Future Billing Methodology

NIC04 Future Billing Methodology Project Progress Report 3 December 2019

Our vision

Report contents

1 Executive Summary

The Future Billing Methodology (FBM) NIC Project commenced in April 2017 and explores three options to provide a "proof-of-concept" framework for a more specific way of attributing the energy content of gas (calorific value or CV) to volumes in GB's gas distribution networks for billing purposes. Each of the three options being explored involves the development of CV zones for billing within each Local Distribution Zone (LDZ) and is supported by field trials.

The field trials cover two LDZ networks in the East of England. Each trial is designed to validate Cadent's network planning models as a basis for creating CV zones, by tracking the penetration of biomethane across the gas distribution network from an embedded entry point, under a range of demand conditions.

The wider project aim is to identify a robust, cost-effective option to support decarbonisation of heat to help meet the UK's 2050 net zero emissions target, using Great Britain's existing gas distribution networks to transport renewable and other low carbon gases without the need for enrichment with fossil-based gases to standardise its energy content for billing.

Phase 1 of the project, covering the initial industry engagement and CBA, was successfully completed in September 2017, with Ofgem's approval that the project could progress to the field trials and onwards to conclusion.

Phase 2 began with liaison with Xoserve and National Grid's Gas Transmission team to gain initial views on potential system and process impacts of implementing a Future Billing Methodology regime. A report on this was submitted to Ofgem on 28th March 2018[1]. This forward-looking work is now being picked up as part of a regular inter-GDN forum, facilitated by Xoserve, to coordinate future system developments.

The main body of work in Phase 2 of the project to date has focused on the following:

a) Technical design development for the measurement installations, encompassing changes to power source, site review and further redesign in respect of (b), together with site-specific design for each unique site, and the development of a battery-power solution for sites affected by land ownership issues.
b) Procurement, build and factory testing of installations, triggering further research on the oxygen sensor, testing and changes to design & procurement.
c) Further liaison with Distribution Network Owners (DNOs) for unmetered power connections to 27 sites across two regions, involving revalidation of quotations.
d) Stakeholder engagement planning, preparation and numerous engagements with residents and local authorities to support the successful installation of the street kiosk sites around Cambridge.
e) Stage 1 installation across 34 sites[2] and the commencement of DNO power connections;
f) DNV GL set up of the Smart Meter test laboratory in readiness for the field trial.

[1] SDRC 9.1b Report on 2nd Phase of Industry Engagement 28th March 2018: https://futurebillingmethodology.com/wp-content/uploads/2018/04/SDRC-9-1b-Report-Final.pdf

[2] Revised site population reduced from 36 to 35 as two sites in East Midlands shared the same feed off the MP system. One further site installation has become impeded by third party temporary construction buildings in the immediate proximity of the gas governor.

To date, 27 of the 35 field trial installations have been installed, with 16 of those now connected to power. Installation of the remaining battery-powered sites is underway and planned for completion in early 2020. Commissioning and Site Acceptance Testing for Stage 1 completed sites is planned to commence in December 2019 for completion in early 2020, with some uncertainty remaining around scheduling of further DNO power connections.

2 Project Manager's Report

Introduction

The Future Billing NIC Project is being undertaken by Cadent, working in partnership with DNV GL. It explores three options to provide a "proof-of-concept" framework for attributing the energy content of gas (calorific value or CV) to volumes in GB's gas distribution networks in a more specific way for billing purposes. The FBM project aims to provide the basis for a billing framework that will remove the need to enrich lower-carbon gases, such as biomethane from renewable sources, with high carbon fossil-based gases such as propane. This will unlock the full benefit of renewable-source gases and facilitate the decarbonisation of heat using existing gas networks.

FBM Project Phase 2

Sensor issues - resolution

The December 2018 PPR reported that the commencement of the field trial had been significantly delayed by a range of site-specific technical and land ownership challenges. Also, that we were in the process of obtaining a replacement for the original oxygen sensors which, on initial testing, had failed to provide reliable measurement of oxygen at the low levels specifically required to detect the presence of biomethane (0.1% - 0.2 % molar in biomethane, as distinct from 0.001% molar for natural gas) for this project.

