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Northern
Gas Networks



Joint Gas Distribution Networks (GDNs) Shrinkage and Leakage Smart Metering Report (SLSM)

July 2016

1. Executive Summary

This report is the second 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 that 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. This report provides an update on the work subsequently completed to assess the validity of these benefits.

Along with a comprehensive review of the Shrinkage and Leakage Model (SLM), GDNs have commissioned an independent project to evaluate smart meter sample size, engaged with stakeholders through a variety of fora and working groups including the Shrinkage Forum, and have considered independent third party reports produced on behalf of the Gas Retail Group. This has been done in order to provide a complete evaluation of the current state of the smart metering rollout and the opportunities to utilise smart meter data to improve the evaluation of Shrinkage and Leakage quantities.

Through this evaluation, the GDNs have continued 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, it is unlikely that GDNs will have access to smart meter data until 2019/20 at the earliest.

Through the independent assessment of sample size requirements for accurate interpretation and use of smart meter data, the GDNs have also identified that it is unlikely that smart meter data will be able to be utilised to improve the evaluation of Shrinkage and Leakage. They will however, continue to engage with stakeholders and the industry to evaluate possible new and innovative ways in which it may be possible to utilise smart meter data.

2. 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). A copy of the Licence Condition is attached as Appendix 1 to this report.

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 20th June 2016. No comments were received on the draft report, therefore this Final Report is unchanged from the published consultation document.

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.

This report forms the second SLSM, the first having been submitted in July 2014. In addition to the first SLSM, the GDNs prepared and submitted the “Joint Gas Distribution Networks Discussion Document on Potential Benefits of Smart Metering on Shrinkage Measurement and Reduction”¹ in January 2015 (henceforth referenced as the *January 2015 submission*) at the request of Ofgem. The *January 2015 submission* included a detailed analysis of the inputs to the Shrinkage and Leakage model and should be considered alongside this document.

In order to produce this report, the GDNs have conducted a comprehensive review of the Shrinkage and Leakage Model. They have engaged with stakeholders through Smart Metering and Shrinkage fora and working groups and have commissioned and evaluated independent third party reports on the subject.

4. Access to Smart Meter Data

To date (Q4 2015), approximately 835,474 Gas Smart Meters have been installed across Great Britain². The GDNs are in receipt of frequent updates from the shippers, however at the time of writing some data was missing from the Q2 2016 update, despite the GDNs requesting that it be made available. Therefore information from the Q4 2015 Shipper update has therefore been included.

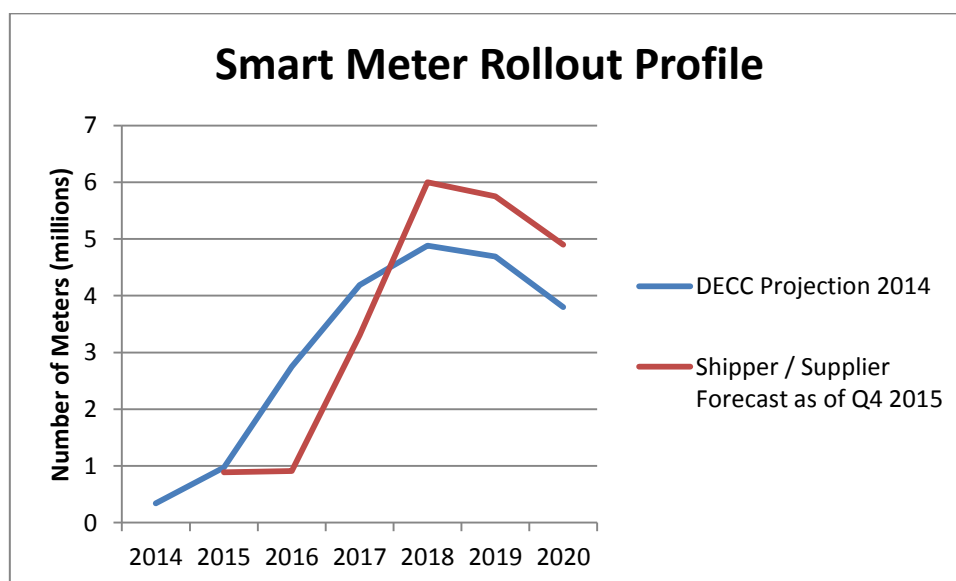
¹ Joint Gas Distribution Networks Discussion Document on Potential Benefits of Smart Metering on Shrinkage Measurement and Reduction (January 2015)

