Gas Network Innovation Competition 2019 Report and Recommendations

Prepared for
The Gas & Electricity Markets Authority

By

Gas Network Innovation Competition Expert Panel

October 2019

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 sole project to be funded in the 2019 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 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).

- **H21 Phase 2 Network Operations – Northern Gas Networks - £6,801k requested (£7,839k 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 H21 Phase 1 was approved in 2017. 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 the 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 submissions and the other information published concurrently 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 which the Panel is required to take into account in the evaluation process. We reviewed Phase 1 of this project in 2017 and the Panel's view is that Phase 2 has been evaluated on the same basis but on its own merits. These criteria are:

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.

(b) Provides value for money to gas customers.

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

(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.

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

(f) Relevance and timing.

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

3 Evaluation of the submission

3.1 H21 Phase 2 Network Operations – Northern Gas Networks - £6,801k requested (£7,839k in total)

The Climate Change Act (2008) legally bound the UK to make ambitious carbon reductions. On 27th June 2019, the government signed legislation committing the UK to a legally binding target of Net Zero emissions by 2050. As a consequence, the UK must now tackle decarbonisation at pace and change the way energy is produced, transported and consumed to meet this new target. In 2017, 48% of the UK's electricity generated was supplied by fossil-fuels, of which 41% was natural gas and 7% coal. Natural gas dominates the heat supply curve, heating 85% of UK households in 2017 and excluding transport, natural gas provided more than 50% of total UK energy consumption. Heat demand is highly variable, and, compared with alternatives such as heat pumps, natural gas is readily capable of meeting peak heat demand. There is, therefore, a huge focus on finding a green alternative to natural gas.

The current GB gas network transports natural gas, predominantly methane (CH4), which is burnt in customers' properties across the country producing largely carbon dioxide, water and heat. Hydrogen (H_2) when burnt only produces water and heat. If hydrogen were to replace natural gas, a conversion of the GB gas networks to enable hydrogen transport would provide customers with all the benefits of the gas networks without the carbon footprint at the point of use. From the data provided from this and other hydrogen focussed projects, it is clear that if the technical challenges can be addressed and overcome, the replacement of methane with hydrogen in the existing gas networks could be the lowest capital and operating cost method to decarbonise heat and with the least disruption to consumers existing lifestyles or homes.

The objective of the H21 project is to reach the point whereby it is feasible to convert the existing natural gas network to 100% hydrogen and provide a major contribution to decarbonising the UK's heat sector with the focus on finding a green alternative to natural gas. The H21 project builds on the work of the 2016 H21 Leeds City Gate project and the 2018 North of England project which has begun to establish that hydrogen conversion is technically possible and economically viable compared to other decarbonised heat options. The H21 project should provide essential evidence to support the Government's £25 million 'Downstream of the Emergency Control Valve' hydrogen programme called Hy4Heat that examines using hydrogen as a potential heat source in the home. This second phase of the H21 project continues to be a collaborative bid involving all of the NLs and now also National Grid. The aim of the H21 Phase 2 project is to provide safety critical evidence to support the viability of a 100% hydrogen live community trial by appraising and demonstrating the current network operation and maintenance procedures for use with 100% hydrogen.

3.2 Low carbon and /or environmental and financial benefits.

The rationale for any natural gas to 100% hydrogen conversion programme must be a net reduction in emissions of carbon dioxide and other greenhouse gases, expressed as their carbon dioxide equivalent in line with the Kyoto Protocol and with a specific focus on supporting the government's ambition for Net Zero by 2050. The carbon savings associated with the conversion of one third of the GB gas distribution network to 100% hydrogen are estimated to be 242 $MtCO_2$ eq. saved by 2050. Decarbonisation in this way is estimated to save customers a cumulative NPV of £46bn by 2050 compared to an all-electric solution or an average annual saving between 2030 and 2050 of around £2.3bn per annum.

3.3 Value for Money.

The Panel recognises that there are benefits to continuing to have the same team that was assembled for the first Phase of H21. On questioning, the Panel was content that, despite the teams being the same, due diligence had been applied in ensuring that costs remained in line with market rates. However, in other future bids, the NLs should provide more evidence in the bid submission that they have taken care to ensure that costs remain in line with the market rates for such services.

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 decarbonisation of the gas network is a viable future option. In the case of H21, after careful consideration, the Panel accepted that a change is being made to the use of the gas network to reduce carbon intensity whilst minimising the changes being required within the consumer's homes and minimising costs. Therefore, it is appropriate for consumers to pay. The project team was focused on the clear customer-facing role of the gas distribution networks and the specific knowledge and evidence they needed to deliver a timely, safe and customer-focused H2 conversion. The Panel was content, on that basis also, that it was appropriate for gas consumers to pay.

3.4 Generates knowledge for the NLs.

The Panel was pleased to see that all of the NLs and National Grid were involved thereby ensuring the dissemination of knowledge across the networks. The Panel welcomed the collaboration across Transmission and Distribution networks for the first time in a NIC bid.

3.5 Innovation.

The project is clearly innovative and the results will be key to determining the future of the existing networks.

The NL is represented on the Hydrogen Programme Development Group which is co-ordinating all of the work being carried out on conversion from natural gas to hydrogen. The project team is also in contact with other teams working in this area, globally which reassured the Panel that the overall programme is comprehensive and that there are no obvious overlaps.

It was interesting that the team was considering lessons from the conversion of the UK from town gas to natural gas, both from the perspective of the roll-out process as well as co-ordination between government and the various commercial entities involved. Since one can expect this same requirement for co-ordination and clear, well-funded, central direction, to be essential ingredients of a successful roll-out, these first steps to ensuring a coherent plan are encouraging.

