Gas Network Innovation Competition 2018 Report and Recommendations

Prepared for
The Gas & Electricity Markets Authority

By

Gas Network Innovation Competition Expert Panel

October 2018

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 single project applying to be funded in the 2018 funding round. The members of the Panel are as follows:

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

1.2 We received only one submission, full details of which will be available on the Ofgem website. The amount requested from the Gas NIC is as follows (the value in brackets shows the total cost of the project).

HyDeploy2 - Cadent Gas Limited - £13,282k requested (£14,969k in total)

1.3 The Panel followed the evaluation process set out in the Gas NIC Governance Document version 3.0 (30th June 2017). The initial submission was received by Ofgem and was screened for compliance with the requirements set out for the Initial Screening Process. Consultants were not appointed by Ofgem to review the submission given both the benefit of Ofgem's technical expertise and as the detailed technical issues had already been examined when HyDeploy was approved in 2016. The Panel met the Network Licensee (NL) early in the evaluation process to allow the project team to present their submission. Prior to the second bilateral meeting, the Panel sent the NL a number of questions

designed to clarify the submission and highlight areas for further explanation and/or concern.

Following those meetings, the Panel met to review the submission in the context of the criteria set out in the Governance Document. In evaluating the submission, the Panel carefully considered all the documents which had been provided and which included: the submission, its appendices and all the additional information (including the answers to further questions) submitted to Ofgem by the NL. The Panel also took account of information from meetings which were held with the NL and materials provided during those meetings. The Panel, as it is obliged to do, reviewed the project against the NIC Governance criteria.

1.4 This Report, which should be read together with the NL's submission and the other information published concurrently on the Ofgem website, sets out the results of the Panel's deliberations and its recommendation 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 which the Panel is required to take into account in the evaluation process. As we reviewed stage 1 of this project we do not have anything to add on this particular project.

We shall be submitting our comments on our experience of the process at the time of the RIIO consultation later this year. In the interim, we have included our reflections on the last six years as an annex to this Recommendation Report.

3 Evaluation of the submission

3.1 HyDeploy2 - Cadent Gas Limited - £13,282k requested (£14,969k in total)

The UK has committed to substantial carbon savings and heat contributes to a third of its current emissions. Reducing heating carbon intensity by mixing hydrogen with methane and delivering it using the existing gas grid provides a solution with minimal disruption to customers. However, this is prevented by the current tight GS(M)R UK limits.

Building on the foundational work undertaken at Keele, this will be the first GB deployment of hydrogen into the public gas network. It will move from the requirement to survey, test and trial all parts of a network prior to injection, to the ability to inject into an untested network, as necessary for roll out. This will be achieved through development of a representative and resilient evidence base though further trials and a roadmap for hydrogen deployment through blending in a 44 month project, running from April 2019 to November 2022.

The project objective is to allow a supplier of hydrogen to apply to inject hydrogen into a GDNs network, just as biomethane producers can today. This would enable hydrogen to deliver cost-effective and non-disruptive carbon savings to the customer.

Successful demonstration has the potential to facilitate 29TWh p.a. of decarbonised heat in the GB, substantially more than the existing RHI scheme is projected to deliver, with the potential to unlock wider savings through more extensive use of hydrogen.

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. The alternative approach to de-

carbonising the UK heat load would appear to be to use heat pumps and both approaches could save an estimated 120m tonnes of carbon dioxide by 2050. However, the use of 20% hydrogen for all consumers could save up to £8 billion cumulatively to 2050 compared with the costs of installing and using heat pumps.

At an intuitive level, one of the strong points in favour of a hydrogen heat de-carbonisation route versus heat pumps is that H_2 can make use of an existing network with very low opportunity cost (the alternative is leaving it as a largely stranded asset) compared with the need to build more generation for the winter and daytime peaks (unlikely to be securely sourced from renewables) and possibly more distribution to cope with the large increase in peak demand, with a comparable fall in the average capacity utilisation of these assets. The delivered cost of the hybrid gas (or H_2) will be largely the production cost of the gas, while the delivered cost of electricity will be the production cost, plus a large share of the fixed capacity and network costs, which will be attributable to peak demand.

