Draft Allocation of Unidentified Gas Statement (For Gas Year 2021-2022)

Prepared for: Xoserve and Industry Stakeholders	**Date:** 30th December 2020
	Version: 1.0
	Status: For Publication

www.engage-consulting.co.uk

ELECTRICITY | GAS | INDUSTRY EXPERTS

1 Executive Summary

INTRODUCTION

This document is the draft Allocation of Unidentified Gas (AUG) Statement for the Gas Year 1st October 2021 to 30th September 2022. Its purpose is to provide the draft Weighting Factors in the AUG Table for this Gas Year and to set out in detail how we determined these, so that they can be consulted upon.

Following this consultation, we will publish the final AUG Statement, along with the final Weighting Factors, for approval by the UNC Committee. The final Weighting Factors will then be used in Settlement for the Gas Year commencing on 1st October 2021.

We have produced this draft Statement in our capacity as the Allocation of Unidentified Gas Expert (AUGE) in line with our generic terms of reference described in Appendix 1.

UNIDENTIFIED GAS

Unidentified Gas (UIG) is gas that cannot be directly allocated to a Shipper and, instead, has to be shared across Shippers. It is caused by a range of issues including (but not limited to) theft, meter and meter configuration errors, data errors, and pressure and temperature impacts on the accuracy of measurement. It is an issue for Shippers as it creates uncertainty in their allocation and therefore in their costs.

OUR APPROACH

The overall approach we have taken in producing the Weighting Factors is founded on the principles of openness and transparency. We have sought to draw out the key issues in quantifying and apportioning UIG and to be very clear about what we have done and why. We have drawn on our knowledge and expertise throughout the process and exercised our balanced judgement to produce Weighting Factors that we believe will allocate UIG in a fair and equitable manner.

Our overarching methodology is founded on three key principles. These are:

- Polluter Pays – we interpreted "fair and equitable" to mean that UIG should be allocated in the same proportions as it is created;
- Line in the Sand – we only considered UIG that will exist at the Line in the Sand (the final Settlement position) and not UIG that exists temporarily prior to this; and
- Bottom-up Determination – we quantified UIG for each identified contributor and added these together, rather than estimating the overall UIG and apportioning it or using it as a means of differencing.

We identified ten contributors to UIG. We undertook a detailed investigation for four of these and defined a new assessment methodology for each. We reviewed and refined the existing methodologies for the remaining six. We acquired and validated a significant set of data from various sources in order to undertake the resulting methodologies and we analysed this in detail in the course of our work.

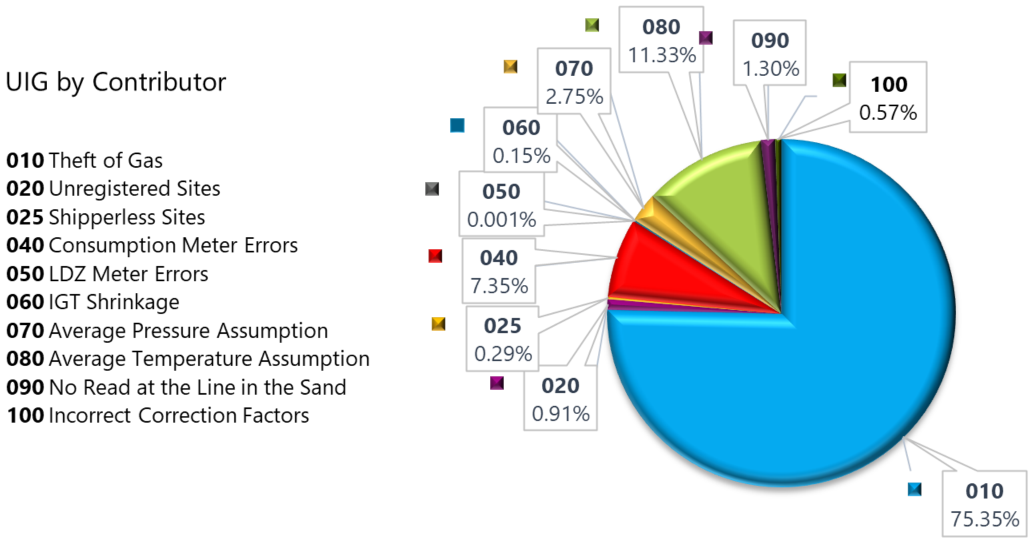
We created a contributor-based model, comprising a harness model with a link to separate contributor sub-models. We used this to collate the output of our analysis into each contributor in a standard format, and to process and aggregate these consistently in the production of Weighting Factors. We also created a forecast of consumption for the target Gas Year that we used in the process.