This is clearly not business as usual.

3.6 Partners and funding.

The partners chosen, DNV GL and HSE-SD, are widely recognised as leaders in their fields and are the same as those undertaking the first phase of H21.

DNV GL is making a £225,000 contribution to Phase 2 of this project.

3.7 Relevance and timing.

The Panel would have liked to have received assurances from BEIS that the timing of H21 Phase 2 was consistent with the overall Hydrogen Transformation Programme. However, this did not prove possible within the NIC timetable. The Panel accepted that the project was designed to fit with the current overall programme, and it was encouraging to hear of the work that the industry had undertaken over the past 12 months in developing a phased roll-out plan. This work was structured to develop an appropriate evidence base for the roll-out.

3.8 Methodology.

The overall Phase 2 project is divided into four separate phases. The Project will undertake a scientifically robust experimental testing programme with two key phases, 2a and 2b, which will provide the following necessary evidence to assist with progression towards a live community trial:

•Phase 2a – Appraisal of Network Operations: Review, test and make recommendations to amend the operational and maintenance procedures required to operate a network on 100% hydrogen, below 7 bar, including network components and initial operational requirements for conversion to 100% hydrogen.

•Phase 2b – Unoccupied Network Trials: Undertake an unoccupied network operations trial on an existing, undisturbed section of network, to demonstrate operational and maintenance procedures in action for a 100% hydrogen network.

The Project also includes continued work on key areas following the work in H21 Phase 1 including:

•Phase 2c – Combined QRA: Combining the H21 Phase 1 QRA with the Hy4Heat QRA for an end-to-end quantification of the comparative risk between a 100% hydrogen network and the natural gas network.
•Phase 2d – Social Sciences: Extending the learning from H21 Phase 1 customer perception research, along with work by Newcastle University for HyDeploy, to develop educational material and a range of language and materials to be used to inform, educate and enhance customers' understanding of the benefits of change to 100% hydrogen conversion. Customer care and their inclusion in this journey is paramount to the success of the overall conversion project.

Overall the H21 Phase 2 project aims to provide the evidence to demonstrate what is required to maintain and manage a GB 100% hydrogen network and what further investment may be needed to address any unsuitable operations or procedures. It will also continue to build on the foundation work of H21 Phase 1 with the continued assessment of relative risk and building the safety-based evidence needed for customer engagement. The Panel was pleased to learn during the bilaterals that the team was utilising the early evidence from Phase 1.

The Panel was concerned that a suitable site for the trial on an existing unoccupied network had not yet been identified and secured. This meant that the Panel was unable to assess fully the suitability and value of the unoccupied network trial.

The bid team was asked to explain the impact of failure to find a suitable site and whether further trails on the test network at Spadeadam could provide sufficient confidence for the live community trial to proceed on schedule. The Panel was convinced that a trial using the Spadeadam micro-grid demonstration network would be more expensive and less conclusive. The NL stated during the presentations that they were broadening their search beyond

their own networks. The Panel would urge all of the partners to continue to do whatever is needed to identify a suitable site.

The case for the testing the operational procedures on an unoccupied network rather than at the Spadeadam micro-grid demonstration network was not made clear in the initial proposal but the Panel was reassured of the need for this step during the bilateral meetings. The re-submission clarified the benefits that the unoccupied network trial is expected to deliver.

The NLs will have the responsibility of operating any hydrogen network safely, so it is appropriate that they lead the work to develop the appropriate safe working methodologies.

The initial submission lacked some detail on how the social science work, to be carried out by Leeds Beckett University, would be carried out and how the results would be used, with some of the language used giving the impression of a more high level H2 awareness and messaging programme. It is important that the research objectives and design adopt an open, bottom-up approach to identifying consumers' issues and concerns. The Panel was satisfied with the responses of the NL, and the academic partner, to questioning in the bilateral meetings. The Panel was reassured that the research will build on the evidence base from Phase 1 and that it will involve deliberative research and co-creation with consumers with diverse backgrounds and characteristics. The NL included this additional detail in the re-submission.

The team has recent experience of working together and came across as professional, well briefed and enthusiastic. The team responded very well to the questions posed during the bilateral process.

3.9 Panel Conclusions.

The Panel was impressed by the project and with the team's presentations and the constructive and engaged manner in which they responded to the questions in the bilateral meetings. The project is timely, well thought through, draws on all the previous knowledge and offers a significant step towards an option for decarbonising the UK heat load at lower cost to the customer. It meets all of the evaluation criteria.

4 Recommendations to the Authority

4.1 We set out below our recommendations to the Authority on the funding of the 2019 project.

4.2 The Panel recommends that the Authority funds the project but creates a stage gate at the identification of the unoccupied trial site.

H21 Phase 2 Network Operations – Northern Gas Networks - £6,801k requested (£7,839k in total)

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

4.4 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 initial concept of decarbonising heating by using hydrogen has been quickly developed from a few isolated pieces of work to a comprehensive and well co-ordinated programme of work with a real sense of momentum.

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 NL's 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.

4.6 The Panel wish to note that given the commencement of a new RIIO price control in 2021 (except for ED), 2020 will be the final year of the Gas NIC as it is currently structured and would encourage NLs to consider availing themselves of the funding. It is also possible that there will be a time gap between the final Gas NIC project(s) and possible innovation funding under RIIO 2. The Panel would urge that this time period be kept as short as possible or that interim measures be considered to minimise what may well be a critical 2-3 years in the continued development of innovative projects e.g. those relating to hydrogen.