A number of alternative sensors were obtained by Orbital for initial testing in early January 2019 and a preferred device was identified. However, this had to be subjected to rigorous factory testing by Orbital over several weeks, to establish accuracy and gain an indication of the likely reliability of this device in the field. Factory testing of the new device continued into March 2019 and proved successful. The new sensor was then authorised for project procurement.

Sensor long-term testing

Since that time, a production version of the replacement sensor has been maintained on long-term test in Orbital's laboratory, using a certified test gas mix designed to closely represent conditions in the field, to assess longevity and continued accuracy of the device. Six-month test results have proven the device to be robust and accurate so far.

Design changes for oxygen sensor

The different configuration of the new oxygen sensor required a number of changes to technical design, which required formal approval and appraisal. Revised designs for the temporary street kiosk installations were submitted to Cadent for User Acceptance in April 2019, for commencement of the physical street installations in May 2019. Redesigns for the DNO-powered governor installations were submitted for Cadent User Approval in May 2019, with governor installations commencing from mid-May 2019.

Preparation for field trial installation

Throughout the testing, procurement and redesign phases, dynamic reprogramming of the installation programme remained in progress to ensure that installations could begin as soon as physically possible after Cadent User Acceptance. A further workshop was held with Cadent Operations in March 2019 to agree and finalise a framework for site Permitry and resourcing, and a design workshop was conducted in early April 2019 with Cadent Integrity engineers, at Orbital's facility in Staffordshire, to gain first-hand knowledge of the installations and thus help expedite the User Acceptance process.

Field trial installation progress – DNO-powered sites

The installation of DNO-powered sites is broken into 3 stages, as follows:

Stage 1	"Dead-state" installation of earth rod, sensors, remote telemetry unit (RTU), power isolator, vents etc.
Stage 2	Unmetered electrical connection to DNO network & testing
Stage 3	"Live-state" Commissioning and site acceptance testing (SAT)

Stage 1 installation

Street Kiosk installations (DNO-powered) – Stage 1 Installation of the 13 temporary street kiosks commenced in mid-May 2019 and was successfully completed in late July 2019, with one site still requiring a gas connection, due to a mis-located LP main. The connection to this site will be delivered in the coming weeks, with the assistance of Cadent's East Anglia (EA) Repair team, subject to operational requirements for emergency workload.

Governor Kiosk installations (DNO-powered) – These began in June 2019 and were substantially completed in late September 2019, except for one site in East Midlands (EM), which has an existing DNO power supply. This site required a bespoke design and method statement for the internal power connection, which has been completed during November 2019.

Stage 2 DNO installation

Due to the delays created by complex design and sensor testing issues, the DNO quotations for unmetered supply connections, originally obtained in 2018, had to be re-validated during summer 2019. As a result, DNO connections could not be initiated until near the end of the Stage 1 installation programme. DNO power connections are now underway, both for the EM and EA field trials. However, there have been further delays in execution of the DNO connections, due to a range of site issues unrelated to the FBM installation or Cadent asset.

Stage 3 commissioning and site acceptance testing

Given the delays in DNO power connections, we are now making final preparations for commissioning and SAT for the FBM street kiosk installations in December 2019 and January 2020. Commissioning and SAT for the FBM installations at existing gas governor sites requires Cadent presence on site and will follow in early 2020, as soon as winter workload and resourcing conditions permit.

Field trial installation progress – battery-powered sites

The December 2018 PPR reported that an alternative, battery-power option was under development to retain a targeted number of governor sites affected by land issues. Also, that the provision of battery power requires a regular battery replacement programme throughout the measurement period, and so the number of governor sites recovered via this option had to be limited to remain within budget.

