Question No.	Proforma section	Criteria	Question	Date question asked	Date response required	Date received	Follow up to Question #	Confidential (y/n)
1	3.4	(a.iii)	Could more detail be provided on the basis of the financial and carbon benefits? In particular, the financial and carbon benefits are largely measured in terms of avoided proponation. However, it is unclear whether or not the carbon impacts of lower CV gas going through the system have been taken into to account. Are the figures net of the cost of obtaining the CV from non-propane sources?	23 August 2016	25 August 2016	02 September 2016		
2	Appendix 1	(a.iii)	Can it be clarified how the figures in A1.1 and A1.2 are reconciled. For example if the project costs £5m and has a benefit NPV of £0.8m in no progression to 2020 it is difficult to see how a benefit to cost ratio of 2 emerges.	23 August 2016	25 August 2016	02 September 2016		
3	P5,26	(d.ii)	If the billing methodology is operated by industry, why couldn't it change incrementally driven by industry over a number of years? What are the barriers preventing fundamental reform if it occurred over a number of years?	25 August 2016	31 August 2016	02 September 2016		
4	P15, Appendix 1	(a.iii)	You note potential interactions with RIIO-GD2. (i) Given the project ends in 2020, how might this project be able to impact your business plans for GD2 which would be developed over 2018 and early 2019. (ii) What specific areas of your business plan could it impact – shrinkage incentive, totex through costs of sensors….? (iii) The sensor costs are a substantive cost of the Project presumably, if rolled out, they would represent a cost line in future business plans. Have the costs of rollout been included in the financial analysis in Appendix 1 or this just showing the benefits of removing propane?	25 August 2016	31 August 2016	02 September 2016		
5	Appendix 1	(a.iii)	Could there be any material reduction in consumer benefits from receiving lower quality, but GSMR compliant, gas? Has this been factored in the benefits table?	25 August 2016	31 August 2016	02 September 2016		
6	P23	(a.iii)& b(i)	(i) Please can you provide further information on how the removal of propane costs would feed into a reduction in the form of 'lower shrinkage and transportation charges' under the price control? A high level diagram or flow chart would be helpful to understand the transmission of any lower costs into bills. (ii) What is the expected proportion of the potential benefits that will accrue to the gas network as opposed to other parts of the energy supply chain?	25 August 2016	31 August 2016	02 September 2016		
7	General	d	(i) Is similar sensor equipment being installed, or investigated, as part of SGN's Realtime network project? (ii) There are parts of the Realtime networks project that are also looking at the FWACV, has this been considered? (iii) Is a letter of support available from SGN?	25 August 2016	31 August 2016	02 September 2016		
8	Appendix 1	a	Why are the benefits from shale gas set out in table A1.1 higher than the benefits from bio-methane?	25 August 2016	31 August 2016	02 September 2016		
9	General	a	The Full Submission Guidance states 'Enough information should be included in this [NPV] summary so that it can be used in conjunction with the data in the Full Submission Spreadsheet to enable the Panel to independently calculate the Net Present Value of each Method.' Please direct us to where you have provided this information in your submission.	25 August 2016	31 August 2016	02 September 2016		
10	2.2	g	(i) Do you expect this project to be changing the Regulations specifically for the 'Pragmatic' and 'Ideal ' scenario or the charging model sitting under the Regulation? Does this change for the 'Ideal' scenario? (ii) Can you provide a bit more information on which specific areas of the regulation pose a barrier to change for each of the scenarios? (iii) if the project is successful, what might the next steps and potential timings for implementation look like?	09 September 2016	15 September 2016			

11	General	b	Work Pack 2: (i) Please provide more detail on why Work Pack 2 is required for this project? What is the value of doing this work over and above the use of current models or of using the results of the CV mixing modelling from Real Time Networks project. (ii) Work Pack 2 makes up the largest cost for this project. The number of estimated FTE days is 3225 at an average day rate of £744. Please can you provide more details on what is making up the 3225 days of work and justify the cost of the average daily rate?	09 September 2016	15 September 2016	15-Sep		
12	General	d	Can you provide more context to justify the difference between this project and Real Time Networks (RTN). This should include: (i) Why the RTN project doesn't support/provide validation for the work this project is trying to achieve? (ii) Why can this work not wait until there are outputs from the RTN project which can be used?	09 September 2016	15 September 2016	15-Sep		
13	2.2	g	Please provide more information to support the use of the Chittering and Hibaldstow networks for the field trials. Will these two examplars provide enough data to support a generic approach. Will there be enough data points to cover the large area of the Hibaldstow network? As part of the answer a map would be useful.	09 September 2016	15 September 2016	15-Sep		
14	3.4	a	Please can you confirm how much consumer money is forecast to be saved if we get rid of the need for propanation? Please can you make clear the assumptions you are using?	09 September 2016	15 September 2016	15-Sep		
15	General	g	Why has there not been more engagement/partnering with key stakeholders such as Xoserve and Shippers?	09 September 2016	15 September 2016	15-Sep		
16	General	g	Please can you provide more commentary on the intended stakeholder engagement?	09 September 2016	15 September 2016	15-Sep		
17	Appendix A	a	(i) Please can you put the updated financial figures and benefits into a new version of the Ofgem template? (ii) There appears to be a small mismatch in the NIC funding request level in the spreadsheet vs. your proforma. Please can you check?	20 September 2016	22 September 2016	22-Sep	1	
18	General	g	The project is clear that it will look any subsequent legislation changes that may be required to move away from FWACV. Will it go as far as looking at potential licence changes? Do you have an initial view on which licensees and, specific licence conditions, might be impacted?	20 September 2016	22 September 2016	22-Sep		
19	3.4	a	If the RHI were removed, do you have any evidence that the costs of propane would represent a marked barrier to low carbon gases being put on the network?	20 September 2016	22 September 2016	22-Sep		
20	General		How would each of the three scenarios under investigation cope with temporal variations in gas quality? For example, suppose a consumer is located close to a low-CV injection point and is billed accordingly. What happens if the low-CV injection point switches off or gets turned down? Can this happen or are there contractual arrangements with entry points which avoid intermittency?	20 September 2016	22 September 2016	22-Sep		
21	General	g	(i) What technology readiness level (TRL) do you consider the project to be at now and where do you think it will by the end of the project. (ii) If the project is successful, which I assume in the short term, means either the pragmatic or composite options being taken forward, do you envisage any other barriers (in particular none-BAU ones) that would prevent it being implemented?	20 September 2016	22 September 2016	22-Sep		
22	General	g & b	(i) What evidence is needed to drive change on CV attribution in billing methodology? (ii) Could changes happen without this specific project and, if so, what would they look like? (iii) For example, could an estimated attribution of CVs based on existing network models be sufficiently accurate compared to the present tolerances permitted?	26 September 2016	30 September 2016	30-Sep (Verbally), 04-Oct (Written)		
23	General	d & b	(i) Could the Real Time Networks (RTN) project provide the evidence to change the CV attribution in billing methodology that Future Billing Methodology is aiming to provide? (ii) Is validation of the existing model required for it to be able to evidence the need for change to the billing methodology? Would it be helpful to start with an existing network model and predict the results that can be compared against the outcome of the trials?	26 September 2016	30 September 2016	30-Sep (Verbally), 04-Oct (Written)		

24	General	a & b	In Q&A 12, you have indicated that the reason for not waiting until there are outputs from the Real Time Networks (RTN) project is time. It has been suggested that RTN will be unlikely to deliver the right outputs for 5 years, which will stall the adoption of extra low CV gas in the networks. Please can you provide, and justify, the costs and benefits to consumers of not waiting for RTN.	26 September 2016	30 September 2016	30-Sep (Verbally), 04-Oct (Written)	12	
25	2	g	(i) What are the rough implementation costs of each of the scenarios described in the FBM project? (ii) What are the barriers to implementation of each of these scenarios	26 September 2016	30 September 2016	30-Sep (Verbally), 04-Oct (Written)		
26	General	g	If a new billing methodology is implemented suppliers will face costs to upgrade their billing systems. Has the industry engagement plan included suppliers? What are their current views?	26 September 2016	30 September 2016	30-Sep (Verbally), 04-Oct (Written)		
27	7	b	In the 2nd Bilateral you said that the cost of the oxygen sensors is approximately £60,000 for each site. (i) On page 44 of the submission, it says the sensors will be installed at 40 existing governor stations and 15 new kiosks. Therefore there are 55 sensors in total. By our estimation this means that £3.3 million of the cost of WP2 will be spent on the oxygen sensors. Is this understanding correct? If not please can we have a detailed cost breakdown of WP2. (ii) As the 55 oxygen sensors are rolled out for the trial will there be an associated decrease in the cost of installation? How have the costs been accounted for – did you assume a fixed costs per site installation or have you assumed a decreasing cost per site? (iii) Can you compare the cost of oxygen sensors to the use of radionuclides as sensors of the low CV gas?	04 October 2016	06 October 2016	06-Oct		
28	P25-26	b	You have said the DNV GL rates are commercial rates. Have these rates been market tested since this seems high in relation to a long-term contract rate? Is there scope to improve on them?	04 October 2016	06 October 2016	06-Oct		
29	General	c & g	How well can the modelling, validated by FBM, be rolled out to other GDNs based on a sample of 2 validation sites? What level of confidence can we have in the model being accurate in other networks where their model has not been validated? How confident can we be in using the validated model in the face of future network change?	04 October 2016	06 October 2016	06-Oct		
30	General	g	Would the FBM validation of the existing network models, remain robust for the potential rollout of new Real-time network models? For example, do you have confidence that the FBM learning to validate old network models, remains relevant to a GDN with a working Realtime Network model?	04 October 2016	06 October 2016	06-Oct		
31	General	N/A	Please can you give a high level estimate of how much involvement you foresee Ofgem to have in the stakeholder engagement for work packs 1 and 4? E.g. Can you provide an estimate of the number of workshops you might expect Ofgem to attend?	06 October 2016	07 October 2016	07-Oct		

Gas Network Innovation Competition Full Submission

Supplementary Answer Form

Project: Future Billing Methodology

Tick if this answer has been provided verbally: ☐

Project code	**NGGDGN04/1**	**Question Number**	**1**
Question date	**23 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**3.4**		
Topic	**Financial and Carbon Benefits**		
Question	**Could more detail be provided on the basis of the financial and carbon benefits? In particular, the financial and carbon benefits are largely measured in terms of avoided proponation. However, it is unclear whether or not the carbon impacts of lower CV gas going through the system have been taken into to account. Are the figures net of the cost of obtaining the CV from non-propane sources?**		
Notes on question			
Answer	Both the cumulative NPV financial benefits and cumulative carbon benefits have been recalculated following the 8th August submission. The NPV calculation has been corrected to reflect the discount factors specified by Ofgem in the NIC submission guidance. In addition, the financial benefits have been re-based on the difference between the assumed cost (p/kWh) of propane and the average wholesale cost of natural gas in 2015-16. The above approach to assessing the financial benefits now aligns with the approach used for calculating the carbon benefits, which is based on the substitution of an assumed proportion of propane which would otherwise be added to forecast bio-methane and shale gas volumes, with natural gas (methane). Shale gas is assumed to have similar CV to bio-methane and therefore require the same proportion of propane. The projections are a simple approximation only and cannot take account of		

	the following: • Implementation costs – as the Project itself will investigate and generate a high-level view of potential implementation costs for the industry • Consequential savings (e.g. logistics and equipment) as a result of removal of propanation • Implementation timescales – benefits are assumed to accrue from 2017, whereas in reality, the implementation of the required changes to systems and processes could take a number of years and may be phased In addition, the calculations assume that the same total energy will be delivered to consumers and any attempt to calculate marginal carbon savings from using lower CV gas could be less robust.
Attachments	Revised calculation of cumulative NPV financial benefits to 2050  Revised FBM NIC NPV from FES v3.xlsx Revised calculation of cumulative carbon benefits to 2050  NIC FBM Carbon Benefits using FES wi

Project code	**NGGDGN04/1**	**Question Number**	**2**
Question date	**23 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**Appendix 1**		
Topic	**NPV Financial Benefits – Benefit to Cost Ratio**		
Question	**Can it be clarified how the figures in A1.1 and A1.2 are reconciled. For example if the project costs £5m and has a benefit NPV of £0.8m in no progression to 2020 it is difficult to see how a benefit to cost ratio of 2 emerges.**		
Notes on question			
Answer	Please note answer to Q1. Revised cumulative NPV financial benefit now corrected, with benefit to cost ratios as shown below.		

BENEFIT COST RATIO

			2020	2030	2040	2050
GONE GREEN	Total	£m	2.0	19.0	45.0	63.9
SLOW PROGRESSION	Total	£m	1.3	9.9	23.8	34.6
NO PROGRESSION	Total	£m	0.7	53.0	134.6	193.3
CONSUMER POWER	Total	£m	1.3	117.3	308.8	451.8

Ratios above now correspond to revised calculation of NPV benefits in Excel file attached to answer to Q1

Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**3**
Question date	**25 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**NIC submission document, pages 5 and 26**		
Topic			
Question	**(i) If the billing methodology is operated by industry, why couldn't it change incrementally driven by industry over a number of years?** **(ii) What are the barriers preventing fundamental reform if it occurred over a number of years?**		
Notes on question			
Answer	(i) This Project recognises the potential scale of the changes to systems and processes that could be required to move to a more specific means of CV attribution and seeks to deliver an incremental and targeted solution that could potentially be delivered over a number of years. It therefore proposes to look at the incremental possibilities for alternative CV attribution, ranging from: • **Short-term –** Lower-cost, quick implementation solution to address specific zones of influence around embedded LDZ entry points via the ***Pragmatic*** option, through the • **Medium-term – *Composite*** option where the LDZ would be broken down into smaller Charging Areas for CV attribution, to the • **Longer-term** – ***Ideal*** option, under which CV would be directly attributed to smart meters and provide the necessary data hierarchy to support ultimate CV measurement at the customer's meter itself. (ii) Although a significant barrier to a phased implementation approach could arise where the complexity of change, together with costs, upheaval and hence risk at each stage of evolution totaled far in excess of a one-hit solution, it is not realistic to expect that the industry could move to CV attribution at the smart-meter in one stage, so an incremental approach is required. This Project will build on the previous work and propose the introduction of new methodologies for CV allocation, demonstrate how this might be delivered and allow the industry to make an informed decision on the reforms knowing the likely costs and benefits of differing approaches		

	and how these might affect different parts of the stakeholder community.
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**4**
Question date	**23 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**P15, Appendix 1**		
Topic	**Potential interactions with RIIO GD2**		
Question	**You note potential interactions with RIIO-GD2.** **(i) Given the project ends in 2020, how might this project be able to impact your business plans for GD2 which would be developed over 2018 and early 2019.** **(ii) What specific areas of your business plan could it impact – shrinkage incentive, totex through costs of sensors….?** **(iii) The sensor costs are a substantive cost of the Project presumably, if rolled out, they would represent a cost line in future business plans. Have the costs of rollout been included in the financial analysis in Appendix 1 or this just showing the benefits of removing propane?**		
Notes on question			
Answer	(i) NGGD believes this Project is an essential proof of concept exercise which will develop potential methodologies for attributing gas energy (CV) to gas flows in the LDZ at a more specific level. It does not include the costs of implementing these methodologies, as the required changes to systems and processes will be identified as part of the Project itself. A key output from the project will be high-level indicative implementation costs for the options explored. We would envisage potential totex adjustments relating to implementation within a RIIO GD2 uncertainty mechanism. (ii) We would expect that there may be some requirement to invest in additional "within-network" measurement apparatus, although a key aim of this project is to optimise this requirement. A clearer understanding of this requirement will emerge as the Project progresses. With regard to shrinkage, the more specific attribution of CV within the LDZ should, in principle, minimise levels of CV shrinkage in the NTS, but any potential implications for the shrinkage mechanism itself should be identified as the Project progresses. (iii) The costs of implementation, including sensor rollout, have not		

	been factored into the Project NPV calculation, as these are to be identified as part of the Project itself. For this reason we have restricted our arssessment of potential benefits arising from the Project to the removal of propane alone.
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**5**
Question date	**25 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**Appendix 1**		
Topic	**Impact of lower CV gas on customers**		
Question	**Could there be any material reduction in consumer benefits from receiving lower quality, but GSMR compliant, gas? Has this been factored in the benefits table?**		
Notes on question			
Answer	We would not expect there to be any reduction in customer benefits from receiving lower quality, but GSMR compliant gas. The use of lower CV gas for a given energy requirement would result in a greater metered volume being consumed than for higher-CV gas. However, the more specific attribution of CV within the zone of influence of the lower-CV gas should ensure that the customer is charged more in line with the gas energy delivered and hence suffer no material financial disbenefit. The fact that the lower-CV gas remains GS(M)R compliant means that there should be no other negative impacts, e.g. in terms of combustion; appliance efficiency, etc.		
Attachments			

Project code	**NGGDGN04/1**	**Question Number**	**6**
Question date	**25 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**NIC Submission P23**		
Topic	**Impact on shrinkage and transportation charges**		
Question	**(i) Please can you provide further information on how the removal of propane costs would feed into a reduction in the form of 'lower shrinkage and transportation charges' under the price control?** **A high level diagram or flow chart would be helpful to understand the transmission of any lower costs into bills.** **(ii) What is the expected proportion of the potential benefits that will accrue to the gas network as opposed to other parts of the energy supply chain?**		
Notes on question			
Answer	(i) Case Study 1 assesses the costs of propane addition – made under the present LDZ FWA CV mechanism in order to avoid the CV cap being invoked – against the potential costs of CV shrinkage that would arise if propane addition were to be ceased *without* changing the method of CV attribution in the LDZ. The removal of propane alone under the current FWA CV mechanism would generate *additional* CV shrinkage costs due to CV capping. Under the Gas (Calculation of Thermal Energy) Regulations, this can only be addressed by having more specific Charging Areas within which to attribute CV to gas flows in the LDZ. Attributing CV in a way that is more in line with the actual gas energy delivered at the customer's meter should: • avoid propanation costs • minimise any charging cross-subsidy between LDZ customers (inherent in any CV averaging approach) • minimise the possibility of any CV capping and hence minimise the level of unbilled energy costs being passed through to the NTS as CV shrinkage. (ii) The implementation of a Future Billing Methodology is not expected to deliver any direct net benefits to gas transporters other than the sustainable future use of gas networks to deliver energy for heat. However it can be expected to deliver substantial benefits to customers in terms of sustainable, secure cost-effective delivery of future heat requirements.		

Attachments	

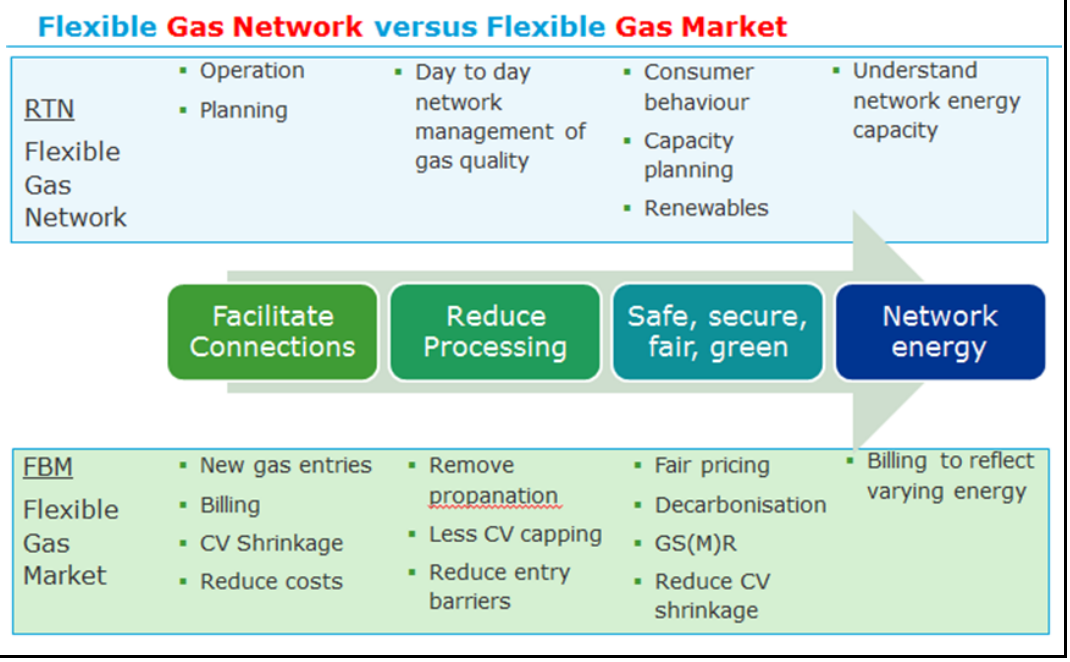
Project code	**NGGDGN04/1**	**Question Number**	**7**
Question date	**25 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**NIC submission document, pages 5 and 26**		
Topic			
Question	**(i) Is similar sensor equipment being installed, or investigated, as part of SGN's Realtime network project?** **(ii) There are parts of the Realtime networks project that are also looking at the FWACV, has this been considered?** **(iii) Is a letter of support available from SGN?**		
Notes on question			
Answer	(i) The Real-Time Networks Project is installing a small number of **accurate** CV and flow measurements in the Medway IP and MP network along with 1200 consumer meter loggers and strategically placed weather monitoring equipment in the SE LDZ. There will also be a laboratory-based study investigating the impact of renewable technologies on gas demand. The Future Billing Methodology Project proposal will also look to install equipment but this will be to track the distribution of biomethane and its penetration in the MP and LP network at varying demand levels to investigate the attribution of CV to consumers. The measurements proposed for this Project are: • Oxygen content - biomethane inputs have a number of unique identifiers but the one chosen for this Project is oxygen content. Biomethane supplies have a GS(M)R exemption for oxygen of up to 1 mol% which distinguishes it from NTS gas which has an entry point limit of 10 ppm. • An innovative and cheap **indication** of flow into the LP networks by monitoring the position of the regulators at governor stations – this will be used to validate the network models • Up to four CV measurements which will be used to demonstrate the transmission of live CV to smart meters in Work Pack 3. There is little similarity between the equipment being installed and the application – a summary is shown below:		

Measurement	Real-Time Networks	Future Billing Methodology
Flow	Accurate meters to understand network flows and operation	Indicative flows only - install sensors in existing governor stations & relate regulator position to flow
CV	Accurate CV to understand variations in gas quality and impact on network operation	A few accurate CV measurements to demonstrate transmission of CV to smart meters
Pressure	Extra sensors to understand network demand	Use existing sensors at governor stations
Oxygen	None	Track biomethane in network to understand CV attribution
Renewable energy technologies	Laboratory based to investigate impact on gas demand	None
Weather	Wind speed and ambient temperature to understand impact on demand	None
Consumer meter flow	Monitor gas flow to update understanding of consumer behaviour	None

(ii) The Real-Time Networks Project and the Future Billing Methodology Project have some common aims:

- Facilitate connections
- Reduce gas processing
- To be safe, secure, fair and green
- To understand energy content due to variations in gas quality

However, the Real-Time Networks Project aims to provide a flexible gas **network** whereas the Future Billing Methodology Project aims to provide a flexible gas **market**. The two projects are compared and contrasted below.



	Learning from the Real-Time Networks Project in terms of a better understanding of network operation and improved network models will be useful to this Project. However, enabling networks to transport a greater variation in gas quality will increase the requirement for an updated CV attribution and billing methodology. The two Projects are therefore complementary. (iii) There is currently no letter of support from SGN. However, the Project's progress is fed back to all of the GDN's representatives on a monthly basis at the Gas Innovation Governance Group (GIGG).
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**8**
Question date	**25 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**Appendix 1**		
Topic	**Future Energy Scenarios – Shale Gas**		
Question	**Why are the benefits from shale gas set out in table A1.1 higher than the benefits from bio-methane?**		
Notes on question			
Answer	National Grid's "Future Energy Scenarios" contemplates four differing versions of an energy economy, two of which are focused on the utilisation of indigenous supplies of shale gas to a greater or lesser extent. The volumes of shale gas that can be expected for injection to the gas grid under the "No Progression" and "Consumer Power" scenarios are significantly greater than the projected volumes of bio-methane / bio-synthetic gas. Early indications suggest that shale gas is likely to be of a lower calorific value than the traditional NTS gas sources. For the purposes of our NPV benefits assessment, we have assumed that both shale gas and bio-synthetic gas will be of a similar CV to bio-methane, and hence propanation would be applied (or avoided) in the same proportions as bio-methane. As a result, the benefits of non-propanation for shale gas under the "No Progression" and "Consumer Power" scenarios are greater than for bio-methane / bio-synthetic gas.		
Attachments			

Project code	**NGGDGN04/1**	**Question Number**	**9**
Question date	**25 Aug 2016 (rec'd 31 Aug)**	**Answer date**	**02 Sep 2016**
Submission section question relates to	**General**		
Topic	**NPV assessment of methods**		
Question	**The Full Submission Guidance states 'Enough information should be included in this [NPV] summary so that it can be used in conjunction with the data in the Full Submission Spreadsheet to enable the Panel to independently calculate the Net Present Value of each Method.' Please direct us to where you have provided this information in your submission.**		
Notes on question			
Answer	The Project is a "Proof of Concept" exercise to develop alternative and more specific approaches to the attribution of CV to gas volumes in the LDZ (simplified as Future Billing Methodology). Since the implementation costs for each of the three options explored can only be determined at high level as part of the Project findings, it is not possible to separate these options in such a way that could enable an NPV assessment for each method. The removal of propane costs has been selected as the clearest, most tangible benefit from implementation of any of the three Options explored, but again, as this can only be a "Proof of Concept" at this stage, full implementation costs can not be determined at this point.		
Attachments			

Project code	**NGGDGN04/1**	**Question Number**	**10**
Question date	**09 Sep 2016**	**Answer date**	**02 Sep 2016**
Submission section question relates to			
Topic	**Impact of Regulations and Time Line**		
Question	**(i) Do you expect this project to be changing the Regulations specifically for the 'Pragmatic' and 'Ideal ' scenario or the charging model sitting under the Regulation? Does this change for the 'Ideal' scenario?** **(ii) Can you provide a bit more information on which specific areas of the regulation pose a barrier to change for each of the scenarios?** **(iii) if the project is successful, what might the next steps and potential timings for implementation look like?**		
Notes on question			
Answer (i)	There are a number of different Regulations associated with gas quality and billing. The aim is for Project delivery and Project recommendations to minimise or eliminate changes to Regulations. **GS(M)R** – no impact during Project delivery or for Project recommendations. The Project is an enabler for GS(M)R compliant gas entry. **Gas (Calculation of Thermal Energy) Regulations -** We believe that none of the three scenarios would require a change to Gas (COTE) Regulations as the charging area is not explicitly defined in terms of geography, number of consumers or network (see Appendix 8 of the submission document). Indeed, the charging area appears to be defined in terms of the calorific value of the gas. The Pragmatic scenario would retain the existing FWACV methodology for the bulk of an existing LDZ with small embedded charging areas around particular gas inputs. The Ideal scenario is unlikely to be achieved during this Project due to limitations in current technology. Any "energy meter" would require Ofgem approval if it were to be used to generate a consumer bill. **The Gas Act 1986 Section 12 –** This section of the Gas Act refers to the measurement of calorific value for billing. All equipment used for CV billing		

	needs to be Ofgem approved. If, under the Composite or Ideal scenarios, a greater number of charging areas were defined it is likely that novel smaller/cheaper technologies would be required - these would require Ofgem approval. However, Ofgem approval is currently frequently sought by manufacturers either updating or bringing new equipment to market so this is largely business as usual. **Uniform Network Code** – The UNC is not strictly a Regulation but it is a legal and contractual framework. Changes may be required to the UNC as this sets out the detailed requirements for gas transporters. The process for updating the UNC already exists and updates are undertaken regularly. The Project would seek to liaise with the Joint Office of Gas Transporters and the GDNs to understand the impacts on the UNC during delivery of the Project. ---
Answer (ii)	There are no specific areas of the Regulations that pose a barrier to any of the scenarios so long as the focus remains on defining charging areas and the attribution of CV. ---
Answer (iii)	The next steps after successful delivery of the Project are likely to follow the order of the three scenarios: 1. Pragmatic – quick win and easiest to implement as FWACV will be largely retained and the Ofgem Directed CV measurements already exist. It is estimated that this could be implemented within 2 years including update of Xoserve systems. 2. Composite – medium term as many more charging areas will be defined and there may be a requirement for more measurement equipment to be installed. This scenario can be implemented incrementally with the Pragmatic and FWACV scenarios remaining in place alongside the introduction of the new charging areas. It is estimated that this scenario could be implemented within 5 years allowing time for update of Xoserve systems and installation of equipment. 3. Ideal – long term as each MPRN is attributed individually. Probably requires development of technology to make this option cost effective. It is estimated that this scenario could be implemented in 10 years or more but it would run in parallel with the installation of smart meters. The next steps may be limited by: • The availability of data handling systems and processes; for example, Xoserve remain central to the speed of roll-out • Costs – measurement and communication equipment and IT systems are likely to get more affordable/adaptable with time • Smart meter roll-out

Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**11**
Question date	**09-Sep-16**	**Answer date**	**15-Sep-16**
Submission section question relates to	**General**		
Topic	**Work Pack 2**		
Question	**(i) Please provide more detail on why Work Pack 2 is required for this project? What is the value of doing this work over and above the use of current models or of using the results of the CV mixing modelling from Real Time Networks project.** **(ii) Work Pack 2 makes up the largest cost for this project. The number of estimated FTE days is 3225 at an average day rate of £744. Please can you provide more details on what is making up the 3225 days of work and justify the cost of the average daily rate?**		
Notes on question			
Answer	(i) Please provide more detail on why Work Pack 2 is required for this project? What is the value of doing this work over and above the use of current models or of using the results of the CV mixing modelling from Real Time Networks project. **1. Why is WP2 needed for this project?** *Current use of network models and how they are validated using pressure only* The network analysis models used within the Distribution Networks are built using • physical asset data (for mains, pressure reduction facilities etc.) • operational parameters (e.g. pressure settings, flow capability) • and demands derived from the Demand Derivation System (DDS). These network analysis models are used to assess the network capacity available to support system demand (existing and new) and develop future capital and replacement programmes. In accordance with IGE/GL/1 a network analysis validation process is carried out on a regular cycle to test that the models are reflective of the physical		

network and can be used for planning purposes. Temporary pressure loggers are installed at various locations in the LP networks to gather data over a period of high demand. The network model demand is then set to the demand level(s) at the time of the pressure data recording using a derived relationship between daily DN demand and 6-minute demand. The resulting modelled pressures are compared to the recorded pressures and any mismatches are investigated. This validation process is based on pressure data with little consideration to flow measurement on the low pressure network.

