Question No.	From	Proforma section	Criteria	Question	Date question asked	Date response required	Date received	Follow up to Question #	Confidential (y/n)
1	RP	1.10	d) Is innovative	Referencing the descriptions of Technology Readiness Levels (TRLs) in the Gas NIC governance document, please explain why: i) the TRL at the Project start date will be 5; and ii) the TRL at the Project end date will be 8.	22 August 2017	24 August 2017	24 August 2017		N
2	OCE	4.1/7	a) Enviro+consumer bens	In the context of the GSMR it would be useful to have some commentary from the HSE on the needs case. Can initial views from the HSE be provided?	22 August 2017	24 August 2017	24 August 2017		N
3	OCE	4.1/7	a) Enviro+consumer bens	The carbon benefits relate to the overall Leeds City Gate project. Please indicate the benefits from the specific achievement of this NIC project. What would happen with and without this project?	24 August 2017	29 August 2017	29 August 2017		N
4	OCE	2.1	Mulitple	i) Is a funding package for the complete H21 Roadmap in place? The roadmap is to comprise of 16 work packages and 60 projects in total. Please provide a description of the individual projects and the parties that are to fund each specific project? ii) How does this proposal link to the projects? iii) What contingency funds will be available in the case of cost over-run?	24 August 2017	29 August 2017	29 August 2017		N
5	OCE	4.1/7	a) Enviro+consumer bens	The existing financial benefits relate to the whole H21 programme. Please indicate the benefits from the specific achievement of this NIC project. Please clarify what would happen specifically with and without this NIC project?	24 August 2017	29 August 2017	29 August 2017		N
6	OCE	4.2	b) Value for money	What justification is there for consumers to take on the risks of this project work and what justification is there for the level of funding.	24 August 2017	29 August 2017	29 August 2017		N
7	NC	2.3	N/A	Our understanding is that the proposed project would take place in three phases: • Phase 1A will test sections of pipe removed from the network in the lab at HSL. • Phase 1B will test sections of pipe at a DNV-GL facility. • Phase 2 will test sections of decommissioned pipe in the field. Is our understanding of the three project phases correct?	29 August 2017	31 August 2017	31 August 2017		N
8	NC	1.10	d) Is innovative	In the Governance Document TRL 4-6 is defined as: "Development activities with a more commercial application including technology validation and or demonstration in a working environment." TRL 7-8 is defined as: "Full scale demonstration in a working environment to test and improve technologies so they are ready for commercial deployment." With specific reference to the TRLs in the governance document please explain how the project will: i) validate or demonstrate the use of H2 in a working environment; or ii) constitute a full scale demonstration of the use of H2 in a working environment.	29 August 2017	31 August 2017	31 August 2017	1	N
9	NC	N/A	d) Is innovative	Please explain why you have not proposed using the NIA (the scope of which includes Research) to fund this work package?	29 August 2017	31 August 2017	31 August 2017		N
10	CO	N/A	g) Robust methodology/ready to implement	H2 has approximately 1/3 of the energy by volume of Natural Gas. What capacity increases will need to be made to enable the current network to maintain its ability to meet the demand based on this factor?	29 August 2017	31 August 2017	31 August 2017		N
11	CO	Multiple	N/A	Where do the national energy consumption values quoted in the paper come from? They don't appear to match those from BEIS ECUK_2017 report.	29 August 2017	31 August 2017	31 August 2017		N
12	CO	2.3	g) Robust methodology/ready to implement	Has the impact of hydrogen embrittlement been factored into the proposed testing? High strength steel (as used in the current high pressure distribution network) is not suitable for H2 distribution due to the embrittlement issue – what is the proposed solution to this issue?	29 August 2017	31 August 2017	31 August 2017		N
13	CO	2.3	g) Robust methodology/ready to implement	In order to meet increased future demands / compensate for the lower energy density of H2 vs Natural gas, would the H2 network need to be at a higher pressure than the network is currently operated at? If yes, how would this increased pressure impact on the likelihood of significant leakage issues being found and consequential poor network performance? Will the testing proposed be carried out at the current operating pressure or a higher expected operating pressure?	29 August 2017	31 August 2017	31 August 2017		N
14	CO	3.4.1/4.2.1	N/A	In section 3.4.1 the total cost of decommissioning the existing network is stated as £8,000m but in section 4.2.4 £88bn of avoided costs are quoted as the all-electric scenario. What does the difference come from?	29 August 2017	31 August 2017	31 August 2017		N
15	CO	2.3	g) Robust methodology/ready to implement	What consideration is being made regarding detection of leaks from an H2 network, as H2 is undetectable by humans, and burns with an almost invisible flame meaning that detecting leaks / failures in the network is very unlikely to be identified by humans?	29 August 2017	31 August 2017	31 August 2017		N
16	CO	N/A	Mulitple	The current natural gas network uses its latent storage capacity to handle peak demands (linepack). The capacity of hydrogen to act in this way is much reduced due to the lower density compared to natural gas. How would the H2 network manage peak demand if this is not a viable option?	29 August 2017	31 August 2017	31 August 2017		N
17	EP	N/A	c) Generates new knowledge	What research and/or trials have taken place on the safety of a hydrogen network elsewhere in the world? Has safety based evidence of hydrogen been studied in other countries? If yes, why is this project required - where and how does it add value to any existing evidence base?	05 September 2017	07 September 2017	06 September 2017		N

18	EP	N/A	f) Relevance and timing	How does the timeline of this project fit with other relevant timelines, including government policy, the iron mains replacement programme and the roll out of blended hydrogen (ie following the HyDeploy project)? i. Please provide a timeline mapping the roll out of each of the above in relation to one another. ii. At what stage is this project on the critical path?	05 September 2017	07 September 2017	06 September 2017		N
19	EP	N/A	c) Generates new knowledge	Does the scope of work allow development of industry best practice, guidelines and regulations so in future it can be replicated and be reasonably proximate?	05 September 2017	07 September 2017	06 September 2017		N
20	EP	N/A	Mulitple	Is this the right amount of money to be spending now to evidence a solution that might not happen? Should other projects, such as the government research into safety evidence downstream of the meter, happen before funding is committed to this project?	05 September 2017	07 September 2017	06 September 2017		N
21	NC	N/A	b) Value for money	Can you please provide the day rates used and the estimated hours for this project for the licensee team and all the Partners / Contractors participating in the project?	05 September 2017	07 September 2017	06 September 2017		N
22	NC	9	g) Robust methodology/ready to implement	Deliverables 1,2, and 5 are focussed on legal contracts. This amounts to 35% of the funding request. These deliverables do not appear to relate specifically to new learning in that completing and agreeing contracts is not normally an innovation activity itself. Please provide a justification that the proposed percentage of funding associated with these deliverables is appropriate.	14 September 2017	19 September 2017	19 September 2017		N
23	NC	9	g) Robust methodology/ready to implement	Project deliverable four appears to be focussed on project inputs rather than learning from the project. Therefore the level of funding associated with this deliverable appears to be high. Please provide a justification that the proposed percentage of funding associated with this deliverable is appropriate.	14 September 2017	19 September 2017	19 September 2017		N
24	NC	9	g) Robust methodology/ready to implement	Given that the key project work product or output will be the test results, please provide a justification that the proposed percentage of funding associated with deliverable ten is appropriate. N.B. Attendance and participation in the conference is a licence requirement and is covered by the standard deliverable, it does not need to be included in any of the others. Not attending or participating in the conference would be a breach of the licence arrangements.	14 September 2017	19 September 2017	19 September 2017		N
25	EP	N/A	b) Value for money	Please justify why gas consumers should fund the creation of evidence to inform a government policy decision. Please explain why NIC funding is appropriate when the ability to realise the potential benefits is outside of the control of the project, and indeed the industry?	26 September 2017	10 October 2017	10/10/2017 and answered at Second Bilateral on 05/10/21	9	N
26	EP	N/A	g) Robust methodology/ready to implement	Please outline how you have engaged with the HSE. What evidence do you have that this project will create the evidence required by HSE to create a safety case confirming the GB gas distribution networks are suitable to transport 100% hydrogen?	26 September 2017	10 October 2017	10/10/2017 and answered at Second Bilateral on 05/10/21		N
27	EP	N/A	f) Relevance and timing	Please justify the timing of this project, including why this evidence is required before any government policy decision. Your answer should consider the timings and risks of other areas on the critical path such as testing hydrogen downstream of the meter, the government policy decision on decarbonisation of heat, and a government policy decision on the feasibility and economics of large scale and widespread CCS. For CCS, please set out the level of investment required and what has been done to commit to taking this to the same stage of enabling a government policy decision as hydrogen.	26 September 2017	10 October 2017	10/10/2017 and answered at Second Bilateral on 05/10/21		N
28	EP	2.3	g) Robust methodology/ready to implement	Please provide more information regarding the Phase 2 field trials. Please provide more detail of the tests that will be carried out and the benefits of this phase.	26 September 2017	10 October 2017	10/10/2017 and answered at Second Bilateral on 05/10/21		N
29	RP	N/A	Multiple	Please explain why this project could not be funded through NIA. If there are no reasons why this project could not be funded through NIA please highlight any possible limitations of using NIA rather than NIC.	10 October 2017	12 October 2017	12 October 2017	9	N

Gas Network Innovation Competition Full Submission

Supplementary Answer Form

Project: NGN_H21

Tick if this answer has been provided verbally: ☐

Project code	NGN_H21	Question Number	Q1
Question date	22nd August 2017	Answer date	24th August 2017
Submission section question relates to	Section 1.10 Technology Readyness Level		
Topic	d) Is Innovative		
Question	"Referencing the descriptions of Technology Readiness Levels (TRLs) in the Gas NIC governance document, please explain why: i) the TRL at the Project start date will be 5; and ii) the TRL at the Project end date will be 8."		
Notes on question			
Answer	The project at start date is considered as being at TRL 5 in that the chemical and physical properties of hydrogen as an element are known, the production and storage facilities proposed within the H21 project are of proven technology in use round the world currently and the capacity and conversion process of the distribution network supplying hydrogen was determined in the initial H21 Leeds City Gate NIA project. However, the impact on the safety case of supplying 100% though the existing mixed PE/metallic distribution networks in Great Britain is unknown. The project at completion date is forecasted to be at TRL 8 in that, in combination with the BEIS "downstream of the meter" study, this NIC will provide the evidence required to 1) Update the quantitative risk assessment (QRA) and software currently used to model natural gas leakage to accurately predict hydrogen leakage within the full range of network assets. 2) Provide evidence for updating and developing operational procedures relating to connection, repair and diversion work on the distribution network infrastructure.		

