SHRINKAGE AND LEAKAGE SMART METERING REPORT

GAS DISTRIBUTION NETWORKS REVIEW THE POTENTIAL BENEFITS SMART METERS COULD HAVE ON THE REPORTING OF SHRINKAGE GAS AND THROUGH CONSULTATION WITH INTERESTED PARTIES, SUBMIT A JOINT REPORT TO OFGEM EVERY TWO FORMULA YEARS.

Joint Gas Distribution Network Submission

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1. Executive Summary

This report is the third Shrinkage and Leakage Smart Meter (SLSM) report. The first report was published on the 31st July 2014, following a period of consultation, and was followed up with an additional document early in 2015. In the document, published on 6th February 2015, the Gas Distribution Networks (GDNs) set out the potential benefits Smart Metering might have on the assessment of Shrinkage. Following the February 2015 report, the report in 2016 provided an update on the work subsequently completed to assess the validity of those benefits.

The purpose of the SLSM is to review the collection and use of Smart Metering Data that may be relevant to The Shrinkage and Leakage Model (SLM). It seeks to explain the relevance and implications of such data for the construction and operation of the SLM and for the reporting of information derived from it. In this report we have provided a further update on the national rollout programme and outlined our assessment of the benefits that smart metering could bring to the Shrinkage and Leakage Model (SLM). Shrinkage gas has reduced in recent years primarily through continued investment in pressure management and a targeted mains replacement programme. GDNs strive to ensure the calculation and reporting of Shrinkage and Leakage gas is continually improved.

To robustly evaluate the status of the smart metering rollout and any benefits smart meters may bring to the modelling process, GDNs have continued to engage with stakeholders via the Shrinkage Forum and have utilised independent assessments relating to meter coverage and sample size. These are referred to in this document.

The GDNs continue to engage with the industry regarding access to smart meter data. Due to delays in the rollout and concerns around the use of consumer data there is minimal update in this area, however, GDNs have not been mandated to be full Data Communications Company (DCC) users and currently do not intend to pursue access.

Since the last report in 2016 there has been insignificant change to evidence that smart meter data will improve the calculation of GDN shrinkage and leakage. GDNs will continue to engage with stakeholders to evaluate ways in which smart meter data would bring benefit to the Shrinkage and Leakage Model.

As part of our ambition to increase stakeholder engagement and understanding of shrinkage related matters, we would welcome any feedback from industry in relation to the points raised in this report.

2. Introduction

Gas Distribution Networks (GDNs) submit a joint "Shrinkage and Leakage Smart Metering Report" (SLSM) to the Authority (Ofgem) once in every two Formula years. There is an obligation which is set out in the Special Conditions applicable to all regulated GDNs (Special Condition 1F Part G). A copy of the Licence Condition is attached as Appendix 1 to this report.

3. Purpose and methodology

The purpose of the SLSM is to review the collection and use of Smart Metering Data that may be relevant to The Shrinkage and Leakage Model (SLM). It seeks to explain the relevance and implications of such data for the construction and operation of the SLM and for the reporting of information derived from it.

Prior to submitting the final report to the Authority, GDNs are required to consult with Gas Shippers and other interested parties. A draft of this report was published as a consultation document on the 27th June 2018. No comments were received on the draft report; therefore this Final Report is unchanged from the published consultation document.

4. Background to Smart Metering

It is the desire of the UK government that energy suppliers install smart meters in every home and small business in England, Wales and Scotland. There are more than 26 million homes for the energy suppliers to reach to, with the goal of every home and small business being offered a smart meter by the end of 2020. Smart meters give customers information about the energy they use to allow them to better manage their usage, save money and reduce emissions. Gas and electricity suppliers are required by their Licence to take all reasonable steps to roll out smart meters to all their domestic and small business customers by the end of 2020.

Smart meters will show customers:-

- how much energy is being used near real time
- how much energy was used in the last hour, week, and month (and what it costs)
- updates every half hour for gas.

If customers have a prepay meter, it will also show:

- how much credit is left
- how much emergency credit there is
- debt balance (if there is one)
- if credit is getting low.

