# Gas Network Innovation Competition 2016 Report and Recommendations

## Prepared for
## The Gas & Electricity Markets Authority

**By**

**Gas Network Innovation Competition Expert Panel**

**October 2016**

## 1 Introduction

**1.1** This report is prepared by the Gas Network Innovation Competition (NIC) Expert Panel (the Panel) and sets out the Panel's recommendations to the Gas and Electricity Markets Authority on the projects to be funded in the 2016 funding round. The members of the Panel are as follows:

- **Ron Chapman**
- **Miriam Greenwood OBE DL (Chair)**
- **Trisha McAuley**
- **Prof. David Newbery**
- **Sean Sutcliffe**

**1.2** We received two submissions. Full details of each submission will be available on the Ofgem website. The names of the companies, titles of the submissions and the amount requested from the Gas NIC are as follows (the values in brackets show the total cost of each of the projects).

- **HyDeploy - National Grid Gas Distribution - £6,777k requested (£7,635 in total)**
- **Future Billing Methodology - National Grid Gas Distribution - £4,799k requested (£5,381k in total)**

**1.3** The Panel followed the evaluation process set out in the Gas NIC Governance Document version 2.1 (28th July 2015). Initial submissions were received by Ofgem and were screened by Ofgem for compliance with the requirements set out for the Initial Screening Process. Consultants were appointed by Ofgem to review the submissions. The Panel and the Consultants met the Network Licensees (NLs) early in the evaluation process to allow the project teams to present their submissions. Prior to the second bilateral meeting the Panel sent

each of the NLs a number of questions to clarify the submissions and highlight areas of concern.

Following those meetings, the Panel met to review each of the submissions in the context of the criteria set out in the Governance Document. In evaluating the submissions, the Panel took into account all of the documents which had been provided which included: the submissions, their appendices, the Consultants' comments as well as all additional information which had been submitted to Ofgem by the NLs. They also took account of information from meetings which were held with the NLs and materials provided during those meetings. Based on this evaluation, the Panel reviewed the projects against the criteria.

**1.4** This report, which should be read together with the NLs' submissions and the other information that is published concurrently with them on the Ofgem website, sets out the results of the Panel's deliberations and its recommendations to the Authority. As such it reflects the considered views of the Panel.

## 2 Evaluation Criteria

**2.1** The Gas NIC Governance Document sets out the criteria the Panel is required to take into account in the evaluation process.

In this section, we list the evaluation criteria and briefly discuss a number of points which arose during the evaluation process and which provide context to the evaluation of the projects described in the following section. A full description of the criteria is set out in the Governance Document itself.

**2.2 (a) Accelerates the development of a low carbon energy sector and/or delivers environmental benefits whilst having the potential to deliver net financial benefits to future and /or existing customers.**

As the number of projects funded through the Gas NIC grows it will be necessary for the NLs to demonstrate that any new projects will offer additional benefits, over earlier projects, to future or existing customers. We look to see continued investment in innovation and development work building on, inter alia, previous projects.

It is helpful if the bids explore the sensitivity of the anticipated benefits to changes in the underlying assumptions. The future role of the gas network is uncertain with alternative gas sources creating opportunities for innovation. Understanding the likelihood that the anticipated customer benefits will be delivered, across a wide range of potential scenarios, is a key consideration for the Panel.

In calculating the expected financial and/or environmental benefits it is important to demonstrate that they can be easily explained to gas customers who are being asked to fund the project.

**2.3 (b) Provides value for money to gas customers.**

The Panel would like to see more evidence that the costs of partners have been market tested and that they reflect any reputational value that will accrue. In particular these projects represent long term, relatively large, contracts for consultants (and other partners) and the level of discounting from 'headline' rates is somewhat lower than could be expected in a competitive market. The NLs which do not produce clear evidence that the costs of all the work packages have been minimised risk damaging the overall credibility of the bid. The Panel has a clear duty to ensure value for money for gas customers and will not fund projects with excessive budgets even where these promise a large positive net present value (NPV).

The Panel was pleased to note that the NLs are contacting a wider range of stakeholders during the bid submissions. In addition, the NLs need to consider how to engage with consumer groups beyond those local to the project. This would generate more enthusiasm for the project and ensure that it was widely implemented and hence can deliver more of the potential benefits.