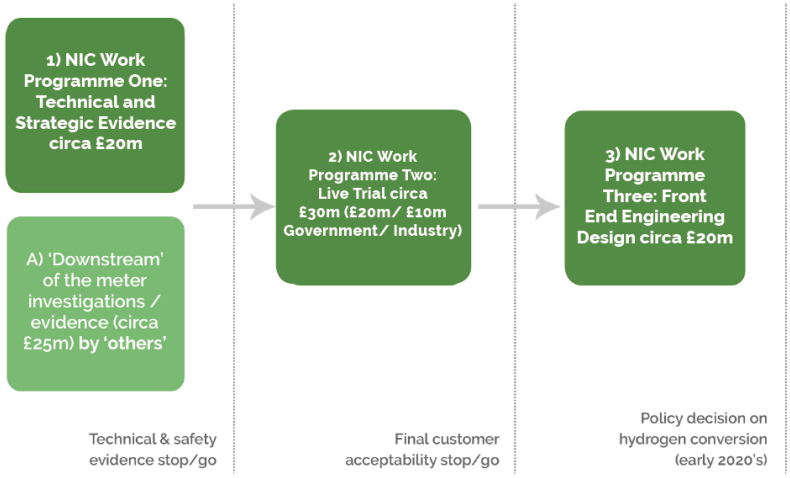
	3) Understand the impact on, and facilitate the updating of, existing legislation, policies and procedures including, but not restricted to, GSMR, Gas Act and the Uniform Network Code/Gas Transporters Licence.
Attachments	

Project code	NGN_H21	Question Number	Q2
Question date	22nd August 2017	Answer date	24th August 2017
Submission section question relates to	Section 4.1/7		
Topic	a) Enviro+Consumer Bens		
Question	In the context of the GSMR it would be useful to have some commentary from the HSE on the needs case. Can initial views from the HSE be provided?		
Notes on question			
Answer	The H21 team have spoken with the HSE at various stakeholder events. These discussion have included the GSMR as well as other gas related regulations and procedures The HSE are an independent organisation concerned about H&S and the gas industry owns the gas safety case. The HSE have to remain impartial but are interested in how the H21 project will provide the evidence for the safety case. (re: last paragraph of the HSE Commentary) The Health & Safety Laboratory (HSL) is a Primary Partner for this NIC bid. As a directorate of the HSE, they understand the issues that the HSE need to see addressed in this project. They will plan and oversee the experimental programme at their Buxton sites, as well as provided a reviewing and support function at Spadeadam, the QRA and Field Trials. The HSE have submitted a commentary and this is provided in the attachment		
Attachments	NGN_H21_220817_Q2 HSE commentary  Q2 Attachment HSE Commentary.pdf		

Project code	NGN_H21	Question Number	Q3
Question date	24th August 2017	Answer date	29th August 2017
Submission section question relates to	4.1/7,		
Topic	a) Enviro+consumer bens		
Question	The carbon benefits relate to the overall Leeds City Gate project. Please indicate the benefits from the specific achievement of this NIC project. What would happen with and without this project?		
Notes on question			
Answer	The Carbon benefits have been projected based on the comprehensive carbon savings evidence determined as part of the H21 Leeds City Gate project and the subsequent rollout scenario example presented in section 11 of that report. This H21 NIC project is the critical enabler to unlock these benefits and has been developed in line with the Governments 'Downstream of the meter innovation programme'. As with all innovation projects the benefits will only arise if the project is successful and is subsequently implemented. This project will provide the critical outstanding evidence that an incremental conversion to 100% hydrogen of the GB gas distribution networks represents a comparable risk to the network operating on natural gas. Once this has been proven all the technical and safety aspects of such an undertaking will be comprehensively understood. The H21 NIC project will provide the evidence to unlock the 100% hydrogen decarbonisation pathway for the UK and will generate unique intellectual property that can be transferable across the world. If a subsequent conversion to 100% hydrogen does not take place the carbon benefits will not be realised. However, assuming the UK remains committed to its obligations as defined by The Climate Change Act, a significant change in the UKs energy system is essential and heat represents one of the biggest challenges. This project will provide the compelling evidence that a conversion to 100% hydrogen is possible. Growing evidence suggests this option is more technically achievable and cost effective than alternative options.		

	The H21 NIC project will ensure the UK government has the evidence required to make a credible policy decision on decarbonising heat. As recommended by the Committee on Climate Change, such a policy is required by the early 20s to allow adequate time for the UK to meet its climate change targets. Without this project the UK will not have the evidence it requires to robustly asses all options. This could lead to sub optimised and/or undeliverable policy ambitions to the detriment of energy customers.
Attachments	

Project code	NGN_H21	Question Number	Q4
Question date	24th August 2017	Answer date	29th August 2017
Submission section question relates to	2.1		
Topic	Multiple		
Question	i) Is a funding package for the complete H21 Roadmap in place? The roadmap is to comprise of 16 work packages and 60 projects in total. Please provide a description of the individual projects and the parties that are to fund each specific project? ii) How does this proposal link to the projects? iii) What contingency funds will be available in the case of cost over-run?		
Notes on question			
Answer	i & ii) The H21 Roadmap was developed throughout 2015 as part of the original H21 Leeds City gate Project. The roadmap was split into 4 key areas: • Technical • Social/regulatory • Strategic • Physical Trials. This original H21 roadmap was significantly enhanced during Dan Sadler's 2016 secondment to BEIS. This now ensures delivery is achieved in a low regrets way whilst providing critical evidence to align with the governments ambitions and timelines. This has resulted in the 'Executing the H21 roadmap' document (attached). The H21 NIC project, coupled with the governments £25m 'downstream of the meter' programme, will provide the technical (and safety) elements of the roadmap. The roadmap has now been reconfigured into the model below taken from the Executing the H21 Roadmap' document:		



This shows that the first critical step is to determine the safety evidence. The £25m 'by others' is now confirmed as the BEIS 'Downstream of the meter programme'. This H21 NIC will provide the complementary evidence in the network.

Funding for the other two elements i.e., live trials / Front End Engineering Design (FEED) is not yet in place. The BIES programme (work package 9) is identifying areas for a live trail should the first stage be successful. Whilst funding for such a trial could come from the NIC there could be other options available which will be developed as the two initial programmes progress.

Furthermore, through the Heat Strategic Options Project, BEIS is seeking to explore some of the social and strategic elements which would support the next two stages.

iii) The H21 NIC project has been comprehensively developed by all the project partners to ensure the funds requested are adequate. The project will be managed by highly experienced staff and partners and will have comprehensive governance in place to manage time and cost variances (see appendix D and section 6). The next elements of the roadmap i.e. live trails and FEED study will be developed over the coming years both in terms of detailed costs and funding sources but these stages are not part of this NIC bid.

Attachments	

Project code	NGN_H21	Question Number	Q5
Question date	24th August 2017	Answer date	29th August 2017
Submission section question relates to	4.1/7		
Topic	a) Enviro+consumer bens		
Question	The existing financial benefits relate to the whole H21 programme. Please indicate the benefits from the specific achievement of this NIC project. Please clarify what would happen specifically with and without this NIC project?		
Notes on question			
Answer	The financial benefits have been projected based on the comprehensive carbon savings evidence determined as part of the H21 Leeds City Gate project and the subsequent rollout scenario example presented in section 11 of that report. This H21 NIC project is the critical enabler to unlock these benefits and has been developed in line with the Governments 'Downstream of the meter innovation programme'. As with all innovation projects the benefits will only arise if the project is successful and is subsequently implemented. This project will provide the critical outstanding evidence that an incremental conversion to 100% hydrogen of the GB gas distribution networks represents a comparable risk to the network operating on natural gas. Once this has been proven all the technical and safety aspects of such an undertaking will be comprehensively understood. The H21 NIC project will provide the evidence to unlock the 100% hydrogen decarbonisation pathway for the UK and will generate unique intellectual property that can be transferable across the world. If a subsequent conversion to 100% hydrogen does not take place the financial benefits will not be realised. However, assuming the UK remains committed to its obligations as defined by The Climate Change Act, a significant change in the UKs energy system is essential and heat represents one of the biggest challenges. This project will provide the compelling evidence that a conversion to 100% hydrogen is possible. Growing evidence suggests this option is more technically achievable and cost effective than alternative options.		