We produced the initial Weighting Factors using the harness model, based on the aggregated results from each sub-model along with our forecast of consumption, and smoothed these to produce the draft AUG Table.

RESULTS

We quantified UIG at the Line in the Sand for the target Gas Year as 11,143 GWh.

This is broken down across contributors as shown in the following diagram and table[1].



Contributor	Related UIG Volume (GWh)	Previous AUGE (GWh)	Change
Theft of Gas	8,396	7,159	↑
Average Temperature Assumption	1,263	555	↑
Consumption Meter Errors	819	25	↑
Average Pressure Assumption	307	55.3	↑
No Read at the Line in the Sand	144	-	↑
Unregistered Sites	101	2.2	↑
Incorrect Correction Factors	64	32	↑
Shipperless Sites	32	29	→
IGT Shrinkage	16	11.4	↑
LDZ Meter Errors	0	-	→
Total UIG	**11,143**	**7,846**	↑

[1] Note that due to rounding the values in aggregate may not equal total value.

It is broken down across Matrix Positions in the AUG Table as shown below (with figures rounded to the nearest GWh).[2]

		CLASS			
		1	2	3	4
EUC BAND	1ND	0	0	773	4,417
	1PD	-	-	14	1,156
	1NI	0	0	407	1,491
	1PI	-	-	0	15
	2ND	-	-	19	216
	2PD	-	-	0	5
	2NI	0	0	306	429
	2PI	-	-	0	0
	3	0	0	159	174
	4	0	1	163	240
	5	-	4	71	166
	6	0	26	36	155
	7	3	33	26	117
	8	8	64	12	174
	9	239	16	2	4

AUG TABLE

The AUG Table containing the draft Weighting Factors is shown below. These include the new sub-EUC bands introduced by Modification 0711[3]. The numbers have been normalised around an average of 100 so that they are comparable year on year. This does not impact the relative proportions in any way.

		CLASS			
		1	2	3	4
EUC BAND	1ND	53.76	53.76	53.76	63.48
	1PD	97.39	97.39	97.39	190.93
	1NI	10.20	508.78	496.53	518.99
	1PI	791.19	791.19	791.19	1298.17
	2ND	141.85	142.18	141.85	170.80
	2PD	92.60	92.60	141.85	170.80
	2NI	10.20	102.11	108.27	108.27
	2PI	15.06	15.06	108.27	108.27
	3	10.20	55.27	57.22	58.24
	4	10.20	60.88	57.69	57.27
	5	10.20	47.13	51.87	52.51
	6	10.20	40.31	48.58	49.09
	7	10.20	36.29	39.96	44.58
	8	10.20	28.04	34.72	37.34
	9	10.20	20.80	25.49	27.41

[2] Note that due to rounding the individual Matrix Position values in aggregate may not equal total value. Zeros are rounded values. Dashes are where the Matrix Position is forecast to be empty.
[3] UNC Modification 0711: "Update of AUG Table to reflect new EUC bands".

