OWN USE GAS CALCULATION ASSESSMENT

Joint GDN Review – September 2022

Contents

Executive Summary

This joint GDN report details the impact, both environmentally and to the consumer, of own use gas (OUG) volumes and the materiality of these volumes in terms of both, total Shrinkage from the UK gas network (2.5% of LDZ Shrinkage volumes), and as a proportion of total carbon emissions (0.4% of LDZ Shrinkage volumes). This report also describes the process for reviewing the OUG model which includes the considerations to validate the assumptions, an evaluation of the current state of the pre-heating assets in operation across the UK, and the availability of actual metered supply data.

The GDN's have adopted a three phased approach to this re-validation exercise. The Exploration Phase, which the GDN's are currently in the process of completing, consists of an extensive data gathering exercise, looking at availability of metered data and telemetered flow, pressure, and temperature data. The second phase is an Optioneering Phase, where DNV will assess the robustness and quality of the GDN data, and either, recommend available options for a potential validation of the current model with updated costs, or suggest further data collection exercises if required. Finally, there will be an Evaluation Phase, in which the GDN's will report back to Ofgem, setting out creditable options, their likely costs, associated workload, and timelines for delivery.

This report also outlines the implications of modifying estimates for OUG volumes, and the way in which costs are allocated. We set out that changing the OUG assumptions has primarily a distributive impact in the allocation of costs between transportation and shipper charges, but the overall cost to the consumer will remain unchanged. Furthermore, given there has already been a significant programme to install more efficient modular pre-heat systems (currently the most energy efficient solution), changes to OUG assumptions are unlikely to have a material impact on investment decisions. Such changes to investment decisions may be muted further by the transition to hydrogen, which in the future would also make pre-heating equipment unnecessary. It should also be noted that any change to the OUG methodology, no matter how significant, will impact, and require a restatement of individual GDN shrinkage targets.

All GDNs are currently actively involved in a project (Digital Platform for Leakage Analytics (DPLA) SIF) looking into alternative methods of evaluating leakage, focussing specifically on the areas where the greatest environmental benefit can be gained. This project is assessing better methods of improving granularity and accuracy in the fugitive emissions elements of LDZ Shrinkage volumes (98.5% of total, excluding 3rd Party Damages). The low materiality of OUG, both in terms of energy lost and any subsequent environmental emissions, means that there are other areas that possibly warrant more attention and funding.

Following the submission of this report, and subject to feedback from Ofgem, the expectation is to progress with the Optioneering phase that we anticipate will be completed by end of January 2023.

Background

This report has been prepared in-line with the action taken following the joint GDN/Ofgem meeting on 12th May 2022 and based on the GDN response, on 6th April, to an Ofgem letter, relating to the challenges raised by a third-party stakeholder around the current Own Use Gas (OUG) calculation methodology. In that response, the GDN's laid out the levels of engagement on this issue and discussed the low materiality of OUG volumes relative to other elements of shrinkage and the limited impact on consumers' bills which we have detailed within this report.

The third party stakeholder challenge is around the continued suitability of the current OUG methodology, created by Advantica (now DNV) in 2002, which was further re-validated in 2005. An alternative calculation methodology was presented to demonstrate a significant under forecast of OUG, however, using a different set of assumptions to the Advantica model.

Following this challenge, GDNs consulted with industry experts DNV to assess the alternative methodology. Further discussions between DNV, Ofgem and the third party concluded that there was a high level of uncertainty surrounding model assumptions which warranted further investigation. The GDNs are committed to improving how we model and assess shrinkage gas and as such, we have laid out a three-phase approach for reviewing the suitability of the current OUG model.

Impact of Own Use Gas Volumes

Unidentified Gas (UIG) is gas that cannot be directly allocated to a Shipper and, instead, must be shared across Shippers using apportionment.

Gas exits the National Transmission System (NTS) network and enters Local Distribution Zone (LDZ) networks, some of which, flows into Independent Gas Transporter (IGTs) networks. Gas exits LDZ and IGT networks at customer Supply Meter Points. The gas entering LDZ networks is metered as is gas exiting the LDZ and IGT networks at Supply Meter Points. The gas taken from the NTS does not equal the gas metered at Supply Meter Points. Some of the difference is attributable to gas lost in the pipes of the LDZ networks and this is termed LDZ Shrinkage. The remainder of the difference is Unidentified Gas. LDZ Shrinkage is the accountability of the individual Distribution Networks that operate the LDZs, and this volume of gas is procured on an annual basis to replace that which is lost. These procurement costs are attributed to the transportation element of the customer bill.