Household impact

In March 2018 Smart Energy GB produced findings[1] on national awareness of smart meters and their impact on households. Key details include: -

- Around three quarters (73%) of people with a smart meter would recommend one to friends, family or neighbours. That's equivalent to 6.3 million people who would recommend a smart meter
- The majority (82%) of people with smart meters say they have a better idea of what they are spending on energy
- More than eight in ten (81%) of people with a smart meter think their energy bill is accurate compared to only 67% with a traditional analogue meter
- More than eight in ten (82%) of people with smart meters have taken steps to reduce energy waste
- One in three (33%) of people with a smart meter are now starting discussions to encourage others in their household to use less energy

[1] Latest findings on national awareness of smart meters, March 2018
https://www.smartenergygb.org/en/resources/press-centre/press-releases-folder/smart-energy-outlook-march18

5. An update on the status of the Smart Metering Implementation Programme

The Smart Metering Programme began in 2011 with a period of engagement with the energy sector, consumer groups and stakeholders. Installation began in November 2016 and will run to the end of 2020. Latest statistics show 12.3 million[2] smart and advanced meters have been installed in homes and businesses across Great Britain by both large and small energy suppliers – around 11.3 million (92 per cent) of these were installed in domestic properties and a further one million in smaller non-domestic sites.

A total of 1,240,500 domestic smart meters have been installed by large energy suppliers in the first quarter of 2018 (531,900 gas and 708,700 electricity meters). This represents a six per cent decrease in domestic smart meter installations compared to the previous quarter.

Over the same period, 17,300 smart and advanced meters were installed in smaller non-domestic sites by large energy suppliers (of which 11,600 were advanced meters and the rest smart meters). This is a three per cent increase in non-domestic smart and advanced installations compared to the previous quarter.

There are still significant numbers of smart meters to be installed with less than 3 years to achieve the 50 million roll-out target. Ofgem recognise that the 2017 ambition for installation rates widely varies across suppliers and some suppliers are planning for a 'very high peak' installation rates later in their rollout[3] progression. Small and large suppliers are required to submit a rollout profile to BEIS on an annual and quarterly basis, respectively.

The Smart Meters Bill was introduced in October 2017 and received Royal Assent on the 23rd of May 2018. The Bill enables the government to continue to regulate the roll-out of smart metering up to targeted completion at the end of 2020. It also extended the first measure of smart meters by five years. This allows the Government to make changes to regulations for smart meters until 1st November 2023, to "make sure the rollout is delivered on time, that benefits are maximised and that consumers are protected during the rollout and in the years beyond" [4].

An open letter from Ofgem[5], dated June 2017, recognised that most large suppliers had installed meters in line with their plans for 2016. An over-air upgrade is required to a sizable proportion of these meters to bring them in line with the SMETS1 compliance and until the upgrade is complete, they will not count towards the 2020 obligations. Ofgem acknowledges that almost all suppliers have

[2] Source Department for Business, Energy & Industrial Strategy "Smart Meters, Quarterly Report to end March 2018, Great Britain" https://www.gov.uk/government/statistics/statistical-release-and-data-smart-meters-great-britain-quarter-1-2018

[3] Ofgem Smart Meter Rollout letter, June 2017 https://www.ofgem.gov.uk/system/files/docs/2017/06/2017.06_final_open_letter_-_smart_meter_rollout_progress_and_plans_.pdf

[4] Smart Meters Implementation Programme 2017 progress update: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/671930/Smart_Meters_2017_update.pdf

[5] Energy Suppliers Progress and Future Plans, June 2017 https://www.ofgem.gov.uk/publications-and-updates/smart-meter-rollout-energy-suppliers-progress-and-future-plans

provided them with the 'credible plans' to complete the upgrades. There was significant 'ramping-up' of installations planned for the remainder of 2017, and these should soon be reflected in the BEIS statistics.

BEIS issued Direction Letters[6] to 12 suppliers on 28th February 2018 to provide operational flexibility and an alternative to the SMETS1 end date, now stated as 5th of October 2018 however, this is under review. It is anticipated that plans for installation rates will again ramp-up as the deadline draws closer. Some suppliers are already rolling out SMETS2 meters, but the stages of progress vary from supplier to supplier.