Further analysis by DNV GL identified four candidate sites in each of the two field trial areas, and design work on a battery-power installation model was initiated. In early 2019 design work was prioritised, to focus on delivery of the DNO-powered installations first, recognising the additional time-risk associated with DNO intervention.

Designs for the battery installations were submitted in September 2019 and received Cadent User Acceptance in mid-October 2019.

The installation of battery-powered sites is broken into 2 stages, as follows:

Stage 1	"Dead-state" installation of earth rod, sensors, RTU, power isolator, vents etc.
Stage 2	"Live-state" commissioning and site acceptance testing (SAT)

Stage 1 battery-powered site installation

Installation of the eight battery sites requires semi-remote earthing and a solid base to support the battery cabinet, so this work had to be programmed separately in advance of the main Stage 1 installation. The main Stage 1 installation of three of the four battery sites in EA is now in progress through December 2019, and the four battery sites in EM are planned for January 2020.

The one remaining battery site in EA has encountered unforeseen site encroachment issues, due to temporary construction buildings having been installed – against Cadent's safety advice – directly next to the gas governor. As these temporary buildings have been sited within the hazardous zone emanating from the governor vents, we are unable to proceed with the FBM installation until this issue is resolved.

FBM Field trial installation progress in summary

A summary of progress on the FBM field trial installations to the end of November 2019 is provided in Section 4 of this report.

3 Business Case Update

The first annual Project Progress Report in December 2017 provided details of the initial Cost Benefit Analysis undertaken as part of Phase 1 of the FBM Project. At this time, we have no further update on the business case for this project.

Details of the methodology used for the initial Project CBA and the summary results are provided in the FBM Stage Gate Report, which is available at www.futurebillingmethodology.com.

The Project CBA will be fully updated for the final Project Report, to be submitted under SDRC 9.5.

4 Progress against Plan

The issues described in Section 2 of this report have further impeded progress against the project plan. However, progress on field trial installations to the end of November 2019 is summarised in Table 4-1 below:

East Anglia - Chittering Field Trial	Planned Total	Stage 1 Install	Stage 2 DNO Connx	Stage 3 CommSAT	Comments
Street Kiosks	**13**	**13**	**11**	-	▸ Gas connection required for 1 site ▸ DNO connections planned for completion in Dec-19
DNO-power governors	**5**	**5**	**3**	-	▸ DNO connections in re-planning
Battery-power governors	**4**	-		-	▸ Site prep complete for 3 sites ▸ Full Stage 1 installs planned for Dec-19 (3 sites) ▸ One site witheld - 3rd party site encroachment
EA Site Total	**22**	**18**	**14**	-	▸ Stage 3 CommSAT for street kiosks planned for December 2019 / January 2020; governors to follow
East Midlands - Hibaldstow Field Trial	**Planned Total**	**Stage 1 Install**	**Stage 2 DNO Connx**	**Stage 3 CommSAT**	**Comments**
DNO-power governors	**9**	**9**	**2**	-	▸ DNO connections in planning / re-planning
Battery-power governors	**4**	-		-	▸ Stage 1 installs planned for Jan-20 (4 sites)
EM Site Total*	**13**	**9**	**2**	-	▸ Stage 3 CommSAT awaiting planning / DNO connections
FBM Overall	**35**	**27**	**16**	-	▸ Position as at end Nov-19

* Note that two governor sites in EM were found to share same supply leg, so one has been deselected, reducing total site population to 35 from 36 sites as at December 2018

Table 4-1: FBM Field Trial installation progress summary (to end Nov-19)

5 Progress against Budget

Table 5-1 reports the position against the project budget in GBP as at end of October 2019.

