Future Billing Methodology

Project consultation report

Report contents

Executive Summary

Cadent's NIC Project - Future Billing Methodology (FBM) – was approved by Ofgem in November 2016. It is a £5.4m "Proof-of-Concept" project, in partnership with our technical consultants, DNV GL. The Project seeks to explore three potentially evolutionary options for a future billing framework that could unlock the decarbonisation of heat but still use the existing gas distribution networks. This would be done by assigning the energy content of gas in a more specific way, hence removing the need for enrichment of low CV renewable and low-carbon gases that are already compliant with safety regulations.

Cadent's view is that the gas grid is a high value asset which already has the capacity and flexibility to fulfil peak heat demand and to transport a range of GS(M)R-compliant gases. Therefore, using the existing gas infrastructure with a billing regime that obviates enrichment provides the basis for a "lower-regrets" approach to decarbonising heat, compared to electrification or other non-gas approaches.

The FBM Project consultation was launched on 2 March 2017 and targeted over 120 personnel across 80 organisations in the GB gas industry; including other gas distribution networks, gas shippers, gas suppliers, producers, scientific/technical innovators and other organisations.

The consultation itself was supported by:-

- two webinars, one for shippers and suppliers and another for other industry organisations;
- presentations at both Gas Transmission and Gas Distribution Network Code Workstreams and;
- conferences at IGEM and ADBA.

Following these events, extensive Q&A material has been published on the Future Billing Methodology web site to provide more detail to enquirers, with active email notifications being sent to consulted parties.

We recognise that the changes that this Project could bring about are fundamental and hence the industry's views are vital to shaping our thinking in taking the Project forward. The original consultation deadline was therefore extended from 14 April to 12 May 2017 to allow extra time for responses, with three waves of reminders being issued over the consultation period. For consistency purposes, the publication of this report has been timed to coincide with the completion and submission of our initial project cost-benefit analysis and stage gate report for Ofgem.

We believe our consultation with the gas industry under the Future Billing Methodology Project has demonstrated broad support for our views on the LDZ FWACV framework and for the proposed field trials to explore the possibilities for an alternative approach. We see this as a clear stakeholder mandate for proceeding with the FBM Project field trials, and to develop the proposed options for creating CV zones for a more direct attribution of gas energy in billing, which will enable the decarbonisation of GB's gas distribution networks.

Our stage gate report to Ofgem therefore recommends that we continue with the FBM Project. Subject to Ofgem approval, we will progress with preparations for the field trials for commencement in 2018-19 and will report on our initial findings on potential changes to billing.

There were a total of 16 respondents to the consultation. Of the 48 individual responses to the first 3 questions, 38 (79%) were supportive of the FBM Project. The responses to the 3 principal consultation questions are summarised at top level in Table 1 below.

Table 1: Summary analysis of responses to Future Billing Methodology consultation top 3 questions

FBM Project Consultation Y/N responses at a glance	Key	
	Y	Support
	O/P	Partial agreement / not indicated
	N	Against
	-	No comment

Question	Org type	GDN	Shipper/ Supplier	Industry bodies	Producer / Producer bodies	Tech/ other	Total
	No. of respondents	3	4	1	3	5	16
Do you agree that the existing LDZ FWACV methodology presents a barrier to a low carbon gas future and that alternative methodologies should be explored?	Y	3	1	1	3	5	13
	O/P	-	1	-	-	-	1
	N	-	2	-	-	-	2
	N/A	-	-	-	-	-	-
Do you agree that the FBM Project could provide the basis to deliver an economical and sustainable pathway to decarbonising heat for 2030 and 2050?	Y	3	2	-	3	5	13
	O/P	-	-	1	-	-	1
	N	-	2	-	-	-	2
	N/A	-	-	-	-	-	-
Do you agree that the proposed Measurement and Validation Field Trials could provide an understanding of the modelled zones of influence of LDZ-embedded gas entry points?	Y	3	3	1	2	3	12
	O/P	-	1	-	-	-	1
	N	-	-	-	-	1	1
	N/A	-	-	-	1	1	2
Totals	Y	9	6	2	8	13	38
	O/P	-	2	1	-	-	3
	N	-	4	-	-	1	5
	N/A	-	-	-	1	1	2

How this report is structured

The full consultation responses are set out as follows:-

- Question
- Cadent's summary of the responses
- Table of the individual responses
- Cadent commentary

For the purposes of the report, respondents have been short-coded as set out in Table 2, below.

Table 2: Short codes used for respondents

Type	Organisation	Short Code
Transporter	Northern Gas Networks	NGN
	Scotia Gas Networks	SGN
	Wales & West Utilities	WWU
Shipper / Supplier	Barrow Green Gas	BGG
	EDF Energy	EDF
	Npower	NPO
	ScottishPower Energy Management Ltd	SPEM
Industry Bodies	Energy UK	EUK
Production	CNG Services Limited	CNG
	Anaerobic Digestion & Bioresources Association	ADBA
	Renewable Energy Association	REA
Technical / Academic	Cardiff University/ CIREGS Research Group	CURG
	Smart DCC Ltd	DCC
	ITM Power	ITM
	Progressive Energy	PEN
	UK Hydrogen Fuel Cell Association	HFCA

Consultation Responses

This section looks at responses to each of the consultation questions in turn. The responses are summarised under the groupings used in Table 1 above.

Q1 Do you agree that the existing LDZ FWACV methodology presents a barrier to a low carbon gas future and that alternative methodologies should be explored?

Cadent summary of responses

The responses reflected a broad acceptance that the existing regime should be reviewed to identify options for decarbonisation. However, there are areas of disagreement from some Suppliers. Cadent notes the level of recognition among respondents that the existing LDZ FWACV framework for assigning energy to gas flows for billing presents a barrier to decarbonising the existing gas distribution grid. We also note the recognition that the existing gas grid has the key capability and flexibility to deliver the very significant peak heat requirement for GB.

Expressions of disagreement with the premise of this consultation question were made by shippers / suppliers. We acknowledge the practical concerns expressed about the definition of CV zones and these will be addressed as part of the learning from the field trial and analysis within this Project.

Individual responses

Gas Transporters		
Name	**Response**	**Additional commentary**
NGN	Agree	Recognised that the narrow capping methodology under the FWACV regime, whilst protecting from large-scale variation, is susceptible to undue influence from small amounts of gas at different CV, such as biomethane.
SGN	Agree	The current regime's requirement for enrichment undoes the green benefit of renewable gases like biomethane and that the costs of enrichment inhibit development in this area.
WWU	Agree	A recent stakeholder workshop at which the current billing and propanation requirements were highlighted as key barriers to large scale production and injection of distributed and green gases. The FBM Project was identified as a key priority for addressing these issues. WWU also referenced a joint project undertaken by three GDNs to understand the impact of, and barriers to, the connection of distributed gases; this identified the current billing arrangements as a potential barrier (NIA_NGGD0059 Impact of Distributed Gas Sources on the GB Gas Network)

Shippers/Suppliers		
Name	**Response**	**Additional commentary**
EDF	Agree	Agreed that LDZ FWACV could present a barrier to gas becoming a low carbon option in the future, but considered that significant evidence would be required to demonstrate that decarbonising mains gas is the most appropriate means of decarbonising energy. There is a wide range of options being considered by government, including heat networks, electrification and, with hydrogen as yet unproven, more clarity is required on the potential for gas in the future energy mix. However, EDF supports a trial that seeks to understand the mains gas decarbonisation option in full.
NPO	Not indicated	Agreed that alternative models should be explored to seek out more efficient, environmentally conscious and cost effective processes, but that gas quality must not be compromised and remain within statutory requirements.
SPEM	Disagree	Commented that the existing FWACV methodology, with propanation of biomethane to obviate CV capping has worked in practice for the multiple biomethane plants already in operation, and were not convinced that this is a barrier to a low carbon gas future, as it still results in gas that is less carbon intensive and utilises a sustainable fuel source. SPEM also recognised that the costs of propanation can be significant and that there are environmental impacts from supplementing biomethane with fossil fuel, but considers there may be an opportunity to assess whether there are other options available to socialise the cost of biomethane injection under the FWACV framework without requiring shippers and suppliers to make extensive and expensive changes to billing systems.
BGG	Disagree	Supported any change that would encourage injection of green gas and so further decarbonise the network, but did not consider the LDZ FWACV regime as a barrier; this being the GDN requirement imposed on biomethane producers through network entry agreements (NEAs) to increase their injection CVs to network average levels. BGG considers that the requirement for enrichment could be dropped immediately, reducing costs for those injecting low CV gas, encouraging further investment and targeting costs appropriately. BGG believes that removing the requirement to enrich low CV gas would result in capping regulations coming into play as designed, with lower initial customer bills offset by higher NTS costs; and policy makers could address the capping mechanism, as appropriate. However, BGG also stated that they had no issues with the aim of the FBM Project of investigating alternatives to billing that could be expected to lead to more accurate cost allocation between customers.
Industry Bodies		
Name	**Response**	**Additional commentary**
EUK	Agree	Recognised that the FWACV regime could present a barrier to a low carbon gas future and that the requirement to add propane both creates a cost burden for biomethane producers and reduces the “greenness” of biomethane; also that

