Allocation of Unidentified Gas

A REPORT PREPARED FOR CENTRICA

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Executive Summary

Unidentified gas is gas which is lost from the gas distribution system before being recorded as consumed. Historically, the costs of this gas have fallen on smaller gas customers. This is the result of a quirk of the accounting and metering practices that have been used in the gas industry up until now.

However, it is generally accepted that the current approach is unfair on smaller customers. To address this perceived inequality, an Allocation of Unidentified Gas Expert (AUGE) was recently appointed. The AUGE's role is to propose a methodology that allocates the costs of unidentified gas in a fair way across both smaller and larger gas customers.

It is in this context that Centrica has commissioned Frontier Economics. Our role has been twofold. First, we considered the AUGE's initial proposed methodology that was published on 4th May 2011. Our findings were set out in our report published in June 2011. This, second, report takes our analysis one step further. In it we set out our own views on a suitable methodology for the allocation of the costs of unidentified gas.

A problem with current approach - known as Reconciliation by Difference (or RbD) - is that the residual of all costs of the gas system fall, by virtue of the methodology, on smaller customers. This is because meter readings of smaller gas customers are not used in the accounting methodology of gas use across the system. Instead, the aggregate of smaller customer consumption is assumed to be the difference between the metered injection of gas onto a gas network and the consumption of larger, metered, customers on the network. One implication of this is that the volume of unidentified gas is never, per se, identified. Rather it all falls upon the smaller customers as their meter readings are not used in this reconciliation process.

Our first main suggestion is that this particular quirk ceases. There are many millions of meter reads made each year of smaller customers. Although not used at the moment in the RbD process, this data could be used to provide an accurate estimate of the aggregate consumption of smaller customers. In our report we suggest a process that could be used to undertake this estimation. This estimate could then be used in conjunction with the process used to calculate larger customer consumption to derive an overall estimate of consumption by both smaller and larger customers. The difference between this and the total volume of gas injected onto the network will provide, for the first time, an estimate of the total quantum of unidentified gas.

Unidentified gas has up to seven components. Most of the main components can, to some degree of accuracy, be measured or estimated. However, the one component that it is difficult to do this for is the theft of gas: by its very nature it is difficult to quantify. Our second main suggestion, therefore, is that the theft of gas is considered to be the residual item once the other components of gas have been quantified.

Having set out a methodology for identifying the volume of gas associated with each of the most significant components we suggest how each component should be allocated across customer groupings. Our main suggestions are:

- The volume of unidentified gas attributable to Local Distribution Zone (LDZ) metering error and shrinkage measurement error should be smeared across all customers in an LDZ irrespective of whether the customer has a daily meter or not. The rationale for this is that these errors in measurement occur before it has reached any particular customer on the network.

- A further element of unidentified gas can be attributed to problems in the registration of sites. Given this is a feature of non-daily metered customers, we suggest it appropriate that these costs are borne by that sector. Given how the benefits and costs of any such inaccuracies are distributed, our view is that there may well be good reasons to breakdown the costs of this component between the smaller and larger customer sectors.

- Finally, we would recommend that the cost of theft – the final balancing item under our proposed methodology – is allocated across all non-daily metered customers. Our view is that it is irrelevant whether theft is more or less prevalent in the smaller or larger supply point sectors– a point often previously raised in the debate on allocation of costs of theft. Notwithstanding the practical problems of identifying levels of theft by sector, to allocate the costs of theft by sector would suggest that it is right that those customers in one sector who do not undertake theft activities should bear the costs of those that do. It seems to us more appropriate that all non-daily metered customers, whether large or small, bear collectively the costs of theft.

1 Introduction

Unidentified gas is gas which is lost from the distribution system before being recorded as consumed. Under the current Reconciliation by Difference (RbD) process the cost of all unidentified gas falls upon small supply point (SSP)[1] sector. This has led some to consider whether this allocation is appropriate.

In order to consider this issue, and potentially to move towards a fair and accurate allocation of unidentified gas between SSPs and LSPs, an Allocation of Unidentified Gas Expert (AUGE) was appointed, consistent with UNC Mod 229[2]. On 4th May 2011 the AUGE published their proposed methodology for allocating unidentified gas in their Allocation of Unidentified Gas Statement (AUGS)[3] and invited comments from relevant stakeholders.

Subsequently on 16th June 2011, the Joint Office of Gas Transporters published a report[4] by Frontier Economics commissioned on behalf of Centrica with initial comments on the AUGS.

This report forms an updated version of our initial response to the methodology proposed on 4th May 2011, incorporating recent developments and industry discussions. It is structured as follows:

- **Section 2** summarises the current system for allocating unidentified gas, and explains why this methodology is not fit for purpose.
- **Section 3** provides an overview of the methodology proposed by the AUGE in the statement published on the 4th May 2011, alongside commentary on certain elements. We also note recent proposed changes to the initial AUGS published on 4th May.
- **Section 4** proposes and evaluates an alternative methodology for calculating the total quantum of unidentified gas, known as a "top-down" approach.

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1 LSP and SSP sectors are defined by the estimated quantity of gas offtake at each point in a year, known as the Annual Quantity (AQ). LSPs have an AQ of 73,201 kWh and above. SSPs have an AQ of up to 73,200 kWh a year.

2 *UNC 229, Mechanism for correct apportionment of unidentified gas*, Joint Office of Gas Transporters, proposed on 20/05/2009 and accepted by Ofgem on 26/05/2010, http://www.gasgovernance.co.uk/0229.

3 *Allocation of Unidentified Gas Statement*, GL Noble Denton 4th May 2011, http://www.gasgovernance.co.uk/auge/state

4 *Fair allocation of unidentified gas: Phase I*, Frontier Economics, June 2011 http://www.gasgovernance.co.uk/auge/comms Ref 009

- **Section 5** discusses possible methods for attributing unidentified gas to the relevant components and allocation between small and large supply points.

2 The current system for allocating unidentified gas

Unidentified gas is gas which is lost from the distribution system, after the LDZ metering point, and after adjustment for shrinkage, but before the gas can be recorded as consumed. Currently small supply point shippers pay the residual of all other metered consumption (specifically consumption metered at daily metered sites and LSPs), and as such the cost of all unidentified gas in the system falls to them.

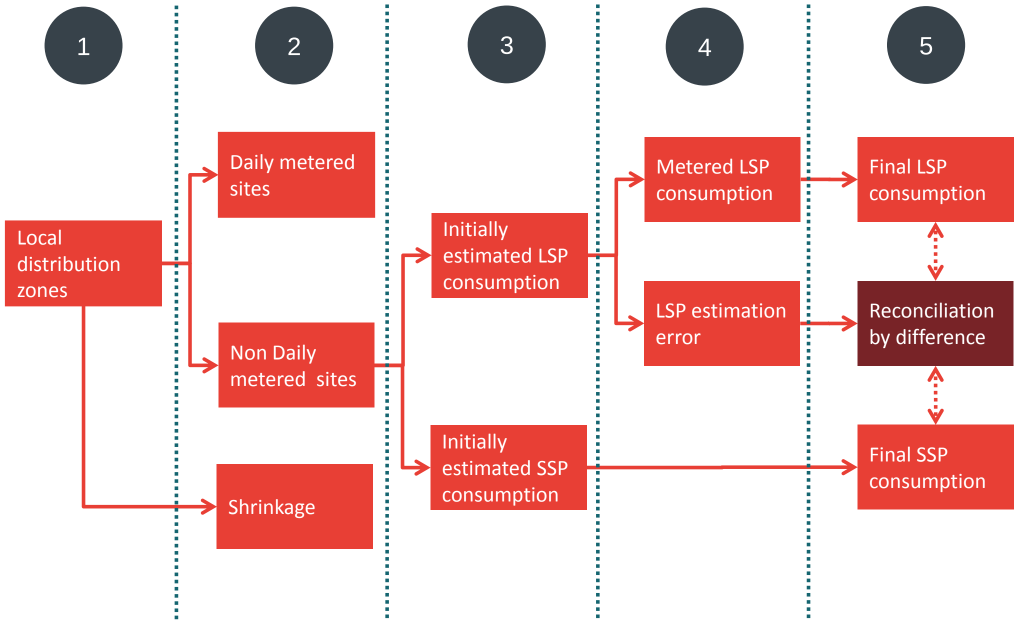
This section sets out the following:

- the current system for measuring gas consumption and the Reconciliation by Difference (RbD) process;
- why the current system is not fit for purpose, and the possible components of unidentified gas; and
- the different approaches that can be adopted for quantification and allocation of unidentified gas.

2.1 Measurement of LSP and SSP gas consumption under the current system

Figure 1below sets out the current approach to estimating consumption across the larger supply point (LSP) and smaller supply point (SSP) sectors.

Figure 1. Current system for estimating consumption



Source: Frontier Economics

There are five stages to this allocation:

1. Gas is metered on a daily basis as it enters the local distribution zone (LDZ).
2. The volume metered at the LDZ is adjusted for estimated shrinkage[5] on the LDZ and for consumption at daily metered sites to give total non-daily metered (NDM) consumption.
3. NDM consumption is then split between NDM LSPs and SSPs to give estimated (or deemed) consumption in each sector. The split is based on algorithms and is a function of, amongst other things, estimated gas annual offtake at each point in a year (AQs), end user categories (EUCs) and weather adjustments.
4. Most LSP meters are read at least once a year, and are regularly reconciled[6]. The LSP estimation error, that is the difference between the initial estimates of LSP consumption and LSP meter reads, is calculated at this stage.
5. The final estimate of SSP consumption is then calculated by assuming that any NDM gas not accounted for by LSP metered consumption has been

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5 Shrinkage is deducted from the total net gas throughput from the LDZ and consists of leakage, own use gas and transporter theft. We discuss its estimation in more detail below.