Unless CCS with CCGTs is cheaper than CCS with coal future gas demand will likely fall alongside gas demand for electricity generation. Clearly turning gas into H_2 with CCS and then burning that in a CCGT makes no sense. Even if gas with CCS is the least cost reliable power generation, the growth in renewables is likely to reduce total generation gas demand, even after allowing for the drop in efficiency caused by the CCS. The network will, therefore, be oversized and the opportunity cost of using it is just the maintenance, not the return on its otherwise low value.

While it is outside the scope of the project submitted, key enablers for any hydrogen roll out would be the technologies for hydrogen production. Within that, the lowest cost, high volume route would appear to be natural gas reformation and CCS. While the steam reformation technology is well known,

CCS technologies still have a long road to commercial scale roll-out within the UK with support for its development having suffered from some setbacks.

Value for Money.

De-carbonising the heat load is a large and difficult problem that needs to be tackled. The early stage provision of Gas NIC funding of £13.3 million over above the £6.8 million for HyDeploy is proportionate in this context.

The project could also enable further carbon savings by enabling more extensive use of hydrogen beyond a 20% mix.

Future submissions on hydrogen should set out clearly why gas consumers should pay to deliver what is Government policy. The Government is funding £25m for the development of 100% hydrogen appliances as part of its investigation into whether complete de-carbonisation of the gas network is a viable future option. In the case of HyDeploy2, after careful consideration, the Panel accepted that a change is being made to the use of the gas network to reduce carbon intensity without any changes being required of the consumer and, therefore, it is appropriate for consumers to pay.

Generates knowledge for the NLs.

The Exemption case for the use of the closed network at Keele University as first demonstration of hydrogen injection in the UK has been submitted to the HSE. These two trials on the public network are necessary to provide the evidence to support a roll out across whole of the UK.

Innovation.

The project will provide the key evidence needed to move from a tightly controlled trial on a closed network at Keele to the ability to inject hydrogen into an untested public network.

This is clearly not business as usual.

Partners and funding.

The project will keep together the team that has been successfully delivering the Keele trial and thus capture all of the learning from that earlier demonstration. Each of the project partners brings specific skills and knowledge to the project. Cadent will lead the project with the support of NGN who are undertaking the Leeds H21 project. 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. Keele University will have a reduced role to support additional technical testing and to host site visits as part of the customer engagement programme. 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 and addressing the Panel's questions.

There is no funding from any of the partners.

Relevance and timing.

The UK is committed through international agreements to reducing carbon by 80% by 2050 and to date little progress has been made in relation to the heat load. HyDeploy2 creates knowledge that is essential for making a less expensive

future heat de-carbonisation choice, which will benefit future households currently using gas, since it lowers their expected future cost of de-carbonisation. If it turns out that low-carbon gas is not the better solution, learning that sooner should still lower the cost of the transition to the alternative.

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. During the bilaterals, the team produced a single page graphic to explain the project, which was extremely helpful.

The Panel had to probe quite hard to be satisfied around the dependencies on HyDeploy and it would have been helpful if these had been set out more clearly.

The Gas NIC rules no longer include the requirement for change control and for successful delivery rewards. These changes require the NLs to be much more explicit on the project deliverables in their submission. Given that disbursements are made against project deliverables those set out in the original submission by HyDeploy2 were somewhat loosely defined but were improved in a supplementary answer.

The agreement of the HSE to the first and then the second public trials within HyDeploy2 will depend on the outcome of the work at Keele and any subsequent learning from the earlier trials or from elsewhere. It would therefore be appropriate to have a stage gate around the granting of each of the two exemptions for the public trials from the HSE. Whilst, the submission did not make clear how the project team were planning to engage with HSE to secure these exemptions and ultimately changes to the regulations, the Panel was able to clarify this during the bilaterals.

- Gaining consumer understanding, buy-in and behavioural change is an essential and integral part of any project, like HyDeploy2, which explores routes to de-carbonisation and energy market transition. This should be given more considered thought in future bids. The requirement to have customer engagement plans was removed from the Gas NIC by Ofgem, as part of the Innovation Review, as they felt they lacked the expertise to approve these. However, the Panel does have the ability to review the customer engagement plans and these remain a key element of any submission.