	The H21 NIC project will ensure the UK government has the evidence required to make a credible policy decision on decarbonising heat. As recommended by the Committee on Climate Change, such a policy is required by the early 20s to allow adequate time for the UK to meet its climate change targets. Without this project the UK will not have the evidence it requires to robustly asses all options. This could lead to sub optimised and/or undeliverable policy ambitions to the detriment of energy customers.
Attachments	

Project code	NGN_H21	Question Number	Q6
Question date	24th August 2017	Answer date	29th August 2017
Submission section question relates to	4.2		
Topic	b) Value for money		
Question	What justification is there for consumers to take on the risks of this project work and what justification is there for the level of funding.		
Notes on question			
Answer	The financial and carbon benefits that this project has the potential to unlock are enormous. A conversion of just 1/3 of the UK to 100% hydrogen represents a £48bn financial saving Vs alternatives. An investment of circa £15m could save customers 3200 times the initial investment in avoided cost. If all the UK were converted this could represent a £145bn saving Vs alternative options i.e. over 9500 times the investment cost. The benefits have been calculated based on guaranteed CO2 savings from heat alone. However, there would be significant benefits arising from the rapid uptake of hydrogen vehicles across cities with hydrogen gas distribution grids. These could be more significant than heat as hydrogen fuel cell vehicles not only remove carbon dioxide but also particulate matter and NOx. For the purpose of this H21 NIC bid trying to calculate this benefit was considered over complicated and held too much reliance on projected uptake of vehicles, the heat benefit savings are guaranteed. Additionally, fugitive methane emissions (25 times more detrimental to the environment than CO2) from natural gas distribution network leaks (current leaks) would no longer pose an environmental threat from hydrogen gas distribution grids. Finally, for hydrogen converted areas, carbon monoxide risk would be eliminated entirely as it is not possible to get carbon monoxide from a hydrogen appliance.		
Attachments			

Project code	NGN_H21	Question Number	Q7
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	2.3		
Topic	N/A		
Question	Our understanding is that the proposed project would take place in three phases: • Phase one will test sections of pipe removed from the network in the lab at HSL. • Phase two will test sections of pipe at a DNV-GL facility. • Phase three will test sections of decommissioned pipe in the field. Is our understanding of the three project phases correct?		
Notes on question			
Answer	There are 2 principle phases. Phase one is split into two distinct parts, 1A Background Testing and 1B Consequence Testing. These will run broadly in parallel. This will be followed by Phase 2 Field Trials. See Section 2 **and Appendix C** for more details. Phase 1A: Background Testing will test a wide range of assets including above and below ground assets (pipes, valves, fittings, regulators etc.) of varying diameters and ages at a purpose-built testing facility (see p62/63) at the HSL site at Buxton. This will determine changes to the background position for existing network assets on day one of a subsequent 100% hydrogen conversion. It will also determine repair technique applicability for ongoing gas leaks. Phase 1B: Consequence Testing will confirm the dispersion, migration and accumulation characteristics and ignition potential of background sources for hydrogen. This will be done by simulating different leaks in different conditions/scenarios including varying pressures, soil types, surface covering, ductwork proximity, volumes etc. (see diagram p67/68). The results of these tests will inform the quantitative risk analysis model to determine change in risk associated with a conversion of the GB gas distribution network to 100% hydrogen. This will be undertaken at the DNV GL testing site at Spadeadam. Phase 2: Field Trials will test a small section of network infrastructure isolated from customers, i.e. recently decommissioned, including pipework		

	(mains and services), fittings, valves, governors etc. in the field. This will confirm the results of the controlled testing in a real-world setting, allow demonstrations of repair techniques and confirm accurate extrapolation of results from Phases 1A and 1B. This will give confidence to proceeding to the live gas trials which would follow the successful completion of this NIC.
Attachments	

Project code	NGN_H21	Question Number	Q8
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	1.10		
Topic	d) Is innovative		
Question	In the Governance Document TRL 4-6 is defined as: "Development activities with a more commercial application including technology validation and or demonstration in a working environment." TRL 7-8 is defined as: "Full scale demonstration in a working environment to test and improve technologies so they are ready for commercial deployment." With specific reference to the TRLs in the governance document please explain how the project will: i) validate or demonstrate the use of H2 in a working environment; or ii) constitute a full scale demonstration of the use of H2 in a working environment.		
Notes on question			
Answer	The H21 NIC project will provide the remaining outstanding pieces of evidence for an overall 100% hydrogen conversion of the GB gas distribution networks in the context of the complete system design. This design, which included hydrogen production and storage facilities, hydrogen transmission, hydrogen distribution in the existing below seven bar network (mains) and hydrogen end use application in appliances was established as part of the H21 Leeds City Gate NIA project (the 17 minute H21 film available on the NGN website is a good and concise review of the above). The system design has been assessed as TRL level 5, i.e. a commercial application has been developed for hydrogen conversion with all elements demonstrated in a working environment. Hydrogen has already been used and demonstrated in all the individual system design component parts with the exception of the below seven bar GB gas distribution network. The system, as designed in the H21 LCG report, would work and hydrogen wodul flow throught the distribution pipes. The evidence gap is quantifying the impact on safety for the GB below seven bar gas distribution networks when operating on 100% hydrogen compared to natural gas. These are made up of components (pipes, valves, connection fittings, regulators, repairs etc.) with a variety of materials (including		

	polyethylene, iron and steel) with a huge range of installation dates (unlike the production/storage and transmission systems which will be new build). In order to provide the safety based evidence to allow progression to a live trial (TRL level 9 - Application of technology in its final form, i.e. the technology has been proven) it needs to be confirmed that the system, and specifically the below seven bar network, can be managed safely. At the end of the project the system design will be at TRL level 8, i.e. a demonstration of all elements of the system in a working environment. This is because hydrogen use and the safety impact in the GB gas distribution networks will have been provided via the H21 NIC, hydrogen use and the safety impact in buildings will be provided by the BEIS programme, hydrogen production and storage is already proven across the world and specifically at Teesside (see p52 and p61 of the H21 LCG report) and finally hydrogen transmission is already proven via hydrogen transmission pipelines across Europe and America (see p185 of the H21 LCG report). Whilst the NIC groups TRL levels in its governance document, the specific TRL levels relative to this H21 NIC are below which make it easier to understand the H21 teams assessment of TRL level. These are taken from the DECC / Ofgem Smart Grid Forum Workstream 3 'Developing Networks for Low Carbon', (https://www.ofgem.gov.uk/sites/default/files/docs/2011/11/smart-grid-forum-workstream-3-report-071011-master_0.pdf) (P31): TRL5: System/subsystem/component validation in relevant environment: Thorough testing of prototyping in representative environment. Basic technology elements integrated with reasonably realistic supporting elements. Prototyping implementations conform to target environment and interfaces. TRL8: Actual system completed and "mission qualified" through test and demonstration in an operational environment: End of system development. Fully integrated with operational hardware and software systems. Most user documentation, training documentation, and maintenance documentation completed. All functionality tested in simulated and operational scenarios. Verification and Validation completed. The final TRL level is level TRL 9 which would come after the completion of the BEIS and H21 NIC projects in the form of a live trial. TRL9: Actual system "mission proven" through successful mission operations: Fully integrated with operational hardware/software systems. Actual system has been thoroughly demonstrated and tested in its operational environment. All documentation completed. Successful operational experience. Sustaining engineering support in place.
Attachments	

Project code	NGN_H21	Question Number	Q9
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	N/A		
Topic	d) Is innovative		
Question	Please explain why you have not proposed using the NIA (the scope of which includes Research) to fund this work package?		
Notes on question			
Answer	The Network Innovation Allowance is to fund smaller technical, commercial, or operational projects directly related to the licensee's network that have the potential to deliver financial benefits to the licensee and its customers; and/or to fund the preparation of submissions to the Network Innovation Competition (NIC) which meet the criteria set out in the NIC Governance Document. The Gas NIC is an annual opportunity for Gas network companies to compete for funding for the development and demonstration of new technologies, operating and commercial arrangements. Funding will be provided for the best innovation projects which help all network operators understand what they need to do to provide environmental benefits, cost reductions and security of supply as Great Britain (GB) moves to a low carbon economy. Up to £20 million per annum is available through the Gas NIC. The H21 NIC project is a £15m collaborative Network Innovation Competition bid including all the GB GDNs, the first ever, which will provide the critical evidence for a 100% hydrogen gas grid conversion through development and demonstration of 100% hydrogen in GB Gas distribution network assets. £15m is significantly higher value than what would be considered via the NIA and the bid has been developed via the H21 Leeds City Gate NIA project. At the end of the H21 NIC the UK will be able to undertaken a complete end to end sustaining live 100% hydrogen trial (TRL9). A location for this will be identified in the BEIS £25m 'Downstream of the meter' programme.		

	Value for money for UK gas customers is essential when considering 'future looking' projects. With a project of this scale, which will have a global impact, this will be assured by the independent, external governance procedure, i.e. the Network Innovation Competition bid process. This ensures full visibility to OFGEM, BEIS and all external parties via a robust and transparent process.
Attachments	

Project code	NGN_H21	Question Number	Q10
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	H2 has approximately 1/3 of the energy by volume of Natural Gas. What capacity increases will need to be made to enable the current network to maintain its ability to meet the demand based on this factor?		
Notes on question			
Answer	This was one of the primary question that was fundamental to the H21 Leeds City Gate NIA project. The network is the appropriate capacity, with minor reinforcement (less than £5m for Leeds), to maintain its current level of energy security and meet the peak 1 in 20 demand requirements when transporting either 100% hydrogen or natural gas. Whilst it is true that hydrogen has approximately 1/3rd the energy by volume this is almost entirely compensated for by the fact that the specific gravity and the viscosity of hydrogen are significantly lower than that for methane (the primary component of natural gas). The H21 report has been extensively reviewed and commended since its release. More detail on this specific question can be found in Section 3 (p85 to p110) which provides detailed explanations on the capacity of 100% hydrogen vs natural gas in the current gas distribution system.		
Attachments			