6 We note that in practice, a certain proportion of LSP meter readings are not submitted to the reconciliation process each year. We discuss this issue further below.

consumed at SSPs. The LSP estimation error determines the Reconciliation by Difference (RbD) transfer. This transfer is made regularly between LSP and SSP shippers[7]. In theory, it could be a credit or debit to either sector (and will be an equal and opposite credit or debit to the other sector). In the absence of unidentified gas, or any bias in the algorithm process, over time, it should average to zero for each sector.

LSP shippers thus pay for their metered quantity of consumption, while SSP shippers pay for all gas entering the LDZ that is not accounted for elsewhere. In practice, the RbD has been a debit to SSPs and a credit to LSPs, to the equivalent of around 10-12 TWh annually.

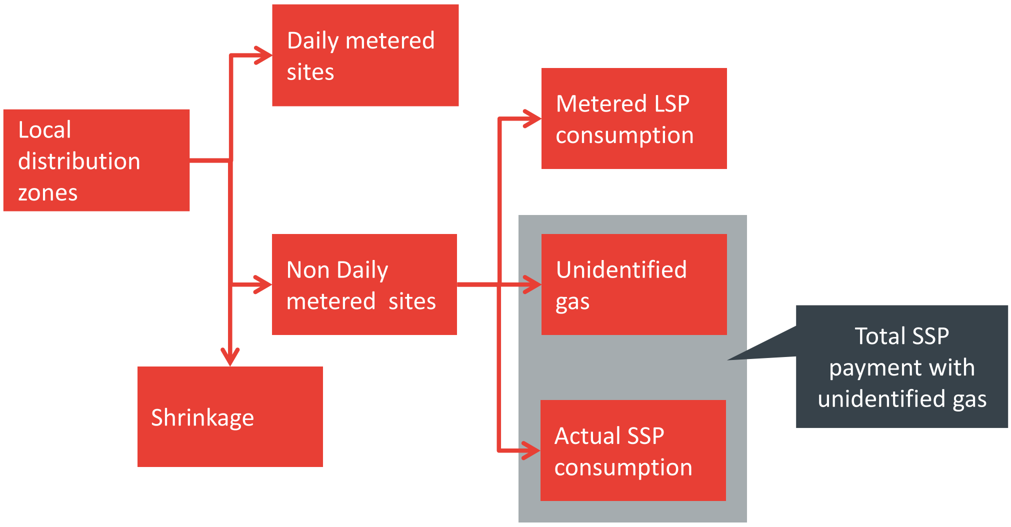
2.2 The problem of unidentified gas

As noted above, currently small supply point shippers pay the residual of all other metered consumption, and as such bear the cost of all unidentified gas in the system. In the absence of any unidentified gas, the transfer between SSPs and LSPs in the RbD process would solely be a reflection of the difference between the initial allocation and metered consumption of LSPs, so-called *"model error."*

Figure 2 below shows that given that some unidentified gas may actually be attributable to LSPs, the presence of unidentified gas in the system may thus mean that SSP shippers are paying for more than their fair share of gas. In recognition of the potential unfairness of this system, the AUGE has been appointed to estimate how much unidentified gas should be attributed to the LSP sector.

7 We note that the RbD payment in any given year can contain reconciliation payments from up to five years previously.

Figure 2. Current allocation of unidentified gas[8]



Source: Frontier Economics

There are at least seven *potential* sources of unidentified gas.

- ***Shipper responsible theft:*** gas which is stolen at metering points contributes to unidentified gas, as its consumption will not have been recorded at any point.[9]

- ***Unregistered, shipperless or unknown sites:*** some sites flow gas but do not appear in the Site and Meters database. Others sites flow gas and appear in the database but are not registered to a shipper. Any consumption at both categories of sites will not be recorded and therefore not paid for, so any gas that is consumed at these sites will add to the quantity of unidentified gas.

- ***Independent Gas Transporters (IGT) measurement errors:*** connected System Exit Points (CSEPs) are small networks owned by IGTs. Registration errors mean that some CSEPs or loads within CSEPs may not be recognised by the system. Any consumption from these unrecognised loads will contribute to unidentified gas.

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8 We note that LSP meters are read and reconciled regularly, but not necessarily each year. This Figure therefore represents the long run situation, rather than the situation in any one year.

9 Gas which is stolen directly from the mains however is the responsibility of the gas transporters and falls into the category of shrinkage.

- ***Error in the estimation of shrinkage:*** shrinkage is gas lost after LDZ metering due to leakage, own use or transporter responsible theft (theft from the mains). Shrinkage is currently estimated based on total throughput, sampled data on leakage and assumptions on the level of own use and theft from the mains. Any over or underestimate of shrinkage will reduce or increase the total quantity of unidentified gas.

- ***Unreconciled LSP points:*** although the working hypothesis of the current allocation is that all LSPs are metered in any one year, this is in fact not the case. Those LSPs that are not reconciled will instead pay for the amount of consumption estimated by the algorithm process. If the algorithm under or overestimates their actual consumption, the error will add to or reduce the quantity unidentified gas in the system at any one point in time.

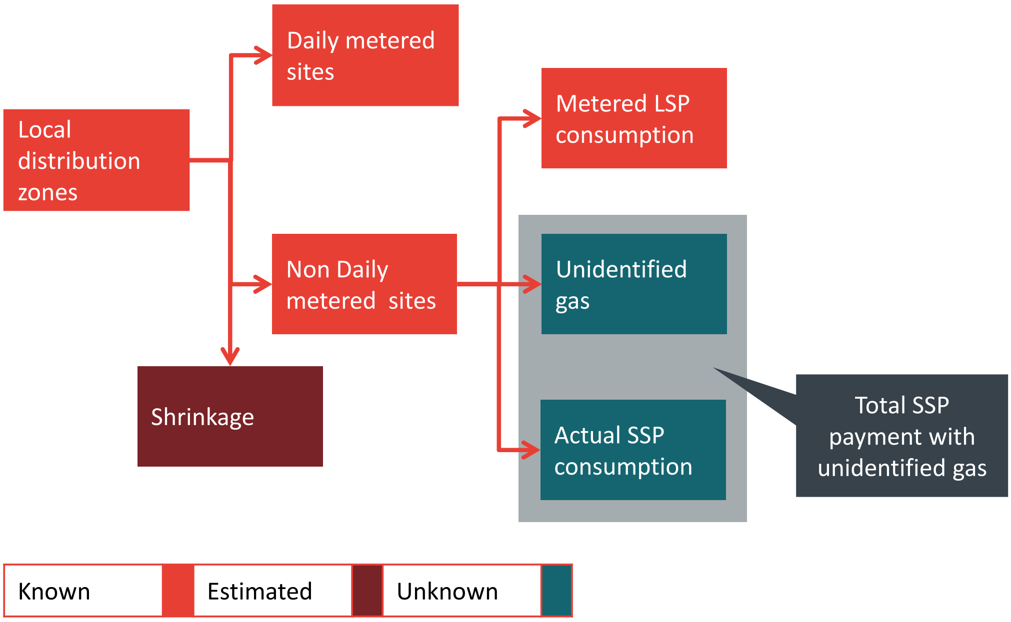
- ***Metering errors:*** any metering errors at the LDZ or the LSP level will contribute to unidentified gas**.** For example, if LDZ meters overestimate gas that enters each LDZ, the quantity of gas thought to be in the system, but not recorded at any consumption point will increase. If LSP meters overestimate consumption, the quantity of unidentified gas will decrease.

- ***Stock change:*** stock change is the difference between opening and closing stock on a given day. Any difference in stock between the opening and closing day of a given year could add or reduce unidentified gas.

2.3 Estimating unidentified gas

Figure 3 illustrates that more than one unknown component of total gas consumption is involved in the allocation of consumption across LSP and SSP sectors.

Figure 3. Estimating unidentified gas



Source: Frontier Economics

Given these two unknown elements, there are two alternative approaches to estimating the annual quantities of unidentified gas.

- ***Bottom-up approach:*** unidentified gas could be estimated directly by estimating the quantity and incidence of each of the seven potential components set out above.
- ***Top-down approach:*** total unidentified gas can be estimated as the residual of gas that is consumed. This approach would require knowledge of both SSP and LSP actual consumption. Here the difference between metered injection onto the LDZs and the sum of consumption of LSPs and SSPs would define the overall value of unidentified gas. In this case, total unidentified gas could be allocated between the LSP and SSP sectors, for example, based on throughput and the characteristics of each sector.

The current system for allocating unidentified gas

3 The AUGE's estimation of unidentified gas

The AUGE has published its initial view of the best methodology for estimating and allocating unidentified gas. In this section, we comment on:

- the AUGE's overall methodology for estimating unidentified gas; and
- the AUGE's methodology for estimating each potential component of unidentified gas.

Throughout we refer to both the AUGE's initial statement published on 4th May 2011 and the AUGE's response[10] to the queries of British Gas on the initial AUGE statement, produced on the 8th of July 2011[11].

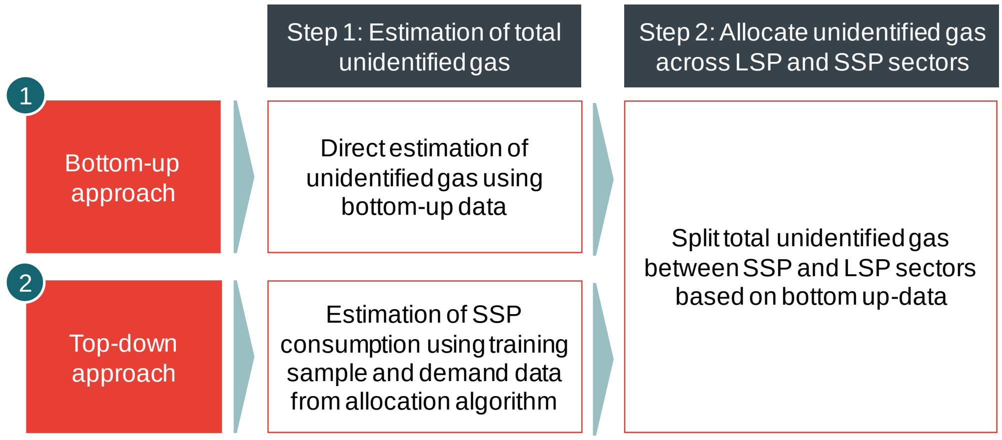
3.1 The AUGE's overall methodology for estimating unidentified gas

In its first statement in on the 4th of May 2011, the AUGE states that its preferred approach to estimating unidentified gas is to undertake a bottom-up analysis. However, it recognises that data constraints may prevent this from yielding an accurate estimate. Depending on data constraints, the AUGE may thus follow an alternative top-down approach (Figure 4.).