<http://www.gasgovernance.co.uk/sites/default/files/Smart%20Metering%20Report%20-%2030012015%20Final.pdf>

² Source Department of Energy and Climate Change (DECC) ‘Smart Meter Statistics, Quarter 4 2015’, Table 1a, 31/03/2016, <https://www.gov.uk/government/statistics/statistical-release-and-data-smart-meters-great-britain-quarter-4-2015>

Table 1 – Forecasts of Smart Meter Rollout (in millions)

Year	DECC Projection 2014	Shipper / Supplier Forecast as of Q4 2015
2014	0.34	N/A
2015	0.97	0.89
2016	2.75	0.91
2017	4.19	3.30
2018	4.88	6.00
2019	4.69	5.75
2020	3.80	4.90
Total	21.62	21.75



It can be seen from Table 1 that the mass rollout of smart meters has been delayed, which impacts on the point in time at which there could be sufficient saturation of smart meters within a network to allow for a meaningful analysis of smart meter data.

Data from smart meters will only be available once the Data Communications Company (DCC) goes live and the meters installed have been enrolled. The DCC requested a contingency drawdown last November which delayed Go-live and recommended two releases. These releases are currently R1.2 for credit functionality on 20th July 2016 and R1.3 for pre-payment and all other functionality on 26th September 2016.

However, in May the DCC consulted on a second drawdown of contingency, due to issues with testing, missed milestones and general readiness. This consultation is seeking to delay R1.2 Go-live until the Central Planning Assumption date which is 17th August 2016, and it would appear that this will be accepted. Currently, R1.3 is still 26th September but it is thought that this may slip to October/November.

The current meters that have been rolled out across the UK are either foundation or SMETS1 meters. These meters will be enrolled into DCC in 2018 at the earliest. The latest information from manufacturers is that the SMETS2 meters will not be available until October 2016 at the earliest. Therefore it is unlikely that sufficient quantities of SMETS2 meters will be available for mass rollout before Q2 2017.

Due to concerns, raised by Citizens Advice, surrounding the potential use of consumer data without specific consumer consent, there has not been any agreement as to what access to smart metering data that GDNs and Distribution Network Operators (DNOs) can expect. This is despite significant work being conducted by DNOs to develop methodologies to anonymise this data through aggregation. Based on recent discussions with the Department of Energy and Climate Change (DECC) it is understood that the Networks (electricity or gas) may not have access to use smart metering data for at least two years after the commencement of the mass rollout. The GDNs however are committed to considering the potential benefits of smart metering in the interim and are currently reviewing a number of proposed innovation projects in the area for potential investment.

5. The Use of Smart Metering Data as an Alternative to or to Validate the Shrinkage and Leakage Model

5.1. Alternative to the Shrinkage and Leakage Model

In the *January 2015 submission* the GDNs put forward and discussed at length three possible alternatives to the Shrinkage and Leakage model. Specifically these consider the monitoring of gas entering the network via offtakes and exiting the system through Smart Meters, the difference being leakage, theft, own use gas and unregistered/shipperless sites.

The three options considered were:-

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

Further details of these options can be found in the *January 2015 submission*. However in summary it was identified that reverting to such a model would introduce a great deal of uncertainty surrounding :-

- the source of the emissions
- the accuracy of the measured emissions
- the impact of the demand not covered by smart meters, and in the case of the third option,
- the cost of implementing local metering on district governors

In addition to this it was also identified that any potential use of smart metering data would require a 'statistically valid sample size of smart meters' on a network before any data could be used for any

analysis. The GDNs have therefore undertaken to evaluate a statistically valid sample size and the initial results are presented in section 6. The detailed analysis of the three options above from the *January 2015 submission* is included in Appendix 2.

5.2. Validation of the Current Shrinkage and Leakage Model (SLM)

In the *January 2015 submission*, the components and inputs to the Shrinkage and Leakage Model were reviewed. Of the ten inputs two were identified as possibly being influenced by the roll out of smart meters and the availability of smart metering data. The two inputs identified were Average System Pressures and Service Pipe Material data quality. The detailed analysis of the inputs into the Shrinkage and Leakage model (from the *January 2015 submission*) is contained within Appendix 3.