UIG is caused by a range of issues which include theft, meter errors, meter configuration errors, the impact of localised variation in pressure and temperature and the means of correcting for this, as well as missing meter readings.

The settlement process attributes the gas measured at Supply Meter Points to the registered Shipper. In order that all gas is accounted for, the settlement process allocates UIG across Shippers, based on the portfolio of customers to which they are each registered.

The weighting factors for each component of UIG are determined annually by the Allocation of Unidentified Gas Expert (AUGE). The objective is to determine factors that allocate UIG as fairly and equitably as possible. The AUGE undertakes detailed analysis of the causes of UIG each year and allocates the UIG appropriately for the required gas year.

The table below shows the 2021/22 Shipper responsible settlement volumes for UIG by component.

Component	Total (GWh)
Theft of Gas	7,730
Average Temperature Assumption	1,249
No Read at the Line in the Sand	643
Consumption Meter Errors	789
Average Pressure Assumption	371
Incorrect Correction Factors	48
Unregistered Sites	101
Shipperless Sites	32
IGT Shrinkage	18
LDZ Meter Errors	0
Total	**10,982**

LDZ Shrinkage is not the responsibility of the Shipper community, but miscalculation of the LDZ Shrinkage volumes would have a direct impact on the UIG volumes. For example, if Distribution Networks are underestimating OUG this would mean that UIG is being overestimated, with the same true in reverse. In 2021/22 the volume of OUG calculated using the Ofgem approved methodology was 59.3GWh, approximately 0.5% of total UIG volumes for the same period.

The table below shows the 2021/22 settlement volumes for LDZ Shrinkage by component.

Component	GWh (UK DNs)	%
LP Leakage (fugitive)	1,537.9	65.5%
MP Leakage (fugitive)	218.1	9.3%
AGI Venting (fugitive)	165.5	7.1%
AGI Leakage (fugitive)	254.1	10.8%
3rd Party Damages (fugitive)	7.8	0.3%
Own Use Gas (combusted)	59.3	2.5%
Theft of Gas (combusted)	104.9	4.5%
Total	**2,347.7**	

Whilst correct allocation of gas losses is important, the materiality of impact is low considering the uncertainty of the other elements of the calculation. As noted above, in the case of OUG, the impact is purely customer cost allocation and does not impact overall environmental volumes.

Materiality of Own Use Gas

Shrinkage gas is a combination of fugitive emissions (gas escaping the network in its natural form) and combusted gas. Comparable fugitive emission volumes (GWh) have a much greater impact on global warming than combusted gas.

OUG, which is gas used in preheating prior to pressure reduction, is a combusted gas. The volume of this gas is estimated using the approved Ofgem methodology, which is cited as 0.0113% of overall LDZ throughput. This factor was determined using science-based assessments and facilitates an efficient method of estimating OUG as a factor of LDZ throughput without the need for costly and intensive metering, increased operational visits, or additional telemetry.

Since the introduction of the modelling methodology, preheating equipment has been replaced, in some cases with more efficient technologies. The gas that is estimated and lost through LDZ Shrinkage is captured within the transportation element of the customer bill. This gas is procured for Shrinkage in GWh but converting this volume of gas to tCO2e determines the overall environmental impact of each Shrinkage component and would be valuable in determining areas of priority for review. The conversion factors used are those captured within the Annual Environmental Report as shown below.