[10] AUGE Response to the AUGS Queries (from British Gas), date of response 08/07/2011

[11] http://www.gasgovernance.co.uk/sites/default/files/AUGS%20Query%20Responses%20Centrica%2008_07_2011.pdf

Figure 4. Overview of the AUGE's proposed approach



Source: Frontier Economics

This approach has since been revised. In its response to the queries of British Gas on the initial AUGE statement, dated8th of July 2011, the AUGE states its intention to follow a hybrid top-down/bottom-up approach to the allocation of unidentified gas.

This will involve the following steps:

- estimation of deeming algorithm error and bias;
- bottom up estimation of each component of unidentified gas, excluding theft; and
- calculation of theft as the balancing factor by subtracting model error and other unidentified gas components from the total RbD quantity.

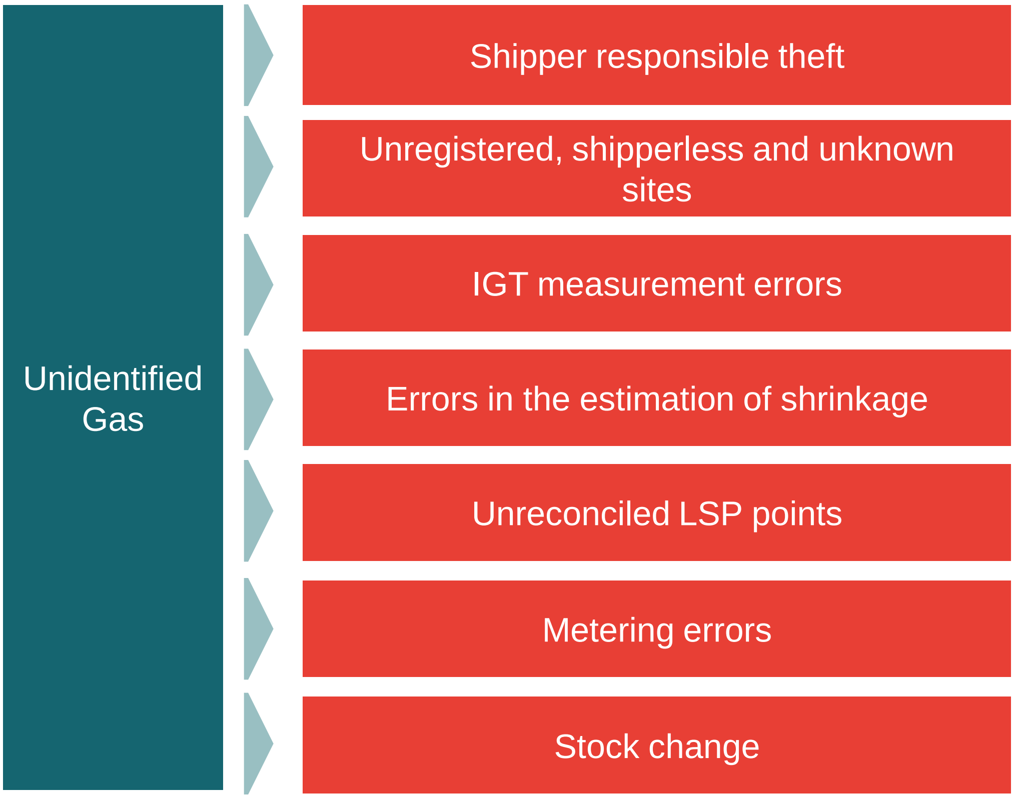
While in principle this methodology seems reasonable, it relies on accurate calculation of the level of bias in the initial allocation algorithms. Without further information on the AUGE's proposed approach to this step, we cannot comment on the robustness of this analysis.

3.2 The AUGE's methodology for estimating each component of unidentified gas

The AUGE's preferred approach to estimating unidentified gas still relies on a bottom up estimation of each element except theft. In this section we work through each potential component of unidentified gas (see Figure 5 below) in turn, assessing the AUGE's proposed methodology at each stage.

The AUGE's estimation of unidentified gas

Figure 5. Potential components of unidentified gas



Source: Frontier Economics

3.2.1 Shipper responsible theft

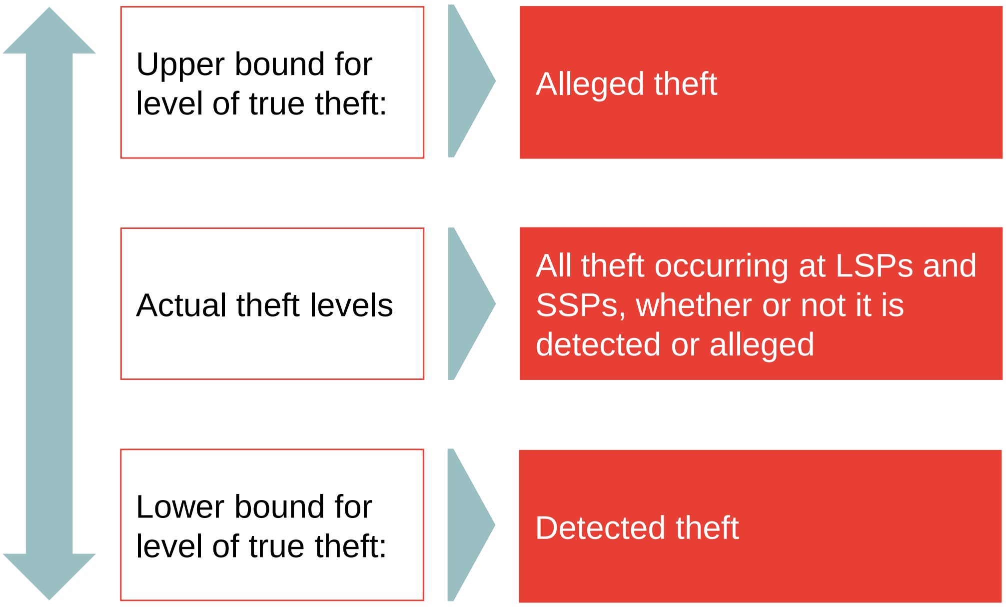
Gas which is stolen at metering points contributes to unidentified gas, as its consumption will not have been recorded at any point. Given theft is, by its nature, a hidden activity its true levels will be very hard to estimate.

In its initial statement published on May 4th 2011, the AUGE recognises that theft is largely unknown but argues that boundaries can be placed around the true level using existing data sources: *"the problem with calculating theft levels is that the true level is unknown, with detected theft and alleged theft acting as lower and upper bounds respectively"*[12]. In order to place true levels of theft between the assumed upper and lower bounds, the AUGE states that it will "*attempt to link changes in theft*

[12] *Allocation of Unidentified Gas Statement*, GL Noble Denton 4th May 2011, p. 21-22, http://www.gasgovernance.co.uk/auge/state

detection rates with shipper initiatives."[13]The AUGE's proposed methodology for calculating theft is shown in Figure **6** below.

Figure 6. The AUGE's proposed boundaries around true levels of theft



Source: Frontier Economics

There are a number of reasons why this approach is likely to underestimate total theft, and allocate proportionally too much theft to the SSP sector:

- ***Detected theft levels may not be a good indication of actual theft levels:***
  - Theft of gas is very hard to detect as thieves have to be caught red-handed. Our understanding is that if perpetrators are given any notice of an inspection, the theft apparatus can be quickly dismantled.
  - Only one major supplier has an active detection unit. Our understanding is that most suppliers, on receiving an allegation of theft, will make an appointment with the customer to investigate it further. This gives the customer ample opportunity to hide the evidence of theft.

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13 *Allocation of Unidentified Gas Statement*, GL Noble Denton, 4th May 2011, p. 21-22, http://www.gasgovernance.co.uk/auge/state

- LSP shippers have no financial incentive to detect theft, since detection effort is costly and all of the costs of theft currently fall to the SSP sector.

- ***Alleged theft is not an appropriate upper bound on actual levels of theft.*** The AUGE notes that shippers are obliged to inspect each meter at least every two years and to report suspected theft to the transporters. According to the AUGE "*assuming that these inspections are carried out properly, this should limit the level of unknown theft closer to the level of alleged theft and hence this is a suggested upper bound for theft.*"[14] We cannot see any obvious link between alleged theft and true levels of theft. It is perfectly possible that many thefts escape allegation. It is also possible that not all allegations are a sign of actual theft. On balance however, we believe that theft allegations are likely to underestimate true theft:
  - Theft allegations rely on meter readers and engineers spotting subtle signs like scratched or polished fittings, while operating under a system which we understand incentivises them to maximise the number of meters they read per day.
  - Meter readers and engineers are likely to underreport LSP signs of theft even more than SSP signs of theft. LSP meters are more diverse, and tend to be based on larger and more complex sites, so tampering is likely to be harder to spot.

- ***Even detected theft under shipper initiatives will underestimate actual theft.*** While using detection rates of shippers with theft detection initiatives will be an improvement on using sector-wide detection rates, we believe these data may still significantly underestimate true levels of theft, and may not accurately represent the split of theft between sectors:
  - Even under an active theft detection regime, given the difficulties around detection, a significant proportion of theft may be missed.
  - It is plausible that customers of companies with active theft detection units may steal less than customers of other suppliers.
  - Where theft detection units exist, theft detection officers may put differing amounts of effort into detecting theft at SSP and LSPs, for example if theft at one type of supply point is easier to detect.