		under FWACV propane would need to be added to hydrogen in the same way to meet target entry CV requirements, suggesting that alternatives should be explored to realise the benefits of green gas options in the network. EUK also commented that other options considered in the full Project submission document were not clearly explained in the consultation document.
Producers/Producer Bodies		
Name	**Response**	**Additional commentary**
CNG	Agree	The current FWACV-driven requirement to propanate low CV gas such as biomethane adds between 30 – 40 per cent (net ~£80k p.a.) to opex for a typical biomethane plant, and capital costs of £100k - £150k for propane storage and injection.
ADBA	Agree	Expressed support for the FBM proof-of-concept Project, stating that the addition of propane presents a barrier to investment and undoes many of the low carbon benefits delivered by biomethane, as an indigenous source of gas which reduces reliance on imports and complements weather-dependent, intermittent renewable energy technologies. ADBA believed it is important to remove any barriers to biomethane to continue decarbonisation of the gas grid, and supported alternative methodologies that encourage safe, low carbon gases being used in the gas grid, as biomethane can replace natural gas in customers' heating supplies, with no need to change technology. ADBA stated its calculations indicated that, with continued policy support, biomethane from AD could generate around 35TWh by 2020-25 and around 80TWh by 2030-35 with the addition of renewable hydrogen. ADBA supported alternative methodologies that encourage rather than discourage low carbon, Gas Safety (Management) Regulations-compliant gases being used in the gas grid. ADBA thought this could save GB £755m in GHG abatement to 2040, and with increases in thermal efficiency, could provide for 30% of domestic demand within 15 years. ADBA also listed a range of non-energy benefits from AD, including waste management and supporting agriculture.
REA	Agree	The requirement to add propane is costly and undermines the carbon-saving purpose of biomethane injection. In REA's view, decarbonising the gas grid could take place without adjustment to the infrastructure or change to customers' equipment; enabling the decarbonisation of heat for hard-to-reach customers without the need to change behaviour or face major disruption to replace or upgrade energy networks. They also recognised that the gas grid is an excellent asset that provides a buffer for coping with peaks in energy demand.
Technical/Academic		
Name	**Response**	**Additional commentary**
CURG	Agree	Regarded the LDZ FWACV method as a significant barrier for alternative fuel gases being transported and utilised in the gas grid economically, given the need to maintain a consistent calorific value. CURG compared this challenge with that of enabling low-temperature waste-heat sources to be utilised in

		district heat networks by accommodating them through new market and regulatory mechanisms in countries such as Denmark and Sweden; this has created significant economic and environmental benefits.
DCC	Agree	Although it has no direct involvement with the existing LDZ FWACV methodology, it is obligated by its licence to actively develop its systems and services to facilitate innovation in the design and operation of energy networks in a manner that best contributes to the delivery of a secure and sustainable supply of energy.
ITM	Agree	Recognised that the current billing methodology and capping mechanism isn't suited to a diverse range of low carbon gases entering the system and that instead of billing customers on real energy delivered, it would result in the exclusion of energy from the billing system and a misallocation of energy costs via increased shrinkage in the National (Gas) Transmission System.
PEN	Agree	The present billing regime does present a barrier, as it relies on metering volume rather than energy. PEN's view was that the "fix" of adding propane to biomethane to mimic [traditional] sources of gas has been a pragmatic solution, but as the gas network moves from single point sources to distributed generation, this needs to be addressed properly. PEN stated that the ideal solution would be simply to bill at the customer's point of use directly measuring the energy consumed, but as this would be unfeasible in cost terms at this stage, identifying a pragmatic solution is important. PEN recognised that if the gas grid cannot deliver low carbon heat, then consumers would face unavoidable disruption and substantial cost to change out their heating system as well as the cost and disruption associated with upgrading the electricity network and substantially increasing generation capacity. PEN referred to Section 9 of the KPMG 2050 Energy Scenarios report, which indicates that a low carbon approach based on gas evolution could avoid between £150-210bn in electrification costs to 2050.
HFCA	Agree	The LDZ FWACV methodology has no provision for hydrogen / natural gas blends and power-to-gas for absorbing surplus [electricity renewable generation], and that the FBM Project presented a short-term, easily achievable route to decarbonisation.

Cadent commentary

Cadent notes the level of recognition from respondents that the existing LDZ FWACV framework for assigning energy to gas flows for billing presents a barrier to decarbonising the existing gas distribution grid. We also note the recognition that the existing gas grid has the key capability and flexibility to deliver the very significant peak heat requirement for GB.

Barrier to decarbonisation

Expressions of disagreement with the premise of this consultation question were made by shippers / suppliers. We acknowledge the practical concerns expressed by respondents with regard to definition of CV zones and these will be addressed as part of the learning from the field trial and

analysis within this Project. We comment further on these aspects below the table of responses to questions 2 and 3.

With regard to SPEM's view that the LDZ FWACV regime does not present a barrier to a low carbon gas future, it is Cadent's view that the existing regime carries an implicit requirement to standardise the energy content of gases prior to entering the gas distribution network in order to avoid large-scale misallocation in the cost of energy being transported. This means that low carbon gases, must have fossil carbon added (in the form of propane) to match the CV of the "traditional" sources of gas which still prevail. This effectively constrains decarbonisation of the gas networks.

Other than removing the LDZ CV cap, as alluded to by BGG (see Cadent's comments below), Cadent cannot envisage any alternative way in which the LDZ FWACV regime could be operated that would facilitate decarbonisation of the gas network. However, we remain open to further input from industry participants throughout this Project.

Requirement to enrich low CV gases

BGG's assertion that the requirement to enrich low CV gases with propane is a GDN-imposed requirement and not required under the regulations[1] is correct. It is also true that the regulations could be changed to alter or remove the CV capping requirement. However, we believe that the existing regulations remain appropriate and proportionate in areas of the LDZ network which are fed by traditional gas sources from the NTS. Hence the ***Pragmatic*** option in the FBM Project proposes to identify specific CV zones around embedded, low CV gas sources, and to retain the LDZ FWACV approach for the remainder of the LDZ.

In BGG's view, the requirement to propanate low CV gas sources could be dropped immediately and allow CV capping to take effect, with the under-billing of gas transportation being offset by a higher network cost in the form of NTS CV shrinkage. However, Cadent believes that such a misallocation of costs between sectors and between customers would be both unacceptable and unsustainable. This is because relatively small quantities of low CV gas can cap out an entire LDZ, resulting in a transfer cost that could be many thousands of times the value of the low CV gas introduced. An example of this is shown in Figure 1 below.

[1] The Gas (Calculation of Thermal Energy) Regulations 1996, as amended 1997.

Fig.1 Worked example of LDZ FWACV capping effect for and LDZ with one biomethane site

SCENARIO 1: LDZ FWA CV Calc Scenario: LDZ with Bio-methane Plant delivering 1000 m^3/hr on a Winter Gas Day where Propanation active				
Source	mcm	cv	MMJ	GWh
Input A	15.0	39.0	585.0	162.5
Input B	15.0	38.6	579.0	160.8
Input C	0.0240	38.1	0.9	0.3
Totals	**30.0**	**38.8**	**1,164.9**	**323.6**
Capped	**30.0**	**38.8**	**1,164.9**	**323.6**
Unbilled LDZ energy to NTS Shrinkage				**-**
Capped out percentage				**0.00%**
System Avg Gas Price e.g.				1.3050
Equivalent cost of excluded energy				**-**

SCENARIO 2: LDZ FWA CV Calc Scenario: LDZ with Bio-methane Plant delivering 1000 m^3/hr on a Winter Gas Day where Propanation stopped				
Source	mcm	cv	MMJ	GWh
Input A	15.0	39.0	585.0	162.5
Input B	15.0	38.6	579.0	160.8
Input C	0.0240	37.0	0.9	0.2
Totals	**30.0**	**38.8**	**1,164.9**	**323.6**
Capped	**30.0**	**38.0**	**1,140.9**	**316.9**
Unbilled LDZ energy to NTS Shrinkage				**6.7**
Capped out percentage				**2.06%**
System Avg Gas Price e.g.				1.3050
Equivalent cost of excluded energy				**£86,913**
Equivalent value of biomethane at SAP				**£3,219**
Annual equivalent CV shrinkage bill*				**£10,468,671**

**Assumes load factor of 33%*

In the worked example above, one large biomethane plant within an LDZ accounts for less than 0.1% of the energy input but, without propanation, would trigger the exclusion of over 2% of the total LDZ energy from customer billing, causing a highly disproportionate cost transfer to the NTS shrinkage account. Over a whole year, this could result in a very significant allocative distortion between customer billing and network costs.

Regulations and policy

With regard to BGG's comments regarding changes to the regulations by policymakers, Cadent would point out that although the FBM Project has been designed to work within the existing regulations, the learning gained through the field trials and network analysis, together with the consideration of the full range of system and code implications for future implementation, should identify if, where and what changes to the regulations might also be required. This provides policy makers with a basis to determine the most appropriate regulatory framework.

Cadent believes that simply dismantling the LDZ CV capping mechanism would result in enduring and unfavourable cross-subsidies from customers receiving lower-CV gases to those fed from traditional sources or higher-CV imported LNG. Furthermore, whatever changes to the regulations may be appropriate, they cannot alone deliver the full mechanisms required to assign gas energy to customers' metered volumes in the most appropriate, effective and cost-efficient manner for a low carbon heat future.

Q2 Do you agree that the FBM Project could provide the basis to deliver an economical and sustainable pathway to decarbonising heat for 2030 and 2050?

Cadent summary of responses

The responses to this consultation question reflected strong support from biomethane producers and technical innovators, with qualified support from shippers / suppliers and academia for the above proposition. Some reservations were expressed by shippers / suppliers and academia with regard to scalability, economics and effective potential of "green gas" to decarbonise heat in GB.