	PROJECT TO DATE			TOTAL PROJECT		
	ACTUAL	BUDGET	VARIANCE	ACTUAL	BUDGET	REMAINDER
LABOUR	2,085,858	2,272,056	186,198	2,085,858	2,402,076	316,218
CONTRACTORS / EQUIPMENT	2,546,373	2,580,004	33,631	2,546,373	2,680,448	134,075
IT	26,972	56,375	29,403	26,972	62,801	35,830
IPR COSTS	-	-	-	-	-	-
TRAVEL AND EXPENSES	4,642	4,642	-	4,642	28,500	23,858
CONTINGENCY	-	-	-	-	-	-
DECOMMISSIONING	-	-	-	-	206,976	206,976
TOTALS	4,663,845	4,913,078	249,233	4,663,845	5,380,801	716,957

Table 5-1: Actual costs v budget to P7 2019-20 and v total project budget

Commentary

Total underspend v budget to end October 2019 of £249k breaks down as:

- DNV GL invoices received to end July 2019, resulting in £66k shortfall against budget to date.
- Underspend of £183k on Cadent internal costs, due to delays in the field trial.

6 Project Bank Account

Arrangements are in hand to provide Ofgem with Project Bank statements, in line with Section 8.15 of the Gas Network Innovation Competition Governance Document. Due to the confidential nature of the project bank statements, they have not been included in this report.

7 Successful Delivery Reward Criteria

Table 7-1 below sets out the project Successful Delivery Reward Criteria (SDRC), each under a subsection labelled 9.1 to 9.5. The SDRC are actions linked to outputs of the project with a realistic but challenging deadline. The following subsections set out each criterion and clearly state the evidence that it is proposed Ofgem should use to assess performance against criterion. All SDRC delivery dates refer to the end of the calendar month. The delivery dates for future SDRCs have been adjusted to reflect the 12-month Project extension agreed last year.

Successful Delivery Reward Criterion	Evidence
9.1a. Industry Engagement – Phase 1 11 August 2017 **ACHIEVED**	The Industry Engagement Phase 1 will take place in Work Pack 1a and this SDRC will provide Ofgem with evidence of the following: • The Terms of Reference for the Industry Engagement • The numbers and types of participants in the Industry Engagement • A compilation of the output from workshops, questionnaires and meetings held during the Industry Engagement (Phase 1) • Initial cost benefit analysis • Requirement for the validation of the network modelling This SDRC will be based on milestone 9a of the Full Submission. Submit Phase 1 report to Ofgem in line with condition 2 set out in section 3 of this Project Direction. Do not proceed on to the remaining SDRC until Ofgem consent is given in line with condition 2.
9.1b. Industry Engagement – Phase 2 31 March 2018 **ACHIEVED**	The Industry Engagement Phase 2 will take place in Work Pack 1b and this SDRC will provide Ofgem with evidence of the following: • Phase 2 industry engagement report to include an update on continuing industry liaison following Phase 1 This SDRC will be based on milestone 9b of the Full Submission.
9.2. Novel tracking of unconventional gases by measurement **31 December 2020**	The novel tracking of unconventional gases by measurement will involve the installation and collation of field trial measurements. This SDRC will provide Ofgem with evidence of: • The installation of additional sensors on the gas network in governor stations and at street level • The efficacy of measuring oxygen content, pressure and flow to support the validation of network modelling for determining the distribution of biomethane in LP and MP networks This SDRC will be based on milestone 12 of the Full Submission.
9.3. Report on novel validation of network	The novel validation of network modelling for embedded and network charging areas will use zonal analysis of pressure, flow and

modelling for embedded and network charging areas **31 December 2020**	oxygen tracking measurements from the field trials. This SDRC will provide Ofgem with evidence of: • How to analyse oxygen, pressure and flow data from the field trials using network modelling techniques • Options and methods for assigning CV to charging areas for the Pragmatic and Composite scenarios This SDRC will be based on milestone 13 in the Full Submission.
9.4. Report on Smart Metering Laboratory Trials **31 December 2020**	The smart metering laboratory trials will be carried out at the DNV GL Technical Assurance Laboratories in Peterborough. Several CV measurement devices will be installed in the network field trial which would transfer CV to the smart meters. This SDRC will provide Ofgem with evidence of: • The transfer of CV to smart meters via a mimic of DCC • Options and further developments required for the future transmission of CV from smart meters to the billing process This SDRC will be based on milestone 11 of the Full Submission.
9.5. Future Billing Methodology Recommendation **31 March 2021**	The Project will report on Future Billing Methodologies and cost benefits of the three scenarios Pragmatic, Composite and Ideal concluding with a recommendation and high-level implementation plan. This SDRC will provide Ofgem with evidence of: • The Project findings through a collation of the outputs from Work Packs 1 to 4 • The Project recommendations and how these were derived including cost benefit analyses • High-level implementation plan of the recommendations This SDRC will be based on milestone 15 of the Full Submission.