Table of Contents

2 Document Control

PUBLICATION

VERSION	ISSUE DATE	AUTHOR	REVIEWER
0.1	15th Dec 2020	Chris Hill/Jonathan Kiddle	Claire Everitt/Richard Cullen
0.2	23rd Dec 2020	Chris Hill/Jonathan Kiddle	Claire Everitt/Richard Cullen
1.0	30th Dec 2020	Chris Hill/Jonathan Kiddle	Claire Everitt/Richard Cullen

CHANGE HISTORY

0.1	Draft version for Xoserve review
0.2	Second draft version for Xoserve review
1.0	Draft Statement for publication

3 Introduction

This document is the draft Statement for the Gas Year 1st October 2021 to 30th September 2022. It presents the Weighting Factors and explains the methodologies used and analysis undertaken to derive them.

We have produced this draft Statement in our capacity as the Allocation of Unidentified Gas Expert (AUGE) in line with our generic terms of reference described in Appendix 1.

BACKGROUND

Unidentified Gas

Gas exits the National Transmission System (NTS) network and enters[4] Local Distribution Zone (LDZ) networks. Some of it flows into Independent Gas Transporter (IGT) 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[4] 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 “shrinkage”. The remainder of the difference is Unidentified Gas (UIG).

UIG is caused by a range of issues. These include theft, meter errors, meter configuration errors, the impact of different localised pressure and temperature and the means of correcting for this, and missing meter readings.

Weighting Factors

Settlement attributes the gas measured at Supply Meter Points to the registered Shipper. In order that all gas is accounted for, Settlement allocates UIG across Shippers, based on the Supply Meter Points to which they are each registered. It does this using a set of Weighting Factors.

These Weighting Factors dictate the proportion of UIG allocated to:

- Different Classes of Supply Meter Point (relating to the metering in place and the meter reading arrangements); and
- Different End User Categories (EUC) of Supply Meter Point (relating to the type of customer and characteristics of use).

Calculation of Weighting Factors

The Weighting Factors are determined annually by the AUGE.

The objective is to have factors that allocate UIG as “fairly and equitably” as possible. The AUGE undertakes detailed analysis of the causes of UIG each year and produces a set of Weighting Factors that they believe will best achieve this for the target Gas Year.

[4] Along with a relatively small amount from sources embedded within LDZ networks.

PURPOSE

The purpose of this draft Statement is to provide the draft Weighting Factors in the AUG Table for the Gas Year 2021-2022 and to set out in detail how we determined these, so that they can be consulted upon.

Following this consultation, we will publish the final AUG Statement, along with the final Weighting Factors, for approval by the UNC Committee. The final Weighting Factors will then be used in Settlement for the Gas Year commencing on 1st October 2021.

AUGE SCOPE

The scope of the AUGE includes:

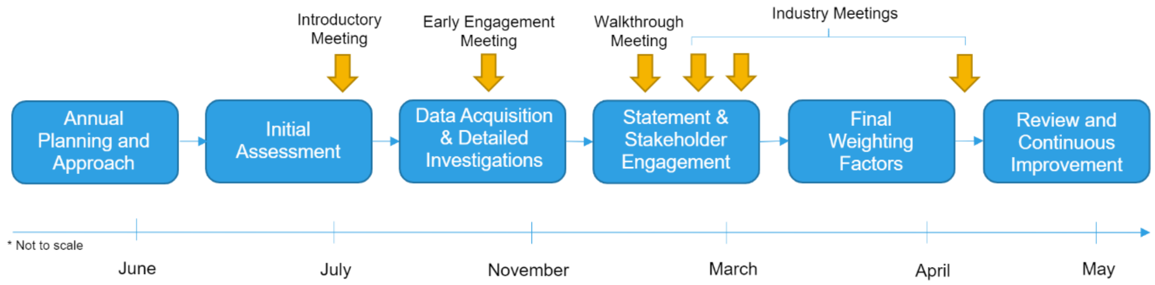
- Developing a methodology for determining annual Weighting Factors;
- Determining data sources for use in the calculation of the Weighting Factors; and
- Documenting the methodology and the proposed Weighting Factors in the Statement and presenting these to industry.