Project code	NGN_H21	Question Number	Q11
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	Multiple		
Topic	N/A		
Question	Where do the national energy consumption values quoted in the paper come from? They don't appear to match those from BEIS ECUK_2017 report.		
Notes on question			
Answer	When considering overall UK energy figures there are often differences between alternative credible sources. For example, the 1500TWh to 2000TWh referenced on p21 can be confirmed in both the Digest of UK Energy Statistics and by Dr Grant Wilson at Sheffield University in their energy modelling statistics (Dr Wilson can confirm this if required). When considering UK net energy, as much as figure may vary between different sources, the 'order of magnitude' is always correct and the variances will make no difference to the overall benefits (financial and carbon) and/or principles of the bid. There are lots of energy values in the bid and most are specifically referenced. Please could you indicate the specific values which need clarification?		
Attachments			

Project code	NGN_H21	Question Number	Q12
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	2.3		
Topic	g) Robust methodology/ready to implement		
Question	Has the impact of hydrogen embrittlement been factored into the proposed testing? High strength steel (as used in the current high pressure distribution network) is not suitable for H2 distribution due to the embrittlement issue – what is the proposed solution to this issue?		
Notes on question			
Answer	The section of the network that would be converted is the below 7 bar, predominantly medium pressure and low pressure, distribution system. Hydrogen embrittlement in hard steels is only an issue at pressures significantly exceeding 20 bar and even then only as a result of extensive pressure cycling. As part of the overall rollout of a 100% hydrogen conversion a new HTS would be built (see section 6 of the H21 LCG report). The materials used to construct the HTS would be specifically selected with resistance to hydrogen embrittlement a primary factor like the many hydrogen transmission pipelines aroudn the world. Constructing an HTS in parallel to the existing natural gas national and local transmission systems (above 7 bar) gives two specific advantages. Firstly, it allows incremental conversion of customers over time as has been done for every major gas conversion (see section 4 of the H21 LCG report) and, secondly, it allows the major industrial customers (power stations etc.) to remain on the high pressure natural gas network to be subsequently converted to hydrogen at the end of their asset lives. The H21 team have offered to provide the expert panel a detailed presentation on the original H21 LCG NIA project if required. This needs approximately 60/90 minutes and has been presented across the UK and globally since the release of the report in July 2016.		
Attachments			

Project code	NGN_H21	Question Number	Q13
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	2.3		
Topic	g) Robust methodology/ready to implement		
Question	In order to meet increased future demands / compensate for the lower energy density of H2 vs Natural gas, would the H2 network need to be at a higher pressure than the network is currently operated at? If yes, how would this increased pressure impact on the likelihood of significant leakage issues being found and consequential poor network performance? Will the testing proposed be carried out at the current operating pressure or a higher expected operating pressure?		
Notes on question			
Answer	Whilst it is true that hydrogen has approximately 1/3rd the energy by volume this is almost entirely compensated for by the fact that the specific gravity and the viscosity of hydrogen are significantly lower than that for methane (the primary component of natural gas). This results in only a very slight loss in capacity in the exisiting network when operating on 100% hydrogen at the same pressures. The H21 Leeds City Gate NIA project confirmed the network is of adequate capacity, with minor reinforcement (less than £5m for Leeds) to maintain the current levels of energy security and meet the peak 1 in 20 demand requirements when transporting 100% hydrogen. These small reinforcement costs will likely be reduced or even eliminated as a part of any conversion process. The conversion process, which requires extensive isolation of adjacent areas with adequate stand-alone supply, will require the installation of a small number of new District Governors. These may be sufficient to restore fully network capacity. There is the opportunity to further reduce infrastructure based reinforcement (or just increase network capacity) by raising existing DG outlet pressures without increasing leakage relative to current levels. This is due to the predominantly PE composition of the distribution networks mains post 2032 (completion of the Iron Mains Replacement Programme). However the pressures would only be increased within the current maximum operating pressure limits of the relevant exisiting pressure systems.		

	One of the major benefits of using hydrogen as the energy supply is that any leakage that may occur (including accidental damage) will not contribute to the carbon emission values as they currently do. The H21 report has been extensively reviewed and commended since its release. More detail on this specific question can be found in Section 3 (p85 to p110) which provides detailed explanations on the capacity of 100% hydrogen Vs Natural Gas in the current gas distribution system.
Attachments	

Project code	NGN_H21	Question Number	Q14
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	3.4.1/4.2.1		
Topic	N/A		
Question	In section 3.4.1 the total cost of decommissioning the existing network is stated as £8,000m but in section 4.2.4 £88bn of avoided costs are quoted as the all-electric scenario. What does the difference come from?		
Notes on question			
Answer	The £8,000m figure in section 3.4.1 is the estimated, stand alone, cost of decommissioning the gas network, i.e. what it would cost to 'turn it off' and make safe. The £88bn (£48bn NPV) figure on page 23 (4.1.4 – we think the reference in the question may be incorrect) is the differential in cost between an all-electric option for decarbonisation and an alternative gas option as estimated in the KPMG '2050 Energy Scenarios report' and represents the spend required to upgrade the electricity infrastructure (production, transportation and consumption) to enable it to replace the energy supply lost should the gas network be decommissioned.		
Attachments			

Project code	NGN_H21	Question Number	Q15
Question date	29th August 2017	Answer date	31st August 2017
Submission section question relates to	2.3		
Topic	g) Robust methodology/ready to implement		
Question	What consideration is being made regarding detection of leaks from an H2 network, as H2 is undetectable by humans, and burns with an almost invisible flame meaning that detecting leaks / failures in the network is very unlikely to be identified by humans?		
Notes on question			
Answer	Like hydrogen, natural gas is also not detectable by humans as it has no smell. As with natural gas, hydrogen would have an odorant added to ensure the smell is detectable at low levels. This odorant will be different to the current odorant (which is a mix of t-butyl mercaptan and dimethyl sulphide) to ensure a non-sulphur based odorant is used so the hydrogen wouldn't poison fuel cell applications (micro CHP / vehicles) in the future. The BEIS £25m 'Downstream of the Meter' programme is investigating alternative odorants as work package 2. The hydrogen flame is 'less visible' which isn't an issue in modern boilers (blue light indicators) and can be enhanced with appliance design for fires and cookers (see H21 film for hydrogen cooker) – the BEIS £25m 'Downstream of the Meter' programme will address this issue. Appliance manufacturers may well be able to design in safety features such as flame colouring with the R&D they will need to carry out once/if the conversion programme is given the go-ahead?		
Attachments			

Project code	NGN_H21	Question Number	Q16
Question date	29th August 2017	Answer date	31st August 2017
N/A	N/A		
Topic	Multiple		
Question	The current natural gas network uses its latent storage capacity to handle peak demands (linepack). The capacity of hydrogen to act in this way is much reduced due to the lower density compared to natural gas. How would the H2 network manage peak demand if this is not a viable option?		
Notes on question			
Answer	The current below seven bar distribution network does not use line pack to manage storage. Line pack is only available in the above seven bar gas transmission network. For a hydrogen conversion this would still be the case; the new Hydrogen Transmission System (HTS) would use line pack coupled with the upstream storage and production facilities to manage intraday swings in demand. The national HTS will have geographically distributed production and storage facilities which will ensure capacity to manage peak demand. Please see Section 2 (Demand Vs Supply), Section 3 (Gas Network Capacity) and Section 6 (the Hydrogen Transmission System) of the H21 Leeds City Gate Report for comprehensive details.		
Attachments			

Project code	NGN_H21	Question Number	Q17
Question date	5th September 2017	Answer date	7th September 2017
Submission section question relates to	N/A		
Topic	c) Generates new knowledge		
Question	What research and/or trials have taken place on the safety of a hydrogen network elsewhere in the world? Has safety based evidence of hydrogen been studied in other countries? If yes, why is this project required - where and how does it add value to any existing evidence base?		
Notes on question			
Answer	As described in section 2 p6 there has been some investigations into the effect of distribution of hydrogen on PE pipe. However, through extensive international stakeholder liaison, there has never been any test on the impact of hydrogen on an existing gas network across the range of distribution assets. There has never been any assessment of a change to baseline position following a hydrogen conversion (Phase 1A) or development of a quantitative risk assessment to determine the change in risk from hydrogen leaks in a gas network distribution system (Phase 1B). Furthermore, there has never been a field trial confirming results obtained in a controlled environment are accurate when applied to a real-world setting (Phase 2). This H21 NIC would be a world first and is supported across the international gas community (see letters of support). It would maintain and improve the UKs position at the forefront of gas grid decarbonisation and 100% hydrogen conversion.		
Attachments			

Project code	NGN_H21	Question Number	Q18
Question date	5th September 2017	Answer date	7th September 2017
Submission section question relates to	N/A		
Topic	f) Relevance and timing		
Question	How does the timeline of this project fit with other relevant timelines, including government policy, the iron mains replacement programme and the roll out of blended hydrogen (i.e. following the HyDeploy project)? i. Please provide a timeline mapping the roll out of each of the above in relation to one another. ii. At what stage is this project on the critical path?		
Notes on question			
Answer	**Government Policy:** As referenced extensively throughout the document it is universally agreed that the government needs to be in a position to set a credible policy to decarbonise heat by the early 2020's. failure to do this will make it impossible to meet the UKs climate change obligations. The most notable document is the Committee on Climate Change 'Next Steps for Heat' report. This project is essential to provide the key outstanding piece of critical evidence to de-risk a 100% hydrogen conversion option for the UK gas distribution networks in line with these timescales. This project is already on the critical path and ideally would have started 12 months ago. The 'H21 Keighley and Spadeadam NIA' project was developed to accelerate delivery. **The Iron mains replacement programme (IMRP):** has been a critical enabler to allow the government the opportunity to convert the gas distribution system to 100% hydrogen (this is also true across gas networks around the world). As explained in section 9 (The next steps – see p272) of the H21 Leeds City Gate Report the earliest a conversion to 100% hydrogen is likely to start is between 2026 and 2029. This is for two primary reasons, firstly the IMRP (due to complete in 2032) will need to be majority complete for conversion to take place or accelerated into the first areas to convert (for example Leeds). Secondly, following a policy decision to convert in the early 20s it will take circa 5 years to build and commission the infrastructure (Steam Methane Reformers, Salt Caverns, hydrogen transmission pipelines) to allow incremental conversion to take place.		