The approaches to consumer engagement in the bids were generally at too high a level. The Panel would like to see more detailed plans such as were produced in response to our questions. This is important given the increasing focus on demand management, safety implications of injecting new substances into the network and changes in billing. These projects are setting trends for the future and it is important that consumer buy-in is an objective.

**2.4 (c) Generates knowledge that can be shared amongst all relevant NLs.**

The Panel was encouraged to see that the projects were building on previous NIA and Gas NIC work. There still seems to be more scope for closer

collaboration between the NLs but there has been an improvement since the start of the Gas NIC.

The Panel was also pleased to note that there is clear evidence that the NLs are developing a vision of how their networks could assist in delivering a low carbon future and are using the NIA and Gas NIC to take coordinated and incremental steps towards that.

The Panel once again saw more evidence that the NLs are inviting ideas and participation from a wider range of partners. In particular the NLs showed a much better grasp of developments in other countries and the Panel would like to see this continue.

**2.5 (d) Is innovative (i.e. not business as usual) and has an unproven business case where the innovation risk warrants a limited development or demonstration project to demonstrate its effectiveness.**

The Panel was pleased to see that the NLs were engaging at an earlier stage with regulatory bodies that are key to the implementation of their innovations. It is important that the route to implementation is thought through at an early stage. A clear implementation plan which leads to rapid adoption of new ideas can generate significant additional benefits for customers.

In the bilateral meetings the Panel was pleased to note that the NLs continued to demonstrate a greater diversity in their project teams. The wider visibility of the project management team helps to build confidence that the project can be successfully delivered. The Panel was again pleased to see a mix of familiar and new faces in the presentation teams which gave confidence that experience in participation in the broader Gas NIC process is being built up and shared.

**2.6 (e) Involvement of other project partners and external funding.**

Collaboration between NLs and other parties in the energy supply chain is a central objective of the Gas NIC. The Panel expects the NLs both to explore and raise additional funding where this is available. Project partners should be expected to make a financial contribution if they stand to gain commercially, and we saw this from one of the bids, albeit after some prompting from the Panel.

None of this year's bids included any significant external funding, which is disappointing.

The Panel was pleased to see real evidence of partnerships developing to deliver innovation but would caution against exclusive relationships to the detriment of wider third party participation. They welcomed the active involvement of a University in one of the projects.

The Panel was also pleased to note a growing awareness of new thinking in other industries and geographies and a willingness by the NLs to explore this. Whilst the UK gas network is unique in many respects there will be value to be found in looking at innovative ideas from around the world and considering how they could be usefully applied here.

**2.7 (f) Relevance and timing.**

The involvement of operational staff in both designing and delivering the projects generates confidence that there is a real business need for the innovation and that the implementation will be timely.

The Panel has been pleased to see that the NLs are willing to challenge the current regulatory framework where this is a barrier to innovation. However,

where appropriate they need to engage more closely with the appropriate Regulator at an early stage in the project formulation. Ofgem has shown a commendable commitment to fostering innovation through the funding programmes and needs to reinforce this by being open to changing regulations as necessary to reflect changing circumstances and by engaging early in the process if required.

The next RIIO price control process will begin in 2019 so it is timely for the NLs to be proposing demonstration projects that could help inform that process.

**2.8 (g) Demonstration of a robust methodology and that the project is ready to implement.**

Although small in number, the Panel was impressed by the overall quality of the bids submitted. On the whole the project plans were well thought through and clearly explained. There has been a step change in the quality of bid presentations since the first year of the Gas NIC process.

The Panel felt that the improving quality of the bids being presented is evidence that the Gas NIC funding is succeeding in fostering a more innovative culture in the NLs. The emergence of processes within the NLs to identify major business challenges and to develop programmes of innovation to explore responses to these is welcome, as is the building on previous NIA and Gas NIC projects.

**2.9 Comments on process**

The most disappointing aspect of the 2016 round was the small number of bids submitted. It is clear to the Panel that the NIA and the Gas NIC is beginning to foster a more innovative culture in the NLs. The failure to try and utilise all of the available funding is puzzling and does not seem to reflect a lack of

innovation opportunities in the industry but other factors. The Panel would be keen to understand the reasons for this and, in particular, whether opening up the competition more broadly may be one way of alleviating the low take–up. The NLs should feel encouraged to suggest any ways in which the Gas NIC process could be improved to lead to the submission of more bids.