Factors:

Fugitive emissions: tCO2e = GWh x 1226.42

Combusted gas: tCO2e = GWh x 183.85

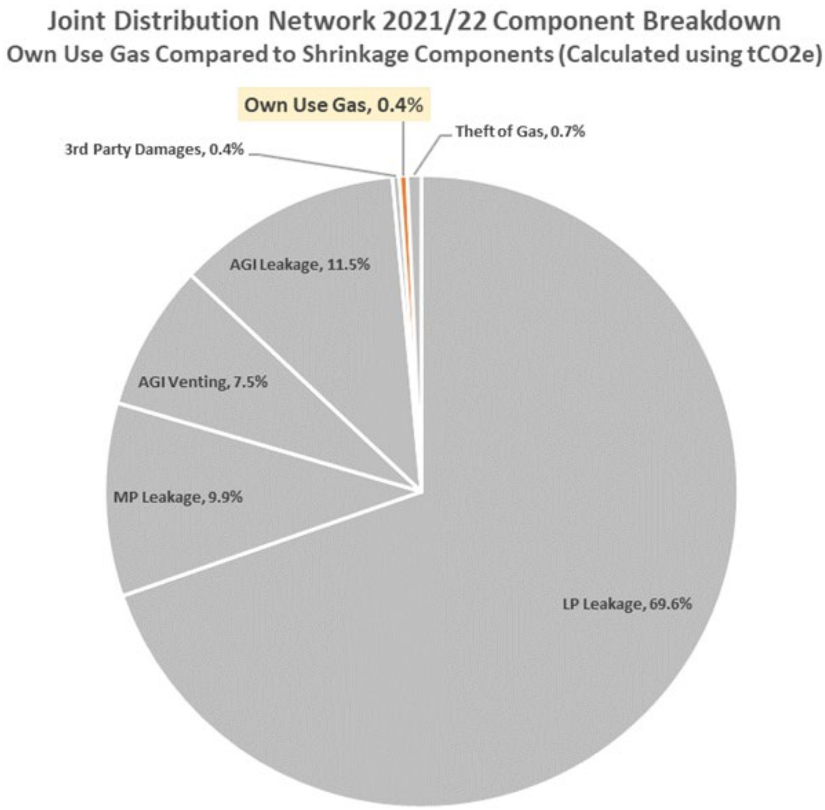
Own Use Gas Calculation Assessment

Due to the nature of the emissions (fugitive vs, combusted), the impact on the environment of OUG is reduced as a percentage of the total Shrinkage volume. This is when it is compared to the other factors once converted to tCO2e.

Component	tCO2e (UK DNs)	%
LP Leakage (fugitive)	1,886,111.1	69.6%
MP Leakage (fugitive)	267,491.9	9.9%
AGI Venting (fugitive)	203,013.6	7.5%
AGI Leakage (fugitive)	311,657.7	11.5%
3rd Party Damages (fugitive)	9,540.8	0.4%
Own Use Gas (combusted)	10,900.3	0.4%
Theft of Gas (combusted)	19,291.2	0.7%

As described in the section 'Impact of Own Use Gas volumes', a misrepresentation of the volumes of OUG does not lead to an underestimation of emissions, it only contributes to the allocation of customer bills between transporter responsibility and shipper responsibility.

The chart below demonstrates the percentage of OUG attributable to Shrinkage compared to the other components.



As previously noted, GDNs have a Licence obligation to continue to identify methods of improving the accuracy of the Shrinkage and Leakage Methodology. All GDNs are actively participating in the Digital Platform for Leakage Analytics SIF project that is assessing better methods of improving granularity and accuracy in the fugitive emissions elements of LDZ Shrinkage volumes (98.5% of total, excluding 3rd Party Damages).

Process for reviewing current Own Use Gas model

The process for reviewing the current Own Use Gas model is listed as follows:

Exploration phase

1. DNV to conduct review of third-party calculations ☑
2. DNV to provide overview of original own use gas model assumptions ☑
3. DNV to share high level view of options to improve own use gas model. ☑
4. DNV to provide networks with data template ☑
5. GDNs to provide DNV with the population of different pre-heater types and data availability ☑
6. GDNs undertake historical data gathering exercise to provide DNV with the previous 4 years of hourly site data for a sample of sites that could support a representative dataset ☐
7. Data landscape review - DNV review GDN data and provide feedback on data gaps, quality, and any immediate follow-on actions for the GDNs to take ☐

Optioneering phase

1. DNV to analyse GDN data ☐
2. DNV to explore data sources for non-network data ☐
3. DNV to provide GDNs with options for next steps following data review ☐
4. Options with current availability of data to be shared ☐
5. Options with additional data to be shared ☐

Evaluation phase

1. GDNs to conduct Cost Benefit Analysis on options provided by DNV to ensure value for the customer, based on expenditure versus overall output value. This needs to be considered in conjunction with other projects to improve and assess shrinkage e.g., DPLA. ☐
2. GDNs to develop a proposal on next steps based on the cost and value assessment. ☐
3. GDNs to share proposal with Ofgem ☐
4. GDNs develop a delivery plan. ☐

Exploration Phase

The initial Exploration Phase is near completion, and available datasets forwarded to DNV. Outlined below are the various high-level model improvement recommendations and route map for re-validation, suggested by DNV, as well as the indicative Rough Order of Magnitude (ROM) costings.