The GDNs continue to engage with the industry regarding access to smart meter data. Due to delays in the rollout and concerns around the use of consumer data there is minimal update in this area, however, GDNs have not been mandated to be full Data Communications Company (DCC) users and currently do not intend to pursue access. Concerns have also been raised by Citizens Advice, surrounding the potential use of consumer data without specific consumer consent.

The current estimated cost of DCC user interface access for upfront costs, then annual fees to retain access rights, is significant. With the current low-level coverage of smart meters and the accuracy and reliability of the current Shrinkage and Leakage Model, we cannot justify this level of investment to the networks as it would not represent good value for money for our customers.

[6] BEIS Direction on the SMETS1 end date derogation https://smartenergycodecompany.co.uk/latest-news/beis-direction-smets-1-end-date-derogation/

6. Assessment of the suitability of the use of Smart Metering Data as an alternative to the use of the Shrinkage and Leakage Model to calculate the levels of Shrinkage and Leakage:-

In our 2016 report, GDNs looked at three alternatives to the Shrinkage and Leakage Model. We considered that the difference between gas entering the network via offtakes, and the gas leaving the system via smart meters could simply be leakage, theft of gas, own use gas and unregistered/shipperless sites. GDNs surmised that this is not the case. Simply measuring gas in versus gas out and attributing any losses to shrinkage and leakage does not take into consideration the source and accuracy of emissions, and this would lead to a loss in clarity as to where GDNs target investment. Furthermore, any demand not being measured by a smart meter would be lost and become difficult to quantify. Any late meter registrations or meter errors is likely to make the process less reliable than the current methodology.

Meter coverage

For smart metering data to be considered for as an alternative to the shrinkage and leakage model, GDNs would need close to 100% coverage on their networks. Almost full coverage is required in order to *at least* maintain the assumed percentage shrinkage error of the current shrinkage calculation methodology. The GDNs commissioned Oxera[7] to provide advice on the use of sampling techniques to estimate network leakage using smart meters. Sampling theory suggests that a representative subset of data from smart meters could be used to estimate the aggregate (or population) usage, with some margin of 'sampling error'. This estimate could be compared with measured gas flows into the network to calculate leakage. As smart meters are currently being rolled out to domestic properties only, Oxera's analysis focussed on the use of smart meters to estimate total domestic consumption. The August 2016 report provides a methodology and guidance for determining smart meter coverage requirements to estimate gas lost via leakage.

The full report can be accessed online[8], and for this report we obtained an updated analysis by Oxera. To summarise the main findings: -

- The coverage requirement to estimate leakage with smart meters is high
- The domestic coverage requirements for smart meters across all three settings are very high when the required sampling error is 0.1% or less
- The city and town settings have lower coverage requirements but are still high (92% for a city, 98% for towns). A rural setting would require smart meters in almost all properties in the network to achieve this level of precision. This is due to a smaller number of properties and relatively high variability in annual consumption data in the rural setting.
- Oxera considers that the 0.1% sampling error would be necessary to estimate leakage; however, if a higher sampling error were acceptable for certain situations, the coverage requirements would be lower across all three settings:-

[7] Oxera are a global economics consultancy, more information can be found at https://www.oxera.com/Home.aspx

[8] Estimation of network leakage with smart meters https://www.gasgovernance.co.uk/sites/default/files/ggf/Estimation%20of%20network%20leakage%20with%20smart%20meters.pdf

Sampling error (%)	Error as a % of leakage	Error as a % of UIG	City	Town	Rural
0.04	7	1	99	100	100
0.06	10	1	97	99	100
0.08	13	2	95	99	100
0.1	17	2	92	98	100
0.2	33	4	75	91	100
0.4	67	9	43	72	99
0.6	100	13	25	54	97
0.8	133	17	16	40	94
1	167	22	11	30	92

- Smart meter data is potentially more promising in estimating peak load (1 in 20 winter day demand) than estimating leakage. This is because a less restrictive sampling error is required, and daily smart meter data may be less varied than total annual gas consumption.
- Once a significant body of smart meter data is available, alternative techniques may be applied to increase the precision of smart meter-based total usage estimates. However, it is not possible to assess the viability of these methods prior to the establishment of such a dataset and does not provide an improved accuracy to methodology used for leakage calculations.
- Even with high level of coverage, shrinkage error is not estimated to be any better than current methodology used by GDNs.

