Joint Gas Distribution Networks Discussion Document on Potential Benefits of Smart Metering on Shrinkage Measurement and Reduction

January 2015

1. Introduction

Gas Distribution Networks (GDNs) are required to submit a single "Shrinkage and Leakage Smart Metering Report" (SLSM) to the Authority (Ofgem) once in every two Formula years. This obligation is set out in the Special Conditions applicable to all regulated GDNs (Special Condition 1F Part G).

Prior to submitting the final report to the Authority in 2014, GDNs consulted with Gas Shippers and other interested parties. A draft report was published as a consultation document on 30th May 2014.

The Joint Office published a notice of the consultation document and it has been published on the Shrinkage Forum area of the Joint Office website[1].

During this period of consultation, Shippers and other interested parties had the opportunity to respond. It was disappointing that no comments were received and the Final Report was, therefore, unchanged from the published consultation document.

2. Purpose

Following the publication of the SLSM Report in July 2014, Ofgem requested, via email of 3rd September 2014 and through the Shrinkage Forum held on 17th September 2014, that the GDNs consider the potential benefits of Smart Metering in more detail.

The specific Ofgem responses to the SLSM Report are included in Appendix 1 (with references to this document) and this discussion document seeks to address these points in more detail focussing on:

- potential data requirements;
- changes to the Shrinkage model; and
- the impact on actual gas lost through transportation.

There is currently insufficient data available from Smart Meters to carry out meaningful analysis, so this report summarises the GDNs current views on potential benefits, blockers, restrictions and next steps and in doing so explores the potential impact of Smart Metering on:

- Access to Smart Meter Data
- The Current Shrinkage and Leakage Model (SLM)
- Alternative to the Shrinkage and Leakage Model – Monitoring Gas In vs Gas Out
- Reduction of Actual Shrinkage Gas

Each section contains a summary of potential next steps followed by a more detailed assessment of the opportunities considered.

[1] Documents relating to the 2014 Shrinkage and Leakage Smart Metering Report can be found on the Joint Office website at http://www.gasgovernance.co.uk/smsl

3. Access to Smart Meter Data

To date, approximately 517,000 Smart Meters have been installed across Great Britain[2], representing 2.5% of the population, of which 215,000 (42%) are SMETS compliant. Approximately 302,000 (58%) are first generation Smart Meters and, therefore, should the customers switch energy provider these meters will only operate as traditional meters, i.e. in 'dumb' mode.

The DECC forecast for roll out is shown in Table 1[3].

Table 1 – DECC Forecast of Smart Meter Roll out

Year	DECC Projection
2014	0.34
2015	0.97
2016	2.75
2017	4.19
2018	4.88
2019	4.69
2020	3.80
Total	21.62

The information in Table 1 is DECC's forecast of SMETS (Smart Metering Technical Specification) roll out from 2014 to 2020. Due to problems with the GBCS (Great Britain Companion Specification), the protocol that DCC (Data Communications Company) will use to communicate to all SMETS meters, a DCC re-plan from either April 2016 or October 2016 has been proposed for the mass roll out. This re-plan is currently out for industry consultation.

NGN on behalf of GDNs has also raised a SPAA (Supply Point Administration Agreement) change to obligate Suppliers to provide quarterly information about forecast roll-out plans – expected implementation April 2015.

At present, GDNs are not able to access Smart Meter data but are fully engaged in the development of the DCC and have provided requirements for data into the process. Due to the requirement to maintain consumer anonymity, GDNs will not have direct access to Smart Meter consumption data

[2] Source DECC 'Smart Meters, Great Britain, Quarterly report to end September 2014' [Table 2b – Page 13]; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/387724/Smart_Meters_Quarterly_Statistics_Report_Q3_2014.pdf

[3] Source DECC Supplier Rollout Profile for Delivery Groups, February 2014

through an IT system. A request will have to be submitted for any data and this will need to be aggregated before it is issued.

This aggregated data could allow GDNs to access consumption for specific sections of the network that are primarily domestic and potentially compare actual flow against predicted. However, until full coverage of the Smart Meters on particular domestic sections of the network is available, results would be of limited value.