Models are not validated for gas tracking so we need the O2 measurements to confirm the model's capabilities/understand limitations

The DN planning assumptions for distribution network analysis modelling are that these are analysed using a fixed CV value – typically 39 MJ/M^3 ,this being a typical average UK gas CV. This is a reasonable assumption while the gas quality measurements have been focussed on the delivery of gas into a DN at the NTS Offtakes to support the FWACV process and as a consequence there has not been any network-based CV measurement in the lower pressure tier networks. If, for example, the CV in the LP network is lower than the planning value (as would be the case with un-propanated biomethane entry) the flow rate in the pipe would be higher than the currently modelled flow to deliver the same required energy to the consumer. This increased flow will cause an increased pressure drop in that part of the network which is not currently evaluated as part of the validation process .

The network analysis assumes a fixed CV across the network the models are not validated for gas tracking. WP2 will allow the impact of biomethane (through O2 measurement) on the local network to be measured. This data will be used with information currently available on consumer demand within year (gathered as part of IFI19 NGGD project) to confirm that the flow pattern can be reproduced using the existing NGGD network analysis models used for network planning . The CV and flow measurements will add an additional dimension to the network analysis validation process focussing not just on the system pressures but also on the penetration of the biomethane into the network.

In the longer term distribution analysis for network planning should take account of the differing gas qualities when assessing the requirements for future capacity. Implementation of the conclusions from the RTN project may allow CV variation and current capacity availability to be assessed on the system as it is operated.

Issues with Current Regulations

The Regulations do not currently allow modelling to generate bills so we need to understand how differing gases move through the networks and how these zones vary with demand. The measurement and modelling work will provide help us understand:

- the zone boundaries for the pragmatic solution
- where extra measurements may be required for the composite solution

WP2 deliverables

This project seeks to explore and validate gas tracking within the lower pressure tier network models with an underlying objective of developing a methodology to allow the customer to be billed on a CV more closely aligned with that which they receive.

The work in WP2 will deliver

- New understanding of the impact of biomethane on the lower pressure tier systems through measurement of a gas component (oxygen) and the consequent ability to evaluate the zone of influence in the networks under consideration
- Detailed network modelling of Chittering and Hibaldstow networks using the gathered data to develop proposals for sharing with the industry
- a quantified review of the proposed Pragmatic, Composite and Ideal solutions for future billing with particular emphasis on practicality, cost, ease of implementation, cross- subsidy issues etc.
- A network planning procedure that can be adopted by all DNs when assessing any new billing zone associated with embedded gas supplies. This will be software agnostic and will be deliverable on both GBNA and Synergi Gas – the tools used in the UK. This will also include a consideration of how the CV values developed in a RTN model could be used to attributed to end user bills

2. **What is the value of doing this work (WP2) over and above the use of current models**

   The current models are used to assess the network capacity available to support system demand (existing and new) and develop future capital and replacement programmes. These analyses tend to be carried out for particular demand levels – peak demand for reinforcement and replacement and min summer demand for new biomethane entry points. There is little information currently available to allow DNs an assessment of how these networks behave at other times of the year and how the gas quality varies to end consumers. The additional information provided by the sensors will inform the analysis and allow the results from modelling to be substantiated. This base data will be important in the discussions with the industry as it will help to understand the issues involved.

3. **What is the value doing this work over and above using the results of the CV mixing modelling from the Real Time Networks project**

- Billing on network models is not allowed currently under the Regulations so using RTN would require a change in law

- The output from Real-Time Networks is not SaaS – it is updating the understanding of network operation, demand and the impact of renewable energy. The current project is using existing proprietary software to evaluate the possibilities for on-line analysis for low pressure system. The software is widely used for on-line implementations in transmission systems where SCADA data is generally available. New RTN Software and the sensors to support it may be several more years away.

- The RTN timeline is focussed on understanding gas end user behaviour through gathering real-time (6min) data at end users premises and using this to develop new demand algorithms which could be used to update those currently included in IGE/GL/1 developed in the early 1980s.

  The first [3] years of the project will be related to gathering this data and combining it with socio-economic data to develop new customer behaviour types and usage patterns (daily and across a year). These will then be used as input data to an "on-line" system which will seek to replicate the network state in real time – a "digital-twin" of the actual network. In this way the performance of the network can be seen in the model as demand changes through the day etc.

  This could then be used operationally to assess:
  - areas of the network where spare capacity may be available at different time periods
  - where there are opportunities to reduce overall system operating pressures to reduce leakage and
  - potentially to evaluate opportunities for demand management to maximise the use of the pipe network.

The CV modelling in RTN will be based on the recorded CV value on the system inputs and, as part of the analysis results, will be determined at each node within those networks. The project will look to see if this "on-line" digital twin methodology is achievable. If it is there is an opportunity to use the model to provide a CV value at each node, in near real-time, based on measured input values then these values could be attributed to the associated consumers and these used for the local billing CV.

There are a number of questions that need to be addressed through the RTN project

- Would it be feasible to run RTN every day/hour etc. to attribute a CV to a MPRN?

  This will be a large data handling process, continuous refreshing of the on-line model, generation of CVs to be attributed to end users and those values passed to Xoserve for billing. The RTN will address these issues but there is a risk that the methodology may be impractical, time consuming and expensive.

- If the RTN model were run, how would the CVs be attributed?

  The CV values generated from the on-line modelling at a node will change as system conditions change. There will need to be a project to define how these values should attributed to individual MPRNs or defined zones of influence. In order to provide complete coverage of the UK then measurements with the appropriate software system setup would still be required to validate the models for billing for everywhere outside Medway.

The value in doing the FBM work in addition to the RTN can be addressed in

several areas:

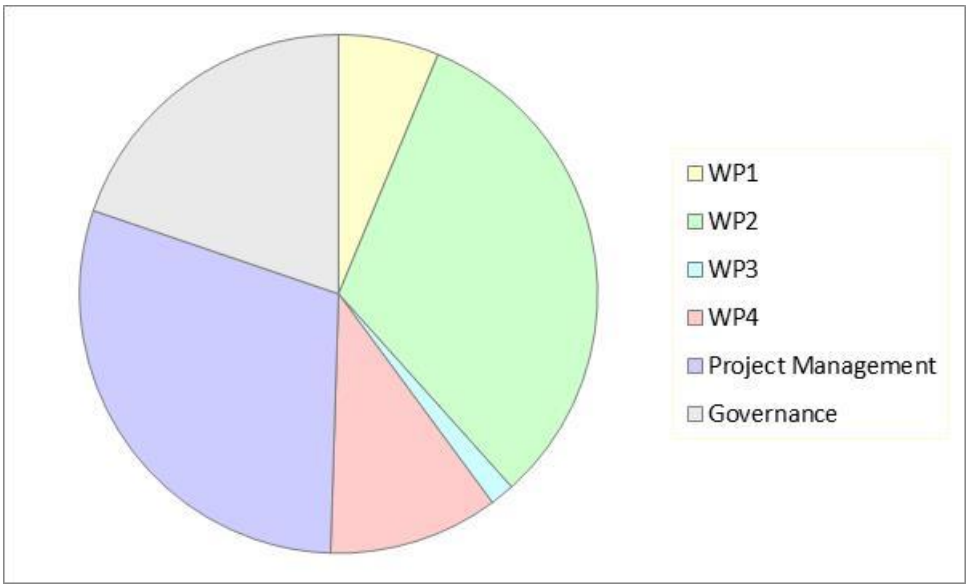
- FBM will set out the possible pathway for future CV attribution, will provide indicative costs and timelines for implementation and ensure that the industry is able to consider the options available and decide the way forward.
- FBM will address the billing issues that would need to be overcome before using the RTN methodology and will thus allow a quicker implementation of RTN when that project is successful. To deliver RTN across the UK would require additional measurements in each network with implementation of these "real-time" network models linked to data clouds and these kept running continuously to provide the necessary CV values.
- FBM will allow an early evaluation with the industry of possible billing futures before any results are available from RTN
- FBM Option 1 will provide a simple methodology that allows entry of biomethane without propanation and other unconventional gases and reduces any consequent billing inequity

(ii) Work Pack 2 makes up the largest cost for this project. The number of estimated FTE days is 3225 at an average day rate of £744. Please can you provide more details on what is making up the 3225 days of work and justify the cost of the average daily rate?

The total number of FTE days from DNV GL and NGGD is estimated to be 3225 to deliver the whole project over three years. This corresponds to 4.8 FTE people per year as shown in the table below.

Total Project Estimate	3225	days over three years
Annual Project Estimate	1075	days/annum
UK Bank Holidays	8	days/annum
Average leave entitlement	28	days/annum
Available working time	224	days/annum
Full time equivalent	4.8	people/annum

The split of effort between the four work packs, Project management and NGGD Project governance is shown in the pie chart below.



An extract from the Project Plan to show the detailed activities in Work Pack 2 is given in the table below. In summary, the Work Pack covers a very wide range of activities ranging from:

- Assessing the risks of installing equipment on the NGGD network
- Undertaking site surveys, designing the installations and carrying out approval and appraisals in compliance with NGGD requirements
- Designing the communications equipment
- Building the measurement units and carrying out factory acceptance testing
- Attending sites, installing the sensors and carrying out site acceptance tests
- Monitoring the measurements to ensure satisfactory performance
- Setting up the network models for Chittering and Hibaldstow
- Populating the network models and providing interim reports for the Pragmatic and Composite scenarios
- Providing options for CV attribution for the Pragmatic and Composite scenarios

Work Pack 2 is fundamental to understanding the options for CV attribution. The results from Work Pack 2 and Work Pack 3 will together support the recommendations to be delivered in Work Pack 4.

Task Name	Activity	Milestone/SDRC
QRA	1 day workshop with DNV GL and NGGD	
	First version of live QRA document	***Milestone 1***
	Quarterly updated version of live QRA document	
Chittering field trial	Detailed specification of field trial	***Milestone 3***
	Site surveys	
	Subcontractor install equipment (except flow)	
	Procure equipment	
	Design approval/appraisal	
	Factory acceptance testing (FAT)	
	Installation	
	Site acceptance testing (SAT)	***Milestone 7a***
	DNV GL install flow equipment	
	Procure equipment	
	Design approval/appraisal	
	Installation	
	Site acceptance testing (SAT)	***Milestone 7b***

	Communications	
	Specification of equipment	***Milestone 4***
	Design, procure and test	
	Collect data over period of trial	
	Decommission equipment at end of trial	
Hibaldstow field trial	Detailed specification of field trial	***Milestone 5***
	Site surveys	
	Subcontractor install equipment (except flow)	
	Procure equipment	
	Design approval/appraisal	
	Factory acceptance testing (FAT)	
	Installation	
	Site acceptance testing (SAT)	***Milestone 8a***
	DNV GL install flow equipment	
	Procure equipment	
	Design approval/appraisal	
	Installation	
	Site acceptance testing (SAT)	***Milestone 8b***
	Collect data over period of trial	
	Decommission equipment at end of trial	
Model network	Model preparation	
	Pragmatic scenario	
	Setup network model	
	Populate with 1 month of data	
	Draft interim report (milestone 10)	
	NGGD review	
	Final interim report	***Milestone 10a***
	Populate model	
	Finalise model	
	Composite scenario	
	Setup network model	
	Populate with 1 month of data	
	Draft interim report	
	NGGD review	
	Final interim report	***Milestone 10b***
	Populate model	
	Finalise model	
	Analysis complete	
Reporting	Draft final report on field trials	
	NGGD review	
	Final report on field trials	***Milestone 12*** ***SDRC 2***
	Draft report on options and methods for attributing CV	
	NGGD review	
	Final report on options and methods for attributing CV	***Milestone 13*** ***SDRC 3***

The average day rate of £744 per day is derived from a combination of National Grid Gas Distribution and DNV GL day rates.

- NGGD ranges from £340 to £770 per day with an average of £501 [redacted]

NGGD rates are taken from the "Gas Distribution Financial Handbook", an internally published Finance Policy document, which is reviewed annually and is used in the pricing of both intra-business services and services provided by NGGD to third parties.

	The DNV GL rates are commercial rates used with clients across the oil and gas chain and within the commercial software business. The rates include recognised industry experts with a proven track record of working on innovative projects with the gas networks in Great Britain and elsewhere DNV GL is a global business and the Project team will have access to a very wide range of expertise and unique facilities such as the DNV GL Technical Assurance Laboratory for the testing of smart meters and developers and users of the range of Synergi and SPS network modelling software.
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**12**
Question date	**09-Sep-16**	**Answer date**	**15-Sep-16**
Submission section question relates to	**General**		
Topic	**Differences between FBM and RTN Projects**		
Question	**Can you provide more context to justify the difference between this project and Real Time Networks (RTN). This should include:** **(i) Why the RTN project doesn't support/provide validation for the work this project is trying to achieve?** **(ii) Why can this work not wait until there are outputs from the RTN project which can be used?**		
Notes on question			

Answer

(i) Why the RTN project doesn't support/provide validation for the work this project is trying to achieve?