Individual responses

Gas Transporters		
Name	**Response**	**Additional commentary**
NGN	Agree	Stated that the FBM Project was looking at the evolution of settlement for a broader range of gas sources, and may enable developments in biomethane, shale and hydrogen to enable a more diverse source of future gas supply.
SGN	Agree	Stated that a new billing methodology alone cannot provide a pathway to decarbonising heat, but that it would form part of a wider path of innovation towards decarbonisation. SGN also asserted that whilst there are a number of routes to decarbonising heat, none would be as economical or as readily achievable as decarbonising gas networks and that undertaking the Project itself will provide valuable information and awareness. SGN also pointed out that the existing gas networks are high value and long-serving assets that are the product of significant long term investment, reinforcing the favourable economics of "greening" existing gas infrastructure as a means to decarbonise heat.
WWU	Agree	Felt that the FBM Project is a fundamental step in being able to decarbonise heat, with gas increasingly coming from diverse sources with differing calorific values, to provide a sustainable, secure and affordable source of heat for the future.
Shippers/Suppliers		
Name	**Response**	**Additional commentary**
EDF	Agree	Agreed that the FBM Project could provide an insight into the role of gas in decarbonising heat for 2030 and 2050. EDF qualified this in that the [future] methodology would only be useful if it considers the scalability of its findings and considers the end-to-end impact of that on all market participants. EDF considered that there would be key milestones and decisions to be made within the industry as a whole regarding future energy policy and the decarbonisation of heat, and that any options explored must allow for an appropriate level of flexibility, to enable parties to adapt and react to future

		developments. EDF thought it would be unwise to develop a single solution that potentially locked the industry into an unsustainable or uneconomical way of operating.
NPO	Not indicated	Thought it difficult to give a firm view on whether FBM would deliver an economical and sustainable pathway to decarbonising heat, but that this should be possible following a thorough impact assessment and learning from the field trials. NPO considered that there would need to be a range of pathways to heat decarbonisation and so agreed that alternative models should be assessed.
BGG	Disagree	Did not believe there is a case now for requiring any enrichment when gas is otherwise compliant with all regulatory requirements. BGG did not view the FBM Project as a necessary requirement for amending the [GDNs'] present approach, which it saw as a real barrier that imposed real resource costs on the injection of low carbon gas.
SPEM	Disagree	Stated that it was not clear what potential existed for additional biomethane injection into the gas grid, or if the economics of biomethane were favourable in the longer term, and so questioned whether keeping the gas network in operation over the longer term is the most sustainable and economic solution for UK Plc. SPEM commented that, without the business case and impact assessment analysis, it was difficult to determine the economics or sustainability of the FBM proposal. SPEM also commented that the main benefit of the FBM proposal appeared to be the continued use of the gas network infrastructure, but that there were other alternatives for the use of the network, including redevelopment for heat networks or hydrogen/natural gas blending, and that consideration should also be given to the electrification of heat.
Industry Bodies		
Name	**Response**	**Additional commentary**
EUK	Partially agree	Commented that the FBM Project could be an element that helps to support a pathway for decarbonising heat via greening of the gas supplied; but the methodology would only support this if it helps to bring forward greater volumes of low carbon gas, whether biomethane, BioSNG, or hydrogen / natural gas blend. EUK considered that all options to decarbonise heat have various cost impacts and levels of disruption for parties along the supply chain, which would need to be assessed in a holistic manner, and awaited a policy decision in this area.
Producers/Producer Bodies		
Name	**Response**	**Additional commentary**
CNG	Agree	Agreed with the above consultation question, provided it resulted in reductions to the propane savings indicated in their response to Q1. CNG also suggested that shale gas would be likely to have a lower CV, similar to southern North Sea Gas, and therefore could require propanation under the

		existing FWA CV arrangement.
ADBA	Agree	Supported the FBM Project in the removal of barriers to further biomethane deployment, as it presents a carbon cost effective source of gas, crucial in the short-to-medium term decarbonisation of heat. ADBA went on to cite support for AD technologies in the decarbonisation of heat, including the Committee on Climate Change, KPMG and Policy Exchange.
REA	Agree	Reinforced their response to Q1 by referencing an Ernst & Young report from 2009, commissioned by National Grid, which suggested that renewable gas (AD and biomass gasification) could meet up to 50 per cent of UK residential gas demand over the longer term. REA also further referenced the same industry reports as ADBA which support the wider deployment of renewable gases in the existing gas grid.
Technical/Academic		
Name	**Response**	**Additional commentary**
CURG	Agree	Viewed the FBM Project as a step in the right direction to unlock the full potential of GB's gas network, and that the use of existing gas grids would be one of the most economic pathways for the UK to transition to low carbon heat. However, CURG referenced a 2012 study by DECC which suggested that "green gas" potential in the UK would not be sufficient to decarbonise heat. CURG's view was that while a change to the billing method may allow more "green gas" to be injected into the gas grids, the scale of the challenge of decarbonising heat requires a far-reaching approach. CURG also commented that the continued use of the gas network would allow the use of cost-effective daily and seasonal storage facilities, especially if gas fired power generation continues in the role of back-up/flex generation.
DCC	Agree	Were supportive of the FBM Project and that it could provide the basis to deliver a pathway to decarbonising heat for 2030 and 2050, but commented that whether the pathway(s) identified are economical and sustainable would depend upon the outcome of the research and any subsequent business cases developed.
ITM	Agree	Believed that the FBM Project had the potential to support the wider production and use of a variety of low-carbon gases, which would provide the basis to deliver the UK gas industry's targets to decarbonise the UK heat load and that the FBM Project would play an important part in achieving this quickly.
PEN	Agree	Believed that the gas network has an important part to play in the decarbonisation of heat, and that, although this would result in changes to the nature of the gas, this could be accommodated from a safety and performance perspective. PEN thought that decarbonisation should not be hindered due to a billing regime developed around pre-existing gas sources. PEN's view was that as the FBM Project proposed to investigate solutions to billing, that this work was necessary and that, as there would be no purely commercial driver for any single entity to undertake this work, it was right for a GDN such as

		Cadent to do so under a network innovation programme. PEN commented that there would be practical and administrative costs associated with any solution to address the billing problem and that these would be borne in different parts of the gas chain, but this should not be a barrier as, when weighed against the potential savings that could be achieved through decarbonisation of heat via the gas grid, these would be minimal. However, PEN thought it important that the FBM Project should identify the most practical, cost-effective solutions to deliver the billing functionality required in the interests of customers whilst enabling new forms of gas.
HFCA	Agree	Made no comment here, but indicated agreement with the consultation question.

Cadent commentary

Cadent notes the level of support among respondents for the view that FBM is worth exploring as a potential basis to decarbonise heat. Our commentary on specific aspects of the responses to this question follows below:

Scalability

We understand why some respondents would have reservations about the scalability of FBM. Scalability and the ability to replicate CV zone definition routines reliably across different networks may pose technical challenges, but this will be better informed by the learning from our field trials and cost benefit analysis. Further comment on these aspects is provided under responses to question 3.

Requirement to enrich low CV gases

Cadent would agree with BGG that the GDNs' requirement to propanate low CV gases imposes real costs on the injection of low carbon gases. However, we view this as a necessary interim arrangement. Until the point that an enduring solution can be delivered, it provides customer protection against both the disproportionate misallocation between billing and network costs, and cross-subsidy between gas customers that would otherwise arise under the existing FWA CV capping regime. We believe that FBM could provide such a solution.

Economics of FBM

With regard to the economics of FBM, we agree with SGN that the existing gas networks are high value, long-serving assets that are the product of significant long term investment. With regard to SPEM's concerns about Cadent's possible motives for the FBM Project, we would add that the existing gas grid already has the capacity and flexibility to respond to the significant diurnal and inter-seasonal swings in heat demand and transport all GS(M)R-compliant gases.

Using the existing gas infrastructure with a billing regime that obviates enrichment could provide the basis for a "low-regrets" approach to decarbonising heat, compared to electrification or other non-gas approaches. We also believe that a CV-zone-based billing regime such as FBM would bring benefits to gas customers in terms of the removal of enrichment costs for low CV gases and reduce losses through a more direct attribution of gas energy to customers.

Further, we believe that there would be significant economic advantages to energy consumers generally, by the use of the existing gas grid to decarbonise heat. FBM would facilitate not only an expansion in the use of biomethane from existing sources, but also BioSNG from domestic refuse; the deployment of hydrogen blend and other new renewable and alternative sources of low carbon gas that could meet safety standards. This benefit would come in the form of avoided costs of significant investment in a range of alternative heat energy sources and infrastructure to replicate the peak capacity, flexibility and responsiveness to demand fluctuations which are already provided by the existing gas distribution network.

It is also recognised that the impact on energy consumers will be a critical factor in the decarbonisation of heat. This is where a potential FBM solution has great strength, in that the bulk of customers could continue to use their existing gas heating and cooking systems, costing GB energy consumers considerably less than a non-gas based approach to decarbonisation.

Cost-benefit analysis

We would strongly agree with comments by EUK and PEN which stress that the FBM Project should act in customers' best interests by seeking the most cost-effective solution, and should therefore take account of impacts throughout the gas chain, considering these against the range of other options for decarbonising heat in GB. This will frame our approach throughout this Project and working towards the final FBM Project cost-benefit analysis in Phase 4.

The initial cost benefit analysis we have conducted suggests that three FBM options being explored could provide an economical basis for decarbonising heat, on the basis of propanation cost savings and the value of carbon abatement achievable, even before considering avoided costs of electrification.

Decarbonisation potential

With regard to CURG's doubts over the potential for "green gas" to decarbonise heat; and their reference to a 2012 study by DECC, Cadent believes that with the removal of the need to propanate and continued policy support, renewable gases including biomethane and BioSNG, could account for up to 108 TWh/a by 2050; with further potential for hydrogen generated from "power-to-gas" technology at renewable electricity generation plants and developments hydrogen blending from other sources. This could supply one third or more of GB's annual domestic gas demand, which would have a significant impact on the decarbonisation of heat.

Q3 Do you agree that the proposed Measurement and Validation Field Trials could provide an understanding of the modelled zones of influence of LDZ-embedded gas entry points?

Cadent summary of responses

The responses to this question reflected general agreement that the proposed field trials would be necessary to validate the GDN network modelling and could provide an understanding of the modelled zones of influence of LDZ-embedded gas entry points. A number of respondents expressed reservations as to what extent the findings would be replicable and scalable across other LDZ networks and over time. One respondent expressed doubts about the extent to which the field trial observations could agree with mathematical network models.