The wider demographic base in HyDeploy2 will address important questions around different housing stocks and less well-maintained appliances. However, the Panel was clear that more thought needed to be given to this consumer base in terms of acceptability, risk appetite and behavioural change in relation to novel gas sources. The submission made passing references to "early engagement" with the School of Geography, Sociology and Politics at Newcastle University. But it was clear from the first bi-lateral that this engagement was indeed at a very early stage.

The Panel was encouraged by the response made by the project team to its concerns on consumer engagement and understanding of the demographics. It was clear at the second bilateral that the team had acted on our feedback and would utilise lessons learnt from Oban and Keele. The Panel were given an update on the involvement of Newcastle University and confirmation that they will take a structured approach to characterising in detail the demographics in both trial areas, undertaking a detailed perceptions survey and commencing specific local engagement via focus groups. This would include perceptions on the appliance performance and roll out experience across the range of devices

and industry sectors and should prove valuable in planning any future large-scale scheme.

The Newcastle University work will enhance the project outputs by complementing the safety, scientific and engineering evidence bases with a clear base of knowledge on consumer behaviours and acceptability. The Panel expects the Project Deliverables now to include the outputs from the Newcastle University work.

The Panel expects that the membership of the project advisory board should now be extended to include the academic advisers from Newcastle University, a consumer body and possibly a local housing association. The project needs to contribute to the dissemination of a wider knowledge base for the future and for its own roadmap.

Panel Conclusions.

The Panel was impressed by the project and with the team's presentations and the constructive and engaged manner in 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 de-carbonising the UK heat load at lower cost to the customer.

4 Recommendations to the Authority

4.1 We set out below our recommendations to the Authority on the funding of the 2018 project.

4.2 The Panel recommends that the Authority funds the project but creates stage gates at each grant of exemption from the HSE for the two public network trials.

HyDeploy2 - Cadent Gas Limited - £13,282k requested (£14,969k in total)

4.3 In Section 2, we have set out a number of observations on the progress that has been achieved over the six years of the Gas NIC. Overall, the Panel sees clear evidence that the NLs are learning from feedback on previous bids and that they are developing a more innovative culture. The Panel is concerned that this progress will not be continued without specific funding for innovation and with competition for these funds. It was disappointing to see only one submission this year and the reasons for this need to be fully understood and addressed.

The bid that was received was comprehensive, detailed and readable and was clearly cross-referenced to the Gas NIC criteria. The bid team was diverse and presented their project in a dynamic and enthusiastic manner.

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 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.

The Panel is pleased to see a significant body knowledge being developed with Gas NIC funding that will support a cost-effective adaptation of the GDNs to a low carbon agenda.

4.5 The Panel would like to thank the project teams for their hard work and for their engagement during the evaluation process; we would also like to thank the Ofgem team for all their support and assistance.

Annex 1

In this section, we set out the NIC evaluation criteria and make observations on the progress that has been achieved during the six years that the Gas NIC has been running. The evaluation of this year's submission is described within the main document. A full description of the criteria is set out in the Governance Document itself.

(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.

Looking back over the six years of the Gas NIC a number of incremental improvements can be observed.

- There has been a convergence of views amongst the NLs that introducing renewable gases to the network will be key to continuing the useful life of the network and to de-carbonising heat. In particular, the use of hydrogen offers a significant opportunity to reduce the carbon footprint of the heat load.
- The submissions being made to the Gas NIC have become more complementary and built on previous successful projects, so we see a continuum developing.
- The evaluation of environmental benefits has become more consistent.
- Planning customer communications has become more sophisticated but convincing customers of the benefits of change is still not always seen as a key objective.

(b) Provides value for money to gas customers.

Over the course of the Gas NIC progress can be seen but opportunities remain for further improvements.