The differences between the FBM project and the RTN project are:

	RTN	FBM
Demand data	Significant effort in gathering consumer gas usage data in order to develop new models of demand for planning and operation.	No data from consumers. Some use of IFI19 data to produce a scaling factor for below peak demand.
CV measurement	Limited CV measurement as an input to the on-line concept model	No additional CV measurement within the network. Values taken from Offtakes, FWACV and embedded entry points
Oxygen concentration	No measurement	O2 used to show the movement of biomethane within the network and hence the zone of influence of that gas.
Network Modelling	The demand data algorithms when available will be used to populate the on-line RTN with demand for the day and the analysis will show the network behaviour in "real time"	Technique will be based on existing planning models with peak demand. Below peak demand will be developed from previous IFI19 study and used to look at summer loads on an off-line mode i.e. in planning terms rather than building a real time operational model.
Network Modelling Software proposed	Synergi Pipeline Simulator - this is normally used for transmission system management purposes when fed with data from SCADA systems. The RTN project will assess the issues associated with creating a "real-time" network on a lower pressure system that has greater integration and connectivity than transmission systems. Synergi Gas – modelling software used by other DNs in the UK for planning purposes	GBNA – modelling software used by National Grid for planning purposes Synergi Gas – modelling software used by other DNs in the UK for planning purposes
Timescales	Potential for working RTN in networks other than Medway by 2025. The network model would be run to generate a CV value at a model node and this would then be attributed to individual customers. The Xoserve system would have to deliver these significant volumes of data updates each day.	A straightforward CV attribution methodology could be developed and discussed with the industry within the life of the FBM project. This could be seen as a first step in the development of billing based on gas quality and hence energy delivered. Implementation of the Pragmatic option would be the most straightforward and the cheapest to implement and could be delivered before the RTN solution is available. The

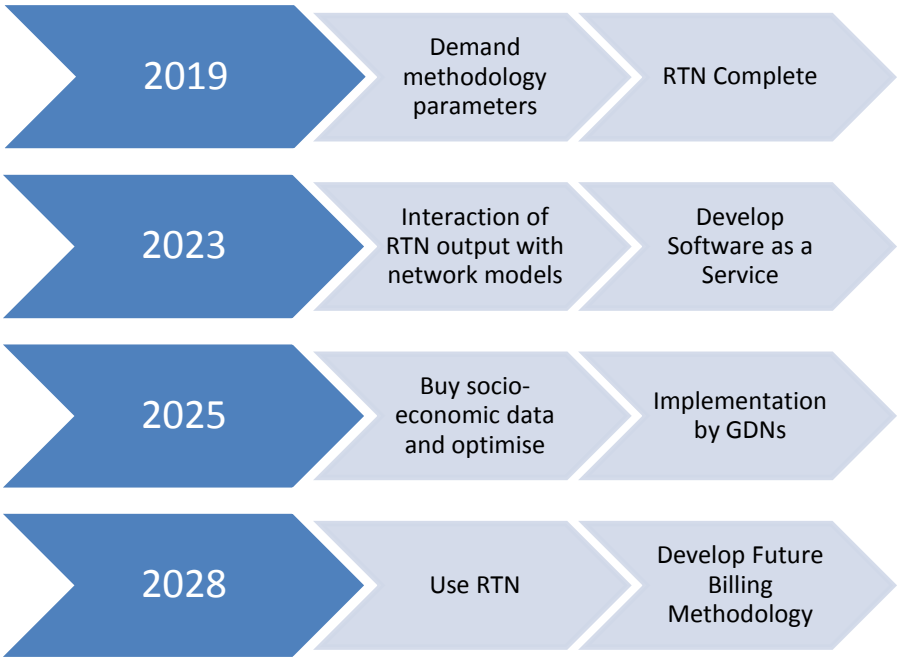
		work done in FBM on billing methodologies would however allow the future implementation of a RTN CV solution when ready.
i) Why the RTN project doesn't support/provide validation for the work this project is trying to achieve?	RTN will develop new demand algorithms which when used as input data and updated hourly should allow the RTN to be reflective of actual operation of the day. The model will deliver CV values at each node but will not address how any CV will be used to bill end users. The FBM project seeks to address this area.	FBM is focussed on CV attribution and evaluating the various ways in which this could be delivered in a billing context. The inclusion of embedded sources of low CV gas has led to propanation on entry or the potential for wider differences between the billing CV and the delivered CV if the CV cap was to be removed. The industry has been looking for a solution to the biomethane issue for a number of years (previous study reported in 2009). The FBM project has identified a potential way forward that could be implemented quickly and at a low cost, but will also look at the implications of more CV measurement (or modelled values) being used to create smaller billing zones. This work will therefore set out the CV attribution/billing possibilities in time for the RTN completion.

(ii) Why can this work not wait until there are outputs from the RTN project which can be used?

The Real-Time Networks Project is a research project that will deliver new concepts around the demand methodology parameters such as:

- The peak six minute demand
- Refinements to consumer categories in the Demand Derivation System
- Influence of composite weather variables
- Impact of renewable technologies.

The Real-Time Networks Project will **not** be delivering commercially available software. Should the Project be successful, further development of Software as a Service would be required to interact with, and further develop, commercially available products such as Synergi or SPS. The approximate time line is shown below:



Although the Real-Time Networks models will be able to improve the understanding of CV changes in a network it is not designed to deliver a billing approach – there will be no mechanism for attributing a CV to a customer meter or for deriving charging zones.

Crucially, it will not be possible to deliver the range of gases into the networks to derive the benefits of Real-Time Networks without significant changes to the FWACV billing methodology.

Attachments	

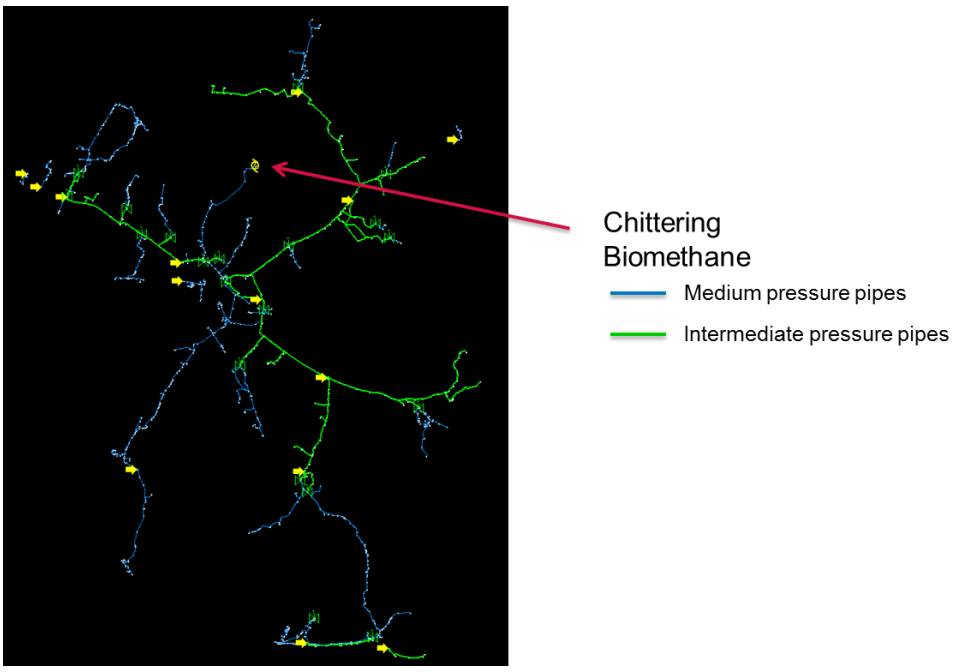
Project code	**NGGDGN04/1**	**Question Number**	**13**
Question date	**09-Sep-16**	**Answer date**	**15-Sep-16**
Submission section question relates to			
Topic	**Selection of Field Test Sites**		
Question	**Please provide more information to support the use of the Chittering and Hibaldstow networks for the field trials. Will these two examplars provide enough data to support a generic approach. Will there be enough data points to cover the large area of the Hibaldstow network? As part of the answer a map would be useful.**		
Notes on question			
Answer	The choice of the two biomethane sites at Chittering and Hibaldstow, is representative of the wider UKD networks as they cover both a single and a multiple feed network. At this stage of market development a number of networks have a single biomethane supplying into the system with a number of existing natural gas feeds. This system setup is represented by the Chittering network in East Anglia LDZ, as shown in the figure below:  Figure 1 Chittering biomethane feed into the MP & IP network.		

Figure 1 above indicates where the Chittering biomethane feeds into the wider Cambridge intermediate and medium pressure network. There are no other non-natural gas feeds into this integrated pipework system. Figure 2, below, shows the wider pipework system including the downstream low pressure systems. There are some LP pipe systems that are supplied from the MP containing the biomethane input.

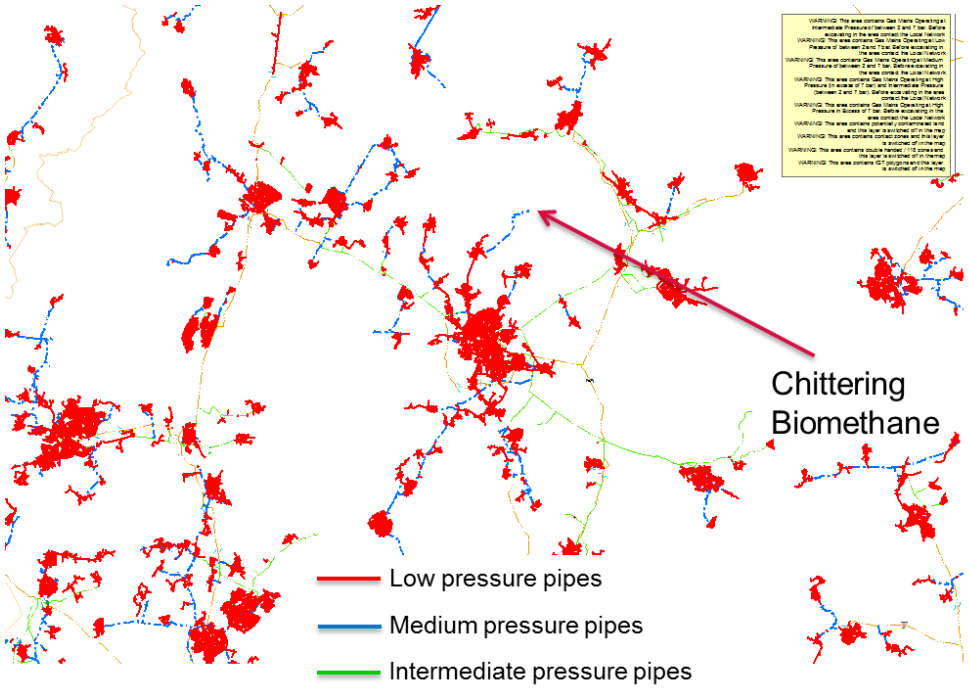


Figure 2 Chittering bio-methane feed with the wider LP, MP & IP network.

There are also an increasing number of "hot spot" areas, in which a number of bio-methane entry points feed into an interconnected system, as is the case at Hibaldstow in East Midlands LDZ. This situation is expected to become more common as more bio-methane facilities and other unconventional gas supplies are developed and connected to LDZ systems. Figure 3 below shows the location of the Hibaldstow bio-methane feed along with 8 other unconventional gas feeds into the wider network around the Lincolnshire and South Yorkshire areas:

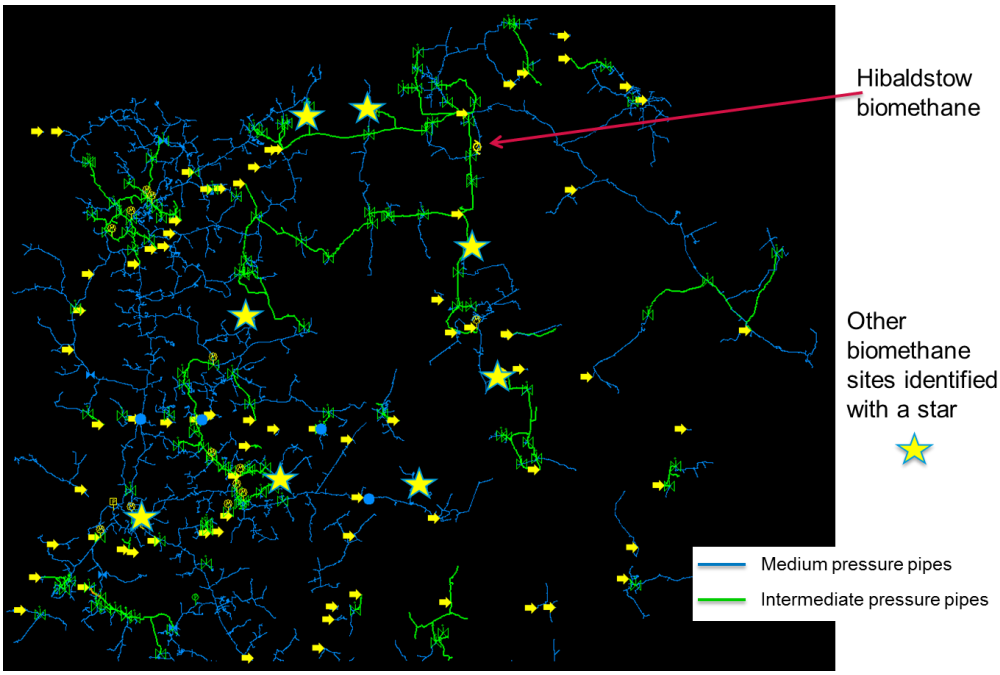


Figure 3 Hibaldstow biomethane feed into the MP & IP network.

Figure 4, below, shows the wider pipework system surrounding the Hibaldstow feed including the downstream low pressure networks.

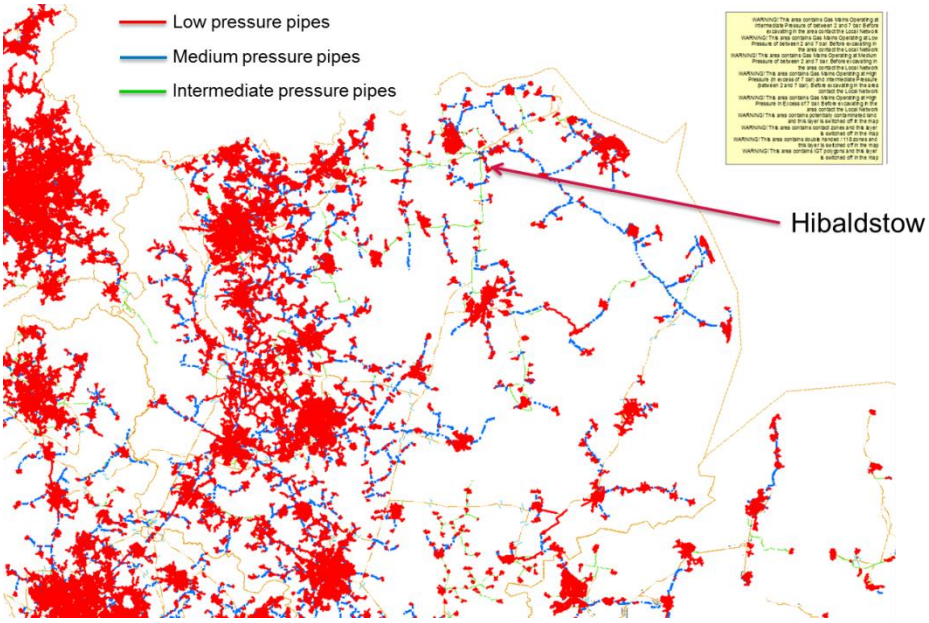


Figure 4 Hibalstow biomethane feed into the wider LP, MP & IP network.

