of the model enables clash detection between the permanent and temporary works to be undertaken. During the study, a concrete lighting base was identified as being too close to a deep excavation. This led to repositioning the installation of the concrete base to avoid any conflict with the excavation.

The learning from the Goxhill constructability review was then applied to the Paull installation on the north side of the Feeder 9 crossing.

Financial savings
The laser scan and resultant 3D model for the Paull installation, when combined with the clash detection software, highlighted a concern related to the initial pig-trap location on site. Applying the BIM technique at this early stage in design allowed us to investigate a number of alternative options, meaning the final option did not require a new pig-trap or associated pipework. The use of BIM at the Paull installation generated a cost saving of £885k including material, plant and labour.

BIM at Peterborough & Huntingdon

The benefits
Upgrade works at Peterborough and Huntingdon compressor stations are underway as part of our ERP. To complete the work safely without lengthy station outages, it is necessary to extend the boundary of both sites onto adjacent land to fit new vent stacks. This land would need to be secured, with an extension to the existing Integrated Site Security (ISS). ISS is a costly enhanced security measure that consists of electrified fencing and monitoring capabilities including high resolution cameras and lighting which feeds back to a central control system in our control room. The cost to extend the existing ISS measures on each site would have been £2.7m for Peterborough and £2.2m for Huntingdon.

To identify potential alternatives to the conventional option, we held a challenge and review session using 3D laser scans of the sites fed into the BIM tool, Navisworks. This allowed our engineers to review the site from different angles and perspectives using 3D models in real-time to identify opportunities that may not have been clear using traditional 2D alternatives. A second option was identified, which removed the need to extend the ISS measures onto the adjacent land. Instead, standard security fencing would be installed and a contingency plan put in place to ensure full operation of the vent stack within 28 days. This alternative option greatly reduced the cost for both sites with Peterborough costing £850k and Huntingdon costing £950k.

Financial savings
Following further analysis by our team of experts to evaluate this new approach, approval was granted and work is now underway to complete the detailed design at both sites. BIM unlocked the opportunity associated with alternative options and as a result avoided the need to extend existing costly ISS measures. In total this has saved £3.1m (Peterborough: £1.85m; Huntingdon: £1.25m).

"The use of 3D models on some of the more complex aspects of the design ensured we provided accurate cost estimates in the short time frame we had available"

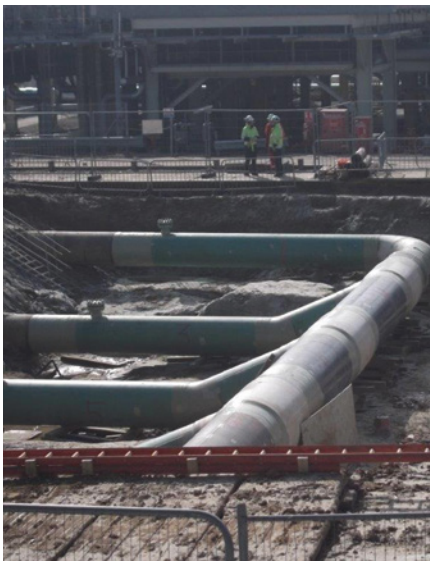
Martin Gould,
Managing Estimator,
National Grid

BIM at Bacton

The benefits
Bacton is a large gas terminal on the NTS which had been identified as one of three sites suitable for a trial run of an inline inspection robot. The robot is being developed as part of Project GRAID, and will be used to inspect buried pipework on large NTS sites. Laser scanning and 3D modelling of the Bacton site was undertaken as part of the works to ready the site for inline inspection with the GRAID robot. The extent of the benefits of having a 3D model of Bacton became clear once asset health works got under way.

These works included the isolation of two incoming pipes from the ENI sub-terminal into the Bacton site ring main and modifications to the pipe manifold. The pipes had been out of service for some time and were beyond their design life. The isolation of the ENI pipes from the other incoming sub-terminals required significant engineering works. Using the Bacton BIM model, the manifold for disconnecting the ENI terminal pipes was designed, built offsite in Leeds and then transported to site to be connected.

Financial savings
The use of the Bacton site 3D model on just this one occasion has realised savings of £647k compared to the conventional alternative. A traditional approach would have involved extensive manual work using engineering line drawings with a greater degree of uncertainty. Laser scanning and building an accurate model enabled off-site construction, which as well as saving costs, increased the safety and lowered the risk of the work, with less time spent on construction activities on a high-pressure gas site.