Individual responses

Gas Transporters		
Name	**Response**	**Additional commentary**
NGN	Agree	Saw the proposed trials as a necessary element to understand CV zones of influence, noting that some work had been undertaken by Xoserve in this area in 2009-10, but did not look into the physical elements. NGN considered that this work should be re-examined and further developed, and that any revision to billing arrangements must be supported by firm analysis.
SGN	Agree	Agreed that field trials would be essential in beginning to understand whether modelled zones of influence can be validated to a high level of surety. SGN also commented that generalisation of results would be difficult due to differing local system intricacies and timing of the trial. SGN were also interested in the impact of higher volumes being flowed in lower CV zones to meet the same energy requirement and whether widespread use of low CV gases would trigger reinforcement.
WWU	Agree	Understood that the oxygen content of the gas was to be used to provide an indication of the extent of the zone of influence of the distributed gas sources and that, as the oxygen content of biomethane is highly dependent on feedstock, they assumed that reasonable precautions would be taken to ensure that variations in oxygen content as a result of variations in feedstock or production techniques would not impact on the measured results.
Shippers/Suppliers		
Name	**Response**	**Additional commentary**
BGG	Agree	Commented that the trials appeared to be appropriately designed to deliver

		the intended outcomes.
EDF	Agree	Believed that the field trials would be likely to provide a baseline understanding of the impact that identifying CV zones of influence could have, but opined that significant further work would be required to extrapolate those findings; the aim being to provide robust and comprehensive evidence as to whether establishing new billing zones would be viable across the whole network.
NPO	Agree	Agreement was indicated but no comment was made to qualify this response.
SPEM	Agree	Believed that it would be beneficial to consider the zones of influence from existing biomethane plants, but that this analysis would only provide a picture of the composition at that time, and that this could not be extrapolated over time to different locations, because the results of the analysis would depend on the biomethane input, the different demand on the system and the points at which demand is taken from the network. SPEM believed it to be equally, if not more important, to understand the implications on individual customers.
Industry Bodies		
Name	**Response**	**Additional commentary**
EUK	Agree	Agreed that the proposed trials would aid the understanding of the zone of influence of the embedded gas entry points during the period of the study, but that this would only be a snapshot at that time. EUK saw the next challenge as extending that knowledge to other entry points with a robust degree of confidence for all stakeholders, so that new billing zones would provide a better reflection of the source of gas delivered and so identify a more appropriate CV for billing. EUK understood that this would involve both modelling and additional measurement points on the gas network. EUK expected that this would be subject to Ofgem scrutiny and potentially, external audit, to ensure no risk of detriment to customers.
Producers/Producer Bodies		
Name	**Response**	**Additional commentary**
CNG	Agree	Commented that there are significant differences between biomethane and natural gas; the absence of ethane and the presence of oxygen being significant. CNG also commented that it would not be possible to differentiate between shale gas and UKCS gas.
REA	Agree	Commented that the proposal in the consultation document appeared to be sound.

ADBA	N/A	Commented that they did not have any scientific or technical reasoning to contribute here.
Technical/Academic		
Name	**Response**	**Additional commentary**
ITM	Agree	Saw the field trials as an essential means of validating the use of existing network planning models for identifying charging areas for a more specific billing methodology, based on energy content.
PEN	Agree	Considered that gaining practical understanding of flows in a real network was important, and that using oxygen as a marker for biomethane seemed a practical approach that avoided any regulatory considerations associated with introducing other markers.
HFCA	Agree	Made no comment, but indicated agreement with the consultation question.
CURG	Disagree	Commented that the zone of influence of the gas would vary dynamically and would be distributed unevenly across the network depending on network topology, gas mixing and the demand variations. CURG referred to research they had undertaken to analyse the impact of transporting alternative gases in the gas distribution grid and had developed a method for analysing the steady-state operation of gas networks with distributed injection of alternative gases, and had analysed the gas mixture and composition at different gas nodes. CURG believed that it would be difficult to get mathematical models to agree with the field trial measurements, and that it would be a significant challenge to designate CV zones with clear boundaries. CURG commented that the method of using measurement for model validation was not clear in the [consultation] document, but that the method seemed to be specific for biomethane injection and so it was not clear how the method could be extended for other types of gas injection.
DCC	N/A	Made no comment.

Cadent commentary

Field trials and analysis

With regard to respondents' concerns over the potential limitations of the field trial and analysis of CV zones of influence, Cadent would comment that this Project is deliberately and essentially a "Proof-of-Concept". Therefore, undertaking the field trials will provide essential learning about the zones of influence exerted by embedded LDZ input points, together with the range and strength of factors that affect those zones under varied system conditions throughout the year.

The time and load-based statistical analysis of those observations will highlight the possibilities, implications and potential limitations of using GDN network analysis models to define CV zones that are sufficiently robust for billing purposes. This will include the degree to which algorithms for CV zone creation would be reliable at varying scale and could be replicated across differing network topographies and combinations of input scenarios.

In preparing for the field trials, we are aware that the zone of influence for a given input will vary across a network. DNV GL has used Cadent's network analysis models, along with data on customer demand variation to predict how the zone of influence should expand/contract with changes in demand. Network analysis software tools in place within Cadent and the other DNs (GBNA and SynergiGas) will also be used to ensure that any zone definition procedure can be delivered correctly in either system. This has the capability of modelling energy use and transported gas CV.

The field trial analysis will observe whether empirical measurements are in line with the network model results, with the aim of defining CV zones around an entry point using a probabilistic method. The basis of this boundary (for which options include setting zone size at peak demand, at average demand, or at low summer demand, etc.) will be evaluated and the gas supply and financial impact on end users will be calculated.

With regard to SGN's view that generalisation of results would be difficult due to local system "intricacies", Cadent would advise that the use of CV zone algorithms developed from the field trial and analysis will be applied in conjunction with each GDN's network planning model, which will reflect specific system parameters and take account of local nuances in system configuration. Hence our expectation that the CV zone creation routines developed from the field trial should be replicable and scalable.

Cadent currently use field pressure data to validate their models for capex and mains replacement planning. The overlaying of oxygen measurements on this existing approach will confirm (or otherwise) the suitability of using these existing models for CV boundary definition. We believe this approach could be used for all entry points, but this will be evaluated during the Project period, as part of the essential learning.

With particular regard to WWU's comment on potential variations in the oxygen content of biomethane, dependent on feedstock used for the gas production process on site; Cadent is confident that the specification of the oxygen sensors deployed in the field trial will ensure that biomethane can be reliably tracked through the potential range, regardless of different feedstock.

The Project findings will be shared with stakeholders and we fully expect that, if the field trial is successful, any following proposal for CV-zone-based billing would be subject to appropriate scrutiny by Ofgem and the industry.

Q4 If your answer to Q2 and or Q3 was "Disagree", what alternative or modified approach would you like to see considered?

Cadent summary of responses

The responses to this question reflected broad agreement with the premises underpinning questions 1 – 3, with the exception of BGG's desire to see the immediate removal of the requirement to propanate low-CV gases. Cadent's view is that the immediate removal of the propanation requirement would not be appropriate, for the reasons given above in our commentary on responses to Question 1.

Individual responses

Gas Transporters	
Name	**Additional commentary**
NGN	N/A
SGN	N/A
WWU	N/A
Shippers/Suppliers	
Name	**Additional commentary**
BGG	Commented that they would like to see either an immediate removal of the requirement to enrich low CV gas that is injected to the network, or removal to coincide with the next review of the CV shrinkage allowance.
EDF	N/A
NPO	Made no comment.
SPEM	Made no comment.
Industry Bodies	
Name	**Additional commentary**
EUK	Made no comment.
Producers/Producer Bodies	
Name	**Additional commentary**
CNG	N/A

ADBA	N/A
REA	N/A
Technical/Academic	
Name	**Additional commentary**
CURG	Commented that state estimation in gas networks is an important area of research and development that could potentially support future billing methodologies, as it combines field measurements and mathematical models of the network to estimate the state parameters – gas pressure and flow rate at each system node or branch. CURG added that this technique could potentially consider gas composition as a new state variable in improved methodologies. CURG referenced a limited measurements gas quality tracking method developed at Ruhr University in collaboration with gas and technology branches of E.On, and suggested that this should be investigated and assessed to drive learning outcomes.
DCC	N/A
ITM	Made no comment.
PEN	N/A
HFCA	N/A

Cadent commentary

Propanation

Cadent notes BGG's desire to have the existing requirement for propanation removed, but would reiterate that we see this as an essential customer protection measure to avoid cross subsidy between customers and distortion between billable energy and CV shrinkage.

Modelling

With regard to CURG's comments on modelling gas states and flows, we have made direct contact with this respondent, and have provided information on the capabilities of existing network analysis tools used by GDNs. We have explained and discussed our modelling approach in detail and CURG has expressed interest in following our field trial. We will be in contact with CURG to share our findings as the project progresses.

Q5 What factors and impacts would you like to see considered through the FBM Project?

Cadent summary of responses

A number of respondents (NGN, BGG, EDF, NPO, SPEM) emphasised the need for a full cost benefit analysis (CBA) that would take account of the potential impacts of FBM implementation on stakeholders throughout the gas chain, including the impact on customer bills. Some respondents (EDF, EUK, SPEM) also wanted to see parallel Workstreams to assess the detailed change requirements that would be needed to support an implementation of FBM, and to avoid delaying benefits. EDF expressed concerns that the FBM Project would have to do more than currently indicated to demonstrate the scalability of findings from field trial to national scale.