The Smart Metering roll out in the UK is the only one in the world that is to be Supplier led. In every other country the Networks have installed Smart Meters on an efficient street–by-street basis. Suppliers propose to use a 'customer pull' process targeting first those customers that want the new meters. The fragmented nature of the Supplier led model means that it is highly unlikely that GDNs will have access to Smart Meter consumption data for a complete section of the network until the end of the roll out.

4. The Current Shrinkage and Leakage Model (SLM)

Whilst GDNs currently have no information from Suppliers on their individual or collective Smart Meter roll out programmes or strategy, it is still possible to provide an assessment of the potential impact Smart Metering data could have on the construction and operation of the SLM and also whether Smart Metering data could be used to validate the SLM.

The current Shrinkage model has three major components:-

a) Gas lost through transportation (leakage and venting)
b) Own Use Gas (OUG)
c) Theft of Gas (TOG)

Gas lost through transportation is calculated using asset populations, asset attributes, system operating pressures and leakage rates developed through operational research. OUG and TOG are a function of throughput.

Of the ten key data inputs required in the SLM, it is estimated that two could potentially be influenced and improved using Smart Metering data. These are as follows:-

- **Average System Pressure** – Smart Metering could provide usage data that might assist in the validation of network analysis models, which are used to calculate average system pressures. Although current network analysis validation policy already requires a high level of accuracy, Smart Metering could help fine tune the process, especially in small, specific areas of networks that are proving difficult to validate. To facilitate this, there would be a requirement for statistical load research to investigate the relationship between individual customer usage obtained via Smart Meter readings and the 'assumed fully-diversified' peak six-minute demand required by the Network Analysis modelling process.

  Smart Metering may also provide the opportunity to improve the pressure management of those networks operating on clocked or drawn profiles i.e. not on intelligent profile control, by providing a more accurate assessment of demand requirements, especially through off-

peak periods. This could potentially allow pressure management regimes to be refined and pressures reduced during off-peak periods, both of which would result in lower average system pressures.

Currently, average system pressures are calculated using network analysis tools that assume a specified average demand across the year for all networks. Smart Metering data will allow this figure to be tested and potentially allow network specific average demands to be used.

To fully explore some of these potential benefits, GDNs will consider the practicalities of setting up trials on specific networks to determine if Smart Metering data can impact on average system pressures and the likely scale of any improvement. However, any trial will be impacted by the Smart Metering rollout programme and the availability of data in specific geographic areas.

SGN are currently running two parallel, NIA funded, feasibility studies into the requirements of trialling Real-Time Networks within SGN's distribution zones. At this stage, the relevance of Smart Metering in this area is unknown as the feasibility studies look to map the validity of various elements of sensor/metering technology requirements.

Although it is uncertain at this stage whether Smart Metering will form one of the key data sets for analysis, it is highly likely that information collected will be considered in some capacity, whether to bolster other live metering information or to further validate demand forecasting.

- **Service Pipe Material Data Quality** - Service pipe data is estimated using a combination of mains data and service pipe populations recorded during mains replacement activity.

  It may be possible during Smart Meter rollout to update the service type information used in the SLM model. However, this would require the support of Suppliers and GDNs will raise this issue as part of Supplier engagement on roll out.

Table 2 summarises the potential impact of Smart Metering data on each key data input in the SLM.

Table 2 – Opportunities to improve/validate the SLM using Smart Metering Data

Component of model	Input	Opportunity from Smart Metering	Data Required	Action	Cost	Benefit / 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 could be used to validate the accuracy of these models	6 minute flow data	The GDNs have already fed in the request for this data to be made available	tbc	**Benefits** **Potential to :-** • 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 of Smart Meters to provide meaningful results • Potentially leakage forecasts could increase • Difficult to assess on medium/large networks

Component of model	Input	Opportunity from Smart Metering	Data Required	Action	Cost	Benefit / Restrictions
	Customer Numbers	No impact – customer numbers already known and held by Xoserve. Supplier 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 Suppliers recording service pipe material during Smart Meter roll out and providing this information to the GDNs	Service pipe material to be recorded by Suppliers on roll out and provided to GDNs	Engage with Suppliers 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 seen as soon as roll out commences in 2017 with full benefit 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**	**Benefit / 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

5. Alternative to the Shrinkage and Leakage Model – Monitoring Gas In vs Gas Out

GDNs consider that the SLM is fit for purpose and is currently the most appropriate mechanism for evaluating leakage and shrinkage.