	Blended Hydrogen: Blended hydrogen and 100% hydrogen conversion are not the same and cannot provide the same objective or benefits. Blending hydrogen into the UK gas grid up to between 10 and 20% may be possible following the completion of the Hydeploy project. The primary benefits of blending will be firstly, to allow use of surplus hydrogen from process industries in areas like Teesside, Liverpool, Grangemouth and South Wales. Secondly, to allow system coupling between gas and electric grids to allow deployment of more renewables onto the electric grid removing the requirement for high carbon intensity electrical peaking plant (e.g. coal power stations). Blending will be important in the short to medium term to meet carbon budgets and drive network energy efficiency. However, even a 20% blend of hydrogen would only deliver a maximum of 6.6% carbon benefit dependent where the hydrogen comes from (electrolysis is not clean if the electric grid is not decarbonised). In the context of a 100% hydrogen conversion blending may also be important to allow 'spill over' of surplus hydrogen into areas not yet converted to allow balancing of the network and offset some initial storage costs.
Attachments	

Project code	NGN_H21	Question Number	Q19
Question date	5th September 2017	Answer date	7th September 2017
Submission section question relates to	N/A		
Topic	c) Generates new knowledge		
Question	Does the scope of work allow development of industry best practice, guidelines and regulations so in future it can be replicated and be reasonably proximate?		
Notes on question			
Answer	The legislation, Industry Standards and Policy and Procedures which govern the gas industry are both extensive and robust. They are vital to ensure the safe efficient running of the gas network and range from the safety case to simple engineering instructions. Many of these procedures are based on management of risk. This H21 NIC will quantify changes to the existing level of risk (higher the same or lower) across the asset range and working environment. Through this quantification it will be possible to make the necessary amendments to gas industry documents as required in preparation for a 100% hydrogen conversion. Additionally, existing maintenance procedures associated with dealing with escapes on the network will be tested and confirmed as adequate through work carried out in phase 1B and phase 2. This evidence will confirm acceptability of existing procedure or will identify potential amendment requirements as necessary. IGEM have already established a hydrogen working group to consider possible amendments to gas industry standards. The results from this H21 NIC will be critical to provide the evidence for amendments to existing documents. Subsequent detailed development of standards following completion of the H21 NIC will not delay a policy decision and / or timescales for conversion but they are not specifically part of this scope.		
Attachments			

Project code	NGN_H21	Question Number	Q20
Question date	5th September 2017	Answer date	7th September 2017
Submission section question relates to	N/A		
Topic	Multiple		
Question	Is this the right amount of money to be spending now to evidence a solution that might not happen? Should other projects, such as the government research into safety evidence downstream of the meter, happen before funding is committed to this project?		
Notes on question			
Answer	As detailed in the 'Next Steps for Heat' report by the Committee on Climate Change the government needs to be in a position to set a credible policy to decarbonise heat by the early 2020's. Failure to do this will make it impossible to meet the UKs climate change obligations. This project is essential to provide the key outstanding piece of critical evidence to de-risk a 100% hydrogen conversion option for the UK gas distribution networks in line with these timescales. This project is already on the critical path and ideally would have started 12 months ago. Timescales for the development of a credible heat policy are now critical, it is essential that the BEIS programme and this H21 NIC are delivered together. One programme will not provide the evidence required for a heat policy decision on its own. For today's gas customers it is essential that a heat policy is absolutely optimised and has considered all options fully based on robust evidence. Failure to do this could lead to significant increases in bills and disruption in the home – evidence to date suggests this is not what UK customers want (see appendix B). Whilst the governments downstream of the meter programme is critical to a hydrogen for heat scenario the level of success of that programme does not make the critical evidence provided by this H21 NIC less valuable or timely. Knowing, based on evidence provided by the H21 NIC, it is possible to repurpose one the UKs largest national assets (i.e. the gas distribution network) to transport an entirely clean fuel (hydrogen) has huge potential		

	benefits. These benefits are not only for decarbonising heat but also decarbonising transport through hydrogen fuelling stations and decarbonising electricity both centralised and decentralised (see section 3.3.3 p16 'other benefits). Having bulk availability of a clean fuel at point of use across the UK will significantly support the UKs climate change ambitions, as well as air quality improvements, irrespective of any changes in end use customers over the longer term. The benefits to the UK for a 100% hydrogen conversion are enormous financially, environmentally, to the UK economy through domestic jobs, improved air quality (and therefore health) and international trade. When compared against investment to date in other technologies this represents a great opportunity for the UK and its gas customers for a comparatively small investment. Following the H21 LCG report A 100% hydrogen conversion is gathering interest across the world, timescales for 'at scale' energy infrastructure development to 2050 are now absolutely critical. This H21 NIC will allow the UK to capitalise on its leading position and meet its climate change obligations in a way that is transferable across the globe.
Attachments	

Project code	NGN_H21	Question Number	Q21
Question date	5th September 2017	Answer date	7th September 2017
Submission section question relates to	N/A		
Topic	b) Value for money		
Question	Can you please provide the day rates used and the estimated hours for this project for the licensee team and all the Partners / Contractors participating in the project?		
Notes on question			
Answer	As per the table on p24 of the submission the day rates range from £1,580/day to £280/day and the total man days are: Phase 1A: 2,426 Phase 1B: 3,305 Phase 2: 2,166 Rates for licensee team are based on professional services framework tendered rates. Rates from DNV GL for office staff are based on tendered framework rates. Rate from the HSL are complied with all Government policy including the stipulations of the hand book Managing Public Money and are also aligned to the HyDeploy NIC project. Please note that the time allocation is reflective of multiple stages of testing occurring in parallel and the role descriptions (for example DNV GL Project Engineer / Scientist / Test Engineer are reflective of multiple staff members working across concurrently occurring design/ build / test programmes)		

Licensee Team	Day Rate	Days
Senior Project Manager	[redacted]	[redacted]
Senior Quantity Surveyor	[redacted]	[redacted]
CDM Principal Designer	[redacted]	[redacted]
Assistant Quantity Surveyor	[redacted]	[redacted]

	Planner	[redacted]	[redacted]
	Office Administrator / document controller	[redacted]	[redacted]
	Project Manager A (GDN)	[redacted]	[redacted]
	Project Supervisor (GDN) Construction	[redacted]	[redacted]
	Project Supervisor (GDN) Asset Collection	[redacted]	[redacted]
	Project Manager B (GDN)	[redacted]	[redacted]
	Project Supervisor (GDN) Construction /testing P2	[redacted]	[redacted]
	Industrial staff for testing (average fully loaded)	[redacted]	[redacted]
	Primary Contractors		
	DNV GL		
	Project Manager	[redacted]	[redacted]
	DNV GL Project Engineer / Scientist/E&I Engineer	[redacted]	[redacted]
	DNV GL Pressure Systems Technician/Mechanical Operative/	[redacted]	[redacted]
	DNV GL Consultant (QRA)	[redacted]	[redacted]
	DNV GL Consultant / Specialist	[redacted]	[redacted]
	HSL		
	B1/B2 Technical Specialist	[redacted]	[redacted]
	B3/B4 Technical Specialist	[redacted]	[redacted]
	B5/B6 Technical Specialist	[redacted]	[redacted]
	Independent Specialist Support		
	Director level support - Specialist Consultants (KIWA, NPL, ELEMENT ENERGY, ERM, YO Energy, Radius - average rate	[redacted]	[redacted]
		TOTAL	[redacted]
Attachments			

Project code	NGN_H21	Question Number	Q22
Question date	14th September 2017	Answer date	19th September 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Deliverables 1,2, and 5 are focussed on legal contracts. This amounts to 35% of the funding request. These deliverables do not appear to relate specifically to new learning in that completing and agreeing contracts is not normally an innovation activity itself. Please provide a justification that the proposed percentage of funding associated with these deliverables is appropriate.		
Notes on question			
Answer	The core deliverables provided in section 9 were developed in line with the guidance document requirements i.e.: 1. Ensure they are specific to the project 2. Clear on what the supporting evidence is 3. No duplication of NIC governance document The H21 NIC is a multifaceted, complex project with a bid level programme (appendix E) containing over 60 activities and circa 100 individual line items. The H21 team have selected project deliverables that are in line with the above criteria and within the maximum ten deliverables as stipulated in the guidance document. Signing legal contracts represent critical milestones in the project delivery which are specific to the overall project. They provide clear supporting evidence and do not represent duplication of the NIC governance document. The percentage funding has been attributed to these, and all other deliverables, based on the forecast cost of the overall programme at these specific points in time. Whilst physical signing of a contract may be considered a 'low cost' activity when taken in isolation, in reality these are critical milestones within the project and will have incurred significant funding to achieve. Additionally, they represent clear measurable activities with very specific supporting evidence i.e. the signed contract. It would not be possible to split a 100% percentage allocation to 10 project deliverables without assigning costs based on projected percentage spend to that point in the programme.		
Attachments			

Project code	NGN_H21	Question Number	Q23
Question date	14th September 2017	Answer date	19th September 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Project deliverable four appears to be focussed on project inputs rather than learning from the project. Therefore the level of funding associated with this deliverable appears to be high. Please provide a justification that the proposed percentage of funding associated with this deliverable is appropriate.		
Notes on question			
Answer	The core deliverables provided in section 9 were developed in line with the guidance document requirements i.e.: 1. Ensure they are specific to the project 2. Clear on what the supporting evidence is 3. No duplication of NIC governance document The H21 NIC is a multifaceted, complex project with a bid level programme (appendix E) containing over 60 activities and circa 100 individual line items. The H21 team have selected project deliverables that are in line with the above criteria and within the maximum ten deliverables as stipulated in the guidance document. Deliverable 4 'Phase 1 completion of build works' represent a critical milestones in the project delivery specific to the overall project. It is a pivotal part of the programme against which there will be clear supporting evidence i.e. completion of the works at Buxton and delivery of 75% of network assets. This will represent a significant amount of completed work (and funding). Completion of this milestone is the essential step in provision of the critical evidence/outputs of phase 1A, Background Testing. I.e. providing quantitative evidence for changes to background leakage levels in a 100% hydrogen network. The percentage funding has been attributed to this deliverable, and all other deliverables, based on the forecast cost of the overall programme at this specific point in time.		