In their response to the queries of British Gas relating to the initial AUGS dated 8th of July 2011, we note the AUGE has revised its proposed approach to the

14 *Allocation of Unidentified Gas Statement*, GL Noble Denton, 4th May 2011, p. 21, http://www.gasgovernance.co.uk/auge/state .

estimation of theft. The AUGE now proposes to estimate theft as a balancing factor rather than through bottom-up analysis. We welcome this approach as believe it will lead to a more accurate estimate of theft. However, the accuracy of this approach is conditional on the estimation accuracy of the other components of the RbD (in particular, deeming algorithm bias and error). Without further information on how the AUGE will estimate deeming algorithm bias and error, we cannot comment on the robustness of their proposed methodology for estimating theft.

3.2.2 Unregistered, shipperless and unknown sites

Some sites flow gas but do not appear in the Site and Meters database. Other sites flow gas and appear in the database but are not registered to a shipper. Any consumption at both categories of sites will not be recorded, so any gas that is consumed at these sites will add to the quantity of unidentified gas.

The AUGE proposes to estimate gas consumed at unknown, unregistered and shipperless sites using xoserve data. The proposed methodology is set out in Figure 7.

Figure 7. The AUGE's proposed methodology for estimating gas from shipperless and unregistered sites

	Description	Estimation
Shipper Activity and Orphaned sites	All sites > 12 months that have an MPRN and appear in Site and Meters database, but are not registered to a shipper	• Assume xoserve category of 'believed to have a meter' are flowing gas and consume their AQ • Adjust for proportion of SA/OS sites with meters which are not flowing gas, using actual meter reads
Shipperless sites	Sites that are shipperless but are still flowing gas	• Use data on shipperless sites that have been visited and found to be flowing gas, total number of sites visited, total number of shipperless sites and aggregate AQ
Legitimately unregistered	Unregistered or shipperless sites with no meter and thus not flowing gas	• Assume that sites designated by xoserve as 'believed to have no meter' are all legitimately unregistered (are not flowing gas) and thus do not contribute to unidentified gas
Sites created < 12 months	All sites < 12 months that have an MPRN and appear in Site and Meters database, but are not registered to a shipper	• Assume same proportion of sites are flowing gas as in SA/OS but that on average they have been only flowing gas for half the period and adjust for fact that I&C consumers do not immediately achieve full flow
No activity	Unregistered or shipperless sites that are currently being processed	• Spread sites proportionately across other categories of unregistered and shipperless sites
Unknown sites	Sites that are taking gas but have never been registered	• Data has been requested from Xoserve and shippers

Source: Frontier Economics

At a high level, we believe the AUGE's approach to estimating unidentified gas in this area seems reasonable. We have three areas of concern however:

- it is possible that sites which are 'believed to have a meter' are only lower bound on the actual number of sites with meters, and it may be worthwhile for the AUGE to investigate the extent to which sites believed not to have a meter, actually have meters;
- before assuming that all sites 'believed to have no meter' are legitimately unregistered, it may be worth investigating a sample of these sites; and
- it is not clear to us how data on unknown sites could be sourced.

The AUGE, in their response to the queries of British Gas relating to the initial AUGS, dated 8th of July 2011, have not significantly revised their intended approach in this area.

3.2.3 Independent Gas Transporter (IGT) measurement errors

Connected System Exit Points (CSEPs) are small networks owned by IGTs. Registration errors mean that some CSEPs or loads within CSEPs may not be recognised by the system. Any consumption from these unrecognised loads will contribute to unidentified gas.

In its original statement published on 4th of May 2011, the AUGE proposes to look only at entire unrecognised CSEPs which are not recognised, on the basis that "*xoserve understands that it is not possible for a site to exist and be taking gas within a CSEP without it being registered.*"[15]

Data on CSEPs is held by IGTs who are not obligated to provide data to the AUGE. The AUGE thus proposes to base its estimation on average CSEP composition from known IGT networks.

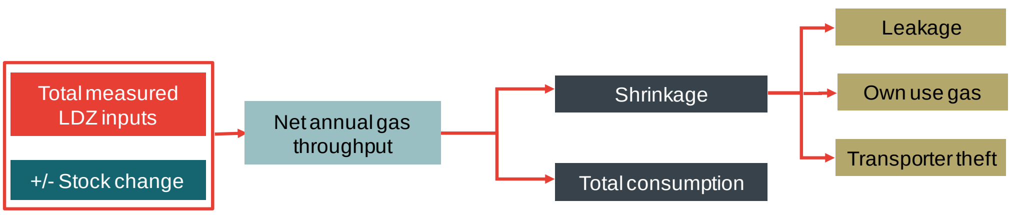
In their response to the queries of British Gas relating to the initial AUGS, dated8th of July 2011, we are pleased to note that the AUGE has revised its position and now states that it is possible for a site to exist *and* be taking gas within a CSEP without necessarily being registered, and any subsequent analysis will be corrected accordingly.

We remain concerned about whether CSEP composition at known IGT networks is representative of overall CSEPs. However, overall this proposed methodology seems reasonable.

3.2.4 Errors in the estimation of shrinkage

Shrinkage is deducted from the total net gas throughput from the LDZ and consists of leakage, own use gas and transporter theft, as shown in Figure 8 below.

Figure 8. Components of shrinkage



Source: Frontier Economics

Each of the above three components is estimated in December for the formula year ahead, based on forecasted dependent variables. At the end of the formula year these estimates are updated using actual variables[16]. Any difference in the before and after formula year shrinkage estimates is accounted for in an adjustment between the SSP sector and the shrinkage account.

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[15] *Allocation of Unidentified Gas Statement*, GL Noble Denton, 4th May 2011, p. 20, http://www.gasgovernance.co.uk/auge/state

[16] That is, the estimation models are trained on actual variables at the end of the formula year, as compared to estimated variables before the formula year.

Errors in the post-year shrinkage estimates will reduce or increase unidentified gas. For example, if shrinkage is underestimated, the gas assumed to have been consumed at NDM supply points will be overestimated. Since SSPs are assumed to consume the residual of measured consumption, they, rather than the transporters, will bear the cost of the underestimated shrinkage.

Each of the components of shrinkage is estimated as follows:

- **Leakage**: distribution mains and service leakage using the results from National Leakage Tests, GL Noble Denton, 2003, and AGI leakage derived from 2003 AGI tests (leakage accounts for virtually all of shrinkage);
- **Own use gas**: derived from Own Use Gas Model, GL Noble Denton, 2006, which applies a national average of 0. 0113% to total throughput; and
- **Transporter-responsible theft**: constant of 0.02% of LDZ throughput is attributed to transporter-responsible theft.

We acknowledge that estimating any shrinkage error is a challenging task; however given shrinkage quantification relies on estimation models there will be inevitably be some error involved. Our view is that we are therefore minded that the shrinkage error component be in the scope of any estimation of unidentified gas.

In its original statement, published on 4th May 2011, the AUGE stated its intention to exclude shrinkage errors from its scope. However, in their response to the queries of British Gas relating to the initial AUGS, we are pleased to note the AUGE has revised this position and has now committed to investigated shrinkage error further. The AUGE now states that any error in the estimation of shrinkage will be captured in the balancing factor calculated as the residual of RbD under the updated hybrid methodology.

3.2.5 Unreconciled LSPs

We understand that a proportion of LSPs are not reconciled to meter reads on an annual basis. The presence of unreconciled LSPs means that the volume of consumption for some LSPs is estimated rather than metered. If any LSP volume deemed under the algorithm process is not reconciled after five years, the opportunity to reconcile is removed, and thus the inaccuracy will persist. Any difference between the estimated level of consumption and the actual level will contribute to unidentified gas and will be allocated to the SSP sector.

Following discussions with Centrica after the publication of our initial report[17], we understand that the proportion of LSPs not reconciling after five years is

17 *Fair allocation of unidentified gas: Phase I*, Frontier Economics, June 2011 http://www.gasgovernance.co.uk/auge/comms Ref 009

relatively insignificant and therefore would concur with the AUGE's position that this component need not be included in unidentified gas.

3.2.6 Metering errors

Metering errors[18] can occur at three different parts of the gas distribution process:

- LDZ
- LSPs; and
- SSPs.

A persistent level of metering error will cause the total quantum of gas for reconciliation at the end of the formula year to be incorrect, which will impact upon the level of unidentified gas and the sector allocations.

In it is first statement on May 4th 2011, the AUGE decided that metering errors will not contribute to unidentified gas, based on the following:

- LDZ and LSP meters are checked frequently and *"demonstrate no particular bias in metering error."*[19]*;*
- LSP meters are constructed using different technology (rotary/turbine) to SSP meters and are less likely to develop errors over time; and
- though SSP meters are more likely to be biased, they are not relevant to the calculation of LSP unidentified gas.

In response, we note that:

- there is evidence that LDZ meter errors can occur[20], and given the volume of throughput at LDZs, even small errors can have a large impact;
- no evidence is presented by the AUGE to show that meters based on rotary/turbine technology are more accurate than the typical SSP meter; and
- even if meters based on rotary/turbine technology were more accurate than the typical SSP meter, consumers can switch between being a SSP to being a LSP as their consumption of gas changes, without any change

18 We are referring here to meters not registering the passing of gas, rather than errors in taking a supplying meter readings.

19 *Allocation of Unidentified Gas Statement*, GL Noble Denton 4th May 2011, p. 22, http://www.gasgovernance.co.uk/auge/state

20 For example, there are 43 current measurement errors listed in the Joint Office of Gas Governance Measurement Report Summary

in their meter type (and we note that currently a large proportion of LSPs use the same meter type as SSPs).

While we accept that metering errors are extremely challenging to detect and quantify, we do not agree that their exclusion from unidentified gas calculations is the correct course of action. Further, it is important to note that the crucial factor in assessing the impact metering errors have on unidentified gas allocation is whether they are persistently biased in one direction. If metering errors have a large standard deviation but are normally distributed around zero then in the long run these errors will be cancelled out. Any work in this area should therefore initially seek to investigate the statistical properties of any metering errors.