Average System Pressure - It was identified that demand information from smart meters may be able to aid in fine tuning the, already highly accurate, network validation process and thus provide for a slight increase in the accuracy of the calculated average system pressures. In the *January 2015 submission* it was identified that statistical load research was required 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”. There is significant uncertainty around access to smart meter data, the likely level of aggregation required to anonymise any smart metering data and the requirement for very high coverage of smart meters, (as identified by Oxera, see Section 6). As such it is now considered doubtful that such a process would add any additional accuracy to the model or be implemented within the current price control. The GDNs are, however, committed to reviewing opportunities to conduct innovative projects that may help to identify alternative uses of smart metering data to validate the current shrinkage and leakage model.

Following the NIA funded feasibility studies identified in the *January 2015 submission*, SGN progressed their Real-Time Networks NIC bid to submission and were awarded the full funding request by the regulator. The project started in April 2016 and will run for three years.

The feasibility study carried out in 2015 identified issues surrounding the integration of Smart Meter data in a real-time model including:

- Lack of smart meter penetration within the identified trial area
- Data anonymization and aggregation compromising model accuracy
- Unavailability of appropriate data granularity (at least 6 minutes) to meet identified benchmarks
- Uncertainty surrounding DCC roll out time lines

The project will instead involve the installation of loggers on a range of properties in the SE LDZ to measure gas consumption. Within the project, the data requirements that may be needed from smart meters in the future to further train and improve a real-time demand model will be outlined.

The Real-Time Networks demand model is being designed in such a way that should smart metering data become available in the future, the demand model could incorporate the data set.

Service Pipe Material Data Quality – In the *January 2015 submission* the GDNs identified that the roll out of smart meters may be an opportunity to gather improved information on service pipe

material. However, any such survey, by shippers on behalf of the GDNs, would only be able to identify the material at the point it enters the meter, rather than the point at which it connects onto the main (the key consideration in the SLM). The GDNs have fed this potential opportunity into various smart metering discussions via their representatives however it is considered to be a low priority, adding additional complexity to a process that has already been delayed. 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.

In preparation for this report the GDNs have undertaken another review of the inputs to the model but have not found any further areas for possible improvements in the validation of the current Shrinkage and Leakage model.

6. Statistically Valid Sample Size of Smart Meters

To understand what a statistically valid sample size would look like the GDNs have commissioned Oxera, as an independent consultant, to review these sample sizes for three representative distribution networks (a city, a town and a rural network). The project itself is still in progress and is expected to conclude in June 2016 with the report being made available following project conclusion.

Initial analysis however indicates that very high coverage of smart meters within networks would be required before smart metering data could be utilised for estimating demand with any accuracy. Specifically the coverage requirements range from 92% in a representative city to 100% coverage in rural locations. These sample sizes provide a 90% confidence of demand estimation to 0.1% accuracy. Whilst 0.1% may seem to be a high accuracy requirement it must be considered that at present Shrinkage is only calculated to be 0.5-0.7% of total demand and thus this represents an error of 14-20% of shrinkage. When considering the total Shrinkage volume across the UK for 2014/15³ this would mean a potential error of $\pm 412.4 - 589.2$ GWh or $\pm \text{£}6.6\text{m} - \text{£}9.5\text{m}$ (based on 2014/15 prices⁴).

At this point it is important to note that the above does not take into account non-coverage of smart meters from properties that contain meters larger than a U6/G4 and it is important to note in some networks it is estimated that these properties will account for 40% of total demand.

Given the very high coverage requirements discussed above, combined with the fragmented supplier led rollout, it is unlikely that a statistically valid sample size of smart meters will be available until the end of the rollout programme, if at all.

7. Gas Retail Group review of the *Joint Gas Distribution Network Discussion Document on Potential Benefits of Smart Metering on Shrinkage Measurement and Reduction*

Whilst no comments have been received on the January 2015 submission, Energy UK, on behalf of the Gas Retail Group have commissioned Imperial College London Consultants (ICLC) to conduct a

³ Shrinkage volumes can be found here: <http://www.gasgovernance.co.uk/aa1415>

⁴ Averaged price from 2014/15 taken from the following <http://marketinformation.natgrid.co.uk/gas/DataItemExplorer.aspx> [Online, accessed 06/07/2015] selecting "Price" \Rightarrow "SAP" \Rightarrow "SAP, Actual Day" and checking 'Latest values' 'Applicable for' and between 01/04/2014-31/03/2015 -

review of the Shrinkage and Leakage model⁵, independent of GDN involvement. The GDNs are currently reviewing the core conclusions and recommendations of this report and are in the process of producing a formal response to this document, however part of this report deals with the use of smart metering with regards to the assessment of shrinkage and leakage.