Access to commercial and industrial meter data

The Smart Meter rollout targets domestic and small commercial users, excluding the larger commercial and industrial users. These larger users account for approximately 40% of consumption on a typical gas network therefore the absence of consumption data for these customers will add significant uncertainty to the estimates of Shrinkage Gas. Without having any data from larger users, the GDNs would be required to review alternative methods of estimating usage for these consumers.

Users who require a meter larger than a U6 are currently offered an Advanced Meter (AMR), where the data is communicated to the supplier rather than the DCC. This creates a significant challenge for GDNs to access this data such as acquiring consumption data from the fragmented supplier market.

There are currently no plans to enroll AMR data into the DCC therefore GDNs will be required to request data from the various suppliers.

7. The steps that DN Operators are taking to ensure that they have appropriate access to Smart Metering Data; and

As per the aforementioned, the current estimated cost of DCC user interface access for upfront costs, then annual fees to retain access rights, is significant. With the current low-level coverage of smart meters and the accuracy and reliability of the current Shrinkage and Leakage Model, we cannot justify this level of cost to the networks as it would not represent good value for money to our customers.

8. How each Licensee intends to use Smart Metering Data to validate The Shrinkage and Leakage Model and the reporting of information under it.

In the 2016 report GDNs discussed whether smart metering could provide a level of validation to Average System Pressure and Service Pipe Material Data Quality in the SLM. It was surmised that demand information from smart meters may be able to aid in fine tuning the accuracy of the calculated average system pressures, only if a high level of coverage was possible. The current network validation process is already deemed as highly accurate.

It was concluded that the high level of coverage required to improve accuracy of system pressure data to reach a robust calculation of 'average' system pressure, was unlikely. With the added issue of meter errors, we do not feel it would add any additional accuracy to the Shrinkage and Leakage model at current levels.

Consideration had been given to using Smart Meter data for the three year Real-Time Networks project which kicked off in 2016, however, a number of constraints, including but not limited to, data aggregation, anonymization and data granularity discounted this option. The Real-Time Networks project uses a real-time energy model able to accommodate existing and future energy requirements. Individual consumer demand data is currently being collected from dedicated loggers fitted at 1200 properties across the south east of England.

The real-time energy model has been designed to incorporate Smart Meter Data should the above constraints be removed at some stage in the future. Furthermore, the reporting in the final year of the project will look to not only outline the potential value of uncompromised Smart Meter data to the GDNs, but also provide high level guidelines in terms of preferences for granularity of data.

In our last report we also looked at whether there was an opportunity to gather smart meter data to improve information on service pipe material. Any survey, by shippers on behalf of the GDNs, would only be able to identify the material at the point it enters the property, rather than the point at which it connects onto the main (the key consideration in the SLM). It is possible that this would add additional complexity to a process that has already been subject to delays. It has also been questioned whether the work force tasked with fitting the meters would be competent to correctly identify the material, especially as the services may be sleeved. The collection of service pipe material data is therefore considered unlikely to happen.

9. Conclusion

The GDNs have undertaken a comprehensive review of the current Shrinkage and Leakage model to identify possible areas that the provision of smart meter data could impact. Of the two areas the GDNs initially identified as being possibly impacted by the smart metering roll out or smart metering data, neither are now considered feasible ways in which to validate the Shrinkage and Leakage model. This is due to the high meter coverage required to produce a valid sample size and the potential introduction of meter errors, which when considered alongside the current methodology, provides no improvement to accuracy.