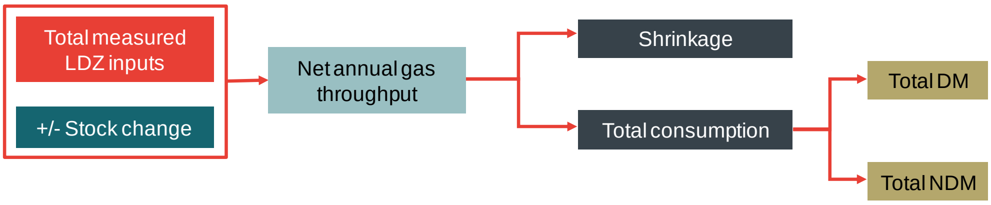
In their response to the queries of British Gas relating to the initial AUGSdated8th of July, we are pleased to note the AUGE has revised its original proposed methodology in this area. The AUGE now acknowledges that LSP meter errors are possible and could be a relevant component of UG. The AUGE notes that it is feasible for LSP meter errors to exist, and the majority of all LSP meters are the same construction as an SSP meter. Further they note that the *"investigation into supply point meter error as a potential cause of UG is ongoing..."*

However, we note that the AUGE continues to exclude LDZ offtake metering errors in their scope under the assumption that all such errors are found and corrected at some point. While we acknowledge that when errors are found they are corrected for, given the potentially large impact that such errors can have on unidentified gas when undetected, we argue that LDZ metering errors should be within the AUGE's scope.

3.2.7 Stock change

Stock change is the difference between the pressure (or stock) of gas at opening and closing time on any given day in the gas calendar. The component of stock change to be incorporated in the RbD process will be the difference between the opening and closing stock in a gas year, as RbD is an annual process. Stock change can either be positive or negative, and is applied to the total measured LDZ input to derive the net annual gas level for sub-allocation, as shown in Figure 9.

Figure 9. Derivation of the level of net annual gas throughput



Source: Frontier Economics

The AUGE notes that *"any adjustment due to stock change (which in this case would be the difference in stock between the start of the UG year and the end of the UG year) will be negligible"*.[21] It has therefore proposed to exclude stock change from the scope of its analysis. Whilst we believe it would be a useful and not particularly onerous task for the AUGE to support the notion that stock change is *"negligible"*, we agree the exclusion of stock change from unidentified gas is appropriate.

4 Calculating the total quantum of unidentified gas via a top-down approach

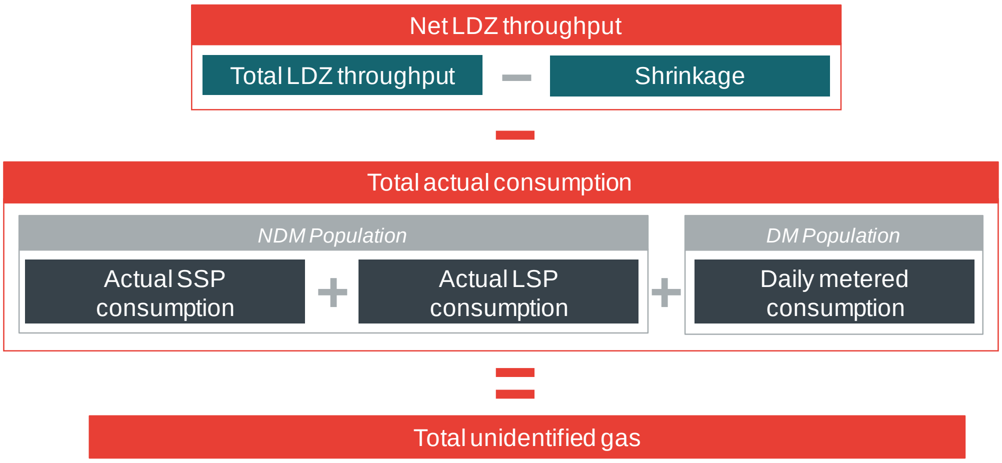
This section focuses on the quantification of unidentified gas using a top-down approach, and discusses the following:

- the intuition behind a top-down approach for quantifying unidentified gas, and why it is likely to be more accurate than a bottom-up methodology;
- the alternative top-down approach proposed by the AUGE in their initial statement, and possible shortcomings; and
- a high-level proposed methodology for estimating total unidentified gas using centrally-held meter readings and initial deeming allocation algorithms.

4.1 Top-down approach to quantifying total unidentified gas

As noted earlier, unidentified gas is the difference between total net throughput into the gas network and actual consumption across all consumers on the network (regardless of their size or metering technology). Figure **10** below shows that there are three components comprising total actual consumption (specifically, consumption of SSPs, LSPs and daily-metered points). A top-down approach seeks to quantify unidentified gas by summing these three components to calculate total actual consumption and then subtracting this from total LDZ throughput once adjusted for shrinkage. Following this, total unidentified gas is sub-divided between the relevant components deemed to be *"in-scope"* and finally each component allocated to the large and small supply point sectors.

Figure 10. Overview of a top-down approach to quantifying unidentified gas



Source: Frontier Economics

As Figure 10above demonstrates, in order to quantify total unidentified gas using this top-down methodology there are five components which must either be known or estimated as accurately as possible. These components, and current data availability on each is shown in Table 1below.

Calculating the total quantum of unidentified gas via a top-down approach

Table 1. Components required for quantifying total unidentified gas

Component	Available data
Total LDZ throughput	Metered and therefore data available.
Shrinkage	Estimated as a function of throughput.
Actual SSP consumption	Regularly metered, but mainly not on a daily basis. Therefore not possible to directly calculate aggregate gas year consumption. LSP meter reads are used in reconciliation process.
Actual LSP consumption	
Daily metered consumption	Daily-metered and therefore data available at a high frequency.

Source: Frontier Economics

As Table 1 indicates, in order for a top-down methodology to be implemented aggregate small and large supply point consumption over the formula year, excluding any unidentified gas[22]requires estimation[23].

Actual LSP and SSP consumption is a significant component of total net throughput to the LDZ, comprising in excess of twenty million supply points. Fundamental to quantifying unidentified gas using a top-down approach is therefore a robust and accurate estimate for actual consumption by the SSP and LSP sectors, in the relevant gas formula year.

We believe a top-down approach is the preferred option for a fair and accurate allocation of unidentified gas for the following reasons:

- ***A bottom-up approach involves a large amount of estimation with data constraints.*** A solely bottom-up approach to quantifying unidentified gas, such as that proposed by the AUGE, requires each component in scope to be individually estimated. Under this approach there is very little or no data available on a number of the individual components of unidentified gas,

22 That is, total actual consumption for the small supply point sector that would be registered if all LSPs and SSPs were daily metered

23 We note that shrinkage is an estimate but one that is currently calculated as part of the RbD process so no additional estimation is required.

in particular shipper responsible theft, and estimation therefore could be very inaccurate.

- ***A top down approach allows theft to be treated as a balancing factor.*** Under a top down approach there are fewer components for which estimation is required, and elements where no data is available such as theft can be treated as a balancing factor[24]. Components which do require estimation, such as actual SSP and LSP consumption have data available on them that can be utilised.

- ***Smart metering data can be incorporated.*** While smart metering is definitely not a prerequisite for a top down approach, a top-down methodology has the advantage that it is forward looking as it allows for the inclusion of smart metering data on actual SSP and LSP consumption if and when it becomes available.

4.2 The top-down approach proposed by the AUGE

In their Allocation of Unidentified Gas Statement (AUGS), the AUGE refers to *"an alternative method for estimating Unidentified Gas"* which seeks to *"calculate a figure for the aggregate SSP load (not including UG) and then calculate UG by subtraction"*. This total quantum of unidentified gas would then be allocated to components and sectors accordingly, using bottom-up analysis.

The AUGE elected not to adopt this top-down methodology on the grounds that *"This approach requires more data, is more complex, and is subject to greater model uncertainty, and hence will only be considered as an alternative to the proposed methodology...*[25]*"*. Figure 11below outlines our understanding of the alternative top-down approach proposed by the AUGE.

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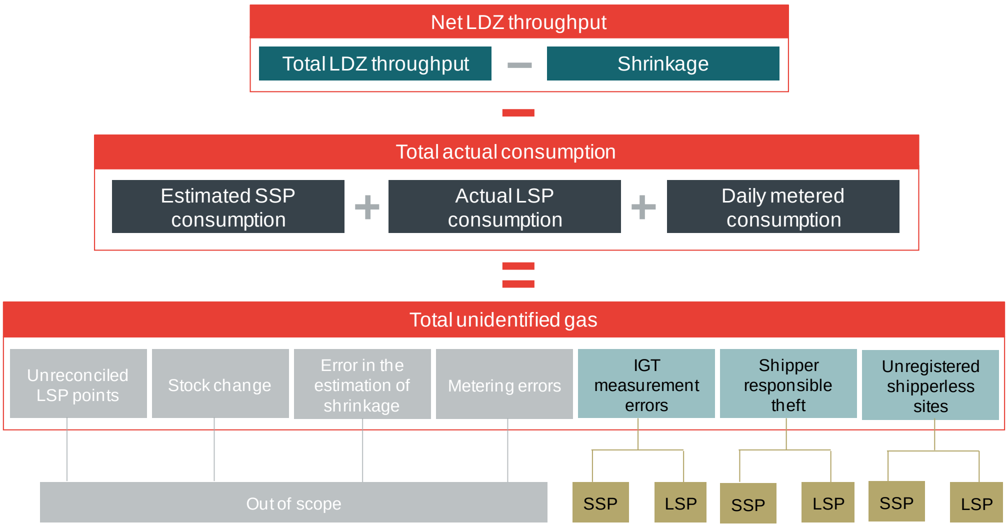
24 We refer to a balancing factor to mean the residual of total unidentified gas once all other components of UG have been allocated.