The Panel met the NLs twice during the evaluation process. Prior to the second meeting the Panel provided the bidders with a list of questions they wished to see answered at the second bilateral. The Panel felt that the quality of the presentations was high and was pleased that the focus of the second bilaterals was in answering the Panel's questions. The NLs responded to the questions in a very constructive manner.

## 3 Evaluation of submissions

### 3.1 HyDeploy - National Grid Gas Distribution - £6,777k requested (£7,635 in total)

The UK has recently signed up to its fifth Carbon Budget as part of its ambitious carbon reduction plan. Heat contributes a third of the UK's carbon emissions. The Carbon Plan specifically identifies the need for low carbon heat in order to meet these targets. Whilst progress is being made to decarbonise electricity, decarbonising heat has proved challenging.

Great Britain has a world class gas grid and gas dominates the heat supply market, heating 83% of buildings and providing most of its industrial heat. Carbon emissions can be reduced by lowering the carbon content of gas through blending with hydrogen. Compared with solutions such as heat pumps, this capitalises cost-effectively on existing gas distribution assets which are designed to deliver peak heat, and importantly means that customers do

not require disruptive and expensive changes in their homes. This route has the potential to deliver 29TWh per annum of decarbonised heat in the UK.

The Gas Safety (Management) Regulations 1996 (GS(M)R) currently only permit 0.1% hydrogen in the network, despite Great Britain's networks formerly distributing town gas containing 40-60% hydrogen. There has been substantial study work into hydrogen injection, but limited practical experience. To pursue this decarbonisation route, GB needs to undertake practical hydrogen injection to establish feasibility and determine the appropriate level of blending on current networks and in appliances. This requires carefully executed, safely managed, real deployment, to demonstrate that the practical, regulatory and operational barriers can be successfully addressed. Specifically this project sets out to demonstrate hydrogen injection into a network under safe and controlled conditions, at the highest concentration that safe operation allows, whilst maintaining appliance performance. It will grow practical experience in hydrogen mixing and injection and an understanding of the impact on network behaviour and end users' appliances, as well as metering, monitoring, and operations. It will build on international hydrogen injection knowledge and best practice, as well as GB best practice in terms of unconventional gas injection, particularly that undertaken at Oban. Finally it will develop best practice in a controlled environment for subsequent testing and roll out of hydrogen injection onto the wider network including engagement with customers. HyDeploy will provide a foundational reference work for the industry, address regulatory barriers through seeking a GS(M)R Exemption from HSE, providing a pathway to wider deployment.

**Low carbon and /or environmental and financial benefits**.

The project seeks to take a significant step towards allowing significant volumes of hydrogen to be used in the gas network. At present, it would

appear an alternative approach to decarbonising the UK heat load would require heat pumps and both approaches are estimated to save approximately 120m tonnes of carbon by 2050. However, the use of hydrogen could save consumers up to £8bn compared with the current estimates of the costs of installing heat pumps. The savings arise from the anticipated ability of hydrogen to be delivered using the existing gas network and household appliances.

**Value for Money.**

There is a reasonable case for assuming low carbon hydrogen can help de-carbonise heating and projects that take this forward are to be welcomed. The project partners recognise that a further demonstration project on a fully connected part of the GB gas network is likely to be needed before a full rollout, but this project should still demonstrate good value for money for customers.

The project could also bring added value by increasing the financial viability of the BioSNG projects previously funded under the NIC, as it would remove the need for the final and complex methanation stage.

**Generates knowledge for the NLs.**

The use of a closed private network, such as Keele University, as the first demonstration of hydrogen injection in GB has been endorsed by the HSE. This trial will develop a sufficient body of evidence to support the planned wider trial on the public network ahead of a roll out across GB.

**Innovation.**

Whilst hydrogen injection is already practiced in some European countries it has not been attempted in GB since the switch from town gas to natural gas, with the range of appliances now installed here. The work builds on the HyStart NIA project and the Oban NIC project.

This is clearly not business as usual as significant hydrogen injection into the network is not currently permitted and would represent a major change in the operating regime.

**Partners and funding.**

Each of the project partners brings specific skills and knowledge to the project. NGGD will lead the project with the support of NGN who have a substantial interest having recently completed the Leeds H21 project. Keele University provide the private network but are actively using it as a living laboratory and will provide close support with customer communications. The Health and Safety Laboratory brings a wealth of experience and a close collaboration with the HSE as the regulator. ITM bring specialist experience in the production of hydrogen using an electrolyser. Finally, Progressive Energy will provide the Project Management and programme co-ordination. The team will call upon industry experts in Kiwa Gastec for survey work, Dave Lander to develop the safety case and Otto Simon to provide construction management. The team came across as well integrated during the bilaterals and all of the team assisted in answering the Panel's questions.