	It would not be possible to split a 100% percentage allocation to 10 project deliverables without assigning costs based on projected percentage spend to that point in the programme. The project deliverables have been selected based on the guidance document criteria. The percentage allocations are based on expenditure forecasts to these milestones (deliverables).
Attachments	

Project code	NGN_H21	Question Number	Q24
Question date	14th September 2017	Answer date	19th September 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Given that the key project work product or output will be the test results, please provide a justification that the proposed percentage of funding associated with deliverable ten is appropriate. N.B. Attendance and participation in the conference is a licence requirement and is covered by the standard deliverable, it does not need to be included in any of the others. Not attending or participating in the conference would be a breach of the licence arrangements.		
Notes on question			
Answer	Deliverable 10 does not have any allocated percentage of funding as per the guidance document requirements. The GB GDNs are aware and committed to the licence requirement associated with the standard deliverable. Deliverable 9 'Report and results' has been identified as a specific activity. This is not the same as the standard deliverables annual report, close down report or attendance at the annual conference (LCNI). The final report from the project will be of a similar quality to the H21 Leeds City Gate (LCG) project. The results of the H21 NIC will be released in a similar event to that delivered for the H21 LCG project whereby a formal launch event(s) dedicated to this project will be held at a major conference centre. At this event the complete report(s) will be made publicly available, there will be the first showing of the H21 NIC film, detailed presentations and panel sessions. For a project of this scale and potential impact this strategy is essential to give access to the result to the full range of stakeholders and supply chain. The H21 LGC project was launched at a similar dedicated conference event on the 11th July 2016 at the IMechE headquarters in London. Over 250 individuals from across the supply chain were in attendance. It has been extensively acknowledged as an excellent way to market and share the knowledge from high profile, high impact projects. Project Deliverable 9 has 5% of the total funding allocated. This 5% represents the remaining funding in the programme between activity 8 and 9. This 5% brings the total allocation to 100% as per the guidance document requirements.		
Attachments			

Project code	NGN_H21	Question Number	'Big Question' Q1 (Q25)
Question date	5th October 2017	Answer date	10th October 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Please justify why gas consumers should fund the creation of evidence to inform a government policy decision. Please explain why NIC funding is appropriate when the ability to realise the potential benefits is outside of the control of the project, and indeed the industry?		
Notes on question	Please see slides 2-5 of the 2nd expert panel presentation		
Answer	**Why should gas consumers fund the creation of evidence to inform a government policy decision:** The H21 NIC along with the BEIS led (and funded) £25m 'Downstream of the meter' programme are both essential to provide the detailed evidence to support a 100% hydrogen conversion of the GB gas distribution network. Collectively these two programmes represent a £40m investment, 60% of which (£25m) will be funded by UK tax payers through the BEIS programme. If this NIC is successful the remainder will be funded through UK gas customers bills, around 85% of these customers are also tax payers. Additionally, and perhaps more significantly, the benefits of a 100% hydrogen conversion of the GB gas grid will have enormous financial, environmental and lifestyle benefits for today's gas customers. A conversion to 100% hydrogen allows long term use of the gas network and will retain choice of fuel for heating (gas or electric) for all these customers into the future. It will negate a mandated move to all electric heating with the disruption to domestic customers this would involve and avoid £145bn (NPV) in costs of an all-electric option for heat (see appendix B H21 NIC bid document). A mandated conversion to all electric is recognised as the only other alternative large-scale decarbonisation option for heat (although success is by no means guaranteed) and would require fundamental changes to properties and the way customers use energy within their homes. In reality gas customers have a great deal to gain from a 100% hydrogen conversion of the gas grid. If this evidence isn't provided the only alternative solution for these customers is to stop using gas.		

Please explain why NIC funding is appropriate when the ability to realise the potential benefits is outside of the control of the project, and indeed the industry?

The NIC funding is an appropriate funding mechanism because the H21 NIC bid comprehensively meets with the NIC evaluation criteria as set out in the NIC governance document. Furthermore, it is in line with Ofgem's own aspirations as indicated in their Future Insights document ''The Decarbonisation of Heat'' which states 'We are keen to engage with government and other stakeholders and ready to work on regulatory solution s for heat supply more broadly. However, given the interactions, we consider it is not sensible for us to take forward work in this area in isolation. We will therefore contribute to liaise with BEIS and other stakeholders and seek to contribute to future work'.

The Climate Change Act is a legally binding act committing the UK to meets 80% emission reduction targets. This evidence will enable an optimised policy decision on heat and specifically will allow gas customers to influence that decision to their own benefit. A 100% hydrogen conversion presents the following opportunities so, noting the legally binding nature of the climate change act, it is possibly more appropriate to understand why the government wouldn't make such a decision.

Benefits of a 100% hydrogen GB Gas distribution network conversion:

- Ongoing use of a 'paid for' strategic UK asset.
- Retention of all the storage benefits of gas and the inherent security of supply.
- Ongoing fuel choice for customers (gas or electric).
- A guaranteed way to meet climate change obligations at the correct scale with technology available today.
- A way to help decarbonize transport and electric (alongside electric from renewables)
- A financially cheaper option to large scale decarbonisation (heat, transport and electric)
- Removal of carbon monoxide risk.
- Significant improvement in air quality, especially for worst polluting vehicles.
- Job creation
- International export potential for the UK both goods and services.

Additional questions at the 2nd expert panel session 5 October 2017

1. [redacted] asked the following question: 'with a total cost of carbon abatement at £292/tonne why would we convert the UK for such a high cost?' The cost quoted was from p266 of the H21 LCG report. The delegation did respond that alternative options are expected to be in excess of £1,000/tonne and indeed p265 of the H21 LCG report quotes options like external cavity wall insulation at as high as £2,244 /tonne. [redacted] commented that 'the H21 option isn't as cheap as a pullover' and the H21 NIC team agree. Every pathway to large scale decarbonisation will cost money. The H21 project has potential to be the lowest cost policy option to provide the level of decarbonisation required as defined in the Climate Change Act. This has an estimated benefit of £145bn (NPV basis) than all electric alternatives as detailed within the H21 NIC bid.

2. [redacted] asked a question based around why we couldn't wait for the evidence from Bio-SNG / Hydeploy looking at blending hydrogen. The H21 delegation answered that the two things are not interrelated in the context of evidence. We need to know if 100% hydrogen is possible urgently (early 20s)

	to make a credible policy decision. Also, that at some point a mandatory conversion is essential to meet the challenge of the climate change act. This is also evidenced in the CCC report (quote included in the slide pack p2) whereby the key immediate recommendation for policy (2017 to 2020) is that Government, Ofgem and industry need to recognise the (potential) case/need for a mandatory switchover of some form – particularly for hydrogen. This finding was further supported in Ofgem's Future Insights series which states in the conclusions 'In general, we support the conclusion from the recent CCC report that the near-term steps should focus on active experimentation, not on a wait and see approach.' Both statements are in stark contrast to the question from the expert panel. 3. [redacted] asked if NIA had been considered for this project, we referred to the answer previously submitted (Q9) of the Q&A responses to date saying NIA was not appropriate for this scale of project.
Attachments	Please see slides 2-5 of the 2nd expert panel presentation

Project code	NGN_H21	Question Number	'Big Question' Q2 (Q26)
Question date	5th October 2017	Answer date	10th October 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Please outline how you have engaged with the HSE. What evidence do you have that this project will create the evidence required by HSE to create a safety case confirming the GB gas distribution networks are suitable to transport 100% hydrogen?		
Notes on question	Please see slides 5-7 of the 2nd expert panel presentation		
Answer	The UK Gas Industry have a regular liaison with the Health and Safety Executive (HSE) via the Gas Transporters Safety Operations Group. This is chaired by the HSE and is the highest-level consultation the Gas Transporters have with them. Hydrogen, including the 100% hydrogen ambition presented as part of the H21 report, has been discussed with the HSE including the requirement to fill the safety evidence gap. It is important to note that the duty holders for the safety case are the individual GDNs (and specifically the asset directors) and it is the networks obligation to define and deliver the evidence for any changes to the safety case. This will then be notified and agreed with the HSE based on evidence and the HSE are there to provide challenge and review. In addition the gas distribution networks are aware that BEIS also chair a regular hydrogen group which includes representation from the HSE. The HSE are fully aware of the £25m 'Downstream of the meter' BEIS programme and this £15m H21 NIC. Finally, In addition to the above, the engagement of the Health and Safety Laboratories (HSL) as a primary partner within the H21 NIC ensures a unique and intrinsic link to the HSE. The HSL functions as the Science Division of the HSE, undertaking research, helping shape regulations and guidance, and investigating incidents. Throughout the H21 NIC project the HSE will be kept fully informed of developments to ensure consensus of the results by all stakeholders at the end of the project.		