Table 7-1 Successful Delivery Reward Criteria reflecting amended delivery dates.

8 Data Access Details

All project information, including project submissions, reports, project findings and analysis has and will be published on the FBM Project web site, which can be accessed using the following link: www.futurebillingmethodology.com

The web site has a web feed facility (RSS) that has been taken up by over 160 individual stakeholders and as we progress with the project, we are seeking opportunities to widen the web site readership, especially among key stakeholders who would be directly impacted by implementation of FBM. The web site is maintained annually and updated at each reporting stage.

However, we will also be utilising a range of existing industry channels such as the UNC Workstreams, ENA and IGEM to actively share project findings.

9 Learning Outcomes

Section 9 of the December 2018 Project Progress Report summarised the initial thoughts gathered from liaison with Xoserve and National Grid NTS on the potential impacts of implementing a future CV zone-based billing framework. The full version of these findings was published in Cadent's SDRC 9.1b Report on 28th March 2018.

This forward-looking work is now being picked up as part of a regular inter-GDN forum, facilitated by Xoserve, to coordinate future system developments.

10 Intellectual Property Rights

The Project team will comply with the default IPR Provisions. The purpose of the project is to provide a proof-of-concept for a new billing methodology. Since there must necessarily be a common billing regime across the country there is no intention or opportunity to exploit arising IPR commercially in GB. Copyright will exist on the reports produced as part of this work, but they will be published in the public domain where required for effective knowledge dissemination.

Background IPR, such as that within equipment supplied for the purposes of executing the project (e.g. oxygen sensors) will remain owned by the suppliers as Commercial Products. This will include, but not limited to DNV GL's background IPR in the network modelling tools Synergi Gas, GBNA and Graphical Falcon. These tools are already licenced and used by the GDNs to underpin their network planning and operational analysis. The modelling and analysis work carried out in the Project is to develop the understanding of CV changes and affected zones and will be delivered on the software versions currently available. No additional software capability will be developed as part of the Project. Any modelling procedures that are developed as part of the final recommendation will be software agnostic to allow ready implementation by any gas network operator.

11 Risk Management

The current Project Risk Summary is provided below:

FBM Project - Summary of Key Risks		
Ref	**Risk description & impact**	**Risk Mitigation(s)**
1	Weather risk - Delays site installation works due to adverse weather conditions	1. Installation works for Phase 2 sites is now scheduled to commence December 2019 2. Contingency time within planned activities 3. Contingency period planned for each stage 4. Further contingency time proposed within overall plan
2	Unforeseen site issues/complications eg Residents' objections to proposed works - May result in delays to site installation works	Cadent has undertaken a targeted customer engagement campaign on FBM kiosks with local residents and the appropriate local authorities. Processes are in place to manage and respond to any concerns. Site teams will be briefed and equipped with Cadent contact details.
3	Cadent site resource availability - This is a dependency for all Governor sites. Especially in winter/high demand periods.	1. Detailed resource requirements issued to Cadent Operations to secure advance support. 2. Remaining works currently scheduled to commence December 2019.
4	DNO unmetered supply (UMS) connections - Late delivery will delay commissioning.	1. Orders placed with suppliers and installation dates TBA with DNO under their service level agreement timescales. 2. Orbital managing DNO delivery.
5	1. Oxygen sensor - Risk sensitivity of unit is not able to differentiate between Biomethane and NTS Gas. 2. Risk of further project delays related to resolution of sensor issues.	1. Advanced testing has been completed and long-term testing is underway to assess accuracy and longevity of electrochemical cell in the sensor. Six-month test results have proven the device to be robust and accurate so far.
6	This is an innovation project involving the development and validation of novel methodologies. There is a risk that the methodologies cannot be validated by the field trials, that the sensors may not operate or be fully suitable for the application, or that the modelling cannot be made to work satisfactorily. This would impact on project costs/timeline/completion of associated milestone and potentially affect the project benefits.	1. Ensure all stakeholders aware and set expectations as a "Proof of Concept". 2. Ensure reasonable steps taken in technical selection and testing of equipment prior to final acceptance. 3. Technical review and monitoring throughout the project.