In their report ICLC have reviewed the January 2015 submission and are generally supportive of the conclusions drawn with regards to the impact of smart metering on Shrinkage and Leakage. The report notes that they agree that any move towards using smart metering in place of the Shrinkage and Leakage model would remove the valuable visibility of the individual components, and hinder the GDNs attempts to reduce shrinkage. Similarly they also acknowledge the GDNs concerns surrounding potential meter accuracy and the required importance of understanding a statistically valid sample size of smart meters – as discussed in section 6.

8. Conclusion

The GDNs have undertaken a comprehensive review of the current Shrinkage and Leakage model in an effort 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.

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, 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. Despite the above, the GDNs are continuing to engage with stakeholders through a variety of working groups, including the Shrinkage Forum and will continually review the opportunities to utilise Smart Meter data in new innovative ways when it becomes available to them. Given the delays to the roll out and issues surrounding the sharing of consumer data, it is not expected that GDNs will have access to any data before 2019/20 at the earliest.

⁵ Energy UK Gas Retail Group Study into the effect of shrinkage on domestic customers, Imperial College London Consultants, October 2015, [Online]
<http://www.gasgovernance.co.uk/sites/default/files/GRG%20shrinkage%20study%20FINAL.pdf>

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. Options to improve shrinkage measurement by monitoring gas in vs gas out

Metering level options	Requirements	Benefit	Restrictions
<p>Offtake Metering In, Smart Metering Out – Full Coverage</p>	<p>Metering at offtakes – already in place.</p> <p>Statistically valid sample of Smart Meters in place within each LDZ. (GDNs will consider engaging independent consultants to determine a statistically valid sample size.)</p> <p>Data requirements would as a minimum be an annual report of the actual demand.</p>	<p>Little additional cost to the Smart Metering roll out for additional meters.</p> <p>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.</p>	<p>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.</p> <p>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.</p>

Metering level options	Requirements	Benefit	Restrictions
<p>Offtake Metering In, Smart Metering Out – Representative Networks</p>	<p>Metering at offtakes – already in place</p> <p>Statistically valid sample of smart meters in place within each LDZ. (GDNs will consider engaging independent consultants to determine a statistically valid sample size.)</p> <p>Data requirements would as a minimum be an annual report of the actual demand.</p>	<p>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.</p>	<p>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. As yet GDNs have not had vision of the roll out plans.</p>
<p>Offtake and Governor Metering In, Smart Metering Out</p>	<p>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.</p> <p>Smart Metering to measure the gas out.</p> <p>Statistically valid sample of smart meters installed in individual low pressure sub-networks with appropriate metering at the governors.</p>	<p>Identify sub-network specific gas loss, allowing for investigative and targeted action to reduce loss and manage shrinkage and leakage.</p> <p>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)</p>	<p>This would require significant investment in flow monitoring, which has not been allowed for in RII0-GD1.</p>

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

<u>Component of model</u>	<u>Input</u>	<u>Opportunity from Smart Metering</u>	<u>Data Required</u>	<u>Action</u>	<u>Cost</u>	<u>Benefit / Restrictions</u>
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

<u>Component of model</u>	<u>Input</u>	<u>Opportunity from Smart Metering</u>	<u>Data Required</u>	<u>Action</u>	<u>Cost</u>	<u>Benefit / Restrictions</u>
	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	<p><u>Benefits</u></p> <p><u>Potential to :-</u></p> <ul style="list-style-type: none"> • Fine tune the validation of network analysis models • Refine pressure management • Validate the average demand used to calculate average system pressures <p><u>Restrictions</u></p> <ul style="list-style-type: none"> • 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
	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

<u>Component of model</u>	<u>Input</u>	<u>Opportunity from Smart Metering</u>	<u>Data Required</u>	<u>Action</u>	<u>Cost</u>	<u>Benefit / Restrictions</u>
	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 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
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

<u>Component of model</u>	<u>Input</u>	<u>Opportunity from Smart Metering</u>	<u>Data Required</u>	<u>Action</u>	<u>Cost</u>	<u>Benefit / Restrictions</u>
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