Individual responses

Gas Transporters	
Name	**Additional commentary**
NGN	Considered it important for the FBM Project to complete a full end-to-end Cost Benefit Analysis for implementation impacts, including GDN CDSP and shipper systems, to ensure cost and complexity would not outweigh benefit. NGN also stated that all parties should have sufficient opportunity to engage with the development, rationale and proposed solution.
SGN	Listed many factors that they would like to see considered throughout the Project including projected implementation and operation costs; potential impacts on shippers from increasing numbers of charging areas and added complexity, and how supply competition could be impacted by exposing a different CV topography across Supply Meter Point portfolios that have a larger or smaller than average number of CV zones. SGN also wanted to understand the impacts on the volume of gas flowing in zones of lower CV gas and the potential impact of this on reinforcement requirements and transportation charging (higher volumes ergo lower unit charges). SGN also wanted the Project to consider the potential complexity of an increased number of embedded inputs in an LDZ and the practicability of numerous charging zones in close proximity, and how data loss would be dealt with in the ***Ideal*** smart metering solution; how frequently CV would be attributed and how reconciliation would be impacted, given fluctuations in CV and how customers at or near CV zone borders would be affected.
WWU	Wanted to understand whether the Composite and Ideal options could restrict flexibility and impose greater constraints on inter-zone gas flows, effectively

	forcing a less efficient model of system operation and how the interaction of various sources within a single CV zone would be managed. WWU also wanted to know what systems would need to be developed in order to support each of the options, both physical and IT. WWU also wanted to understand how seasonality and inter-day flow variances would effect changes in CV zones of influence, together with the process and workload requirements for new entry and exit points being added, together with what systems / processes / assumptions would be required to define new zones.
Shippers/Suppliers	
Name	**Additional commentary**
BGG	Would support a cost benefit analysis that looks at the alternative costs and benefits, focusing on real costs, as opposed to those that are transferred between parties.
EDF	Considered it vital that the FBM Project considers the full end-to-end impacts from supply chain to customer billing. EDF also considered that the Project would need to do more in terms of demonstrating the scalability of the findings from the field trial to national level, including testing and contingency for areas where a zone of influence cannot reliably be identified. EDF felt the FBM Project paid little attention to potential impacts on shipper and suppliers, which are fundamental to the viability of the methodology, and would like to see a parallel Workstream to consider the three FBM options in terms of data flows, how CV would be received by suppliers and how far / frequently CV could fluctuate. EDF also felt that the updating of CV values suggested in the consultation in respect of the smart meter trial does not align with how CV is managed for smart meters today, and that smart design / meter configuration and central data systems should be factored into implementation costs in order to assess customer benefit. EDF added that suppliers would be likely to have to change billing systems and processes to accommodate any new methodology and that, although a more dynamic CV could improve billing accuracy, cost could outweigh benefit depending on complexity.
NPO	Stated that the main consideration should be a thorough end-to-end impact assessment, including cost benefit analysis, which must include impacts on supplier systems, processes and end consumers. NPO considered that the FBM proposals would have a significant impact on supplier processes, mainly data capture, data transfer, data storage, billing systems and billing processes.

	NPO added that the smart meter trial proposal [Ideal option] implied sending the CV figure to the meter, whereas suppliers presently receive a daily data file from National Grid containing the CV figure. This would mean suppliers having to capture the CV figure from the meter each time a consumption reading is obtained and then process this through the billing system, which would have significant impacts, more so when considering prepayment meters and the smart metring display. NPO considered that the Project should also consider impacts on the non-domestic market and how the proposals would affect AMR meters. NPO also felt that CV quality should be a key measure of the Project, including the impacts of deteriorating CV quality, and the impacts on the gas network of needing to flow higher volumes to meet a given energy requirement. NPO felt the FBM Project needed also to cover the impacts on the CV capping mechanism; measures that would need to be in place to cover low CV zones; cut-over method and transitional issues for implementation.
SPEM	Expressed concern over the lack of focus on the commercial and operational arrangements that would be necessary for shippers and suppliers to manage the change to the billing framework, noting that these changes would need to flow through the industry's Network Code review process. SPEM commented that early engagement would be preferable, as this had not been a consideration of the Project, and noted that engagement with the industry through its governance arrangements was now starting to happen.
Industry Bodies	
Name	**Additional commentary**
EUK	Stated that the FBM Project was unlikely to fail in its objective of gaining an understanding of the zones of influence of embedded gas supplies, but the real challenge would be taking that knowledge and applying it across all embedded entry points, and so would be about how and when to implement rather than if. EUK also wanted to see the Project take more account of end-to-end implementation costs, including all parties in the supply chain. EUK believed that all projects of this type should consider these issues and that even if a wider assessment was outside the Project scope, there should be some work in parallel to it, and that to consider implementation sequentially could delay benefits. EUK also stated that costs and timescales for changes to shipper / supplier and central systems could be substantial, but were barely mentioned in the Project documents.
Producers/Producer Bodies	

Name	Additional commentary
CNG	Mentioned that the impact of any change to GS(M)R that would allow higher Wobbe LNG to be injected into the NTS without pre-ballasting with Nitrogen would increase the CV of the GB gas grid and would so result in more propane needing to be added for biomethane and possibly shale gas. CNG also commented that they would like to see a change to the FWACV / Letter of Direction regime to reduce capex and risk around CV measurement [at embedded input points.]
ADBA	Would be interested in seeing a comprehensive carbon reduction assessment in subsequent stages of the Project which would build on the initial analysis of 1-2 million tonnes CO_2 saving. ADBA believed the FBM Project would be strengthened by further analysis of the potential carbon savings from changes to billing, and that smart meter element of the Project could consider interaction with electric smart meters.
REA	Would like to understand the implications for the longer term if billing stays on the same basis as today, as with the revision to GS(M)R to allow higher CV LNG to be injected without nitrogen ballasting, this would increase the amount of propane required for enrichment of low CV gas sources, exacerbating the current problems of cost and carbon impact. REA also wanted the FBM Project to look into lower cost CV measurement equipment.
Technical/Academic	
Name	**Additional commentary**
CURG	Considered that the development of future billing methodologies focuses on financial arrangements, but must reflect the physical rules of the gas networks with alternative gas injections, and technical studies would be required to support this. CURG also thought that it would be good to look beyond the current regulatory framework and consider the use of future gas networks from first principles. CURG considered that the present GS(M)R[2] requirements needed to be revised.
DCC	Commented that the FBM Project should consider that implementation of the Ideal option could increase the amount and frequency of data transmission through DCC systems beyond that originally identified in BEIS' Volume Projection Analysis, which ties in projected expansion to forecast uptake in smart meters, and could therefore require the expansion of DCC systems and services. DCC also pointed out that, in order to transmit data to smart meters, GDNs would need to become registered DCC Users and would require an amendment to DCC systems and processes and these changes could be sought

[2] The Gas (Safety) Management Regulations, which govern the composition and combustion properties of gas that can be transported in gas pipelines.

	via the Smart Energy Code modification process. DCC also noted reference to future gas energy measurement within smart meters and that this is outside the currently agreed specification but could appear in line with the meter policy age replacement horizon of fifteen years, but that technological developments in CV measurement devices could see such being attached to existing smart meters ahead of that time.
ITM	Would like to see the future impact of the adoption of hydrogen and hydrogen/natural gas blends considered through the FBM Project.
PEN	Noted that potential increases in Wobbe allowed under GS(M)R would increase the enrichment burden on those injecting low CV alternative gases and that it would not make sense to propanate hydrogen/natural gas blend. PEN also commented that the FBM Project should be cognisant of the possibility that technological advances in appliances could enable CV measurement, which could provide a significant population of distributed CV data, although that could be of lower accuracy than Directed CV devices.
HFCA	Wanted to see consideration of the rollout of hydrogen / natural gas blends of varying percentages and methodologies for billing based on slightly different energy content caused by adopting low concentration admixtures in Local Distribution Zones.

Cadent commentary

Cost-benefit analysis

Cadent agrees with respondents who have emphasised the need for a full end-to-end cost-benefit analysis (CBA) that will take account of the potential impacts of FBM implementation on stakeholders throughout the gas chain, including the impact on customer bills. This comprises Work Pack 4 of the Project, which will deliver a final high-level CBA for implementation of each of the three options: ***Pragmatic***, ***Composite*** and ***Ideal***.

Our Stage Gate submission to Ofgem, due on 11th August 2017 includes an initial CBA, within which implementation costs are, as yet, very high-level estimates. However, the final Project CBA will reflect the Project findings from the field trials and analysis, together with the learning gained from further liaison with Xoserve on options for reflecting CV zones for billing within the transportation billing system, and from further engagement with shippers / suppliers and other industry participants during the project. It will also source external published information, where appropriate, to complete the high-level CBA picture.

Changes to industry codes and regulations

At this point it is important to emphasise that, as an innovation project, Future Billing Methodology must remain a "Proof-of-Concept" which aims, by means of field trials and analysis, to establish that CV zones can reliably be determined for the purpose of billing.

The Project will identify where and broadly what changes might be required to regulations and industry codes at high level. However, the detailed drafting of those changes must remain outside the remit of the FBM Project itself. This is in line with direction from Ofgem on limitations to the scope of projects approved under its Gas Network Innovation Competition Governance.

Cadent's view is that it would not be cost-effective to commit key industry resources to parallel work-streams to specify detailed code / legislative changes while the fundamentals remain uncertain and subject to trial. However, should those field trials and analysis prove positive; we believe it would be appropriate to commence a separate, parallel review of regulations, codes and system specifications from that point, to avoid delay in realising the benefits of implementation. However, ahead of a final CBA output, this investment of resource would remain at greater risk.

Impacts on Shipper / Supplier billing systems

With regard to concerns expressed by EDF and SPEM over lack of attention / focus on impacts to Shipper / Supplier billing systems, Cadent would comment that we are in the early stages of engagement with Xoserve on potential options for implementation of CV-zone-based billing. Once we have a clearer view of this we will share this information to allow those parties to make a meaningful assessment of potential impacts of implementation costs.

Smart metering functionality and data flows

Similarly, with regard to EDF, NPO and DCC's comments on the proposed smart metering trial, Cadent recognises that data requirements and flows envisaged under the Ideal option are outside of existing specifications, but the aim of developing this option is to explore the implications of moving to a wholly smart-metered future in a way that could support a further transition to gas energy metering (measurement of CV at the smart meter).

Current Smart Meters compliant with the government's minimum technical requirements already include the underlying support for the conversion of measurement data based on CVs. The functionality is required to support the configuration of CVs for the purposes of the optional provision of meter balance information.