25 *Allocation of Unidentified Gas Statement*, GL Noble Denton, 4th May 2011, p. 11, http://www.gasgovernance.co.uk/auge/state

Calculating the total quantum of unidentified gas via a top-down approach

Figure 11. The AUGE's top-down alternative methodology



Source: Frontier/AUGS

Our understanding from the AUGS is that aggregate SSP load excluding unidentified gas would be estimated using the *"training sample"* and initial deeming allocation algorithms maintained by xoserve. The training sample is a sample of daily-metered SSPs and LSPs used by xoserve to create end user categories (EUCs), apportion non-daily metered (NDM) demand and determine load factors.

Whilst we are supportive of the overarching alternative top-down methodology proposed by the AUGE for quantifying *total* unidentified gas, we have the following reservations regarding the training sample were it to be used as a basis for estimating actual SSP consumption:

- the xoserve demand estimation models that make use of the training sample *"are not suitable for short term demand forecasting – this is not their intended purposes*[26]*"*, and it is these models (which use the training sample) that ultimately are responsible for model error;
- prepayment meters are excluded from the training sample, a not insignificant proportion of approximately 10% of SSPs, with different consumption behaviour;
- participants have to opt-in to participate, which may cause self-selection bias.

26 03 June 2011 DETF presentation (provided by Xoserve)

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For the reasons outlined above we believe using the xoserve training sample to estimate aggregate SSP consumption could lead to large inaccuracies in the allocation of unidentified gas.

4.3 Proposed top-down approach to quantifying unidentified gas

As mentioned above, the components that require estimation in order for unidentified gas to be quantified through subtraction are the actual consumption level of the entire non-daily metered population (SSPs and LSPs). Under our proposed methodology, estimated actual consumption is required for the gas formula year, which runs from the 1st October to 30th September. The following sub-sections outline:

- how actual non-daily metered consumption might potentially be estimated using meter read data held centrally by xoserve, and the initial deeming allocation algorithms; and
- subsequent to the relevant estimations, the steps required to quantify total unidentified gas in any given formula year.

4.3.1 Estimation of actual SSP consumption using xoserve meter readings

In 2010, xoserve recalculated annual quantities (AQs) for approximately 83%[27] of the SSP sector, and 65% of the LSP sector. For an AQ to be recalculated, a pair of recent meter readings is required for comparison with the initial deeming allocation. Given the large volume of meter read data held by xoserve for use in the AQ review, it seems sensible for these meter reads to also be used in the allocation of unidentified gas process.

Using a pair of meter readings and the initial allocation algorithm it may be possible to estimate the actual consumption of a supply point (either large or small) in any specific gas formula year. The intuition behind this is as follows:

- given two meter readings it is possible to calculate the actual consumption between these readings;
- there is a high probability the times of these readings do not correspond to the start and end of a gas formula year;

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27 The AQ Operational Review Group 2010, 4th November, xoserve, slide no. 2

- to correct for this, the meter readings are adjusted to reflect what they most likely would have been if read at the start and end of the relevant formula year;
- this adjustment is performed using the initial allocation algorithm to calculate the estimated consumption between meter readings and the start and end of the formula year, and also a correction ratio to reflect that the initial allocation may not be fully accurate; and
- the difference between adjusted meter readings is a measure of estimated actual consumption for the supply point in question in the formula year.

A simplified worked example of how a supply point's annual consumption could be calculated using meter readings is provided below. For the avoidance of doubt, we would stress that the methodology proposed above should be interpreted as a starting point for this form of top-down methodology, and taken in its current form could lead to biases. For example, it is possible that the model error could exhibit high month on month variance, and therefore the correction ratio above would not account for such patterns. We would suggest details of the approach such as these would need to be agreed upon based on examination of the relevant data.

Calculating formula year consumption for a NDM supply point using meter readings: example

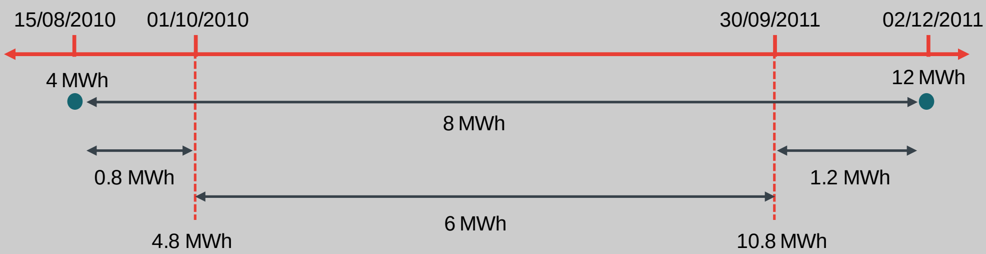
Input data

- Meter reading 1: $4\ MWh$ on 15/08/2010
- Meter reading 2: $12\ MWh$ on 02/12/2011
- Deemed allocation between 15/08/2010 and 02/12/2011: $10\ MWh$
- Deemed allocation between 15/08/2010 and 01/10/2010[28]: $1\ MWh$
- Deemed allocation between 30/09/2011 and 02/12/2011: $1.5\ MWh$

Calculations

1. Consumption between meter reads: $12\ MWh - 4\ MWh = 8\ MWh$
2. Correction ratio: $\frac{8\ MWh}{10\ MWh} = 0.8$
3. Deemed allocation between 15/08/2010 and 01/10/2010 adjusted for correction ratio: $0.8 \times 1 = 0.8\ MWh$
4. Deemed allocation between 30/09/2011 and 02/12/2011 adjusted for correction ratio: $0.8 \times 1.5 = 1.2\ MWh$
5. Estimated consumption in formula year:

$$(12\ MWh - 1.2\ MWh) - (4\ MWh + 0.8\ MWh) = 6\ MWh$$



28 The exact date for the start/end point will depend on the time at which the formula year is deemed to start and end.

Calculating the total quantum of unidentified gas via a top-down approach

This methodology will calculate an estimated consumption figure for a single supply point. As the above methodology uses the initial allocation algorithm for some elements, it will by definition partially include unidentified gas. The extent to which this occurs will depend upon how close the meter readings are to the start and end of the gas formula year, as the initial allocation algorithm is relied upon more the further the meter readings are from these points. However, it has the advantage of using the most extensive dataset available on actual NDM supply point consumption, and therefore should have a marked improvement relative to the current approach.

As already noted, for total unidentified gas to be quantified via a top-down approach an *aggregate* actual NDM consumption figure is required. The methodology outlined above for estimating a single supply point consumption could be used to derive an estimate for aggregate NDM consumption (that is, consumption by SSPs and LSPs) in two ways:

- ***Sampling*** – form a representative sample of NDM consumers (LSPs and SSPs), ideally those with meter readings close to the start and end of the formula year, and perform the above calculation for each supply point in the sample. Following this, sum to calculate the aggregate consumption for the sample and then scale to reflect the entire NDM population.

  We note a potential issue with this approach is that those supply points who do not have a meter reading may exhibit different consumption behaviour to those who do. As such, scaling the sample to reflect the entire NDM population may result in bias. .

- ***Entire NDM population*** – perform the above calculation for *every* NDM supply point that has a pair of meter readings fitting a set of specified criteria. As noted above, the further meter readings are from the start and end of the formula year, the greater the emphasis on the initial deeming allocation and thus the risk of estimation error increases. There is therefore a trade-off between using actual consumption data (meter readings) and not introducing too much estimation (using the initial allocation and correction ratio).Robustly deriving the rule for this trade-off would require analysis of the data. In the absence of having examined the meter read data, we would suggest that any supply point requiring more than twelve months of initial allocation data to be used be excluded from the above process.

  For all supply points who do not meet the above criteria use their initial allocation as a proxy for actual consumption (whilst appreciating these estimates will include unidentified gas). Summing across all NDM supply points will give an estimate of total actual consumption for the NDM sector, for later use in the top-down approach.

In addition to aggregating NDM consumption to form an annual NDM consumption figure, we note an alternative approach to the above which is for SSPs to be reconciled in the same manner as LSPs currently are. This would allow a "rolling" reconciliation by difference process to be followed.

The central theme of the methodology proposed in this section is that it makes use of the large volume of data on actual consumption held by xoserve that is currently not used in the RbD process.

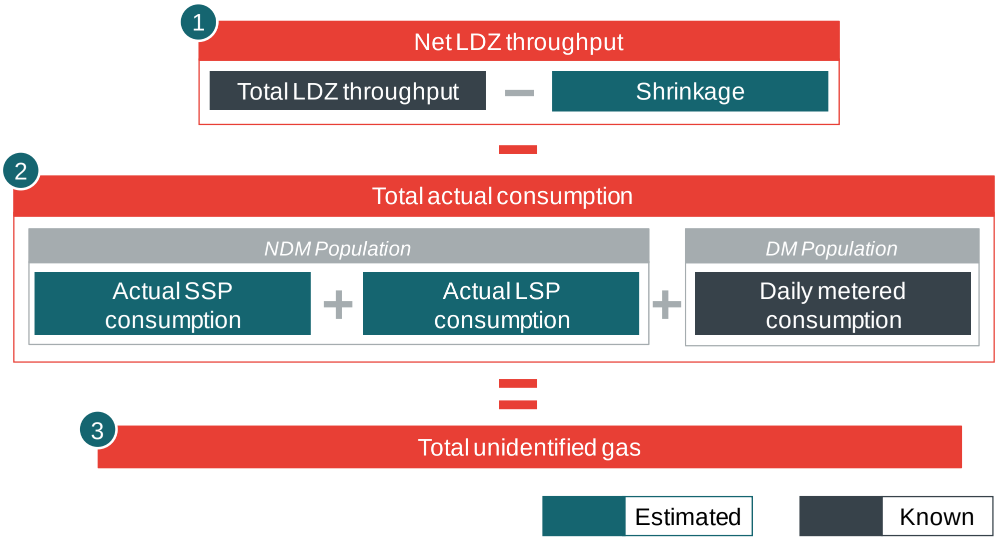
4.3.2 Quantifying total unidentified gas

Given an estimate for the previously unknown quantum of consumption by the NDM population, total unidentified gas can be quantified by subtraction. As Figure 12 below shows, this consists of three steps:

- calculate net LDZ throughput by adjusting total input to all LDZs for shrinkage;
- sum estimated consumption by the non-daily metered sector (derived above) to total metered consumption to calculate total actual consumption; and
- subtract total actual consumption from net LDZ throughput, the result of which is the total quantum of unidentified gas for the relevant formula year.