Hot tap buried sample probe

Reliability and operability

Project:
Project: NIA_NGGT0033 Hot Tap Buried Sample Probe

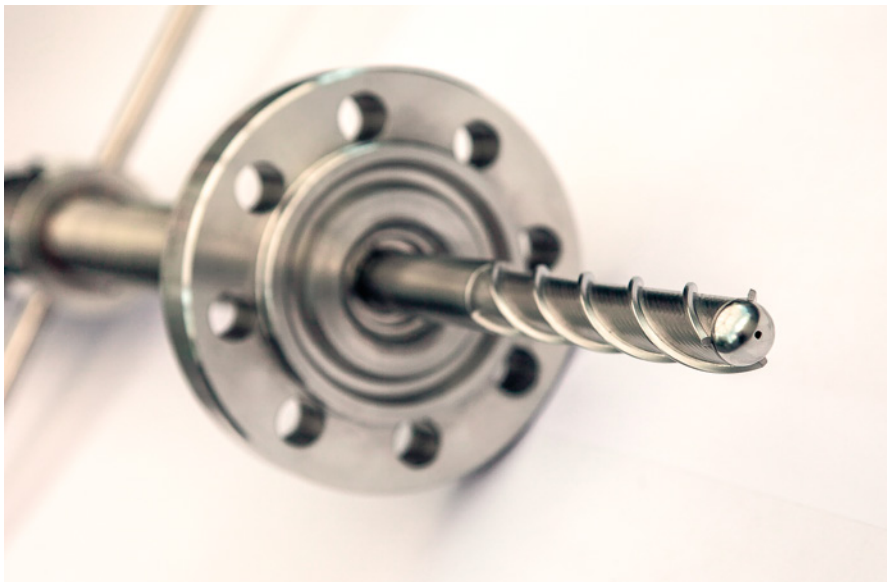
PEA cost: £610k

Duration: 2 years 6 months

Supplier: Orbital, Macaw, JAS, Mott McDonald

PEA benefits: £310k and safety

Benefits realised: £1.3m



Implemented across all

37 sites

£1.3m

cost savings

Background

New gas analysers are being installed across the NTS to replace obsolete analysers and improve the accuracy of calorific value calculations. To meet the stringent gas sampling requirements, new sampling probes are needed. Three new probe designs and construction techniques were developed and field tested in order to create a holistic solution for probe/sample installations across the NTS.

What's new?

In the construction phase, the new sample probe designs (above) reduce the amount of civil excavation work and construction materials required in comparison to conventional sample pit and platform construction methods.

Traditional sample probe solutions used at the 37 calorific value sample points across the NTS required employees to work at height and within confined spaces in sample pits. It was a two-man operation and required specific training. The new sample probe solutions ensure the maintainable plant is at ground level, providing improved access and reducing human factor risk.

The benefits

- Reduced design/appraisal costs due to standardisation of design
- Reduced project delivery time
- Quicker and easier installation
- Reduced health and safety risks
- Improved working conditions
- Lower installation costs
- Reduced operational costs
- Minimal concrete requirement
- Reduced carbon footprint
- Application for gas distribution networks.

Financial savings

The hot tap buried sample probe delivered significant savings in comparison to traditional sample pit and platform construction methods. Cost savings are achieved through reduced excavation work and sample pit/platform materials, as well as shorter project delivery time with consequently lower project service costs. The new technique delivered a total saving of £1.3m across 37 installations.

Improving CP data with MiniLog

Reliability and operability

Project:
Project: NIA_NGGT0043 MiniLog Stray Current Monitoring Devices for Cathodic Protection Re-Life

PEA cost: £20k

Duration: 2 years

Supplier: NGGT Internal

PEA benefits: £186k

Benefits realised: £144k

16
Number of back-logged defects safely closed

£144k
saved

"The MiniLog provides definitive confidence into the level of corrosion prevention operating on a pipeline, reducing the risk of error from human interpretation and allowing for more defects to be safely closed"

Michael Chenery,
Lead Project Manager – Site Campaigns, NGGT

Background
Cathodic Protection (CP) is applied to gas pipelines to prevent corrosion of the metal pipeline surface by connecting it to a more easily corroded "sacrificial metal" and supplying an electrical current from an alternate source. Using this technique, the sacrificial metal is corroded instead of the pipeline surface, helping maintain the integrity and reliability of the pipeline over time.

The effectiveness of these CP systems is assessed by periodic measurement of the pipe-to-soil potential over the entire pipeline. Accurate readings of CP effectiveness are difficult to capture as it is not uncommon for measurement errors to arise from the effects of stray currents, for example, from overhead wires.

Instances where accurate CP effectiveness cannot be determined are logged as potential 'defects'. In the past, each defect was subject to a lengthy investigative process which included multiple follow-on surveys and, in some cases, excavation and the installation of probes, in order to build up an accurate picture of the CP system. This process relied heavily on expert interpretation which opened the possibility for misinterpretation of the data and inaccurate classification of the pipeline condition.

What's new?
The MiniLog Stray Current Monitoring Device, piloted as part of this NIA project, enables readings to be automatically taken every few seconds over a 48-hour period. This produces a complete and accurate picture of the CP effectiveness on pipelines which previously would have been subjected to a time-consuming and costly investigation process.