	The H21 NIC has been developed across all gas GDNs, utilising an extensive range of project partners including DNV-GL and the HSL. All Partners believe this project, when delivered in full, will deliver the evidence required to solve the project statement. All partners and wider stakeholders also agree that the field trials represent the definitive evidence on which to base such a consensus of agreement.
Attachments	Please see slides 5-7 of the 2nd expert panel presentation

Project code	NGN_H21	Question Number	'Big Question' Q3 (Q27)
Question date	5th October 2017	Answer date	10th October 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Please justify the timing of this project, including why this evidence is required before any government policy decision. Your answer should consider the timings and risks of other areas on the critical path such as testing hydrogen downstream of the meter, the government policy decision on decarbonisation of heat, and a government policy decision on the feasibility and economics of large scale and widespread CCS. For CCS, please set out the level of investment required and what has been done to commit to taking this to the same stage of enabling a government policy decision as hydrogen.		
Notes on question	Please see slides 8 (part A), slide 9-10 (part B) of the 2nd expert panel presentation.		
Answer	**PART A: Please justify the timing of this project, including why this evidence is required before any government policy decision. Consider timings and risks of other areas on the critical path such as testing hydrogen downstream of the meter, the government policy decision on decarbonisation of heat** Within the last year there has been a public recognition by government that it needs to readdress heat policy. This was first publicly discussed in Baroness Neville Rolfe's (the then Department for Business, Energy & Industrial Strategy (BEIS) Minister of State for Energy and Intellectual property) address at the Policy Exchange "The Heat Summit: How we can decarbonise heating" on 14 December 2016. At this summit, the Baroness's keynote speech acknowledged that 'As a first step we need to thoroughly re-assess the evidence, and support practical projects to test different approaches' and 'Our ambition is to be able to agree in the next few years, together, on the right long-term direction for heat policy'. Furthermore, it was acknowledged in the speech 'As we know there are a wide variety of technologies which can deliver low carbon heat – ranging from the electric heat pumps and district heating networks I have already mentioned, to perhaps a more radical possibility; replacing natural gas with hydrogen in the gas grid'. Both Ofgem and the Committee on Climate Change (CCC) have recognised the potential for a 100% hydrogen gas grid conversion. The CCCs 'Next Steps for Heat' report has a key immediate recommendation for policy (2017 to 2020) which is "Government, Ofgem and industry need to recognise the (potential) case/need for a mandatory switchover of some form – particularly for hydrogen". This finding was		

	further supported in Ofgem's Future Insights series which states in the conclusions "In general, we support the conclusion from the recent CCC report that the near-term steps should focus on active experimentation, not on a wait and see approach". An additional conclusion in Ofgem's document is "We are keen to engage with government and other stakeholders and ready to work on regulatory solutions for heat supply more broadly. However, given the interactions, we consider it is not sensible for us to take forward work in this area in isolation. We will therefore continue to liaise with BEIS and other stakeholders and seek to contribute to future work". The Gas Distribution Networks (GDNs) of Great Britain believe this H21 NIC proposal coupled with the BEIS £25m hydrogen programme 'Downstream of the meter' meets with this ambition. Other important documents have been published since the H21 LCG report release, and all have three similar principle themes. Firstly, that 100% hydrogen conversion should be considered a serious option for decarbonisation. Secondly, that a deliverable policy decision on decarbonising heat must be made in the early 2020s if the UK is to meet its Climate Change Act obligations. Finally, that there is an urgent need to provide the evidence to confirm the viability of a 100% hydrogen conversion option. Examples of these reports include: • Hydrogen Roadmap – Innovate UK. • Role of Hydrogen in the UK Energy System – Energy Research Partnership. • Managing Heat System Decarbonisation – Imperial College. • How to Decarbonise Domestic Heating – Policy Exchange. • Scenarios for Deployment – E4Tech/UCL/Kiwa. • 2050 Energy Scenarios – KPMG. • Next Steps for Heat – Committee on Climate Change. • Lowest cost decarbonisation for the UK: the critical role of CCS – The Parliamentary Advisory Group on Carbon Capture and Storage. • Carbon Connect: Next Steps for the Gas Grid (Future Gas Series: Part 1) The need to address heat policy with a credible, large scale and deliverable policy is universally agreed as urgent. To make such a policy the government needs the critical evidence, specifically for a 100% hydrogen gas distribution network conversion. This evidence includes both downstream of the meter (the BEIS £25m programme) and upstream of the meter, i.e. this H21 NIC bid. These programmes need to be completed, in their entirety, by 2020 to allow progression to a live trial involving customers/the network operating on 100% hydrogen by the early 2020s. Due to the pressing timescales to make a credible policy decisions on heat (and electric and transport decarbonisation) it is not practical, or appropriate, to adopt a 'wait and see approach' which is emphasised in Ofgem's Future insights document. Both programmes are on the critical path, waiting for the downstream of the meter programme to complete before progressing with this programme will add 3 to 4 years delay to progression to live trials. Such a strategy would add significant delays to policy decision and would put significant risk onto the UKs ability to meet its climate change obligations. There is also already evidence that both the downstream and upstream of the meter programme will deliver favourable results and should be progressed in parallel.

It is critical for gas customers that the government has all the evidence to ensure optimised decisions for heat policy. Failure to provide the evidence from the H21 NIC bid could result in sub optimised policy and/or customers being 'forced' off gas onto more expensive alternatives requiring significant disruptions in their homes and removing choice of fuel (gas or electric) for the market in the long run.

Furthermore, obtaining the evidence to confirm the credibility of a 100% hydrogen conversion in the gas network is also essential to develop no regrets GD2 business plans. Understanding what upfront work may need to be done to facilitate the conversion is essential to ensure delays are not embedded into a future conversion policy. Failure to develop no/low regrets options in GD2 business plans will potentially add five to ten years of delay to the ability to convert the networks. This is because much of the work is relatively low cost, for example inserting zonal isolations values, but takes a significant amount of time. Additionally, if certain equipment is found to be non-compatible new 'hydrogen ready' equipment can be purchased and incremental programmes to modify any areas of concern can be developed. This H21 NIC bid is the predominant evidence on the critical path to both the heat policy and enabling the timely subsequent conversion of the GB gas distribution networks.

Finally, providing the evidence that the network is fit for purpose for a 100% hydrogen conversion is essential to heat policy and live trials but also provides clarity on the long-term future of the UK gas grid irrespective of end used customers in the long run. Knowing the gas grid can be converted can decarbonise heat (maintaining all the inherent benefits of gas and the gas network), and help decarbonise transport and electric by having bulk availability of a clean fuel (hydrogen) at point of use across the UK gas grid.

Additional questions/comments at the 2nd expert panel session 5 October 2017

Following presentation of slide 8 at the expert panel session, there seemed to be confusion within the expert panel as to why BEIS would have launched the downstream of the meter programme and expected gas customers to fund the H21 NIC.

The H21 delegation advised that Ofgem and BEIS have an existing relationship and it is not within our gift to answer questions as to why BEIS were not funding all the work. The delegation did make the following observations, although it was difficult to discuss due to a level of frustration from the expert panel. They are included below for clarity.

- The opportunity to convert the UK gas grid to 100% hydrogen is very new thinking and was only considered credible following the launch of the H21 Leeds City Gate report in July 2016. It is testament to the credibility of the idea that BEIS have shown such quick support and leadership by developing the £25m 'Downstream of the meter' programme.
- The downstream of the meter market is fragmented without any natural leadership or access to funding. It is an area which would not qualify for NIC funding and is not suitable for the GDNs to address.
- Irrespective of the BEIS programme this H21 NIC bid would have been progressed. It meets all the criteria and presents gas customers with the potential to release enormous long-term benefits.
- This H21 NIC bid is the right thing to do and not only supports gas customers but allows Ofgem to meet its own stated aspirations (see quotes above) and shows the UK as a forward thinking, world leader in decarbonisation strategy. In this sense the H21 NIC would seem to fully support Ofgem's aspiration to

	provide greater clarity on one of the future decarbonisation pathways for the UK. **PART B Please justify the timing of this project, including why this evidence is required before any government policy decision. the government policy decision on the feasibility and economics of large scale and widespread CCS. For CCS, please set out the level of investment required and what has been done to commit to taking this to the same stage of enabling a government policy decision as hydrogen.** Over the last three years whilst developing the H21 project the gas industry has developed a strong relationship with Statoil. Statoil are one of the world's leaders in CCS with over 20 years' experience. To show the level of commitment and belief Statoil have in the H21 project they flew in Rune Thorsen, their Principal Geophysicist, to the UK to attend the expert panel session and support in answering this question. The attached letter provides high levels of confidence into the viability of CCS deployment within the UK. It also confirms Statoil's view that a hydrogen conversion policy could remove the requirement for a CCS policy by allowing CCS to be managed as a competitive tender as part of the Hydrogen conversion policy decision. **Additional questions/comments at the 2nd expert panel session 5 October 2017** [redacted] asked Statoil several questions about their independent project converting one of Hollands power stations to hydrogen. Our delegation as to the relevance of this line of questioning to the H21 NIC bid. Statoil came to the UK to support the H21 bid and were surprised to be questioned about their own independent project work. After the questions the expert panel commented that 'this would be a good way to demonstrate 100% hydrogen in the UK and how to capture carbon from electrolysers'. The H21 delegation were concerned at this statement which shows the potential for a fundamental lack of understanding of the H21 bid. Firstly, proving upstream production of hydrogen is not critical evidence, this is demonstrated around the world today. Secondly, carbon is not captured from electrolysers and it raises concerns that members of the expert panel may not have read the bid in sufficient detail or considered all the referenced background material. We have made several offers to present the entire H21 Leeds City Gate report to Ofgem and the expert panel (we would need around 1.5/2 hours) but these have been rejected on the basis of falling outside the NIC governance procedures; this offer is still available. It would be disappointing if Ofgem did not progress with this H21 NIC bid based on a misunderstanding of the some of the key technical aspects of the project, the urgency, requirement for the work and potential benefits.
Attachments	 Statoil CCS letter.pdf • Statoil CCS Letter • Please see slides 8 (part A), slide 9-10 (part B) of the 2nd expert panel presentation.