Unconventional gas supplies such as bio-methane plants typically have a constant gas output rate. As a result, the zone of influence exerted by these input points is greatest in summer (low gas demand). In these conditions and in certain parts of the LDZ network, bio-methane sites may contribute a greater proportion of the gas infeed than the natural gas sources. Correspondingly, their zone of influence is much reduced in winter (high gas demand). Below figures 5 and 6 show in red the changes to the area impacted by the biomethane.

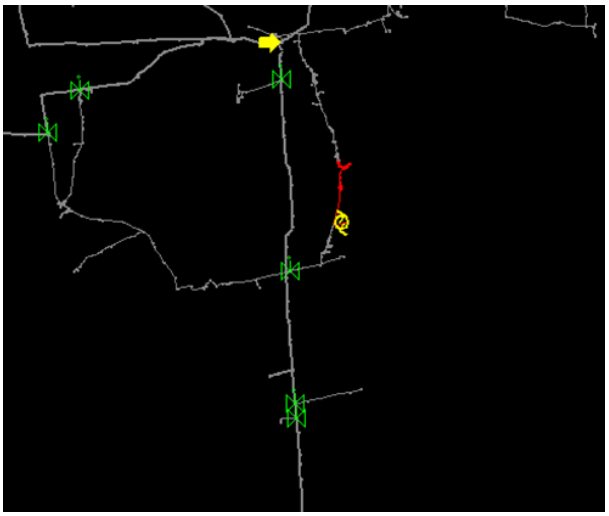


Figure 5 modelled zone of influence at high demand levels

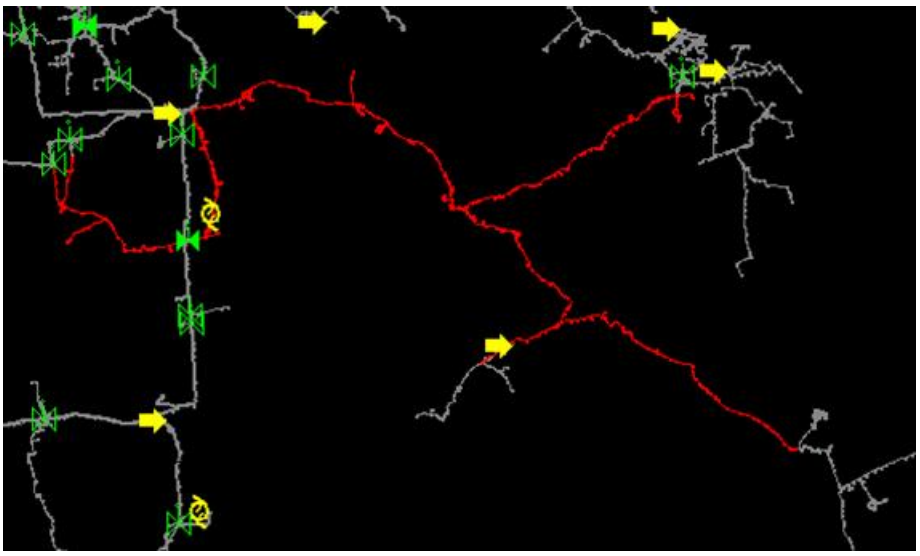


Figure 6 modelled zone of influence at low demand levels

With the number of embedded inputs within the wider network around Hibaldstow there is a probability that, particularly at low demand, the zones of influence of these gases will interact. Hibaldstow provides the opportuinity to examine the issues associated with modelling this level of complexity. The methodologies developed as part of work pack 2 will consider such complex situations such as Hibaldstow as well as the simplier system configuration as Chittering. It is anticipated that these 2 selected networks will adequately cover the range of operating parameters experienced in networks where new entry sites are being added.

Some initial network analysis has been carried out under different demand conditions to indicate where the biomethane affected zone could be. The data point locations will be set to capture the movement of the zone boundary as demand changes. We have therefore planned for data points to be sited inside the minimum boundary, between the minimum and maximum boundaries and also outside the area we expect to be influenced by biomethane. By measuring at these location we will be able to build up a good picture of the zone of influence as it moves with system demand.

The zone development methodology and procedures that we will derive from

	a review of our two selected networks can be tested against other networks, as appropriate, and should allow various zones to be evaluated (e.g. under low demand, high demand, average demand, seasonal values etc.). The aim is to develop a procedure that can be used by DNs to determine a suitable charging area associated with different CV gas inputs. The CV zone will be determined for each site or group of input points, as appropriate, and would not be changed unless there are changes to the local network topology / demand / reinforcement / replacement, etc. We would expect that an update process could be run perhaps once a year and any changes to the billing zone identified and updated at that time.
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**14**
Question date	**09-Sep-16**	**Answer date**	**15-Sep-16**
Submission section question relates to	**Section 3.2 Financial Benefits – Removal of Propane**		
Topic			
Question	**Please can you confirm how much consumer money is forecast to be saved if we get rid of the need for propanation? Please can you make clear the assumptions you are using?**		
Notes on question			
Answer	The use of all four of National Grid's Future Energy Scenarios to evaluate the potential savings from de-propanation was intended to reflect the range of uncertainties which surround future gas usage in GB. Given the prevailing political and economic uncertainties, one could argue that the most likely outturn for gas in 2050 might be somewhere between: • "Slow Progression" in which bio-methane and bio-synthetic gas meet just 4.5% of demand (£173m cumulative NPB at 2050) and • "No Progression" where bio-sourced gases continue to account for less than 0.5% of demand, but affordability drives deployment of indigenous shale gas in larger volumes, meeting just under 22% of demand (£947m NPB at 2050, assuming similar CV and propane requirement as bio-methane). The Future Energy Scenarios make no assumption on changes such as the those being explored by the Future Billing Methodology Project. Removing the need for propane injection would favourably alter the economics both for the injection of bio-source gas and shale gas. This could result in a greater uptake of bio-source gases under a "Slow Progression" scenario, and increased deployment both of bio-source and shale gases under "No Progression". Given the above, the projected 2050 NPB cumulative propane saving of £173m under "Slow Progression" can be regarded as a very conservative view of the potential benefit of a Future Billing Methodology. Providing a more robust benefit projection would require quantification of the degree of sensitivity to the removal of Propane costs for each gas type in each scenario. This would require detailed collaborative analysis, which is not practicable within the remaining current NIC bid cycle, but would be		

required as part of the high-level CBA in Work Pack 4 of the Project itself.

As such, it may be reasonable to take the view that the outturn benefit of removing propane could be more in line with the projected cumulative NPB for "Gone Green" of circa £300m by 2050, although the component low-CV gas shares would very likely be different. Under this scenario, direct benefits of the project would be as shown in the table below.

Description of Direct Benefit	2016/ 17	2017/ 18	2018/ 19	2019/ 20	2020/ 21	2021/ 22	Total
	-	-	-	-	-	-	-
NPV Propane Savings- per Annum	-	2.34	3.09	3.99	-	-	9.42
Total Direct Benefits	**-**	**2.34**	**3.09**	**3.99**	**-**	**-**	**9.42**

(NB: The above requires the simplified assumption that propane saving benefits would arise during the project, whereas this Project would not include implementation of the actual changes to systems processes required.)

Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**15**
Question date	**09-Sep-16**	**Answer date**	**15-Sep-16**
Submission section question relates to	**General**		
Topic	**Engagement / Partnering**		
Question	**Why has there not been more engagement/partnering with key stakeholders such as Xoserve and Shippers?**		
Notes on question			
Answer	NGGD recognises that the changes being explored as part of the Future Billing Methodology Project will affect stakeholders across the gas industry in Great Britain. As a GDN, we are strongly motivated to ensure that continued use of the gas grid – into which customers have already made significant investment over decades – is soundly established as part of a low-carbon energy future. However, we recognise clearly that (a) the costs of implementing the envisaged changes to CV attribution and (b) the benefits in terms of savings from removal of the propane requirement may be distributed quite differently among system users, due to widely varying customer portfolio profiles and business drivers. For this reason, we have not sought to partner with any particular individual or group of customers, as we believe that an objective assessment of any proposed changes must involve wide and balanced input from across all parts of the industry. We have commenced discussions with Xoserve on the potential changes to CV attribution and we are investigating the way in which the billing system uses LDZ CV and volume data, but we are cognisant of and constrained by the current imperatives around implementation of the "Nexus" UK-Link system replacement (now expected in April 2017). We have not sought to partner formally with Xoserve, as their role is to act as billing agent for all gas transporters (and under FGO, as portfolio management agent for shippers and suppliers) and hence would not be correctly placed to influence changes that would affect their range of clients in varying measure. We have formal letters of support from two of our fellow GDNs (NGN and WWU) and we interact with SGN on a monthly basis via GIGG. Please see our response to Q16 for further information on our intended		

	stakeholder engagement approach.
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**16**
Question date	**09-Sep-16**	**Answer date**	**15-Sep-16**
Submission section question relates to	**General**		
Topic	**Stakeholder Engagement**		
Question	**Please can you provide more commentary on the intended stakeholder engagement?**		
Notes on question			
Answer	At high level, the intended stakeholder engagement for the Future Billing Methodology Project will comprise: • Initial industry engagement in summer 2017, comprising a project launch workshop, with questionnaires and the opportunity for bi-lateral or multi-lateral meetings to follow up on specific issues arising during the initial engagement • Project web site as repository for all project information, dissemination of findings and learning at each stage and portal for industry responses, questions, etc. • Industry engagement on findings, learning and high-level CBA in autumn/winter 2019 • Final Project report – March 2020 In order to provide a credible, cogent cost benefit analysis and proposals for future implementation, we are anxious to engage as widely as we can across industry stakeholders, including consumer groups, shippers, suppliers; industry groups such as ENA and IGEM, together with smart metering stakeholders, including manufacturers and the DCC. We will also set up a Project Advisory Board comprising a range of industry experts which will meet on a six-monthly basis to oversee the Project. Subject to approval of this project, we will make use of our existing Stakeholder Engagement mechanisms to raise awareness, seek deep understanding and elicit opinion to ensure that our stakeholders' interests influence the final outcomes of the project in a manner consistent with our obligations under Standard Special Condition A6 of our Licence.		
Attachments			

Project code	**NGGDGN04/1**	**Question Number**	**17**
Question date	**20 Sep 2016**	**Answer date**	**22 Sep 2016**
Submission section question relates to	**Project Funding Submission & Financial Benefits**		
Topic			
Question	**(i) Please can you put the updated financial figures and benefits into a new version of the Ofgem template?** **(ii) There appears to be a small mismatch in the NIC funding request level in the spreadsheet vs. your proforma. Please can you check?**		
Notes on question			
Answer (i)	**FINANCIALS -** The total cost (£5,381k) and funding request (£4,799k) for the FBM Project remain unchanged on the corrected submission made to Ofgem on 9th August 2016 and the revised spreadsheet and pro-forma (Section 1.5) reflect this. The updated NPV Financial and Carbon savings tables in Appendix 1 of the FBM pro-forma will be updated in line with the revised information provided in our response to Q1 in a full document resubmission to be made in October, following our final bi-lateral meeting with the Ofgem NIC Panel. **DIRECT BENEFITS -** The FBM Project is a "Proof of Concept" exercise which aims to explore three options for attributing CV to gas flows in the LDZ at a more specific level than the current FWA CV approach. The Project output will include a high level CBA for the implementation of each of the options. The aim being to enable the industry to decide on next steps towards detailed development and implementation of the required changes to systems and processes identified by the FBM Project. As such, this project will not generate any direct benefits, i.e. there will be no income stream or NGGD savings to offset the funding requirement for this Project. (The figures previously supplied in the table at the end of our response to Q14 were intended to give some idea of what the industry savings might be in a hypothetical situation where implementation was immediate in 2017-18 Formula Year.)		
Answer (ii)	As above, the total cost (£5,381k) and funding request (£4,799k) for the FBM Project remain unchanged on the corrected submission made to Ofgem on 9th August 2016 and both the revised spreadsheet and pro-forma		

	(Section 1.5) reflect this. (Confirmed with Rebecca on Wed 21 September.)
Attachments	

Project code	**NGGDGN04/1**	**Question Number**	**Q18**
Question date	**20 Sep 16**	**Answer date**	**22 Sep16**
Submission section question relates to			
Topic	**Legislation Impacts**		
Question	**The project is clear that it will look any subsequent legislation changes that may be required to move away from FWACV. Will it go as far as looking at potential licence changes? Do you have an initial view on which licensees and, specific licence conditions, might be impacted?**		
Notes on question			
Answer	Investigations into potential licence changes will form a part of the industry engagement and development of CBA for work packs 1 and 4. Our initial view is that there are unlikely to be any changes required to GDN, Shipper or Supplier licences. However, as part of our industry engagement in Work Packs 1 and 4, we would be seeking input from other GDNs, Shippers and Suppliers on potential Legislation and Licence impacts. We would expect there to be some potential requirement for changes to the Uniform Network Code as a result of the changes to billing systems and processes proposed by the Project, as pointed to in our response to question 10, but this will also be the subject of our industry engagement on Project findings in Work Pack 4. For clarity, we do not envisage any detailed development of UNC Modifications as part of this Project, as this would form part of a subsequent industry exercise, towards implementation.		
Attachments			

Project code	**NGGDGN04/1**	**Question Number**	**Q19**
Question date	**20 Sep 16**	**Answer date**	**22 Sep 16**
Submission section question relates to			
Topic			
Question	**If the RHI were removed, do you have any evidence that the costs of propane would represent a marked barrier to low carbon gases being put on the network?**		
Notes on question			
Answer	We do not have any formal evidence from biomethane producers on the impact of the removal of RHI as this is commercially sensitive information. Before the introduction of the RHI there were no Biomethane sites in the UK. The development of biomethane sites and entry of biogas into the network coincided with the introduction of RHI. It is therefore reasonable to assume that RHI is underpinning the economic viability (with propanation) of those plants. If so, removal of RHI, with a continued requirement for propanation, would have an adverse impact on these sites.		
Attachments			