There is no direct funding from any of the partners which is somewhat disappointing but the Panel recognizes the contributions in kind.

**Relevance and timing.**

The UK is committed through international agreements to reducing carbon by 2050 and so far little progress has been made in relation to the heat load. This project could make a timely contribution to addressing this issue.

**Methodology.**

The project plan is well thought out and was clearly explained to the Panel.
The team has recent experience of working together and came across as ready and enthusiastic.

**Panel Conclusions.**

The Panel were impressed by the team's presentations and by the constructive way they responded to the questions in the bilaterals. The project is timely, well thought through, draws on all the previous knowledge and offers a significant step towards decarbonising the UK heat load at lower cost to the customer.

### 3.2 Future Billing Methodology - National Grid Gas Distribution - £4,799k requested (£5,381k in total)

Great Britain has relied on North Sea Gas since the 1970s with regulations and billing regimes designed for this stable and reliable source of gas. The supply market is changing rapidly with liquefied natural gas (LNG) imports making up 18% of supply in 2015. By 2030 biomethane and bio-substitute natural gas from a large number of sources could account for up to 10% of domestic gas usage.

However, the requirements of the Gas (Calculation of Thermal Energy) Regulations (G(COTE)R) may restrict entry of unconventional gases that otherwise comply with the GS(M)R. Currently additional expensive processing is therefore undertaken to broadly match the anticipated G(COTE)R Flow Weighted Average Calorific Value (FWACV) of the primary inputs solely in order to minimise further cross-subsidy to customers. The Project explores options for assigning calorific values (CV) at a more local level to reduce this processing and could provide a more robust attribution of gas energy to customers generally for the future.

Three scenarios will be explored using measurement, network modelling (using existing network models) and smart meter data transfer following industry engagement. The first scenario will look to retain the existing FWACV methodology with small embedded charging areas around particular gas inputs. The second will look at using additional measuring sensors in the network alongside existing CV measuring points to provide more, smaller charging areas. Finally the third scenario will examine how billing could be based on attribution of actual individual CV to end users, possibly via smart meter functionality. The project will recommend a revised energy assignment methodology that is robust and equitable to consumers and industry stakeholders to meet future needs.

The project aims to recommend a revised billing methodology to deliver the following benefits:

- Minimise cross-subsidy between consumers where different CV gases are injected into the network.
- Increase fairness of consumer billing by more accurately attributing the CV.
- Promote entry of all GS(M)R compliant low carbon and unconventional gas supplies anywhere in the network.
- Enable gas transporters to accept GS(M)R compliant gases reducing the need for additional processing such as the addition propane which reverses some of the carbon benefits.
- Reduce NTS CV shrinkage caused by the impact of lower CV of the various gases injected into the network.
- Ensure the longevity of the gas network for delivering energy for space and water heating.
- Support the GB rollout of other low CV carbon gas innovation projects.
- Reduce/eliminate the requirement to manage CV shrinkage in the NTS and gas distribution networks.

**Low carbon and /or environmental and financial benefits**.

The project would open the gas network to greater access by low carbon gas sources and avoid the requirement for expensive and carbon intensive processing. Under the Slow Progression scenario, avoiding the need for propanation saves a NPV of £173m by 2050. It would also reduce the release of carbon as methane has a smaller impact than propane.

**Value for Money.**

The bulk of the costs of this project come from Work Pack (WP) 2 where field work using oxygen sensors will be used to show how accurately the existing flow and pressure models of the networks can be used to predict the mixing of gas sources of differing CVs.

However, until WP 1 is complete it is unclear what, if any, evidence will be required to justify changes in the billing methodology. A wide range of possible conclusions could be reached from WP 1.

- The evidence that the project will collect may not be adequate to support a change to the billing methodology with, or without, a change in regulations.
- There may be no need for the fieldwork at all.
- The fieldwork that has been costed may be exactly what is needed.
- The cost of the changes may outweigh the benefits.

So until WP 1 is complete it is not possible to know what may be required. In the first case the project would not seem to provide value for money without an explanation on how it would form a necessary step towards future implementation of a new billing methodology, while in the second case there is clearly no need to proceed further. The Panel therefore recommend that a stage gate is placed at the end of WP 1 when the need or otherwise to commit to the £4.1m of work proposed in WP 2 is clearer.