However, an alternative to using Smart Metering data to amend or validate the SLM would be to replace the current SLM with a model that would monitor gas entering the network via offtakes and exiting the system through Smart Meters; the difference being leakage, theft and own use gas.

Three options have been considered:-

- Offtake Metering In, Smart Metering Out – Full Coverage
- Offtake Metering In, Smart Metering Out – Representative Networks
- Offtake and Governor Metering In, Smart Metering Out

Details of the requirements, benefits and restrictions of each of these options are summarised in Table 3.

GDNs need to understand at what level the coverage of Smart Metering becomes statistically valid. As such it is proposed that GDNs commission a trial project utilising innovation funding to obtain a better understanding of the feasibility of each of these three options. At an early stage, GDNs will liaise with Suppliers to influence the Smart Meter roll out as much as possible to maximise the installation of Smart Meters on trial networks and, wherever possible, utilise Smart Meters that have already been rolled out. However, Smart Meter rollout is Supplier led and GDNs will require the support of the wider community in order to realise the potential benefit of any trials.

It should also be noted that fully electronic meters are only required to be accurate to ±2%, and diaphragm meters to accuracy of 3%. Current shrinkage / leakage levels are currently modelled to be approximately 0.6% of throughput, therefore the inherent error in meter readings to provide actual demand data could be greater than the actual shrinkage levels. However, this error should be mitigated by sample size once a representative population is achieved.

There is a concern, however, that a 'gas in vs gas out' model would make it harder for GDNs to influence shrinkage, particularly the leakage element, as there would be reduced clarity regarding the source of the lost gas.

It is important that any revised model for estimating shrinkage enables the GDNs to assess the level of fugitive emissions (leakage and venting), as these represent the vast majority of the GDNs' Scope 1 environmental emissions. In GDPCR1, Ofgem introduced a 'capped' incentive scheme to encourage GDNs to reduce fugitive emissions, which led to significant investment by the GDNs and associated reductions in emissions. For the RIIO-GD1 price control period, the strength of this incentive was effectively doubled and the cap removed, which has led to further initiatives for potential emissions reduction being investigated, e.g. improvements to the modelling of AGI venting and leakage from the medium pressure system. In order to facilitate investment and ensure that performance in respect of the licence incentives is assessed appropriately, a consistent and accurate estimation of fugitive emissions will be required.

Currently, Shrinkage only includes what is deemed ‘transporter responsible’ theft, which is estimated to be only a small proportion of overall theft. Due to its nature, the level of theft is unknown but it could be of equal or even greater magnitude than the level of leakage; this would provide a significant obstacle to being able to separate out the sources of ‘unaccounted for’ gas in a ‘gas in vs gas out’ model. Carrying out assessments at different times of the year may help with regard to this; the level of leakage is likely to be fairly flat throughout the year, but the level of theft is likely to follow a seasonal profile.

In a ‘gas in vs gas out’ model, consideration would need to be given to the units in which the comparison is carried out. Errors associated with calorific values and standard pressure and temperature correction could be significant if comparing energy values. This will have an influence on the data required from DCC.

In summary, whilst an alternative ‘gas in vs gas out’ model will be considered, the SLM currently provides the most effective measure of leakage and shrinkage.

Table 3 – Options to improve shrinkage measurement by monitoring gas in vs gas out

Metering level options	Requirements	Benefit	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. (GDNs will consider engaging independent consultants to determine a statistically valid sample size.) 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, it is expected that any benefit would only be realised late into the roll out programme (estimate 2019/20 roll out to representative samples + one year worth of data); however, this will become clearer once the roll out programmes are shared with the GDNs.	Smart Metering is only applied to U6 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	Benefit	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. (GDNs will consider engaging independent consultants to determine a statistically valid sample size.) 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 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. As yet GDNs have not had vision of the roll out plans.

Metering level options	Requirements	Benefit	Restrictions
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 and power source resulting in a total estimated cost of at least £1.1bn. 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. Ability to start assessing individual sub-networks as soon as statistically representative sample of smart meters are installed and meters are present at all the governors (inlets) to the sub-networks. This learning can then be applied to similar networks before they reach representative numbers of smart meters. (est. 2019/20)	This would require significant investment in flow monitoring, which has not been allowed for in RIIO-GD1 and GDNs have discounted this option as not being feasible.