Project code	**NGGDGN04/1**	**Question Number**	**Q20**
Question date	**20 Sep16**	**Answer date**	**22 Sep 16**
Submission section question relates to			
Topic			
Question	**How would each of the three scenarios under investigation cope with temporal variations in gas quality? For example, suppose a consumer is located close to a low-CV injection point and is billed accordingly. What happens if the low-CV injection point switches off or gets turned down? Can this happen or are there contractual arrangements with entry points which avoid intermittency?**		
Notes on question			
Answer	There are contractual arrangements in place that should prevent this from happening, however, as now, there may be instances when the site does not feed or the CV value does not get passed through through to the billing systems. There are a number of scenarios that can be developed for variations in low-CV gas injection rates and/or loss in CV measurement data and these will be evaluated as part of the 3 options within work pack 2. Each of the billing options will be tested against these scenarios to ensure that any billing proposal is practicable and has contingency rules in place that provide an appropriate balance between practicability and robustness of process. In the question example, if a consumer is close to a low-CV input with that entry CV value attributed to them for billing purposes then: • If the low-CV injection point switches off then it may be possible to continue to use the CV measured at the biomethane site although this will be the network CV for the period of time the injection was off. • If the low-CV injection point reduces flow for a sustained period then it may be possible to change the billing zone (i.e. reduce in size) for the period or if the reduction is for a shorter period it may be reasonable to retain the previously defined zone. • In either case if consumers are billed on the low CV value but sometime receive high-CV gas then this is to the advantage of the individual customer.		
Attachments			

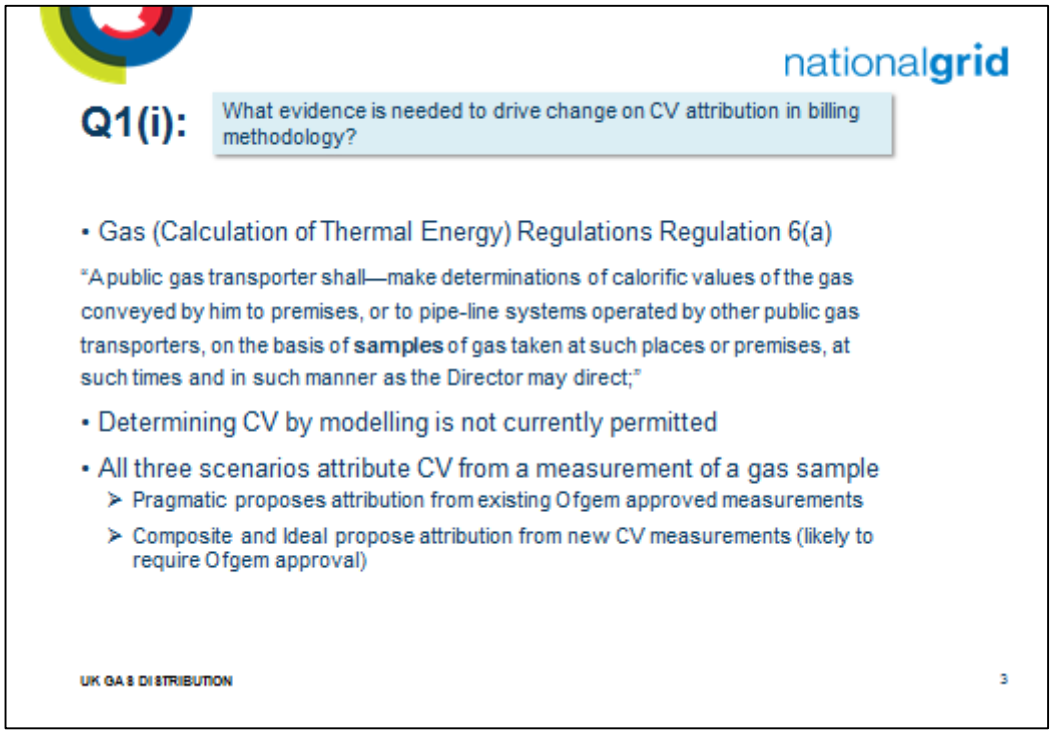
Project code	**NGGDGN04/1**	**Question Number**	**Q21**
Question date	**20 Sep 2016**	**Answer date**	**22 Sep 2016**
Submission section question relates to			
Topic	**TRL and barriers to Implementation**		
Question	**(i) What technology readiness level (TRL) do you consider the project to be at now and where do you think it will by the end of the project.** **(ii) If the project is successful, which I assume in the short term, means either the pragmatic or composite options being taken forward, do you envisage any other barriers (in particular none-BAU ones) that would prevent it being implemented?**		
Notes on question			
Answer (i) Answer (ii)	According to the TRL definitions found in Ofgem's NIA Governance Document (2012) we believe that this project will cover Development, TRL 4-6, activity on generating and testing solutions to the problem. We believe this project covers TRL 4-6. At this moment we do not see there being any insurmountable barriers to implementation. This view is based on our initial discussions with Xoserve, the billing agency who would be implementing any changes developed from the "proof of concept" output from this Project. This is not to say that implementation would not be difficult, as the potential changes to billing systems and processes which Xoseve currently operates as BAU could be complex and could present short-term technical and commercial issues as the changes bed in. **Work Pack 1 –** The intended industry engagement exercise will seek a wide input base, including Ofgem, and will thoroughly investigate any potential blockers to implementation. This will then inform the remainder of the project and will be taken account of in the Project outputs.		
Attachments			

Tick if this answer has been provided verbally: ☒

Project code	**NGGDGN04/1**	**Question Number**	**22**
Question date	**26 Sep 2016**	**Answer date**	**04 Oct 2016**
Submission section question relates to			
Topic			
Question	**(i) What evidence is needed to drive change on CV attribution in billing methodology?** **(ii) Could changes happen without this specific project and, if so, what would they look like?** **(iii) For example, could an estimated attribution of CVs based on existing network models be sufficiently accurate compared to the present tolerances permitted?**		
Notes on question	The following is a commentary supporting the slides used in the bilateral meeting on 30/09/16.		
Answer	**(i) What evidence is needed to drive change on CV attribution in billing methodology?** The Regulations require that calorific value is determined by measurement which precludes the determination of calorific value by network modelling. The Gas (Calculation of Thermal Energy) Regulations Regulation 6(a) state that: "*A public gas transporter shall—make determinations of calorific values of the gas conveyed by him to premises, or to pipe-line systems operated by other public gas transporters, on the basis of* ***samples*** *of gas taken at such places or premises, at such times and in such manner as the Director may direct;*" The Future Billing Methodology Project proposal aims to provide solutions that comply with the current Regulations. The Project aims to define new charging areas and this is permitted under the Regulations. The Pragmatic scenario proposes attribution of calorific value within new charging zones but using existing Ofgem approved measurements. The Composite and Ideal scenarios propose attribution from new calorific value measurements (and these are likely to require Ofgem approval as any new		

measurement site would). There are currently four methods approved for attributing calorific value – directly measured, declared minimum, lowest-source and FWACV.

The Project would also be required to comply with the Regulations during delivery; it is for this reason that the two proposed biomethane sites which form the focus of the field trial will continue to propanate throughout. Gas from biomethane sites has a GS(M)R exemption allowing up to 1 mol% oxygen whereas the limit for NTS gas is 10 ppm. A novel solution of tracking oxygen in the network is proposed to determine penetration of biomethane in the network downstream; this will facilitate the accurate definition of new charging areas and the development of new billing methodologies.

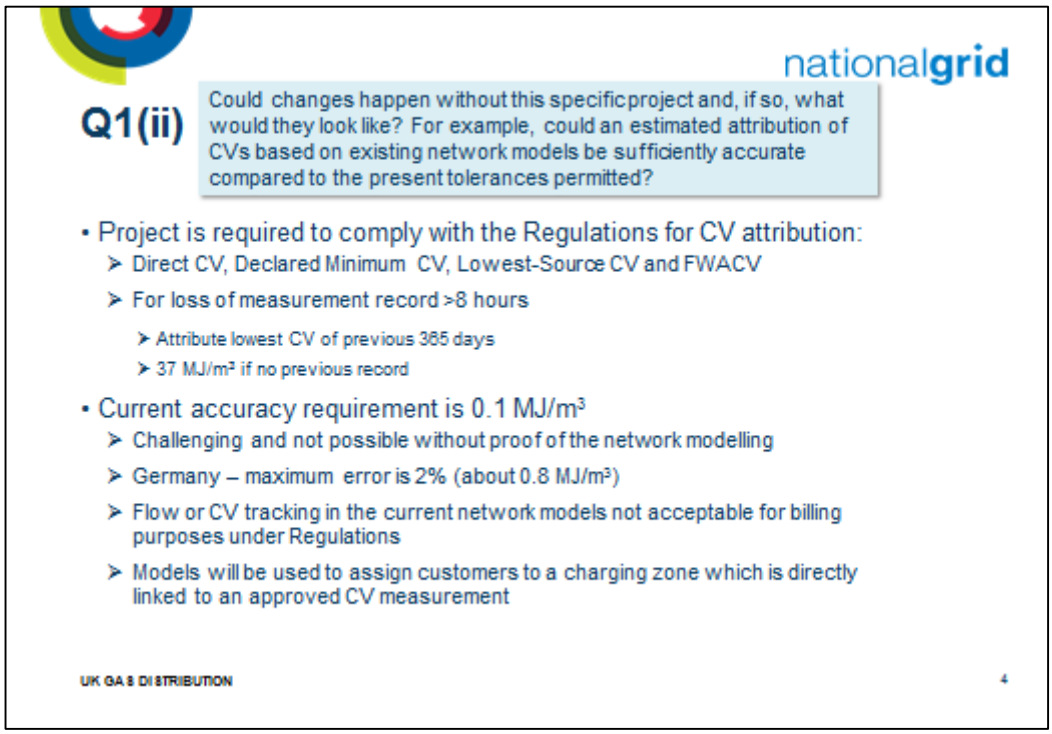


(ii) Could changes happen without this specific project and, if so, what would they look like?

It is unlikely that changes could happen without this specific Project as it requires agreement and input from stakeholders across the billing chain. Changes to billing are not something that can be carried out by a single party in isolation.

For example, could an estimated attribution of CVs based on existing network models be sufficiently accurate compared to the present tolerances permitted?

The current accuracy requirement for the determination of calorific value is 0.1 MJ/m^3. This is challenging for the majority of on-line measurement

	systems and it is unlikely to be possible using network modelling alone. As a benchmark, the German Regulator DVGW requires the maximum error to be 2% (about 0.8 MJ/m^3). There are some projects in Europe investigating flow and calorific value tracking using mobile gas analysis systems but this would not be acceptable for billing purposes under the Regulations. The Regulations apply sanctions to gas transporters who lose measurement records for periods longer than 8 hours – this includes mis-measurement. The calorific value attributed would be the lowest calorific value measured in the previous 365 days of, in the absence of any previous record, a value of 37 MJ/m^3 (this should be compared with a typical calorific value of about 39.5 MJ/m^3). 
Attachments	

Tick if this answer has been provided verbally: ☒

Project code	**NGGDGN04/1**	**Question Number**	**23**
Question date	**26 Sep 2016**	**Answer date**	**04 Oct 2016**
Submission section question relates to	**General**		
Topic			
Question	**i. Could the Real Time Networks (RTN) project provide the evidence to change the CV attribution in billing methodology that Future Billing Methodology is aiming to provide?** **ii. Is validation of the existing model required for it to be able to evidence the need for change to the billing methodology? Would it be helpful to start with an existing network model and predict the results that can be compared against the outcome of the trials?**		
Notes on question			
Answer	The following is a commentary supporting the slides used in the bilateral meeting on 30/09/16 shown below. ***(i) Could the Real Time Networks (RTN) project provide the evidence to change the CV attribution in billing methodology that Future Billing Methodology is aiming to provide?*** The FBM project, through the industry engagement and the Cost Benefit Analysis of billing options, aims to drive forward the commercial framework to enable CV attribution for a consumer at a level different to the current FWACV. The RTN project does not seek to address the commercial / billing system requirements of attributing a CV to a consumers bill; this is fundamental to FBM. In our opinion RTN is not able to provide the evidence for a change to CV attribution. The aims of the projects are different and can be summarized as: • RTN will "improve the understanding of consumer demand to enhance network planning capability to ensure efficient network management." (words taken from RTN NIC document) • FBM will drive forward the commercial framework to enable CV attribution for a consumer In RTN, measurement of CV in the Medway network will be carried out on		

	the entry points to the MP/IP system and on the pipeline taking gas away from Medway. There is no CV measurement carried out on consumers' premises or indeed within the LP network. RTN will use network modelling of the Medway system to recreate the network conditions at the time of the flow logging. The CV measurement points will be an input to a network analysis model which will then evaluate the changing CV values at each logged flow site, which when combined with the logged consumer flows will allow the consumed energy to be determined. The outcomes of RTN will therefore not satisfy the aims of FBM and will not avoid costly upstream gas processing or unlock de-carbonisation of the GB gas grid. However, RTN outputs will complement the FBM methodology through better understanding of consumer behavior and improvements in the consumer demand algorithm underpinning the modelling of gas networks at peak and particularly below-peak demands In summary • RTN and FBM are not inter-dependent • All low-carbon gas-to-grid initiatives depend on FBM • RTN demand measurement and associated energy values should help in the longer term to enhance the network analysis models that form part of the CV allocation principles within FBM. The modelling techniques within FBM are not geographically specific and can be applied now without the findings from RTN. The key questions for CV attribution are related to timescale, complexity, benefits and cost. FBM will allow these issues to be evaluated and discussed with the industry while RTN is developing the energy algorithms that could help to enhance a future CV attribution framework. A simple zone of influence based on network modelling with minimal additional CV measurement could be a first step to achieve the FBM project objectives. The affected zones could then be brought into greater resolution as the finer energy detail improvements from RTN are gathered.

nationalgrid

Q2 (i):

Could the Real-Time Networks (RTN) project provide the evidence to change the CV attribution in billing methodology that Future Billing Methodology is aiming to provide?

- The aims of the Projects are:
  - RTN - "improve the understanding of consumer demand to enhance network planning capability to ensure efficient network management." (words taken from RTN NIC)
  - FBM - drive forward the commercial framework to enable CV attribution for a consumer
- Therefore the outcomes RTN will not satisfy the aims of FBM and will not
  - Avoid costly upstream gas processing
  - Unlock de-carbonisation of the GB gas grid
- RTN outputs will complement FBM methodology
- RTN and FBM are not inter-dependent
- All low-carbon gas-to-grid initiatives depend on FBM

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(ii) Is validation of the existing model required for it to be able to evidence the need for change to the billing methodology? Would it be helpful to start with an existing network model and predict the results that can be compared against the outcome of the trials?

- The network modelling work that forms part of Work Pack 2 will use an existing National Grid network model and using existing software capability will predict the zone of influence of the embedded biomethane input. This modelled zone of influence will be compared against the Oxygen tracking test results.

- The O2 measurement and the associated network modelling in WP2 will demonstrate to the industry that the current models are suitable for generating a billing zone around a low-CV input as they are able to reasonably reflect the movement of that gas through the system.

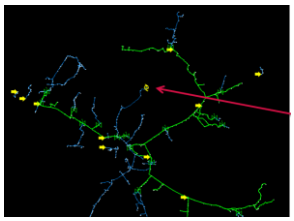
- Some of the significant industry stakeholders e.g. Shippers have not had any significant exposure to network modelling of distribution systems and it is expected that they will require some understanding of the issues being addressed and justification of the modelling principles and techniques used.

nationalgrid

Q2 (ii):

Is validation of the existing model required for it to be able to evidence the need for change to the billing methodology? Would it be helpful to start with an existing network model and predict the results that can be compared against the outcome of the trials?