The Panel recognises that this may extend the timescales for completion of the project.

**Generates knowledge for the NLs.**

The project would generate knowledge on how well the existing network models forecast the mixing of gases of different CVs. However, the extent of

any additional evidence needed to support changes and future implementation is unclear ahead of further engagement with all the stakeholders.

**Innovation.**

There is a clear need for innovation in the regulations around the gas networks as their role in enabling a low carbon future evolves. The use of oxygen sensors to determine the spread of biomethane through the gas networks also represents an innovation. The Panel is very supportive of the aims of this project and wish to see it succeed.

This is clearly not business as usual as this would be a significant change to the long–standing existing CV attribution methodology.

**Partners and funding.**

DNV GL are not making any financial contribution to this project and it is not clear how much commercial pressure was put on their rates.

**Relevance and timing.**

An update of the CV billing methodology seems very timely given the growing variety of gas sources, both low and high CV, looking to use the network. This is an enabling project building on previously funded NIC projects.

**Methodology.**

The Panel would have liked to have seen more involvement with Xoserve, shippers, suppliers, biomethane producers and end consumers in the formulation and in the first part of this project. We would suggest that future bids look to carry out more of the stakeholder engagement which has been

included in WP 1 whilst formulating the project. Completing some of the stakeholder engagement before bringing the project to the NIC could help to justify the project through industry support.

**Panel Conclusions.**

The Panel welcomed the bid which was timely, well presented and which addresses commercial rather than technical challenges. As the role of the gas network in enabling a low carbon future changes so must the policies and regulations governing its operation. Ideally policy and regulation should lead, not lag, changes. The Panel support the aim of the project and wish to see it proceed. However, the extent of field work required to produce the evidence to enable regulatory change will only become clear after the completion of the industry engagement in WP 1. Therefore the Panel recommends that Ofgem place a stage gate after WP 1 so that it can ensure that the evidence gathering envisaged under WP 2 and WP 3 is needed and/or sufficient before committing customer's money to complete the project. The Panel recognises that this could delay the overall timetable for the project.

## 4 Recommendations to the Authority

**4.1** We set out below our recommendations to the Authority on the funding of the 2016 projects.

**4.2** The Panel recommends that the Authority funds the following project.

- **HyDeploy - National Grid Gas Distribution - £6,777k requested (£7,635 in total)**

**4.3** The Panel recommends that the Authority funds the following project but creates a stage gate, after the first Work Pack, to ensure that any subsequent field work is justified as necessary for any change in billing methodology.

- **Future Billing Methodology - National Grid Gas Distribution - £4,799k requested (£5,381k in total)**

**4.4** In Section 2, we have set out a number of observations on the evaluation process. Overall, the Panel was pleased with the quality of the bids submitted compared to the early years. The expected consumer benefits were more clearly articulated and embedded as the key drivers throughout the bids. This is clear evidence that the NLs are learning from feedback on previous bids and that they are developing innovation processes based on customer need. Future bids would be strengthened by greater engagement with consumer organisations.

The main disappointment for the Panel was the small number of bids submitted. The NLs should discuss why this has happened and the Panel would encourage them to make any suggestions which could address this in future.

Both bids were comprehensive, detailed and readable and were clearly cross referenced to the Gas NIC criteria. The bids also demonstrated linkages with the Carbon Plan and the work of the Committee for Climate Change.

The bids teams were diverse and presented their projects in a dynamic and enthusiastic manner. The fact that both bids were led by partners of the NLs was encouraging and showed that the process of encouraging a more innovative culture is working.

The bids increasingly refer to evidence from previous NIA and Gas NIC projects. There is also an increasing willingness to look in more detail at international experience and to look to look to extract learning from this. The NLs are increasingly drawing on third parties, including both suppliers and academics for fresh ideas. It has been encouraging to see how the vision of the potential role of the gas network in supporting a low carbon economy at least cost to consumers has developed since the Gas NIC began in 2013.

Increasingly we are seeing bids that are designed to provide evidence for changing regulations or industry codes that impede de-carbonisation. The industry and the Regulator should, in the light of the changing use of the gas network, consider a more pro–active approach to reviewing these issues.

**4.5** The Panel would like to thank the project teams for their work and for their engagement during the evaluation process; we would also like to thank the external Consultant and the Ofgem team for all of the support and assistance that was provided.