Similarly, the coverage requirements of smart meters for their potential use as an alternative to the Shrinkage and Leakage model, has been considered and it has been determined that coverage requirements are too high for this to be considered an option. This is especially true when it is considered that the 90%+ coverage requirement excludes demand from meters that will not be covered by the smart meter roll out i.e. those larger than U6/G4. A third-party report, produced on behalf of the Gas Retail Group[9], also agreed with the GDNs finding that attempting to utilise smart meters in this manner would remove any clarity on the sources of the emissions and thus hinder any attempts to reduce them.

Smart Metering may further enhance the current 'Real-Time' energy model concept and demand forecasting assumptions. The real-time energy model has been designed to incorporate Smart Meter data should the aforementioned constraints be removed at some stage in the future.

As a result of reviews undertaken, it is not foreseen that the availability of Smart Metering coverage (even at a high percentage level) will provide improvements to the current Shrinkage calculations, however, GDNs will continue to engage with industry and further explore other ways to improve accuracy.

[9] Energy UK Gas Retail Group Shrinkage Study
https://www.gasgovernance.co.uk/Shrinkage/Retail-Study

Appendix 1. Gas Transporter Licence Special Condition 1F Part G

Part G: Report to the Authority on the use of Smart Metering Data

1F.31 The Licensee must, in conjunction with other DN Operators, ensure that a single report is submitted to the Authority once in every two Formula Years called the Shrinkage and Leakage Smart Metering Report ("the SLSM Report").

1F.32 The first SLSM Report must be submitted to the Authority not later than 31 July 2014, and subsequent SLSM Reports must be submitted to the Authority not later than 31 July once every two Formula Years.

1F.33 The purposes of the SLSM Report are:

(a) to review the collection and use of Smart Metering Data that may be relevant to The Shrinkage and Leakage Model; and

(b) to explain the relevance and implications of such data for the construction and operation of The Shrinkage and Leakage Model and for the reporting of information derived from it.

1F.34 The SLSM Report must be made publicly available and must include:

(a) an update on the current status of the national smart metering implementation programme;

(b) the DN Operators' assessment of the suitability of the use of Smart Metering Data as an alternative to the use of The Shrinkage and Leakage Model to calculate the levels of gas Shrinkage and gas Leakage with respect to each Distribution Network that they operate;

(c) the steps that DN Operators are taking to ensure that they have appropriate access to Smart Metering Data; and

(d) how each Licensee intends to use Smart Metering Data to validate The Shrinkage and Leakage Model and the reporting of information under it.

1F.35 Before submitting the SLSM Report to the Authority, the Licensee must, in conjunction with other DN Operators:

(a) consult on a draft of the report with gas shippers and other interested parties;

(b) allow all such persons a period of at least 28 days within which to respond to the consultation;

(c) ensure that all non-confidential responses to the consultation are made publicly available; and

(d) use best endeavours to ensure that those responses are summarised and taken into account in the final SLSM Report prepared for submission to the Authority.

1F.36 The Licensee must submit the SLSM Report to the Authority in such form and manner as the Authority may direct.

Appendix 2. **Assessment of shrinkage measurement by monitoring gas in vs gas out**

Metering level options	Requirements	Potential Value	Restrictions
Offtake Metering In, Smart Metering Out – Full Coverage	Metering at offtakes – already in place. Statistically valid sample of Smart Meters in place within each LDZ. High level of coverage is required (see Section 6) Data requirements would as a minimum be an annual report of the actual demand.	Little additional cost to the Smart Metering roll out for additional meters. Due to the requirement for a statistically valid sample of meters (with at least one full year of data) to be in place before any calculations of the gas lost could be made.	Smart Metering is only applied to U6/G4 size meters therefore excluding larger domestic and commercial/industrial consumers – these consumers (excluding daily metered sites) account for approximately 40% thereby adding significant uncertainty to estimates of lost gas, including theft and own use gas. This would require some form of alternative modelling to determine what is lost gas and how much I&C customers are using. Such an approach whereby shrinkage and leakage are measured at an LDZ rather than sub-network level would significantly impact the way in which shrinkage is managed as there will not be the same level of the granularity regarding the source of the lost gas.