FBM Project - Summary of Key Risks		
Ref	**Risk description & impact**	**Risk Mitigation(s)**
7	Biomethane sites may not operate and perform as required and/or may not provide valid data for the purposes of the project and model (O2).	1. Ensure all stakeholders aware and set expectations. 2. Ensure reasonable steps taken in technical selection and testing of equipment prior to final acceptance. 3. Technical review and monitoring throughout the project.
8	Site and infrastructure condition/asbestos and location/access to pipelines. Project assumption is that the condition of Cadent assets is suitable for safe installation of proposed equipment. Risk if not suitable is significant delay and additional costs.	1. All sites have been selected and surveyed in detail. 2. Experienced industry-approved contractor undertaking street site works. 3. Detailed Construction Phase Plans and site specific RAMS to be issued and agreed ahead of works start.
9	Demand level variations. There is a risk that the weather variations within the trial LDZs and project time period may not provide sufficient high and low demand periods	Field trial covers two different networks. A 12 month schedule is planned for the field trial which also offers some contingency.
10	Delays to sensor installation schedule due to site land owner/third party issues/traffic management plan plus permissions/way leaves etc. Impact would be on project delivery timeline and potential cost implication.	1. Assess risks and review with sub-contractor/Cadent following the site surveys - Completed 2. Obtain early visibility of requirements - Completed 3. Effective and early engagement by Cadent with land owners, Highways Agency and Local Authority - Completed 4. Management review and monitoring throughout the project.
11	Governor Hazardous Area Assessment site adjustments - Completion ahead of planned Governor installations is a dependency.	Work programme complete.

12 Accuracy assurance Statement

This report has been prepared in accordance with the Gas Network Innovation Competition Governance Document published by Ofgem. The project has been subject to review and challenge by the Cadent Project Manager and signed off by Damien Hawke, Future Networks Manager, who is Project Sponsor for this NIC project.

Damien Hawke has confirmed that the processes in place and steps taken to prepare this Project Progress Report are sufficiently robust, and that the information provided is accurate and complete.

13 Glossary of Terms

Term	Meaning
CBA	Cost-Benefit Analysis
CV	Calorific Value – expressed in mega Joules per cubic metre of gas (mJ/m^3) at standard temperature and pressure
DNO	(Electricity) Distribution Network Owner
DNV GL	Project partner of Cadent
EA	The LDZ known as East Anglia
EM	The LDZ known as East Midlands
ENA	Energy Networks Association
FAT	Factory Acceptance Testing
FBM	Future Billing Methodology
FWACV	Flow Weighted Average Calorific Value
GB	Great Britain
GDN	Gas Distribution Network
GS(M)R	Gas Safety (Management) Regulations – governs the safety of the GB gas supply
IGEM	Institute of Gas Engineers and Managers
LDZ	Local Distribution Zone (gas distribution networks in GB comprise 13 LDZs)
NIC	Network Innovation Competition
RTU	Remote Telemetry Unit
SAT	Site Acceptance Testing
SDRC	Successful Delivery Reward Criteria
UMS	Unmetered (electricity) Supply

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