Using the MiniLog, technicians visit each site just twice: once to fit the device into the test post, the same way as they would with their standard testing equipment, and once more to retrieve the equipment at the end of the trial. The MiniLog records true pipe-to-soil potential data, i.e. error-free data, reducing the requirement for detailed analysis and the installation of probes to ascertain whether further investigation of possible defects is required.

The benefits
NGGT has invested in eight MiniLog devices and there are now six people trained to use the device. With the MiniLog system, technicians no longer need to travel to several locations along a pipeline to take readings. The device is small enough to fit inside a standard CP test post and can be left unattended, reducing the number of visits required by a technician and allowing more definitive evidence to be collected.

Building a larger catalogue of data over a period of time with MiniLog has enabled more reliable interpretation of CP readings and has proved an effective way of assessing pipeline defects. The production of error-free readings reduces reliance on expert interpretation, eliminates the risk of human error and allows for more defects to be quickly and safely closed. It is reducing the backlog of defects that was commonplace with the traditional process and achieves a more accurate classification of defects as compliant or not. Since implementation, the use of MiniLog has directly enabled us to close 16 defects, which would otherwise have been subject to extensive and time-consuming expert assessment. This has generated a total saving of £144k to date. There are significant future benefits too, as we have identified a further 86 existing defects where MiniLog will be used.

Continuing our innovation journey

"Develop joint forums between business users and the supplier community to promote the development of new ideas"

Matthew Longman, DNV GL

"We regard NGGT innovation highly in respect to other companies in terms of their helpful and timely feedback"

Ian Chirnside, Steer Energy

Our ambition is to continue to build on the success of our innovation portfolio to date, maximising value to customers through our innovations. This will create a safe, efficient and reliable gas transmission network into the future.

Throughout the report, we have reflected on the broad reach of our innovation portfolio and where real value is achieved from implementation of successful innovations. It is clear that focus must be given to implementation if the full customer and business benefit of the innovation portfolio is to be realised.

Collaboration continues to be a key driver to successful innovation and plays a significant role in implementation. In particular, working with other gas and electricity networks to identify innovation opportunities to be implemented across networks is becoming increasingly important.

However, successful implementation can only be achieved if there is a robust business case with a clear problem to solve or business need driving the demand. Support, internally from the business and externally from key stakeholders, is also central to ensuring that the project is successful. We work closely with our existing innovation partners and reach out to potential new partners through attendance at various gas and innovation-focused events.

The challenge we face is how to become more effective at taking successful innovation projects and implementing these into the business. Furthermore, how do we effectively track the value of innovations once their implementation is complete?

In compiling the case studies within this report, we have identified a number of key action points which will be the focus of our implementation activities going forward. These will be rolled out across our entire NIA portfolio to provide a robust and consistent approach. These are summarised on the following page:

"The comments from our stakeholders make me feel very proud of the work we've done to date, and all the more determined to realise the full potential of the innovation portfolio."

Tamsin Kashap, Gas Transmission Innovation Manager, NGGT

"Our regulatory framework has driven a strong innovation culture, which has resulted in substantial value for network customers to date and provides significant prospects for the future."

Martin Watson, RIIO Strategy and Innovation, Manager

Right:
Tamsin Kashap, Gas Transmission Innovation Manager

“It would help if you could provide more clarity on the specific areas of interest to NGGT”

Tim Plowright, HSL

NGGT’s innovation activities are always very visible at conferences and on the website”

Barry Authers, DNV GL

On reflection, the ten case studies presented in this report have realised significant value and will continue to generate financial benefits for our customers in future years. The cost-benefit ratio (4:1) is extremely positive. It is important to note, in addition to the £6.9m value realised to date, that there will be significant savings in line with our compressor investment and asset health works in the second half of the price control period as these project outcomes continue to be applied to our growing investment programme.

We will also look to enhance our implementation and value-tracking activities. Improvement in this area will be essential to drive the full potential of the £100m value associated with the complete portfolio. It will be crucial to ensure implementation activities begin in a timely manner to ensure outputs feed into business as usual programmes of work. We will also work closely with other network licensees to assess whether their innovation work can be applied to NGGT customers and stakeholders.

The innovation survey we carried out provided an excellent insight into the interactions that our stakeholders have with innovation. The results were very encouraging but have also indicated the need to further engage and improve on implementation activities. As we move through the remainder of this price control and preparations begin for RIIO T2, close stakeholder engagement will inform both the short and longer-term improvements we make to our approach to managing our innovation portfolio.

This is the first published mid-term value report and we would value your feedback (you can find our contact details on the back page). We believe it is imperative that Network Operators are transparent on the innovation investment being made and the benefits they deliver, to enable our stakeholders to understand and appreciate the value that the innovation incentives are delivering.

nationalgrid

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