- The NLs are involving a wider range of stakeholders including some international collaborations but early involvement of consumer groups is limited.
- The NLs have developed some strong relationships with third parties but there is scope to engage more widely with the international supply chain to see more competitive pricing.
- With newer technologies it is important to make the case that current and/ or future gas customers should pay rather than Government. This is particularly important where projects are clearly linked to, or take place within the context of, Government policies on future national network infrastructure and on de-carbonisation.

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

The Panel was encouraged to see a marked improvement since the start of the Gas NIC competition.

- The projects are building on previous NIA and Gas NIC work.
- There has been closer collaboration between the NLs and a shared vision of how their networks could assist in delivering a low carbon future has emerged.
- The NLs are using the NIA and Gas NIC to take coordinated and incremental steps towards delivering the shared vision.
- NLs are inviting ideas and participation from a wider range of partners/ third parties. In particular, the NLs showed a much better grasp of developments elsewhere in the world.

(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.

One of the key outcomes of the Gas NIC has been to fund large scale demonstration projects that would never have been achievable under NIA funding which is used to fund numerous, early stage explorations of new concepts.

- The demonstration projects provide the evidence that is required to convince regulatory bodies to endorse the changes being trialed.
- The trials also provide important evidence to win public support for the changes although this is a benefit that is not yet fully exploited.
- The trials also help speed up implementation of successful developments by reassuring operational staff about the safety case. This is a key element of the wider culture shift that is required if the NLs are to become more innovative.

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

Over the course of the Gas NIC, we have seen some progress in this area but there remains scope to do more.

- 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. The Panel welcomed the active involvement of Universities in projects.
- In some projects external product development partners have been involved. Whilst there may be some reluctance to fund these projects which are providing services to the NLs from commercial entities, it is to a large extent from such innovations that the industry will be able to make significant improvements. It would appear likely that there is below optimal investment versus the potential for savings, given the slow speed of innovation take-up from purely market forces and the relatively limited market.
- Only a few bids over the period have included significant external funding but there has been parallel funding from several Government sources to sit alongside e.g. the hydrogen projects.

- It is important to recognise the value of shared learning both of successful and unsuccessful outcome. The dissemination of learning is one of the key outputs of the funded NIC projects.

(f) Relevance and timing.

The Panel has seen the following changes over the six years of the Gas NIC.

- The NLs now routinely seek an operational involvement in both the project definition and delivery.
- The NLs now acknowledge the time and effort required to change the regulatory framework and engage closely with the appropriate regulator at an early stage in the project formulation.
- The NIA is intended to test early stage technologies before they are ready for demonstration through a Gas NIC project but this initial funding route is not always utilized.

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

The Panel has seen steady progress over the course of the Gas NIC.

- The requirement to have customer engagement plans was removed from the Gas NIC by Ofgem, as part of the Innovation Review, as they felt they lacked the particular expertise to approve these. The Panel itself, however, does have the ability to review the customer engagement plans and these remain a key element of any submission.
- The overall quality of the bids submitted has improved markedly from the first year of the Gas NIC. By and large, the project plans are now well thought through and clearly explained. There has been a step change in the quality of bid presentations over the period.

- The NLs have an improving record on the implementation of the projects.

Comments on process

One of the main objectives of the NIA/NIC programme is to support the NLs to develop a more innovative culture.

- The NLs have shown that they have developed innovation teams that drive projects from a vision of business needs but this is not a culture that always pervades whole organisations. The implementation of successful trials will be key to this in the long term.
- The NLs have become familiar with the Gas NIC process and are increasingly willing to engage constructively with the Panel and to modify and strengthen their plans.
- The low number of bids into the competition indicate one of two things. Either that there is a paucity of potential projects that meet the criteria, or that the risk reward balance for NLs does not give them an incentive to submit bids. While the former explanation is possible, the experience of the Panel, to date, on issues within the sector and projects submitted makes this seem less likely than the latter explanation. The risk reward equation could be directly in relation to the competition itself e.g. management resource cost is high versus return from a project and risk if it fails. Alternatively, it could be in the interaction between the competition and the broader price control framework, e.g. improvements from competition projects are not seen as enhancing NLs potential future returns. In any mechanism to encourage innovation under a future price control framework the successful drivers of innovation need to be both well understood and addressed.