While the fundamental device support is present and implemented by device manufacturers, SM-JAN equipment and DCC capabilities require extension to allow Energy Retailers, consumers and related parties to access converted data for the purposes of billing and energy management. The project team is in the early stages of analysing the data requirements, volumes and use cases which will result in the deployment of the trial, using live calorific data acquired from in-field sensors with lab based Smart Meters to simulate the ideal end-to-end DCC ecosystem.

The trial will help evaluate the technical requirements and costs to implement the modifications in Smart Metering devices, the DCC, and Energy Retailer's data management and billing systems. The change management process will require support from a number of stakeholders including the DCC,

Smart Meter device manufacturers, Energy Retailers, networks, system integrators, energy services providers, and other interested DCC Service Users.

Future LDZ system operation and capacity provision

In relation to WWU's comments that the Composite and Ideal options could restrict flexibility and force a less efficient model of system operation. The central driver for FBM is to facilitate the decarbonisation of heat using the existing gas distribution networks and that this must rely on ever greater deployment of renewable and low carbon gases from distributed sources. We view this as an essential evolution of the gas grid and that moving from a wholly NTS-based gas supply model to an increasingly distributed supply base will require changes to the way in which the gas distribution system is developed and operated. Whilst the FBM Project focuses on the commercial / regulatory framework, we recognise the implications for physical system operation and the way in which system capacity is made available to facilitate ever-increasing distributed supply. These physical aspects will be addressed through separate initiatives, and we would expect cost efficiency to be a central consideration.

Changes to gas safety regulations

Cadent agrees with comments from CNG, REA and PEN that a potential forthcoming change to the gas safety regulations to remove the need for nitrogen ballasting of LNG (by increasing the allowable upper Wobbe limit) could result in a higher target average CV across LDZs. This would significantly increase the amount of propane required to enrich low CV gas inputs such as renewable biomethane, if the existing LDZ FWACV regime were retained. We would expect this to have an even greater negative impact on net carbon abatement from the use of renewable gases. We therefore see this as strengthening the mandate for exploring alternative billing regimes that could supersede the present requirement for enrichment to standardise the CV of gas across the LDZ.

Impact of CV zone complexity on supply competition

SGN's comments on potential distortion to supply competition from the introduction of CV zones and variations in numbers of CV zones represented within varying shipper portfolios are interesting. Cadent's initial thoughts are that, providing that the functionality for recognising different CV zones and CVs within an LDZ can be built into shipper/supplier billing systems, then the processes which use CV data and volumetric measurements should be generic and unaffected by the number of CV zones and CV values. However, Cadent would be interested to hear more from shippers and suppliers, once Xoserve's initial findings on potential changes to the CDSP transportation billing system can be shared. These investigations are currently in progress.

Impact of low CV gas on transportation charging

SGN raised the question as to how transportation charging could be affected by the exposure of the underlying lower CV of distributed gas supplies. On the assumption that customers' absolute energy requirements remain unchanged by the introduction of a FBM regime, Cadent expects that higher volumes would be recorded in affected customers' meters and that this would be naturally countered by lower CV in the billing calculations to leave customer bills unchanged *ceteris paribus*. At this point it is worth noting that the present LDZ transportation charging methodology is based upon approximately 97% for capacity charges. Cadent's expectation is that lower daily recorded zonal CV and higher periodic metered volumes would also be taken into account in the meter point settlement process (referencing a further point raised by SGN) which would then inform the annual

AQ review process for Non-Daily Metered (NDM) Supply Meter Points and also the Demand Estimation process which informs NDM End User Category (EUC) load factors used in capacity charging calculations.

Customers situated on CV zone borders

Cadent has been working with DNV GL and Xoserve to develop its thinking on the basis that will be used to configure CV zones for billing purposes. Our present position on this is that a geographical approach, whilst appearing simpler initially, would have significant shortcomings around the establishment of newly connected Supply Meter Points (SMPs), since geographical data such as post codes remain within the control of the *SMP portfolio* holder. We are therefore exploring the configuration of CV zones using physical system attributes that directly drive the network analysis modelling. An asset-based model such as this should, in principle, minimise the mis-attribution of CV at zonal borders.

Other matters for consideration

With regard to CURG's comments that we should be exploring the use of future gas networks from first principles, Cadent believes that whilst this could be looked at separately by the industry, the focus of the FBM Project must be on leveraging the existing gas distribution networks to decarbonise heat. Our view is that, as customers have invested in these networks for many decades and since this infrastructure already has the capability to safely transport all compliant gases, an FBM solution could provide the basis for an economical and "lower-regrets" means to decarbonise heat. We would add that the design and execution of the field trials and analysis will take proper account of the physical attributes of the existing gas network in developing algorithms for defining CV zones.

Finally, Cadent would support the views of ITM and HFCA with regard to the future deployment of hydrogen blend, as we see this as an essential part of delivering low carbon heat for the future.

Q6 If implemented, how would the suggested changes to the existing LDZ FWACV billing regime benefit your company/organisation, e.g. what savings would the changes bring?

Cadent summary of responses

Responses to this question clearly differed by type of respondent, with GDNs noting potential benefits of FBM for decarbonisation and security of supply. NGN noted that regulatory and system implications would need to be clearly assessed, and foreseeing increased costs and complexity for GDNs.

Shipper/Suppliers understandably focused on increased costs from changes to systems and processes and concerns over potential impacts on competition. Industry bodies (EUK) echoed Shipper/Supplier views, but noted potential wider benefits to society from decarbonising the energy mix towards meeting carbon budgets.

Producers and producer bodies noted the potential decarbonisation benefits, with CNG noting the positive impact which removal of the requirement to enrich low CV gases would have on project proposals and the potential for providing a more economical connection route for shale gas.

Technical/academic respondents focused on the decarbonisation benefits of FBM and as a key enabler for hydrogen deployment, including power-to-gas developments.

Individual responses

Gas Transporters	
Name	**Additional commentary**
NGN	Commented that benefits could not be fully assessed without understanding the regulatory and system changes required. NGN also thought that encouraging diverse gas sources to enter the system would provide future certainty for GDNs.
SGN	Commented that implementation of an FBM billing regime would encourage the development of more embedded gas entry points, which would assist in better network utilisation; bring more "green" developments supporting decarbonisation and would also bring benefits from more accurate energy reconciliation and settlement. SGN thought that there would be additional costs for GDNs from closer network monitoring, analysis and data transmission. SGN also thought that there could be increased queries due to complexity in billing and CV management and a greater risk that "out of spec"

	gas could be injected into the gas network.
WWU	Did not anticipate any direct savings to GDNs, but could see costs associated with producing new strategies and methods for operating the gas network and additional data requirements. WWU considered this could ultimately impact on overall network efficiency and trigger a requirement for additional network investment.
Shippers/Suppliers	
Name	**Additional commentary**
BGG	Considered that, as a small supplier with no significant IT systems, it would not expect to see any change in its own costs if the suggested changes were implemented.
EDF	Supported the need to understand the true cost of decarbonising the gas network and noted that the Project needed to look beyond network costs and consider the overall costs to the industry, to deliver a transparent and holistic view of the overall costs, in order to inform future policy decisions and consider this option against others for decarbonisation, such as electrification and hydrogen conversion. EDF did not anticipate any cost savings, but that the changes to systems and processes would all drive additional costs for suppliers and customers.
NPO	Noted that the FBM proposals could provide some improvement to billing accuracy / transparency, but could not foresee any savings. NPO also commented that the proposals would have a significant impact on supplier billing systems and processes and a thorough impact / cost benefit analysis would provide a clear view, but assumed that costs would vastly outweigh savings.
SPEM	Could not see any benefit from this Project; only additional cost and complexity in billing customers.
Industry Bodies	
Name	**Additional commentary**
EUK	Could not envisage any savings for shippers / suppliers and generators, only costs, arising from changes to systems and processes. EUK also opined that there could be a risk that that significant costs could distort competition between suppliers, if the cost of implementation per customer were to vary between large and small suppliers. However, EUK noted that there would be benefits for other parties such as biomethane producers and benefits from

	reduced billing cross-subsidies; network benefits from a more enduring role for their assets, if supporting decarbonisation, and wider benefits to society from decarbonising the energy mix and contributing towards meeting carbon budgets.
Producers/Producer Bodies	
Name	**Additional commentary**
CNG	Noted that reduced opex [from removal of the requirement to enrich low CV gas] would mean reduced subsidy and so an increased likelihood of projects going ahead for a given level of UK Government support. CNG also noted that the injection of shale gas into the gas distribution Local Transmission System (LTS) would be more cost-effective than injecting into the upstream gas National Transmission system (NTS), due to the lower operating pressure in the LTS, which would reduce the compression requirement, along with associated cost and GHG emissions. However, savings from this would take some time to calculate.
ADBA	Noted that changes [under FBM] could increase the low carbon credential element of biomethane, and further stimulated demand for low carbon gases on the grid, helping achieve government carbon budget targets.
REA	Thought that a CV-based billing system would be of direct benefit to its members involved in biomethane injection, gasification and for future companies producing hydrogen for grid injection, with reduced opex due to removal of the requirement to enrich low CV gases.
Technical/Academic	
Name	**Additional commentary**
CURG	N/A
DCC	Felt that it was not possible to quantify any cost or benefit at this time.
ITM	Thought that the suggested changes to the billing regime would help in the early demonstration and subsequent adoption of hydrogen/natural gas blends, such as those being demonstrated in the HyDeploy NIC Project.
PEN	Saw short term benefits from reduction in enrichment costs and that [FBM] was fundamental to the adoption of hydrogen in the gas network.
HFCA	Considered that establishing an appropriate method for billing for hydrogen/natural gas blends would facilitate the rollout of power-to-gas systems in the UK and enable the gas grid to absorb surplus renewable energy

	from the electricity grid, providing benefits to manufacturers of power-to-gas systems and to the electricity system operator for balancing an increasingly renewable-based electricity grid.