The data extraction and consolidation exercise is extensive and time-consuming, largely due to the number of data points required and also because we are using some data which is not currently routinely captured or validated, therefore requires a level of sense checking and validation. The SCADA data exercise involves extracting and formatting pressure, flow, and temperature data for each site, on an hourly basis, for a four-year time period. The data sent to DNV at this stage will hopefully allow an accurate and representative view of the pre-heater estate to be formed. This has necessitated a significant amount of manual intervention from the GDN's over the summer, including:

- Telemetered data extraction and processing
- Site visits to complete meter reads
- Processing of meter read data (reconciliation of units, MPRN matching, etc.)

Initial Options and Considerations from DNV:

DNV have suggested a number of considerations to improve the current OUG model, varying in logistical complexity and cost. Some recommendations are also dependent on the outcomes of others.

Pre-Heater Metering:

This option would involve the installation of fiscal metering on all operational sites with a pre-heat system (or on a sufficient scale to enable the remainder to be accurately scaled up). The primary benefit of this option would be to negate the requirement for an OUG model, although this would rely on the accuracy of the metered data to ensure a robust result. There would also be a requirement to undertake manual data collection activities or to install and maintain additional telemetry on sites to enable remote data collection. Even though this would provide a definitive volume for each LDZ, the significant expense would not be a cost-effective use of consumers' money and should only be considered if any re-validation exercise uncovered significant uncertainty within the current OUG model.

Pre-Heater Efficiency Tests:

Heat Exchanger efficiency tests would be carried out on a subset of newer Pre-Heaters, under a range of different operating conditions, to enable a new set of pre-heater efficiencies to be derived as the current model assumes 50% efficiency based on a population of predominantly water bath heaters. As noted earlier, the low efficiency water bath heaters have since been replaced with higher efficiency modular gas boilers.

Although this would inevitably lead to improved heater efficiency representation within the model, there would be a significant cost associated with this option.

Re-Validate Model using subset of metered Pre-Heaters:

This would encompass the collection of pre-heater metering data from sites either manually or with telemetry which could then be utilised to validate the model with metered consumption and provide confidence in the current model. Potentially beneficial to demonstrate whether the current model is still valid.

Improved Pre-Heater Strategies:

Obtain and update pre-heater operational information (likely efficiency, detailed on/off schedules, etc.) to improve the overall accuracy of the current model.

Refresh Hourly/Monthly Data for Model:

This would require a large dataset, including 4 years of telemetered consumption data, and comprehensive pre-heater information, which could be utilised to bring the current model up to date, reflecting the current operating conditions. Large workload and potential high cost (subject to quality of existing data) but would enable all operational changes that would impact the model, to be updated.

Ground Temperature Update:

This could quite easily be requested from authority such as the MET Office and used to update model assumptions. Low impact, low cost.

Individual Pre-Heater Modelling:

This would involve treating each individual pre-heater separately within the model, rather than at overall site level, to account for different pre-heater usage strategies, and would refine the model results in-line with pre-heater on/off schedules, and efficiency adjustments if not operating at full capacity. Would require extensive data gathering on each pre-heater configuration, both telemetered and on site. Potentially a high impact/high-cost option.

DNV have suggested that any work generated from the above actions, should be phased in a way that would ensure that the more expensive and logistically problematic options could be dropped if sufficient data was available from the less intrusive options to allow an accurate validation to take place. The table below sets out a possible route map through the various options and also some high-level indicative costs.

DNV Route Map and ROM Costs

Item	Option	Pre-Requisite	Phase	ROM Cost	Phase Cost

Pre-Heating Estate:
A summary of GDN pre-heating assets indicates that traditional Water Bath Heaters equate to just over 25% of the total estate, with the majority of sites operating with efficient modular gas boilers. Just over 5% operate using electric plant (inc. ProHeat).