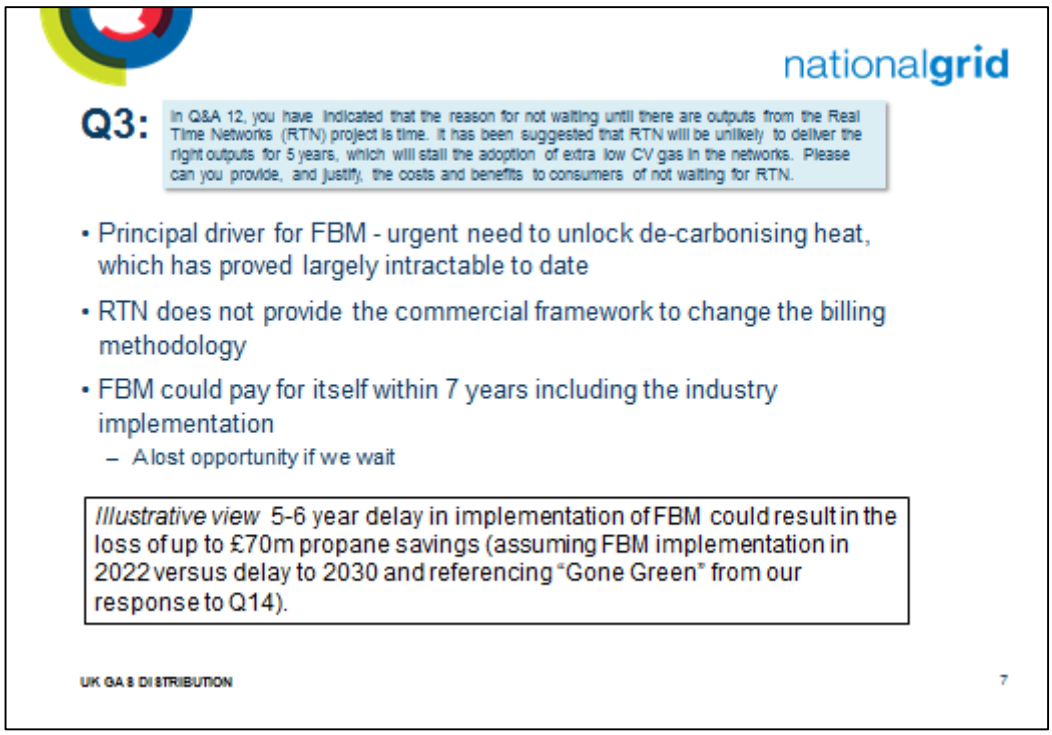
- Empirical evidence is essential to provide the correct level of assurance to the industry
- The zone of influence will be proved using oxygen tracking as demand changes during the year
- Modelling in Work Pack 2 will use an existing network model and predict the zone of influence of the embedded bio-methane input



Attachments

Tick if this answer has been provided verbally: ☒

Project code	**NGGDGN04/1**	**Question Number**	**24**
Question date	**26 Sep 2016**	**Answer date**	**04 Oct 2016**
Submission section question relates to			
Topic			
Question	**In Q&A 12, you have indicated that the reason for not waiting until there are outputs from the Real Time Networks (RTN) project is time. It has been suggested that RTN will be unlikely to deliver the right outputs for 5 years, which will stall the adoption of extra low CV gas in the networks. Please can you provide, and justify, the costs and benefits to consumers of not waiting for RTN.**		
Notes on question			
Answer	The following is a commentary supporting the slides used in the bilateral meeting on 30/09/16 shown below. The FBM project would still need to be conducted even if we did wait for the outputs of the RTN project. The projects are independent of each other. FBM aims to unlock the full potential of low CV gases to decarbonise the heat sector by negating the need to propanate and attributing CV to a customers bill, whilst RTN is principally a planning tool to enhance capacity utilisation, enable flexibility of the gas network to accept low carbon gases, etc. RTN does not provide the commercial framework to change the billing methodology, this being the principal aim of FBM. Based on projected NPV savings, we believe that FBM could pay for itself within 7 years including the circa £60m required to implement industry changes. An illustrative view suggests that a 5-6 year delay in the implementation of FBM could result in the loss of up to £70m propane savings (assuming FBM implementation in 2022 versus dealy to 2030 and referencing 'Gone Green' from our response in Q14). If this project was put on hold to wait for the RTN project to finish this would make decarbonisation of the gas network very hard to achieve and would impact upon the UK's ability to meet the 5th Carbon budget by 2030. This target is already looking very hard to achieve and a step change to decarbonise the heat sector is required immediately inorder to meet the		

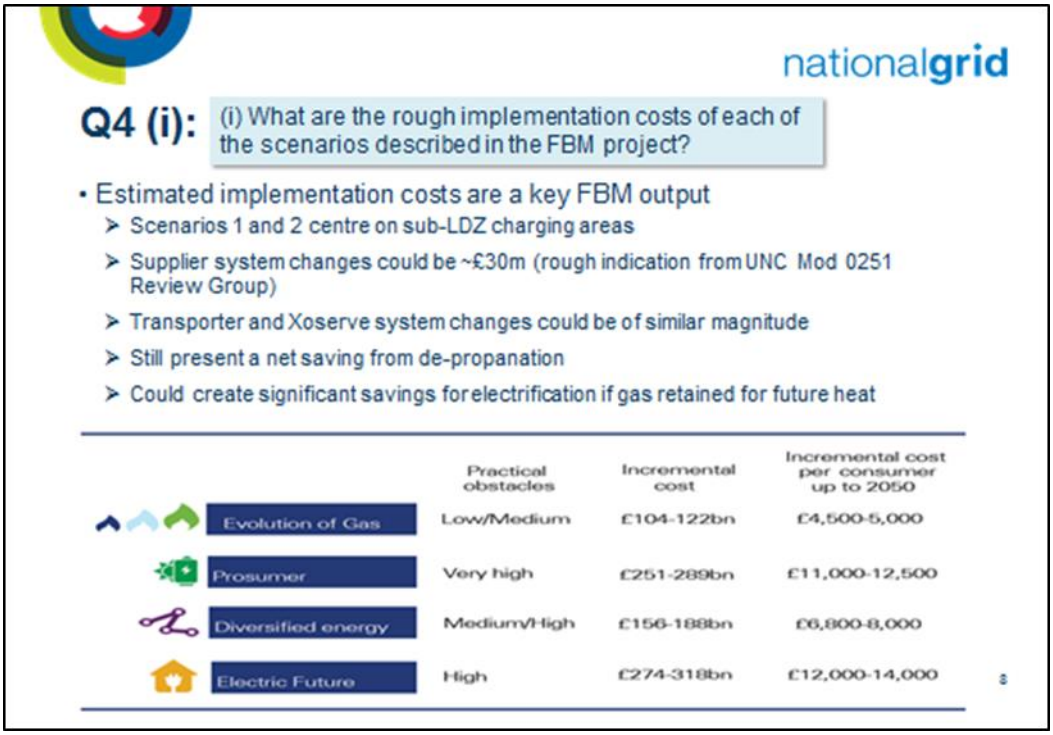
	target. 
Attachments	

Tick if this answer has been provided verbally: ☒

Project code	**NGGDGN04/1**	**Question Number**	**25**
Question date	**26 Sep 2016**	**Answer date**	**04 Oct 2016**
Submission section question relates to			
Topic			
Question	**(i) What are the rough implementation costs of each of the scenarios described in the FBM project?** **(ii) What are the barriers to implementation of each of these scenarios**		
Notes on question			
Answer (i)	The following is a commentary supporting the slides used in the bilateral meeting on 30/09/16 shown below. **(i) What are the rough implementation costs of each of the scenarios described in the FBM project?** A key aim of the FBM Project is to develop a high level quantification of potential implementation costs. Without completing the intended Project engagement with Xoserve, as part of WP 1, on the requisite system developments (and having due regard for the likely scale of the commensurate code changes) it is difficult to make any truly realistic or reliable assessment of the final implementation costs. From what we know today, the key changes for Options 1 (Pragmatic) and 2 (Composite), lie in the subdivision of the LDZ into few or many CV Zones, and then reflecting this within the billing system and shipper invoices. The scale of developing and implementing such changes is potentially within tens of millions of pounds and so could be expected to provide clear a net saving when compared to the projected propane saving benefits. We estimate that the overall cost of implementation could be in the region of £60M. The development and implementation of the smart metering-based Option 3 (Ideal) would likely be substantially more costly than Options 1 or 2, and would rely on further significant industry investment in smart metering. The intention of exploring this Option in FBM is to try to identify and answer key		

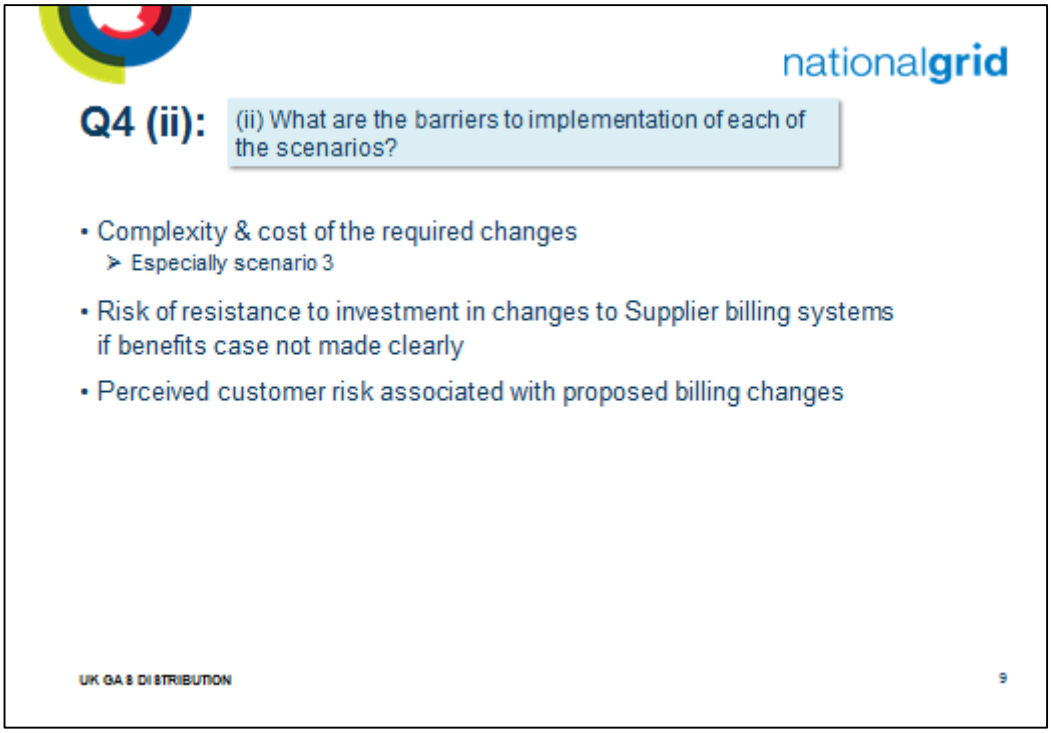
industry questions at an early stage, e.g. in terms of the data hierarchy required to support a full smart meter regime.

From the table shown in the slide 8, for all of the differing scenarios shown, the cost of implementing a new billing system is proportionately low compared to the overall cost . A link to the full KPMG report can be found here:
https://www.energynetworks.org/assets/files/gas/futures/KPMG%20Future%20of%20Gas%20Main%20report%20plus%20appendices%20FINAL.pdf



(ii) What are the barriers to implementation of each of these scenarios

The barriers to implementation can include complexity and cost of the required changes, especially scenario 3. There could be a risk of resistance to investment if a Shipper is not fully appreciative of the benefits to them of the change and there could be a perceived customer risk associated with the proposed billing changes if the messaging/communications is not done effectively.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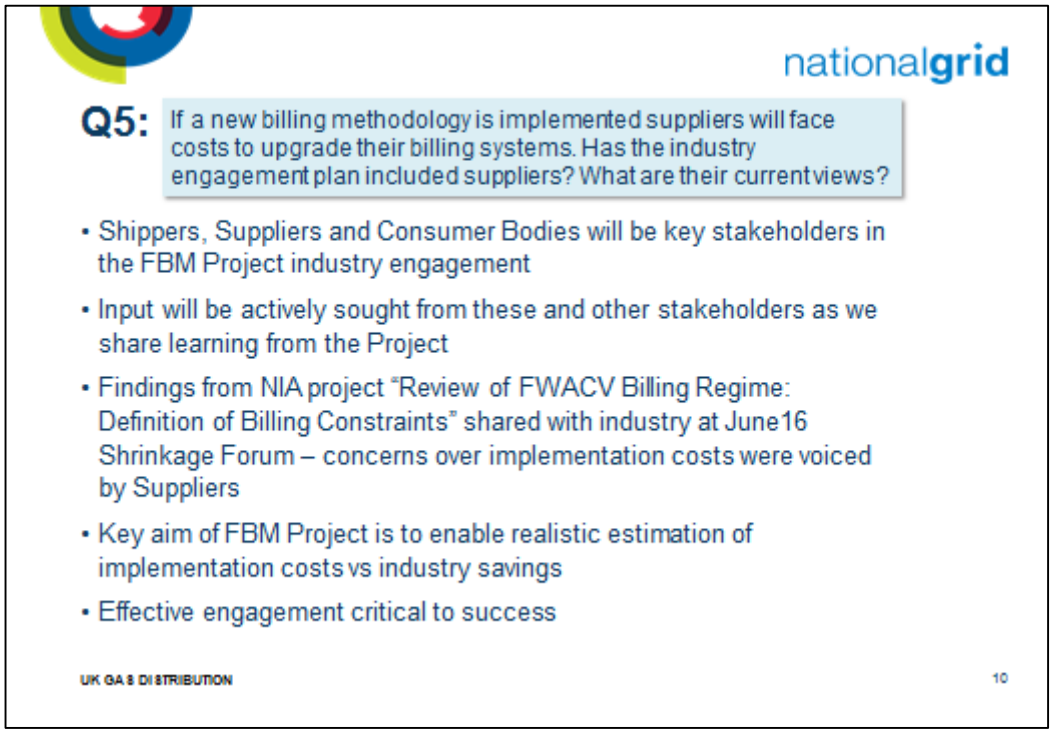
Tick if this answer has been provided verbally: ☒