The scope does not include:

- LDZ shrinkage errors;
- Determining the daily levels of UIG; and
- Implementing any performance assurance techniques.

THE ANNUAL AUG CYCLE

The production of the Statement is an annual cycle, with the AUGE consulting with industry in relation to the development of the Weighting Factors. The timeline below shows the stages in this process.



COMPLIANCE WITH GENERIC TERMS OF REFERENCE

Our means of compliance with the Generic Terms for Reference for the AUGE is detailed in Appendix 1.

MODIFICATION 0711

The implementation of UNC Modification 0711[5] has meant that the 2021-2022 Gas Year is the first to reflect this change.

In summary, UNC 0711 mandates that the AUG Table contained within the Statement be updated to include the new sub-EUC bands introduced by the implementation of Data Services Contract (DSC) Change Proposal XRN4665[6]. This has split EUC bands 01 and 02 into new sub-bands:

- Non-prepayment/Domestic (sub-EUC bands 01ND and 02ND);
- Pre-payment/Domestic (sub-EUC bands 01PD and 02PD);
- Non-prepayment/Non-Domestic (sub-EUC bands 01NI and 02NI); and
- Pre-payment/Non-Domestic (sub-EUC bands 01PI and 02PI).

This sub-division of EUC bands 01 and 02 above has led to the number of Matrix Positions contained within the AUG Table increasing from 36 to 60. This allows UIG to be allocated to those new Matrix Positions in a more granular manner than was previously the case. Therefore, all analysis of contributors, the output of sub-models and the AUG Table take account of this change for the 2021-2022 Gas Year.

IMPACT OF COVID

We considered whether the ongoing pandemic could have impacted the inputs to our analysis or could impact the causes and extent of UIG in the target Gas Year. Our assumptions about any COVID-related impacts are detailed within our demand forecast and for each contributor in Sections 5 and 6 of this Statement.

STRUCTURE OF THIS DOCUMENT

This document is structured as follows:

- Section 4 - Overarching Methodology: details the overarching methodology we followed;
- Section 5 - Detailed Investigations: provides details of the in-depth contributor investigations;
- Section 6 - Other Contributors: provides details of how we assessed the other contributors;
- Section 7 - Results: provides a summary of the results and the process of validating these;
- Section 8 - Weighting Factor Determination: explains the calculation and smoothing of the Weighting Factors;
- Section 9 - AUG Table: provides the Weighting Factors;
- Section 10 - Glossary: provides an explanation of acronyms and defined terms;
- Appendix 1 - Compliance with the Generic Terms of Reference;
- Appendix 2 - List of Data Sources;
- Appendix 3 - Actual Annual Quantities and Supply Meter Points;

[5] UNC Modification 0711: "Update of AUG Table to reflect new EUC bands".

[6] Change Proposal XRN4665: "Creation of New End User Categories".

- Appendix 4 - Pressure and Temperature Impact on Energy Content; and
- Appendix 5 - Future Considerations.

COPYRIGHT AND DISCLAIMER

4 Overarching Methodology

SUMMARY

Our overarching methodology is founded on three key principles. These are:

- Polluter Pays – we interpreted "fair and equitable" to mean that UIG should be allocated in the same proportions as it is created;
- Line in the Sand – we only considered UIG that will exist at the Line in the Sand (the final Settlement position) and not UIG that exists temporarily prior to this; and
- Bottom-up Determination – we quantified UIG for each identified contributor and added these together, rather than estimating the overall UIG and apportioning it or using it as a means of differencing.

We created a contributor-based model, comprising a harness model with a link to separate contributor sub-models. We used this to collate the output of our analysis into each contributor in a standard format, and to process and aggregate these consistently in the production of Weighting Factors.