Calculating the total quantum of unidentified gas via a top-down approach

Figure 12. Quantification of total unidentified gas via top-down approach



Source: Frontier

This section has suggested a methodology for estimating the actual consumption of the non-daily metered population. Given this estimate, and other available data currently used in the RbD process it is possible to quantify total unidentified gas. Total unidentified gas can then be allocated between the relevant components, and apportioned to SSPs and LSPs accordingly, which is discussed in the following section.

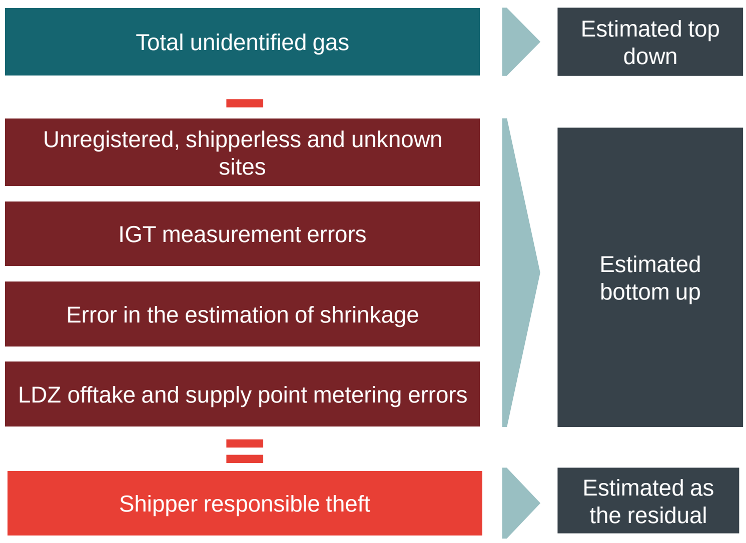
5 Allocating unidentified gas between components and sectors

Each element of unidentified gas may be attributable in different proportions across the LSP and SSP sectors. We therefore argue an estimate should be made of each component of unidentified gas before it is allocated between sectors. This estimation should proceed as follows:

- A bottom-up estimation of all elements of unidentified gas except theft should be undertaken, according to the methodologies set out in Section 3. Given stock change and unreconciled LSPs are likely to make a negligible contribution to unidentified gas (see Section 3 above), we propose to exclude them from this analysis.
- Given the nature of theft as a hidden activity, we do not believe it is possible to determine its levels through a bottom-up analysis. The second step is therefore to estimate theft as the residual amount of unidentified gas left once all other elements have been subtracted from total quantum of unidentified gas identified through our earlier top down analysis.

Figure 13 below illustrates our overall approach.

Figure 13. Allocation of unidentified gas between sectors



Source: Frontier Economics

In essence, we are proposing that shipper responsible theft is not quantified directly through the collection of evidence on the incidence of theft. Rather, we propose it is calculated as the residual of total unidentified gas minus the four other non-negligible components of unidentified gas. The calculation described in Figure 13 can therefore produce an estimate of total theft, which, along with the other components, we can then allocate appropriately between sectors.

Given the methodology set out above, the total quantity of unidentified gas can be allocated between its components. We now discuss a methodology for splitting each between sectors. We discuss in turn:

- potential options for ways in which unidentified gas might be allocated either between sectors and/or between shippers;
- criteria for assessing these options; and
- our recommended approach to the allocation for each component of unidentified gas.

Finally, we provide a summary of our conclusions.

5.1 Options for allocating costs of unidentified gas

The total costs of unidentified gas must be allocated between shippers. In principle, and disregarding for the moment issues of practicality, there are three broad options for allocating unidentified gas between shippers. These are:

- **By shipper –** a bottom up allocation by shipper, would base the allocation of costs between shippers on the incidence of each component of unidentified gas that could be attributed to that shipper's customers. Conceptually at least, in this regime some shippers would bear proportionately greater cost of unidentified gas (e.g. per kWh of their throughput) than other shippers.
- **By sector, socialised within sectors** – a bottom up allocation by sector would base the allocation of costs between sectors on an analysis of the incidence of the unidentified gas by the SSP and LSP sectors. The allocation to each shipper within the sector would be based on socialisation - for example costs would be smeared across all shippers within a sector according to throughput. In this regime one sector could bear proportionately greater cost (e.g. per kWh of throughput) than the other sector, but all shippers within a sector would bear the same per unit cost. This is the current approach, in that all the costs are borne by shippers to the SSP sector.
- **Socialised across shippers and sectors –**socialising the costs across shippers and sectors would involve smearing the costs evenly across each shipper or sector – for example according to throughput. In this

regime, per unit costs of unidentified gas (e.g. costs per kWh) would be equalised across both sectors and shippers.

It is worth noting that it might also be possible to treat each sector differently.. For example, one sector might have costs allocated to shipper and the other socialised.

5.2 Criteria for assessing options

We propose to assess the allocation methodology for each option against three criteria. These are:

- **Efficiency:** Regulatory and market design aims, where possible, to reflect costs back on those that cause them. This is known as the polluter pays principle. In the case of unidentified gas, where it is possible to ensure that each shipper bears the cost of unidentified gas for which it is responsible, applying this principle should incentivise minimisation of unidentified gas, and therefore, in turn, minimisation of cost to consumers. The clearest example is in the field of theft detection –for example if each shipper directly bore all the costs of theft that occurred in their part of the market, they would be incentivised to invest theft detection up to efficient levels.

- **Fairness:** Where it is not possible to achieve an efficient allocation, it may still be possible to achieve a 'fair' allocation. In this context we define a fair allocation as one which does not unduly discriminate against one segment of customers. An unfair allocation may result if one sector bears a disproportionate amount of costs to another, given the allocation of customers between sectors is somewhat arbitrary at least at the margin (given it is only based on the volume consumed), and given customers cannot voluntarily switch between sectors.

- **Practicality:** No matter how efficient or fair an option is, if implementing it is not practical, it cannot be considered further. There are two conditions for practicality in this case:
  - sufficient evidence must be available to undertake an allocation of unidentified gas; and
  - the cost of applying the methodology must be proportionate to the benefits of applying it.

5.2.1 Assessment of options for each component of unidentified gas

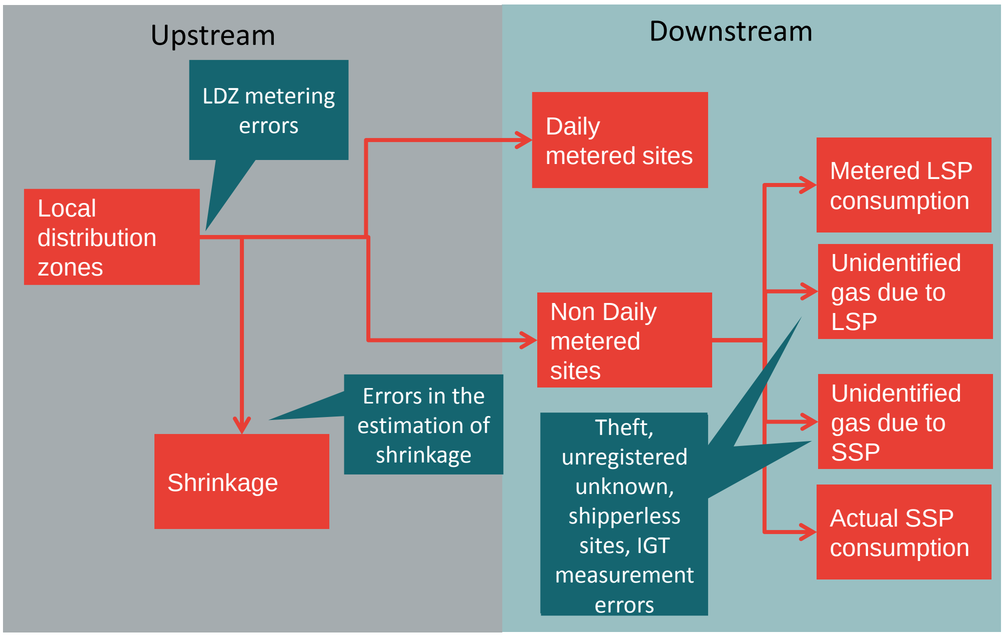
The five non-negligible elements of unidentified gas can be split into two broad categories. These are:

- **Upstream:** Upstream unidentified gas results from errors in the estimation of gas that enters the daily metered, LSP and SSP sectors. LDZ metering errors and errors in the estimation of shrinkage fall into this category.

- **Downstream:** Downstream unidentified gas results from gas that is consumed at LSP or SSP points, but is not recorded as being consumed. Theft, consumption at unregistered, unknown and shipperless sites and IGT measurement errors fall into this category. We note that supply point meter errors would also fit into the downstream category. However, given both SSP and LSP meters reads are employed in our methodology, and in the absence of any evidence that meters at one type of supply point would have a different level of accuracy (or population bias) to meters at the other type of supply point, we propose to exclude this category of error from further analysis.

Figure 14 below shows this split in the context of earlier illustrations on unidentified gas.

Figure 14. Upstream and downstream elements of unidentified gas



Source: Frontier Economics

Given this split we now consider how upstream and downstream unidentified gas can be allocated.

Allocating unidentified gas between components and sectors

5.2.2 Assessment of the allocation of upstream unidentified gas

Given that upstream unidentified gas, by definition, cannot be attributed to any one shipper or sector through a bottom-up analysis, it appears that the only appropriate option for allocating these types of costs are to socialise them across sectors on a per kWh basis., given that the overall volume of throughput is likely to be a driver of the overall level of upstream unidentified gas.