Metering level options	Requirements	Potential Value	Restrictions
Offtake Metering In, Smart Metering Out – Representative Networks	Metering at offtakes – already in place Statistically valid sample of Smart Meters in place within each LDZ. High level of coverage is required (see Section 6) Data requirements would as a minimum be an annual report of the actual demand.	As above; however, instead of waiting for statistically representative sample of Smart Meters across the LDZ before any perceived benefits may be realised, specific networks are targeted in the meter roll out allowing for statistically representative number to be achieved in these networks earlier and thus allowing the measured demand from Smart Meters in these networks to be applied to other similar networks to build an overall expected demand.	Such an approach would require that shippers / suppliers coordinate with GDNs to focus roll out of Smart meters to specific networks if the full perceived benefits with regards to shrinkage and leakage are to be realised before the completion of the roll out programme.
Offtake and Governor Metering In, Smart Metering Out	Additional meters to be fitted at each network governor. There are approximately 22,000 governors nationally and to achieve the level of metering accuracy required, it is likely to cost at least £50k-£100k per governor to include orifice meter, pressure/temperature correction, power source. Smart Metering to measure the gas out. Statistically valid sample of smart meters installed in individual low pressure sub-networks with appropriate metering at the governors.	Identify sub-network specific gas loss, allowing for investigative and targeted action to reduce loss and manage shrinkage and leakage.	This would require significant investment in flow monitoring, which has not been allowed for in RIIO-GD1.

Appendix 3. Opportunities to improve/validate the SLM using Smart Metering Data

Component of model	Input	Opportunity from Smart Metering	Data Required	Action	Cost	Potential Value / Restrictions
Low Pressure Leakage	Pressure data	No impact on recorded data – Smart Meters do not have the ability to record pressure and would require a pressure sensor before the regulator for this to be of any use if they did.	NA	NA	NA	NA
	Average System Pressure	This is currently calculated using a combination of recorded pressures and network analysis models. Data from Smart Meters may allow for minor improvements in the validation of these models	6 minute flow data	The GDNs have already fed in the request for this data to be made available	tbc	**Potential Value:-** • Fine tune the validation of network analysis models • Refine pressure management • Validate the average demand used to calculate average system pressures **Restrictions** • Requires high coverage (90%+) of Smart Meters to provide meaningful results – aggregation of smart meter data • Potentially leakage forecasts could increase • Difficult to assess on medium/large networks

Component of model	Input	Opportunity from Smart Metering	Data Required	Action	Cost	Potential Value / Restrictions
	Customer Numbers	No impact – customer numbers already known and held by Xoserve. Shipper led roll out means there is very limited opportunity to determine shipperless sites from installation of gas meters	NA	NA	NA	NA
	Mains pipe material / length	No impact	NA	NA	NA	NA
	Service pipe material	Possible opportunity to collect data on service types; however, this would require Shippers recording service pipe material during Smart Meter roll out and providing this information to the GDNs	Service pipe material to be recorded by Shippers on roll out and provided to GDNs	Engage with shippers to establish if the collection and transfer of this information is feasible as part of roll out	Unknown	Low pressure services currently account for 16-22% of low pressure leakage, mostly due to steel services. Populations are estimated in the shrinkage and leakage model. Improvements would be expected to be realised on completion of roll out
	Gas quality information	No impact - Smart Meters will not measure gas quality information	NA	NA	NA	NA
	MEG Concentration	No impact – Smart Meters will not have the functionality to measure MEG concentrations	NA	NA	NA	NA

Component of model	Input	Opportunity from Smart Metering	Data Required	Action	Cost	Potential Value / Restrictions
Medium Pressure Leakage	Pipe material / length	No impact – the introduction of Smart Meters will not provide additional information on the makeup of the medium pressure network	NA	NA	NA	NA
AGI Leakage / Venting	AGI Numbers / Types	No impact – Smart Meters will not provide additional information with regards to AGI numbers / types and venting	NA	NA	NA	NA
Interference Damage	Number of Incidents	No impact – Smart Meters will not impact on the number of incidents that occur	NA	NA	NA	NA
Own Use Gas		No impact as in the current model this is a factor of throughput	NA	NA	NA	NA
Theft of Gas		No impact as in the current model this is a factor of throughput	NA	NA	NA	NA