We also created a forecast of the estimated consumption and number of Supply Meter Points in the target Gas Year for each LDZ and Matrix Position. We used this to quantify UIG for several contributors and allocated it across Matrix Positions, and to produce the Weighting Factors from the aggregated results.

Our overarching methodology contained the following stages:

- Identifying the potential UIG contributors and undertaking an initial assessment of these;
- Selecting the set of contributors to progress, including those to be investigated in detail;
- Acquiring data to support the investigations as well as the quantification and allocation of UIG;
- Investigating the chosen set of contributors;
- Deriving methodologies for quantifying and allocating UIG;
- Applying the methodologies using the various sub-models and our Consumption Forecast to quantify and allocate UIG;
- Determining the initial Weighting Factors using the harness model, based on the aggregated results from each sub-model along with our Consumption Forecast; and
- Smoothing these Weighting Factors to produce the AUG Table.

The data we acquired, the detailed investigations we undertook, the methodologies we derived and the application of these methodologies are all described in detail in Sections 5 and 6. Determination and smoothing of the Weighting Factors is described in Section 8. Other components of our overarching methodology are described in more detail in the following sections.

IDENTIFICATION AND INITIAL ASSESSMENT OF CONTRIBUTORS

We identified 12 candidate contributors based on:

- Topics reviewed by the previous AUGE;

- Remaining open topics contained within the industry issues spreadsheet managed by the previous AUGE; and
- Topics that we identified ourselves, based on our own expertise, knowledge and experience.

We scored the candidate contributors based on:

- The likely level of UIG created by that contributor;
- The current degree of uncertainty (based on data, methodology and knowledge) in relation to the level and/or source of UIG for that contributor; and
- The potential ability to increase the degree of certainty in relation to the level and/or source of UIG for that contributor.

Contributor ID	Contributor Name	Score	Investigation
10	Theft of Gas	60	Y
40	Consumption Meter Errors	56	Y
50	LDZ Meter Errors	40	Y
90	No Read at the Line in the Sand	35	Y
30	IGT Unknown Projects	22	N
100	Incorrect Correction Factors	22	N
110	CV Shrinkage	20	N
80	Average Temperature Assumption	18	N
120	Meter Exchanges	17	N
20	Shipperless and Unregistered Sites	13	N
70	Average Pressure Assumption	9	N
60	IGT Shrinkage	5	N

We ranked the contributors by their overall score as shown above. A higher score indicates greater adherence to the above three criteria and thus an increased prioritisation for detailed investigation.