Current Operational Pre-Heater Types

Pre-Heater Type	Number of Units	% of Pre-Heater Population
Water Bath Heater	343	25.67
Modular Gas Boilers	906	67.81
HOTCAT/Catalytic Heaters	15	1.12
ProHeat	19	1.42
Electric	52	3.89
Gas to Gas	1	0.07
Total	1336	100

As demonstrated in the table above, the majority of pre-heating systems are the more efficient modular gas boiler systems. This has been due to an extensive investment programme carried out over the previous two price controls.

Availability of Pre-Heating Metered Data:
All GDN's have found accurate and robust metered data at pre-heating sites to be sporadic at best. Although some sites do have records of regular meter reads, it remains to be seen whether this will provide enough certainty to be considered representative of the entire pre-heating estate. The reason for the gaps in quality in some areas, is that this data has never previously been required or used, so has not been routinely captured.

There are potential pitfalls to using manually recorded meter reads, which may make them unreliable or unrepresentative, and may result in inaccurate conclusions:

- The data is sometimes recorded in different units, both metric and imperial
- The data may be either corrected or uncorrected for pressure
- No indication if the meter reads have 'rolled over' numerically
- Some sites, when a quarterly read has been missed, simply use the same value as the previous quarter
- The meters themselves are not maintained to the same regime as fiscal metering

Telemetered Data (Flow, Pressure, and Temperature)
The GDN's have been provided with a data template from DNV and are in the process of gathering telemetered flow, pressure, and temperature data for a number of sites to provide a representative sample, which DNV can hopefully extrapolate across the whole network. This data, following DNV's instructions, consist of hourly reads for gas volumetric flow, inlet and outlet pressures, and outlet gas temperature for each site, from the SCADA system, over a 4-year period.

Even considering the limited sample size, this is an arduous process, not only to extract this level of data for each site manually, but also to process the dataset on such a scale. If further data extraction is required by DNV, the GDN's will estimate the time and costs associated with this workload, and an investment plan may need to be drafted to fund a robust and extensive dataset.

Optioneering Phase

This phase will involve DNV analysing the site data provided by the GDN's, alongside a data gathering exercise for non-network information, such as ground temperatures, and assessing whether the dataset is of sufficient depth and quality to enable a level of OUG model validation. Following this, DNV will present a series of next steps and potential options available to conclude this review.

If the dataset allows validation of the OUG model, DNV will at this stage provide the GDN's with firm costs to complete this exercise, otherwise we would expect DNV to either, recommend more extensive data gathering, or additional potential options to progress the project. Timelines for completion of this second phase have not yet been agreed, but it is fair to estimate that DNV would be able to provide this feedback by the end of January 2023.

Evaluation Phase

The final Evaluation Phase will encompass a comprehensive review of DNV's recommendations. Each option will be fully costed and tested against a stringent CBA to not only ensure value for money for the consumer, but also in relation to other, ongoing GDN led undertakings aiming to improve and assess Shrinkage methodologies, such as the current Digital Platform for Leakage Analytics (DPLA) SIF project.

On completion, the GDN's will develop proposals and next steps based on this cost and value assessment, alongside accurate timelines for delivery, which will then be shared with Ofgem for review and comment on the GDN proposed direction.

Impact on Investment Decisions

Any change to the OUG methodology, no matter how significant, will warrant a re-appraisal of the individual GDN shrinkage targets. In relation to the current pre-heater estate, the impact on GDN investment decisions is low and unlikely to change, given that the majority of sites now operate with modern modular gas boiler plant. The GDNs continue to maintain and upgrade our pre-heating equipment to ensure that they are operating effectively because Own Use Gas as an element of shrinkage will persist until the gas networks transition to hydrogen when pre-heating equipment will eventually become obsolete.

The GDN’s, with DNV’s assistance, will consider the costs and merits of all available solutions and scenarios, with a particular focus on any potential benefits to the consumer. Required increases in GDN workload to amass the necessary datasets will also need to be assessed in detail. As previously mentioned, the GDN’s are all actively involved in a project looking into alternative methods of evaluating leakage are evaluated, specifically the areas where the greatest environmental benefit can be gained. The low materiality of OUG, both in energy lost and environmental impact, means that there are other areas that possibly warrant more focus and funding.