Considering this approach from the perspective of our three criteria:

- **Efficiency:** There is no efficiency loss in socialising these costs as it is not in the gift of individual shippers to reduce the errors in the estimation of gas upstream
- **Fairness:** Socialising these costs according to throughput would not unduly discriminate between shippers or their customers.
- **Practicality:** Socialising these costs according to throughput is likely to be practical.

We would therefore suggest that the costs of LDZ metering errors and errors in shrinkage measurement are socialised across shippers according to throughput irrespective of whether the shipper's customers are in the LSP or SSP sector or, indeed, whether the customer is a Daily metered on Non-Daily metered customer.

5.2.3 Assessment of the allocation of downstream unidentified gas

Downstream unidentified gas consists of gas that is consumed at supply points, but is not recorded as being consumed. We divide this into two categories and consider with each in turn:

- **Unidentified gas due to errors in the registration of sites**: Gas consumed at unregistered, shipperless, orphaned and unknown sites falls into this category, as do IGT measurement errors. The key feature of this category of sites is that, because of incorrect data, a proportion of these sites will have shippers supplying and billing them so may gain revenue from supplying gas to them, but will not incur the costs. However it is thought the majority of sites in this category are not being billed by any supplier.
- **Unidentified gas due to theft:** Gas stolen at supply points and consumed without being recorded as such falls into this category. The shippers supplying to sites where theft is occurring neither directly incur the costs of supplying to these sites, nor will they gain the revenue.

Unidentified gas due to errors in the registration of sites

We first consider the allocation of unidentified gas due to errors in the registration of sites. Table 2, below, sets out an assessment of allocation methodologies for unidentified gas due to errors in the registration of sites.

Table 2. Assessment of allocation methodologies for unidentified gas due to errors in the registration of sites

	Efficiency	Fairness	Practicality
By shipper	✓ Passing the costs of gas supplied at these sites back to the shippers supplying these sites would ensure that the cost of this type of unidentified gas falls on those shippers that cause it (and that gain the benefit from it).	✓ Allocating these costs by shipper would be fair – some shippers already gain the benefits of supplying gas to these sites, so it is fair that they should also incur the costs.	X Robust, up-to-date information on the incidence of these sites by shipper is not available. Nor is it possible to assess what proportion is being billed by shippers.
By sector, socialised within sectors	X Allocating the costs by sector, and socialising them within sectors will have little or no impact on individual shippers' incentives to reduce the number of these sites in their portfolio.	✓ No customer will be unduly discriminated against as the costs associated with these sites will be spread among the shippers. If the incidence of these sites is different by shipper within a sector, customers can switch shipper.	✓ The data the AUGE is collecting on these sites are split into categories coinciding with LSPs and SSPs. Hence the bottom-up estimation will allow this element of unidentified gas to be split between the LSP and SSP sectors.
Socialised across all shippers and sectors	X Socialising the costs will have little or no impact on shippers' incentives to reduce the number of these sites in their portfolio.	X If the incidence of unidentified gas due to these sites is different by sector, customers in one sector could be bearing an unduly large share the costs, relative to the benefits they receive from the existence of these sites, since customers cannot switch sector.	✓ Splitting the costs of these sites by throughput would be practical.

Source: Frontier Economics

As Table 2 above shows, in our view the most efficient and fair option would be to allocate this category unidentified gas according to its incidence by shipper. However, this would be equivalent to eradicating this problem. We are not aware of any data and/or processes that currently exist on the incidence of these sites by shipper. This option is thus not likely to be practical.

Given this, our initial view on an appropriate option would be to undertake a bottom up assessment of unidentified gas between sectors, and to socialise these costs within sectors. In part, the final view on this will be informed by the extent to which the responsibility for the error is due to shipper error, network operator error or whether the fault lies with the customer itself. This option is not likely to result in an efficient outcome, but is likely to be practical, and, to the extent that errors on the part of shippers drive the overall level of cost, seems fairer than the alternative of full socialisation. By contrast, to the extent that customer error is the main driver, then it may be more appropriate to consider full socialisation (as we discuss below in the section on treatment of theft).

We consider this approach against our three criteria:

- **Efficiency**: This option will not improve efficiency. Socialising the costs will have little or no impact on small supply point shippers' incentives to reduce the total number of these sites. However, it may provide an incentive on large supply point shippers given that, currently, the SSP market bears all of the costs.

- **Fairness:** Since some sites in this category generates revenue without any associated costs, shippers, and therefore potentially their customers, receive some benefit from the presence of these sites within their portfolio. To the extent that supplier faults are the driver of the error, allocating the costs of these sites to the sector that holds the most of these sites seems fair, as only shippers within this sector will be able to benefit from the existence of these sites.

- **Practicality:** This option is also likely to be practical as the data the AUGE is collecting on this category of sites can be split into LSPs and SSPs categories. Hence the bottom-up estimation will allow this element of unidentified gas to be split between the LSP and SSP sectors.

Given the difficulties in achieving an efficient outcome in this case, we suggest there is a strong case for an increase in regulatory effort aimed at identifying and registering these sites and thereby ensuring that total quantity of sites in this category is minimised.

Unidentified gas due to theft

We now consider the allocation of the category of unidentified gas caused by theft across sectors.

Unidentified gas due to theft is very different to unidentified gas due to errors in the registration of sites. Shippers supplying to sites where theft is occurring neither directly incur the costs of supplying to these sites, nor do they gain the revenue

Table 3 below sets out an overview of our assessment of alternative ways of allocating theft across sectors.

Table 3. Assessment of allocation methodologies for upstream unidentified gas

	Efficiency	Fairness	Practicality
By shipper	✓ The costs and benefits of theft reduction are aligned. Shippers have incentives to invest in theft reduction up to efficient levels.	✓ No customer group is unduly discriminated against. Customers can switch to the shippers that invest the most efficiently in theft reduction.	X This option is not likely to be practical. By its nature, theft is a hidden activity and determining its levels by shipper is not likely to be possible.
By sector, socialised within sectors	X No individual shipper will have an incentive to invest in theft up to efficient levels as the benefits of any theft reduction they invest in will be spread across all shippers in their sector.	X Customers cannot readily switch between sectors. If there is more theft in one sector customers who are within that sector purely because of the volume they consume will be unduly discriminated against.	X This option is not likely to be practical. By its nature, theft is a hidden activity and determining its levels by sector is not likely to be possible.
Socialised across all shippers and sectors	X No individual shipper will have an incentive to invest in theft up to efficient levels as the benefits of any theft reduction they invest in will be spread across all shippers.	✓ No customer group is unduly discriminated against as the costs of theft are spread evenly across all customers.	✓ Splitting the costs of theft by throughput would be practical

Source: Frontier Economics

As Table 3 above indicates, in our view, the most efficient and fair option would be to allocate theft according to its incidence by shipper. In this case, the full costs and all of the benefits of any investment in theft detection would fall on individual shippers, and so shippers would be incentivised to invest in detection up to efficient levels. However given the impossibility of determining the true levels of theft by shipper, this option must be ruled out as impractical.

Allocating unidentified gas between components and sectors

The second best, but most practical, option in this case is to socialise fully the costs across sectors. While this will not, by itself, result in an efficient outcome, it will be fairer and more practical than the alternative of allocating within sectors. We consider this approach against our three criteria:

- **Efficiency:** Implemented by itself this option is not likely to be efficient. Once the costs of theft are socialised, no individual shipper will be able to capture the full benefits of an investment in theft detection – rather it will be smeared across all customers. This will tend to encourage underinvestment in theft detection practices. This underinvestment in theft detection will, in turn, tend to lead to higher levels of theft overall;
- **Fairness:** This option is likely to be fair as no customer is unduly discriminated against purely because of the volume of gas they consume. The contrary position of smearing across sectors in some proportion – or all being borne by the SSP sector (as is the case at the moment) seems, to us, inherently unfair. Even if the incidence of gas theft is higher amongst smaller customers (and there is no evidence, on a per kWh basis, that this is the case), we can see no legitimate reason why a small customer that is not stealing gas should bear a higher proportion of the cost of theft than a large customer not stealing gas (or vice versa). In our view, such as approach would be highly regressive.
- **Practicality:** This option is also likely to be practical as the total costs of theft can be split by throughput.

In passing, we note that theft detection has characteristics that make it akin to a public good as it is not possible to exclude the benefits of theft detection to all customers. This is a classic example of "market failure" and, without further intervention, is likely to lead to an under-provision of theft detection services. Our view is that the current approach in which all of the costs of theft fall on the SSP sector, as well as being iniquitous and regressive, is highly inefficient as any individual shipper does not have sufficient incentive to invest in theft detection. This will lead to an overall increase in the level of theft to the detriment of society.

Typically, such market failures are addressed by some form of centralised intervention or by, in some way, changing the way in which benefits of the public good are allocated to ensure the incentives to deliver such goods are improved. We understand that the gas industry is currently considering a range of options to address this issue and, given the clear problem that we have identified with the current regime, believe that this would be potentially very beneficial to both the industry and society more widely.

5.3 Summary

Table 4 below summaries our views on both the method of calculation for each component of Unidentified Gas and also on the method of allocation.

Table 4. Summary of approach to calculation and allocation of each component of Unidentified Gas

	Calculation approach	Allocation
LDZ metering error	Bottom up estimate for LDZ	Per kWh across all NDM and DM customers
Shrinkage measurement error	Bottom up estimate for LDZ	Per kWh across all NDM and DM customers
Unregistered, shipperless and unknown sites	Bottom up estimate by sector	Sector specific per kWh across SSP and sector specific per kWh across LSP
IGT measurement error	Bottom up estimate by sector	Sector specific per kWh across SSP and sector specific per kWh across LSP
Theft	Residual	Per kWh across all NDM customers

Source: Frontier Economics

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