Cadent commentary

Net cost advantages from FBM implementation

Cadent notes comments from GDNs and shippers / suppliers in particular, that the implementation of an FBM regime would result only in increased costs. Whilst we do accept that the gas transportation and billing process would bear increased costs, we would comment as follows:

The FBM Project is predicated on the high priority given to reducing the UK's GHG emissions to achieve the 2050 target and the intractability to date of decarbonising heat (which accounts for 45% of GHG emissions). In this context we believe that the FBM Project is exploring options which, if implemented, could provide a "lower-regret" route to decarbonising heat than electrification or other non-gas approaches, because it will use the existing gas network, which already has the capability to transport all GS(M)R-compliant gases and to meet the significant swings in heat demand.

We believe that with the removal of enrichment costs and the right policies in place, the gas distribution networks could transport up to 108 TWh of renewable gas per year by 2050, together with the added potential for hydrogen from constrained-off renewable electricity generation through "power-to-gas" initiatives. We believe that FBM would be a key enabler to a range of gas-based solutions that – based on indications from a range of industry reports – could save the UK well over £100bn investment in electrification. We also see FBM as playing a key role in supporting future security of supply in an ever more diverse gas market.

Cadent therefore believes that the additional processing and infrastructure costs that implementation of FBM may generate for gas billing would be more than offset in two ways:

a) Gas customers would not need to replace their heating system, except on the normal life-cycle replacement schedule, and
b) Energy customers generally benefit by avoiding a significant proportion of the potential costs of decarbonising heat through electrification / distributed alternatives

As part of our project stage gate requirements we have prepared an initial Project CBA which includes an initial high level view of potential implementation costs and compares this on a cumulative NPV basis to 2050 against three key benefits:

i. Savings from the avoidance of enrichment costs for low CV gas;
ii. Monetised carbon savings from the carbon abatement from (i) and
iii. Monetised carbon savings from the additional deployment of renewable gas which we believe could be facilitated by the implementation of FBM

The results of our initial Project CBA show a strong positive cumulative NPV to 2050 for all three FBM options, and this will be published on the project web site along with an explanatory note, following approval by Ofgem.

Risk of "out-of-spec" gas

With regard to SGN's concern that a significantly increased population of embedded supply points would heighten the risk of non-compliant gas being injected into the gas distribution network; Cadent's view is that safety must always remain the utmost priority. Therefore any additional risk posed by the increased scale of distributed entry would need to be mitigated through industry reviews and evolution of the regulatory mechanisms that presently exist to prevent such breaches of the gas transporter duties under GS(M)R.

Impact of CV zone complexity on supply competition

In addition to our comments on this topic in relation to Question 5, Cadent would respond to concerns expressed by EUK about possible differences in change implementation costs for large / small Shippers, that we would expect these costs largely to be a function of the efficiency of billing system design and the effective procurement of information services and so cost impacts should be broadly proportional. However, we will continue our engagement with the industry and Shippers/Suppliers as we gain a clearer understanding of the billing implications of FBM from our liaison with Xoserve, as input from these stakeholders is vital to the final Project CBA in year 3 of the Project.

Other matters

With regard to WWU's comments regarding impacts on network efficiency, we would refer to Cadent's commentary on this under Question 5.

Q7 Do you envisage any legal or regulatory issues arising if any of the FBM options were to be implemented?

Cadent summary of responses

GDNs and shippers/suppliers noted the potential need to revise thermal energy regulations and the gas transportation contract (Uniform Network Code or UNC) and SGN commented that the Project should assist in mapping these out. NGN also pointed to potential changes to supplier licences, the Smart Energy Code and a future retail code. WWU questioned how variable CV zones of influence would work, noting potential complexity. NPO highlighted the need to consider regulatory requirements surrounding charging, billing and bill presentation to customers. Additionally, HFCA noted that changes would be required to GS(M)R to support the deployment of hydrogen. CURG commented that maintaining consumer trust through transition to FBM would be challenging.

Individual responses

Gas Transporters	
Name	**Additional commentary**
NGN	Believed that the FBM changes might require changes to the Gas (Calculation of Thermal Energy) Regulations, gas transporter licence and Uniform Network Code (UNC), and that changes to supplier billing methods could also require changes to supplier licences, the Smart Energy Code, and possibly a future retail code that could be introduced through Ofgem's Faster Switching Programme.
SGN	Anticipated significant change to the UNC, including changes to the OAD to support the CV zone-based billing process, and that the Project should assist in mapping the required changes for smooth implementation. SGN further questioned whether there should also be a re-evaluation of the GS(M)R to see if gas specification could be amended to better support low carbon inputs.
WWU	Would need to understand how variable zones of influence would work in the Pragmatic solution and how accurate they would need to be. WWU also considered that the Composite option could get very complex, with many different gas entry points, gas types and variable zones of influence and that it could add on a whole new layer of settlements process to determine an appropriate CV for each MPRN on a given day. However, WWU thought this may still be worth developing if the avoided costs of enrichment and ballasting were sufficient.
Shippers/Suppliers	

Name	**Additional commentary**
BGG	Did not anticipate any regulatory impacts at this stage, but that if policy makers considered that the existing arrangements did not provide sufficient customer protection, given the changes in the nature of gas being injected into networks, it would be a matter for them to change the Regulations irrespective of whether any of the FBM options were to be implemented.
EDF	Believed that more detailed consideration of the need to amend the Gas (Calculation of Thermal Energy) Regulations was required and that this should be within the remit of the Project. EDF were concerned that the new methodology might not be suitably reflected in the appropriate regulations and urged that the Project consider whether changes to the regulations would better deliver the overall objectives. EDF also pointed out that changes would be required to the UNC, but acknowledged that this would form part of any formal industry modification process.
NPO	Thought there would be issues if CV quality fell below minimum statutory requirements. NPO also highlighted the need to consider regulatory requirements surrounding charging, billing and bill presentation to customers.
SPEM	Identified that the UNC and Offtake Arrangements Document (OAD) would need to change and reiterated the need for an early engagement and analysis exercise to provide certainty of arrangements and the opportunity to create new market rules, should the Project cost benefit analysis warrant proposed changes.
Industry Bodies	
Name	**Additional commentary**
EUK	Pointed to the need to change the UNC and OAD; that it would be beneficial to engage affected parties at an early stage, and that commercial issues would need to be considered.
Producers/Producer Bodies	
Name	**Additional commentary**
CNG	Commented that there would be regulatory issues, but these could be resolved.
ADBA	Did not envisage legal issues, as gas quality and safety would continue to be regulated by GS(M)R, but thought that regulatory guidance could be required to ensure suppliers were billing customers in line with the actual CV of the gas

	being consumed.
REA	Did not envisage any legal implications from a successful implementation of CV-based billing, commenting that this should be a fairer system, reducing inaccuracy and cross-subsidy.
Technical/Academic	
Name	**Additional commentary**
CURG	Thought that maintaining customer trust through the [development and implementation] process would be challenging. CURG also pointed to potential legal issues on how to ensure the said CV value of the gas is delivered to the customer.
DCC	The main regulatory issues from DCC's perspective were the registration of GDNs as DCC users and potential modifications to the Smart Energy Code. DCC also pointed out that the installation of a smart meter is not mandatory for households, and that the rate of geographic dispersal of installations should be considered in proposing any future options.
ITM	Noted that the FBM Project avoids seeking changes to the existing regulations.
PEN	Noted that the FBM Project was designed to identify solutions requiring the least regulatory impact, and that this was important.
HFCA	Commented that changes to both the G(CoTE) and GS(M) Regulations would be required, because slight changes to the gas quality specification and the upper / lower energy content tolerances would be required to enable the adoption of hydrogen / natural gas blends. HFCA referred to current legislation governing appliance specification, noting that post-1995 gas appliances should operate safely with up to 23 per cent hydrogen. HFCA added that FBM considerations should address both the introduction of modest hydrogen/natural gas blends in the short term and more substantial hydrogen blends of 20% or more in the longer term.

Cadent commentary

Changes to industry codes and regulations

Most respondents expected that implementation of an FBM regime would require changes both to the UNC and gas regulations. Cadent agrees that the creation of CV zones for billing and the supporting changes to billing and associated processes described in the UNC will require potentially significant change to the gas transportation contract and we will work to map these out at high level as the FBM Project progresses.

With regard to gas regulations, our thinking has developed since the preparation of this Project, and we recognise that the additional, within-network, CV measurement required under the ***Composite*** option is likely to require changes to the Gas (Calculation of Thermal Energy) Regulations, in order to include those CV measurements within the billing process, whereas it had initially been expected that they would be used purely for analytical purposes.

Cadent also agrees with HFCA's view that changes will be required to GS(M)R to facilitate the deployment of hydrogen/natural gas blends and to that end, we are consulting with HSE on our separate NIC Project HyDeploy.

As SGN suggests, the FBM Project will endeavour to identify and map the required changes to the UNC, including the OAD and the gas regulations. In this regard, input from industry code experts will be essential and, as mentioned in our commentary on responses to Question 5, we feel it would be beneficial to commence a separate, parallel industry dialogue on potential changes, once we have gained a sufficient level of confidence in the results of the field trial.

Further, we recognise that future implementation of the smart metering ***Ideal*** option would be likely to require some changes both to the Smart Energy Code and the systems, processes and data volumes operated by DCC. However, we would emphasise that this option in the FBM Project is intended to explore the future requirements of a regime that will only be achievable in the longer-term. The FBM Project will assist in mapping out the required changes at high level, but we do not envisage directly initiating any formal review of the Smart Energy Code as part of this innovation project.

Other matters

With regard to WWU's comments about the potential complexity of CV zone-based billing under the Pragmatic and Composite options, Cadent would clarify that our aim is principally to have set CV zones for billing, the boundaries of which would be defined using time-based probabilistic analysis and the specific network model for the LDZ concerned. We would emphasise that the daily recording of CV would continue and that settlement would be based on recorded volumetric meter readings and daily CV data for the relevant CV zone. In relation to WWU's comment on cost-effectiveness, we would refer to our commentary on responses to Question 6 under the sub-heading, "Net cost advantages from FBM implementation".