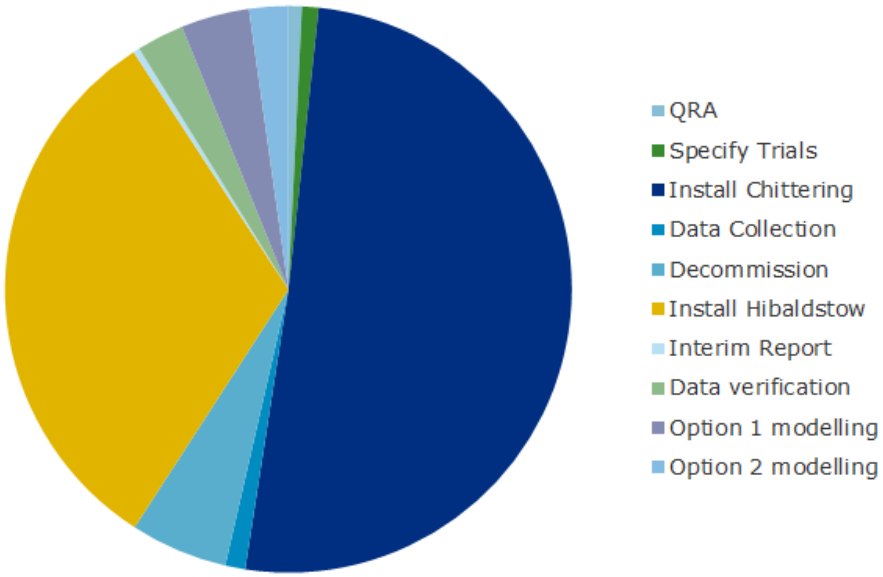
Project code	**NGGDGN04/1**	**Question Number**	**26**
Question date	**26 Sep 2016**	**Answer date**	**04 Oct 2016**
Submission section question relates to			
Topic			
Question	**If a new billing methodology is implemented suppliers will face costs to upgrade their billing systems. Has the industry engagement plan included suppliers? What are their current views?**		
Notes on question			

Answer	The following is a commentary supporting the slides used in the bilateral meeting on 30/09/16 shown below. Shippers, Suppliers and Consumer Bodies will be key stakeholders in the FBM Project industry engagement exercise. As we gather and disseminate learning from the Project, we will be seeking and sharing views from Shippers, Suppliers and Consumer Bodies on likely implementation costs and the impact on customer bills. Following completion of the recent NIA project [Review of FWACV Billing Regime: Definition of Billing Constraints], findings were shared with the industry via the Shrinkage Forum and concerns over costs were voiced by shippers. We feel that it is vital to be able to provide more detail through the Project to enable realistic cost impacts to be determined.
Attachments	



Project code	**NGGN_04**	**Question Number**	**27**
Question date	**04 October 2016**	**Answer date**	**06 October 2016**
Submission section question relates to			
Topic			
Question	**In the 2nd Bilateral you said that the cost of the oxygen sensors is approximately £60,000 for each site.** **(i) On page 44 of the submission, it says the sensors will be installed at 40 existing governor stations and 15 new kiosks. Therefore there are 55 sensors in total. By our estimation this means that £3.3 million of the cost of WP2 will be spent on the oxygen sensors. Is this understanding correct? If not please can we have a detailed cost breakdown of WP2.** **(ii) As the 55 oxygen sensors are rolled out for the trial will there be an associated decrease in the cost of installation? How have the costs been accounted for – did you assume a fixed costs per site installation or have you assumed a decreasing cost per site?** **(iii) Can you compare the cost of oxygen sensors to the use of radionuclides as sensors of the low CV gas?**		
Notes on question			
Answer	***(i) On page 44 of the submission, it says the sensors will be installed at 40 existing governor stations and 15 new kiosks. Therefore there are 55 sensors in total. By our estimation this means that £3.3 million of the cost of WP2 will be spent on the oxygen sensors. Is this understanding correct? If not please can we have a detailed cost breakdown of WP2.*** There will be two types of site installation – 40 at existing governor stations and 15 new kiosks at street level. These installations comprise more than oxygen sensors as shown in figure 2.5 and table 2.1 in the submission document. To recap, at the governor stations, oxygen, flow and pressure sensors will be installed. In the 15 new kiosks oxygen and pressure sensors will be installed. At four of the governor stations CV measurement equipment will also be included and these will be used to support the delivery of Work Pack 3. Additionally, all sites will require a power supply and communications equipment. The price of decommissioning has also been included. A		

breakdown of the costs and sub work packs associated with the installations at Chittering and Hibaldstow is shown in the pie chart below.



Total Price £4.1M

Installation at Chittering	**Installation at Hibaldstow**
Planning	Planning
Design and procurement T/PR/G/17 approval and appraisal	Design and procurement /approve/appraise
Install 35 x oxygen, pressure and GPRS	Install 20 x oxygen, pressure & GPRS
2 x CV measurements for WP03	2 x CV measurements for WP03
15 x civil works for new kiosks	
Flow indication @ 20 governors	Flow indication @ 20 governors
Decommission	Decommission
Average price per site £59k	Average price per site £64k

The oxygen sensors will track the biomethane whilst the flow and pressure measurements will be used to provide further confidence in the network models and hence the attribution of calorific value.

The sensors will be installed at positions that should capture both the high and low demand – in essence they will form two circles around the biomethane injection points with a small number of sensors positioned further out to confirm that those customers never see the biomethane.

(ii) As the 55 oxygen sensors are rolled out for the trial will there be an associated decrease in the cost of installation? How have the costs been accounted for – did you assume a fixed costs per site installation or have you assumed a decreasing cost per site?

There will be several initial generic designs which will be grouped depending on the type of governor station or the location of the new installations – this should enable a common approach to be taken in the factory and it will

	ensure consistency across the Project. The aim will be to produce a solution that is fully tested in the factory to minimise the time on live gas sites. The designs will be modified on a site-by-site following site surveys, again to reduce the time spent at site. £60k is the average installation cost – the initial sites may be more expensive than the later sites. The quotation was made by a reputable and experienced company that understands the requirements and constraints of working on a live gas network. All the installations will individually need to comply with NGGD's T/PM/G/17 *Management Procedure for the Management of New Works, Modifications and Repairs*. The purpose of the Management Procedure is to provide a framework for management and control of new works, modifications and repairs on gas systems. Formal Management Procedures are necessary to ensure National Grid Gas's compliance with legislation, including the Pressure System Safety Regulations 2000 (PSSR), the Construction (Design & Management) (CDM) Regulations 1994, the Health and Safety at Work etc Act (HASAW) 1974, the Electricity at Work Regulations 1989, the Pipelines Safety Regulations 1996, the Gas Safety (Installation and Use) Regulations 1998 and Dangerous Substances and Explosive Atmosphere Regulations 2002 and to comply with the Control of Major Accident Hazards Regulations (COMAH), the National Grid Gas Safety Case and the Major Accident Prevention Document (MAPD). T/PM/G/17 incorporates the philosophy outlined in the Institution of Gas Engineers & Managers (IGEM) guidance document IGE/GL/5 "*Plant Modification Procedures*" which recommend the processes for appraising and approving modifications to a gas transportation system and its associated support systems. This Management Procedure is based on assignment of responsibilities to nominated personnel who, where appropriate, have been assessed to ensure technical competence and suitability for their roles. ***(iii) Can you compare the cost of oxygen sensors to the use of radionuclides as sensors of the low CV gas?*** We assume that this is a reference to the difference in ratio of carbon 13 to carbon 12 that is to be expected between natural gas and renewable sources of gas. We investigated the use of tracking by radionuclides but there does not appear to be anything on the market that is suitable for use in (a) hazardous areas or (b) routine on-line analysis outside the laboratory environment. The use of radionuclides would have meant visiting each location several times each day and taking samples for laboratory testing which was not deemed practical, cost effective and it did not fulfil the technical objectives. The tracking of oxygen was the optimum solution – measurement of oxygen is routine at entry points to the NTS, relatively cheap, does not impact on business as usual for the biomethane suppliers and it is a differentiator between NTS gas (maximum 10 ppm oxygen) and biomethane (up to 1 mol% oxygen).

Project code	**NGGD_04**	**Question Number**	**28**
Question date	**04 October 2016**	**Answer date**	**06 October 2016**
Submission section question relates to			
Topic			
Question	**You have said the DNV GL rates are commercial rates. Have these rates been market tested since this seems high in relation to a long-term contract rate?** **Is there scope to improve on them?**		
Notes on question			
Answer	The DNV GL rates are constantly being tested in the market place as we regularly competitively bid for consultancy and innovation work. The rates quoted are similar to those previously approved by Ofgem and used for the Real-Time Networks Project. The rates are not the highest that are charged by DNV GL but they do reflect the specialist expertise, experience, qualifications and technical knowledge of the staff required to undertake this innovation project. The rates are discounted as we are not passing on a year-on-year increase in line with inflation. The Project delivery team will include engineers and scientists ranging from Graduate Engineers to Principal Consultants. In order to minimise costs, much of the day-to-day delivery of the Project will be by appropriately qualified, but more junior, staff with technical direction and governance provided by the more senior staff.		
Attachments			

Project code	**NGGD_04**	**Question Number**	**29**
Question date	**4th October 2016**	**Answer date**	**6th October 2016**
Submission section question relates to			
Topic			
Question	**How well can the modelling, validated by FBM, be rolled out to other GDNs based on a sample of 2 validation sites? What level of confidence can we have in the model being accurate in other networks where their model has not been validated? How confident can we be in using the validated model in the face of future network change?**		
Notes on question			
Answer	**How well can the modelling, validated by FBM, be rolled out to other GDNs based on a sample of 2 validation sites?** The modelling procedure for determining a 'Billing Zone' that is to be delivered as part of this project will be applicable to all GDNs. The demonstration (validation) of two sites is intended to identify the ability of network modelling software to mirror the behaviour of networks using the available peak and below-peak demand data. The two networks – Chittering and Hibaldstow – will allow demonstration of a single low-CV source feeding into a network and the zone affected, and also a network where there is more than one low-CV entry and where these could interact with each other. The project aims to show that the network modelling software is able to model gas flows and gas components in line with recorded values and this can therefore be assumed to be valid across all network models. **What level of confidence can we have in the model being accurate in other networks where their model has not been validated?** DN network models are validated against pressure on a regular basis to ensure they are appropriate to support capex and repex forecasts. This project aims to show that these models can also predict the movement of gases from a range of input points and that they can be used to generate a "Billing Zones" based on an agreed procedure which is applicable to any network model.		

	How confident can we be in using the validated model in the face of future network change? The "Billing Zone" procedure will be based on assessment of the size of the zone under low demand and high demand conditions and determining what level of demand would be appropriate when deciding the zone boundary. It is expected that the "Billing Zone" procedure would be run perhaps once a year for each network unless major changes occurred which would impact of the pattern of gas flows within year i.e. major reinforcement, significant increase in load, major replacement schemes. It would be expected that this would be the exception and most of these would be picked up in an annual update. If new energy/demand information were to be adopted by the industry then this would be incorporated into the demand imposed on the model and would be incorporated in the "Billing Zone" analysis in due course.
Attachments	

Project code	NGGD_04	Question Number	30
Question date	4th October 2016	Answer date	6th October 2016
Submission section question relates to			
Topic			
Question	Would the FBM validation of the existing network models, remain robust for the potential rollout of new Real-time network models? For example, do you have confidence that the FBM learning to validate old network models, remains relevant to a GDN with a working Realtime Network model?		
Notes on question			
Answer	**Would the FBM validation of the existing network models, remain robust for the potential rollout of new Real-time network models?** Yes **For example, do you have confidence that the FBM learning to validate old network models, remains relevant to a GDN with a working Realtime Network model?** Yes – FBM is using existing network models and RTN aims to deliver new demand algorithms for input to existing network models. FBM aims to deliver a study and a "Billing Zone" procedure that will be applicable for the existing networks (with demand models based on 1980s) as well as any new energy/demand information that is delivered by RTN. Current position The existing network models are constructed from asset information (on pipes, regulator stations etc.) and the most recent data available on consumer demand , developed in the early 1980s. This demand data is derived from consumers billing information and a peak consumption input to the model based on an annual to peak algorithm. Demand away from peak is assessed based on load curves and weather information. All network models used in GB are built using this demand data. All DNs carry out a validation process on their network models, comparing recorded pressures at key points in the network over a high demand period with the pressures predicted by the network analysis software (GBNA or Synergi gas) **FBM validation process** The FBM 'validation' is intended to identify the ability of network modelling		

	software to mirror the behaviour of networks using the available peak and below-peak demand data. The current network models (built from current asset and derived demand data, as detailed above) will be used to predict how the gases are transported within the network. The affected zone, or zone of influence, will be larger during periods of low demand and will be smaller when the demands are high. Both of the software tools used in DNs are able to model the movements of gas from various input points through the network and this functionality will be used to facilitate a comparison with the O2 measurements in WP2. The FBM measurement of O2 and comparison against the model results will be the basis for determining the methodology for creating a billing zone around a particular entry point. It is accepted that not all consumers in the billing zone will receive gas from their attributed entry point on all days in the year but the analysis will seek to identify the impact of this on a consumer bill and use this to develop a generic DN network planning "Billing Zone" procedure on how a billing zone should be defined. "New realtime network models" as described in the question are not new network models. RTN will use the same software as FBM and no new functionality will be developed for RTN. The main difference is the development of new demand algorithms from the logged flow at consumer sites. No CV measurement will be carried out at consumers' premises but the model will be used to infer CV values at those sites using CV recorded on the entry and exit of the [MP] network. When RTN has developed new energy/demand algorithms and these have been accepted by the industry then these will be incorporated into the existing DN network models as an update to the demand on the planning models. The "Billing Zone" procedure will be robust and will still generate an appropriate billing zone albeit based on the latest view of demand. RTN is looking to deliver a proof of concept for a working real time network model based on the software tools currently available and the CV tracing capability available today in those tools. The RTN model will use the energy demand model to generate a set of demands for end users and add these to the model of the physical network to produce a view of the network at that time. The analysis of the model will determine the actual flows and pressures across the network and allow a view to be taken of the available capacity in "real time". If successful The RTN methodology should be able to determine a CV value at each node in "real time" using the standard CV tracing methodology but it does not develop a way in which these can be used for billing purposes. FBM is seeking to generate a procedure that will be appropriate for network models both now and also as understanding of consumer behaviour improves through projects such as RTN. FBM learning and confirmation of the gas quality and gas properties modelling capability of GBNA and Synergi Gas through O2 measurement and evaluation will underpin the development of the "Billing Zone" procedure.
Attachments	

Project code	**NGGD_04**	**Question Number**	**31**
Question date	**6th October 2016**	**Answer date**	**7th October 2016**
Submission section question relates to			
Topic			
Question	**Please can you give a high level estimate of how much involvement you foresee Ofgem to have in the stakeholder engagement for work packs 1 and 4? E.g. Can you provide an estimate of the number of workshops you might expect Ofgem to attend?**		
Notes on question			
Answer	We envisage Ofgem being involved in 6 days of workshops throughout the course of the project. We would welcome more engagement from Ofgem if they thought it necessary once the project commences.		
Attachments			