6. Reduction of Actual Shrinkage Gas

Regardless of how shrinkage is actually measured, whether by using the SLM or a version of a 'gas in vs gas out' model, it is important to understand whether Smart Metering has the potential to reduce actual Shrinkage gas lost from the network. This has been considered for the following:-

- Leakage
- Own Use Gas
- Theft of Gas

There is the potential that Smart Metering may reduce demand, most likely during off-peak periods, allowing GDNs to operate those networks fitted with clocked or drawn profiles at lower pressures thereby reducing average system pressures which will, in turn, reduce leakage.

However, the behaviour of customers cannot be forecast with any certainty and this will only be understood once significant volumes of Smart Meters are installed and a number of year's data compared.

The measure of Own Use Gas is not impacted by Smart Metering.

Smart Metering may also make it easier to identify theft downstream of the ECV e.g. via zero meter reads.

Table 4 summarises the potential for reduced shrinkage resulting from the roll out of Smart Metering.

Table 4 – Potential for Smart Metering to reduce actual shrinkage

Area	Benefit	Comments
Leakage	Customers use less gas, demand decreases therefore GDNs are able to operate their networks at lower pressures thus reducing the volumes leaked from the low pressure network.	It will not be clear whether a Smart Meter impacts customer's behaviour until significant data is available. When it is available, it will need to be weather corrected to understand the impact. The GDNs are currently engaging the Met Office on a piece of work on weather correction. Information on the actual demand from domestic customers may in some instances help GDNs to optimise some network pressures and thus reduce leakage. However, by the end of RIIO-GD1 a high percentage of the metallic network length will be influenced by intelligent profile control which already minimises pressures based on network performance.
Own Use Gas	None	
Theft of Gas	The use of smart meters should make it quicker and easier to identify sites where theft is occurring as a result of meter bypass i.e. from zero meter reads.	This would require MRPN specific information, which is not currently available to GDNs

Appendix 1 – Ofgem Response to Shrinkage and Leakage Smart Metering Report (dated 3rd September 2014)

Requirement	Comment	Section
1. Review the collection and use of Smart Metering Data that may be relevant to The Shrinkage and Leakage Model.	This section does not appear to fulfil the requirements of the licence condition. It does not, for example, say how many smart meters have been rolled out or will be rolled out in advance of mass roll out. While it says GDNs do not expect to become system users until there is a sufficient density of data, and definitely not before 2017, the report does not say what GDNs consider to be sufficient density. Becoming a "user" earlier may allow them to be better informed even if there is no universal coverage, especially given their customers will start paying for the data as each meter becomes enrolled in the DCC. We'd expect to see evidence of work to understand when it is likely to be viable to commence studies checking the assumptions in the shrinkage model.	See Section 3
2. 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.	The report does not say what information is available now or what will be available in the future. The report says that a Shrinkage Forum working group will be established that will work on these issues. We'd expect that this should have been done by now and reflected in the report.	See Sections 3 and 4
3. Update on the current status of the national smart metering implementation programme.	There is no mention of meters being rolled out in the current reporting period or forecast for the next reporting period. DECC forecast data could have been used. There is also no mention of the trial data that could be made available to licensees that they could work with to see how the new data from smart meters could be captured and analysed to inform either the	See Section 3

	replacement or development of the model.	
4. 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.	We acknowledge that there is uncertainty and the lack of smart metering data. However, we'd have expected to see the results of thinking undertaken on how GDNs can go about addressing this question. For instance, what data needs to be analysed, what systems would need to be in place, noting that the GDNs already have a clear understanding of the data they will start receiving through the DCC from the start of the mass roll out.	See Section 5
5. Steps that DN Operators are taking to ensure that they have appropriate access to Smart Metering Data.	The report does not go in to any detail on what GDNs are doing proactively to ensure they get access to and properly capture useful data from DCC. This is an urgent requirement and by the time of the next report, the mass smart meter roll out will already be underway with all data formats fixed.	See Section 3
6. How each Licensee intends to use Smart Metering Data to validate The Shrinkage and Leakage Model and the reporting of information under it.	Licensees could have done more work during the reporting period. Just because limited actual smart metering data is currently available, this does not prevent GDNs from thinking about how they might use it to validate the model, noting again that the GDNs know exactly what data they will be receiving through the DCC. We'd have expected this thinking to be captured in the report.	See Section 4