Q8 Do you have any other comments on the FBM Project? (e.g. issues not covered in this document)

Cadent summary of responses

Respondents' additional comments covered a wide range of topic areas. With regard to engagement, NGN, EDF and NPO emphasised the importance of considering costs and impacts to all parties. SPEM commented that there had been limited consideration of the Shipper/Supplier and customer experience. EUK would have liked to have seen a more comprehensive end-to-end assessment of costs and impacts as part of the main Project. NGN suggested that engagement with industry parties via the Change Overview Board would be beneficial. SGN mentioned two of their current NIC projects which may impact or be impacted by FBM.

Individual responses

Gas Transporters	
Name	**Additional commentary**
NGN	Commented that it is not possible to understand specific costs and impacts at this stage of the FBM Project, but that NGN were keen to ensure that the Project considered costs and impacts to all parties. NGN added that, as a further evolution of settlement, this Project might not see firm changes being introduced for some years, and that it may be useful to further engage with industry parties through the Change Overview Board to ensure that parties are aware of this Project, together with proposed developments and timescales.
SGN	Wanted to remind industry participants of their NIC project: "Opening up the Gas Market" which explores the physical/regulatory barriers and changes required to enable more diverse sources of gas to be accepted, and "Real Time Networks" which aims to model the transient use of the network more effectively. SGN also cited the exemption within Schedule 3 of GS(M)R for higher oxygen levels in biomethane and that the FBM Project offers an opportunity to model the zones of influence of higher oxygen gas.
WWU	Pointed to the potential amendment to GS(M)R for high-CV LNG imports increasing the need for the FBM Project, given the potential increase to the differential in CV between NTS and distributed gas sources, and the requirement for increased enrichment for low CV gases that would otherwise arise. WWU also commented that the proposed CV zones under FBM needed to be suitably robust to avoid increasing the level of CV shrinkage and other unallocated gas costs.
Shippers/Suppliers	

Name	**Additional commentary**
BGG	Made no further comment.
EDF	Considered it important that the Project output was balanced and recognised the impact that decarbonising the gas network is likely to have on the overall energy mix. EDF thought this must be a well-rounded and holistic view to best inform future decisions on decarbonisation. EDF also commented that the Project should consider how best to present its findings to ensure these were understandable both to policy makers and technical experts.
NPO	Reiterated the importance of a thorough end-to-end impact and cost benefit analysis prior to making any final decision on implementation.
SPEM	Commented that there appeared to have been a lack of understanding and consideration of the market arrangements and the impact on the market, and that this was the second instance where transporters have commenced a programme with limited consideration of the Shipper/Supplier and customer experience. SPEM proposed that cognisance of impacts on all stakeholders should be imperative where funding is provided under the Network Innovation Competition.
Industry Bodies	
Name	**Additional commentary**
EUK	EUK would like to have seen a more comprehensive end-to-end assessment of costs and impacts as part of the main Project, without which there would be no defined pathway to implementation. EUK felt this raised questions about NIC Project appraisal by Ofgem, in terms of transparency, stakeholder engagement and prioritisation, but accepted that was an issue for Ofgem.
Producers/Producer Bodies	
Name	**Additional commentary**
CNG	Reiterated the importance of the impact of the potential change to GS(M)R for LNG; the biomethane producers' issue with the FWACV/Letter of Direction regime and the potential savings from future injection of shale gas into the LTS rather than the NTS.
ADBA	Had no additional comments.
REA	Were keen to see the Project taken forward successfully.

Technical/Academic	
Name	**Additional commentary**
CURG	Made no further comment.
DCC	Made no further comment.
ITM	Considered this a very important project with the potential to make far reaching and positive impacts on the wider adoption of low carbon gases, which would support the UK gas industry's targets to decarbonise the UK heat load.
PEN	Made no further comment.
HFCA	Welcomed the reference to hydrogen blends in the consultation document, which they believed to be achievable in the near term. HFCA encouraged the establishment of appropriate regulatory and billing frameworks for hydrogen blends at the earliest opportunity to allow the associated benefits to be realised. HFCA saw early adoption of hydrogen blends in the UK as bringing competitive advantages.

Cadent commentary

Engagement and Impact on Stakeholders

With regard to comments from NGN, EDF, NPO SPEM and EUK on engagement and impact analysis, we would reflect that the reason that the FBM Project has been submitted as an innovation project under the Gas Network Innovation Competition is that it is a "proof-of-concept". At the heart of the FBM Project are the field trials which are aimed to demonstrate that:

a) Zones of influence exerted by LDZ-embedded inputs such as biomethane sites can be understood and modelled using the GDNs' network analysis tools to create CV zones that are sufficiently robust for billing purposes, and
b) That gas CV data collected in the field trial can be reliably attributed to SMETS2 smart meters and used for billing purposes.

This is the core of the FBM project, which will provide the detailed learning essential to moving forward to design the means to bill customers using a directly attributed gas CV and evaluating the three options, ***Pragmatic***, ***Composite*** and ***Ideal*** for potential future implementation.

As we progress the FBM Project, we will share our findings and thoughts with stakeholders across the gas chain and we will continue and seek to expand our engagement with those who will be impacted by implementation. We recognise that an open and active industry dialogue on the potential changes, associated costs and benefits of FBM will be essential to determine whether and to what extent an FBM solution can play a cost-effective role in decarbonising heat in GB.

Potential impact of other projects

With regard to SGN and WWU's mention of the NIC project "Opening up the Gas Market", we would agree with WWU that the potential introduction of un-ballasted LNG resulting from an increase to the allowable upper Wobbe limit in GS(M)R would have the effect of increasing the average CV in some LDZs. A direct consequence of this would be that low CV gases such as biomethane would require increased levels of propanation (adding further processing cost into the gas chain) to avoid the CV cap being invoked under the current LDZ FWACV regime, and so we regard this as strengthening the case for a solution such as FBM, which would remove the need to enrich these gases.

SGN's "Real Time Networks" NIC Project seeks to maximise the effective utilisation of capacity across the LDZ and, whilst the projects are not interdependent, if FBM and RTN were implemented, they could potentially complement each other in driving an efficient future system operation regime.

Other matters

Cadent notes the endorsement from ITM and HFCA for the FBM Project. We believe that the FBM Project is very important and has the potential to make far-reaching and positive impacts on the energy industry in seeking a least-regret, most cost-efficient pathway to decarbonising heat in GB.

Conclusions

In Cadent's view, GB's gas distribution networks can and should play a vital part in the decarbonisation of heat towards 2050 and beyond. They are an existing high-value asset that already has the capability to transport all GS(M)R compliant gases and to respond to the significant diurnal and inter-seasonal swings in heat demand. In our view, the present LDZ FWACV regime presents a significant barrier to decarbonisation of GB's gas distribution networks, as it requires a standardised energy content of gas across each LDZ, to avoid CV capping and associated distortion in the allocation of energy costs across the gas chain and between gas customers.

We believe our consultation with the gas industry under the Future Billing Methodology Project has demonstrated broad support for our views on the LDZ FWACV framework. We also note that respondents who disagreed with our views on LDZ FWACV have shown support for the proposed field trials to explore the possibilities for an alternative approach. We see this as a clear stakeholder mandate for proceeding with the FBM Project field trials, and to develop the proposed options for creating CV zones for a more direct attribution of gas energy in billing, which will enable the decarbonisation of GB's gas distribution networks.

With regard to potential customer impacts, we also note views recently expressed by Ofgem that the impact on energy consumers will be a critical factor in the decarbonisation of heat. This is where a potential FBM solution has great strength, in that the bulk of customers could continue to use their existing gas heating and cooking systems, costing GB energy consumers considerably less than a non-gas based approach to decarbonisation.

Recent energy industry reports from KPMG, Policy Exchange and Imperial College London (see Appendix 1) indicate that the electrification of heat could cost the UK up to £300bn in broad terms. Based on the initial indications from our CBA at this stage, we believe that the future implementation of a zonal CV billing framework could facilitate the decarbonisation of a significant proportion of the GB heat load by 2050, because it is the key enabler for a range of gas-based solutions that would maximise the use of renewable gases and support the deployment of hydrogen. We believe this could save the UK well over £100bn investment in electrification. We also see FBM as key to underpinning future security of supply in an ever more diverse gas market.

Recommendations and Next Steps

In summary, based on:

- The positive feedback to this Project consultation;
- The strongly positive NPV from the initial CBA submitted to Ofgem, and
- The indication from industry research that a gas-centred solution to decarbonising heat, facilitated by FBM, could cost GB energy consumers considerably less than a non-gas-based approach

Cadent's Stage Gate Report to Ofgem recommends that the FBM project should progress through the field trials to its conclusion. This will deliver the learning required to make a fuller cost-benefit assessment of billing consumers using an FBM approach and equip the industry with an economically favourable option to decarbonise heat in a way that balances effectiveness with affordability for customers and continued security of supply.

Subject to Ofgem approval, we will progress with preparations for the field trials for commencement in 2018-19 and will report on our initial findings on potential changes to billing. As we progress the FBM Project, we will we will continue and seek to expand our engagement with those who will be impacted by implementation. We recognise that an open and active industry dialogue on the potential changes, associated costs and benefits of FBM will be essential to determine whether and to what extent an FBM solution can play a cost-effective role in decarbonising heat in GB.

Appendix 1 – Links to Industry Reports

KPMG report for ENA available at: http://www.energynetworks.org/gas/futures/the-uk-gas-networks-role-in-a-2050-whole-energy-system.html

Policy Exchange Report available at: https://policyexchange.org.uk/publication/too-hot-to-handle/

Imperial College Report available at: http://www.imperial.ac.uk/media/imperial-college/research-centres-and-groups/icept/Heat-infrastructure-paper.pdf

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