Project code	NGN_H21	Question Number	'Big Question' Q4 (Q28)
Question date	5th October 2017	Answer date	10th October 2017
Submission section question relates to	N/A		
Topic	g) Robust methodology/ready to implement		
Question	Please provide more information regarding the Phase 2 field trials. Please provide more detail of the tests that will be carried out and the benefits of this phase.		
Notes on question	Please see slides 11 - 12 of the 2nd expert panel presentation.		
Answer	The H21 NIC project will undertake an experimental testing programme which will provide the necessary data to quantify the comparative risk between a 100% hydrogen network and the natural gas network. This is required for the UK to make a policy decision on decarbonisation of heat in the early 2020s and to allow live trials to progress in 2020/21 when combined with the results of the BEIS programme. All stakeholders (including the HSL, DNV GL, GDN Asset Directors and Local Authorities) agree failure to undertake the field trials will not provide the evidence required to justify the live trials or gain consensus that a 100% hydrogen gas grid conversion would be possible. It would also add significant delays to the live trial and subsequent policy decision requirement. Although the H21 NIC project has been written in 2 phases i.e. controlled testing (Phase 1A and 1B) and field trials (Phase 2) it is important to note that the field trials will provide the critical pieces of evidence. The phases were developed to help the non-gas industry audience understand the project as per the requirements of the NIC governance document. However, it should be considered that phase one is an essential part of the design / enabling work for Phase two, the field trials. **The project is fundamentally about delivering the field trials**. In order to undertake the field trials the gas industry must develop a safety management system (SMS). This SMS will be 'owned' by the asset directors as the duty holders for the safety case and will be justified via the results of the controlled testing. There is already agreement across experts that it is unlikely that the results in the controlled testing environment (Phase 1) will prevent the field trail occurring. The controlled testing is necessary and essential to justify the SMS and enable the field trials which will solve the problem and allow progression to a live trial. As with all controlled testing, definitive assessment can only be corroborated with in-situ testing. All H21 NIC Partners agree that in-situ testing is essential to solve the		

problem statement and provide the final evidence requirement. The field trials will confirm the results of the controlled testing undertaken in Phases 1A and 1B, i.e. that the results obtained and modelled in controlled conditions could be used to accurately predict and certify field conditions.

The field trial area will be identified and developed in conjunction with the West Yorkshire Combined Authorities, as explained in slide 11 of the second expert panel session. This will identify a suitable site where by the maximum number of assets can be subjected to 100% hydrogen with a master testing plan designed specifically to ensure acceptance of the SMS which will be developed to progress to a subsequent live trial.

Alongside identification and design of the field trial site a detailed master testing plan will be developed throughout 2018 by the GB GDNs in conjunction with the HSL and DNV GL. The testing plan will be developed to provide the most economic range of tests on the given site to justify a subsequent deviation to the safety case to progress to a live trial. The types of test will include:

- Soundness tests on the mains/services on natural gas
- Additional asset configurations if required and different surface coverings.
- Predictive analysis (based on the evidence of the controlled testing (phase 1) for hydrogen concentration across the site when 'filled' with 100% hydrogen.
- Confirmation of predictive analysis across the full range of assets (services, connections, valves, joints etc.). This will include ground and air concentration and leakage predictions.
- Demonstration of pressure management using a temporary district governor.
- Demonstration of typical gas network site operations e.g. operational repairs, flow stop, connections.
- Flow tests to demonstrate the accuracy of the gas industry's hydrogen system modelling.
- Levels of odour detection across the site.
- Accuracy of extrapolation from controlled testing data, i.e. that the results obtained in the controlled environment (Phases 1A and 1B) can be used to accurately extrapolate across the range of network assets in a real-world setting.

The project will have strict governance in place through the Steering Committee and Project Board meetings. It is considered unlikely that the project will find 'showstoppers' to a 100% hydrogen conversion or field trials progression. However, as per the NIC governance document and identified in section 6.5 of the NIC bid, if such evidence is identified the steering committee (in conjunction with Ofgem) have the ability to stop the project and return the funding.

This H21 NIC should be considered as a single well developed and essential project. It is important from a delivery, cost and timeliness point of view that all the project is awarded and delivered. Failure to do this will have several significant consequences:

- Add cost to the field trials as the length of the project will extend and economies of scale within the project team will be removed.
- Add delay to providing the evidence to justify a change to the safety case in order to progress to live trials.
- Delay the ability to make a credible policy decision on heat with all the evidence.

	• Delay the UKs ability to understand if the gas network can be re-purposed to 100% hydrogen (for decarbonised heat, transport and electric benefit). • Potentially lose the UKs current position as world leading in this area. At the expert panel session 5 October 2017 Tom Knowland, Head of Sustainable Energy and Climate Change for Leeds City Council, commented that 'As the democratically elected representatives for the people of West Yorkshire we have been incredibly supportive of the H21 NIC bid and have worked closely with the H21 team jointly sharing offices for the last six months. We see the field trials as the only credible piece of evidence to justify a live trial. We consider the field trials as essential to allow the local Authorities to accept the results and recommend moving forward'. **Additional questions/comments at the 2nd expert panel session 5 October 2017** The expert panel seemed not to value the views and expertise of the industry experts, HSL, GDNs and local/wider stakeholders. There didn't seem any recognition of the three years of cross-industry collaboration and extensive stakeholder engagement (including working closely with local and national government) to arrive at this detailed H21 NIC. The expert panel suggested that we could obtain the outputs by just undertaking phase one of the project. We explained the importance of the field trials to firstly, gain consensus in the results across all stakeholders. Secondly, from a critical timing perspective to develop the safety based evidence for a deviation to safety case to justify live trials. Finally, to economically undertake the work. Additionally, the two asset directors from the GDNs who were part of the H21 delegation stated the 'field trial evidence was essential to them both to accept the safety case deviation for live trials'. We did not feel that the expert panel understood these arguments. For clarity, to further emphasise the written response to 'Big Question 2', It is important to note that the duty holders for the safety case are the individual GDNs (and specifically the asset directors) and it is the networks obligation to defined and deliver the evidence for any changes to the safety case. This will then be notified and agreed with the HSE based on evidence and the HSE are there to provide challenge and review. This is a critical stage gate required to progress to live trials, the asset directors and/or the HSE would not approve a change to safety case without field trial evidence. The expert panel also suggested that the HSL could certify hydrogen ready equipment which the GDNs could start to buy as part of ongoing network investments. The key part to unlocking the potential for a 100% hydrogen gas grid conversion was to prove that the existing extensive gas distribution network could be converted not to replace the network with new hydrogen certified equipment which doesn't currently exist.
Attachments	Please see slides 11 - 12 of the 2nd expert panel presentation.

Project code	NGN_H21	Question Number	Q29
Question date	10th October 2017	Answer date	12th October 2017
Submission section question relates to	N/A		
Topic	Multiple		
Question	Please explain why this project could not be funded through NIA. If there are no reasons why this project could not be funded through NIA please highlight any possible limitations of using NIA rather than NIC.		
Notes on question			
Answer	The Network Innovation Allowance is to fund smaller technical, commercial, or operational projects directly related to the licensee's network that have the potential to deliver financial benefits to the licensee and its customers; and/or to fund the preparation of submissions to the Network Innovation Competition (NIC) which meet the criteria set out in the NIC Governance Document. The Gas NIC is an annual opportunity for Gas network companies to compete for funding for the development and demonstration of new technologies, operating and commercial arrangements. Funding will be provided for the best innovation projects which help all network operators understand what they need to do to provide environmental benefits, cost reductions and security of supply as Great Britain (GB) moves to a low carbon economy. Up to £20 million per annum is available through the Gas NIC. The H21 NIC project is a £15m collaborative Network Innovation Competition bid including all the GB GDNs, the first ever, which will provide the critical evidence for a 100% hydrogen gas grid conversion through development and demonstration of 100% hydrogen in GB Gas distribution network assets. £15m is significantly higher value than what would be considered via the NIA and the bid has been developed via the H21 Leeds City Gate NIA project. At the end of the H21 NIC the UK will be able to undertaken a complete end to end sustaining live 100% hydrogen trial (TRL9). A location for this will be identified in the BEIS £25m 'Downstream of the meter' programme.		

	Value for money for UK gas customers is essential when considering 'future looking' projects. With a project of this scale, which will have a global impact, this will be assured by the independent, external governance procedure, i.e. the Network Innovation Competition bid process. This ensures full visibility to OFGEM, BEIS and all external parties via a robust and transparent process. This project meets all the NIC criteria and is of significant value and importance to the UK / global gas industry and its customers. The timescales mean it needs to be delivered within a three-year window with most of the expenditure in the first two years. This project would not be considered appropriate under NIA which is for much smaller projects. Progression via the NIA route would effectively remove the majority of smaller pre-developed projects from the NIA supply chain to the detriment of gas customers. The GB GDNs would not fund a project of this scale under NIA and it is correct that this is progressed under the NIC provision in conjunction with the regulator. The H21 NIC project meets all the NIC evaluation criteria, is of the correct scale and is at the correct TRL level. It has also been developed through the existing H21 Leeds City Gate NIA project. There are already several more 'H21' and other small hydrogen based small NIA projects underway (see p37 NIC bid). NIC funding is the appropriate mechanism for this project.
Attachments	