SELECTION OF CONTRIBUTORS TO PROGRESS

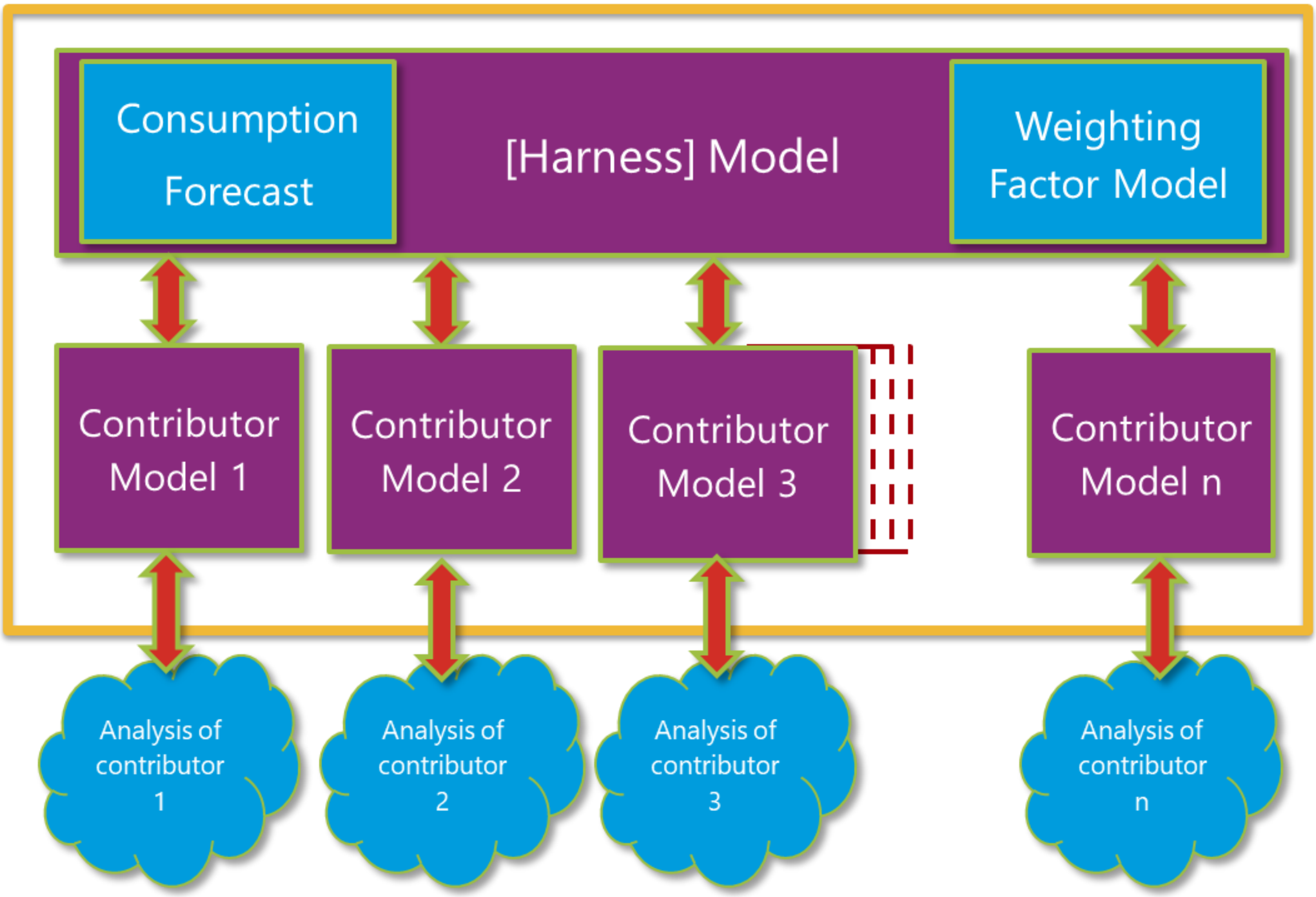
We considered the appropriate means of progressing each of the contributors identified. The outcome was as follows:

- The four contributors receiving the highest scores were designated for detailed investigation;
- We decided to assess Shipperless and Unregistered Sites contributors separately, as 025 and 020 respectively, as we considered that the causes are sufficiently independent;
- IGT Unknown Projects (030) do not create UIG post June 2017 and so this was not progressed; and
- CV Shrinkage (110) and Meter Exchanges (120) were also not progressed pending initial assessment in the next AUG year, as they had not been assessed previously, do not have an existing quantification methodology and require a detailed investigation to establish one.

CONTRIBUTOR MODEL

We created a contributor-based model, comprising an overarching harness model, which calculates the Weighting Factors, linking the separate contributor sub-models. These sub-models are supported by analysis which can be used for more than one sub-model.

Each sub-model provides UIG energy values and characteristics for the relevant contributor and has a common interface with the harness model, namely the UIG by Matrix Position in the AUG Table. The model structure is detailed in the diagram below.



CONSUMPTION FORECAST

A forecast of the consumption in the target Gas Year is a key data input for several of our UIG calculations and an essential component in the calculation of the Weighting Factors.

We forecast Seasonal Normal consumption in each LDZ for the target Gas Year based on trends in the numbers of Supply Meter Points, average AQs and movement of Supply Meter Points between Classes.

Inputs

We used the following data inputs in the construction of the Consumption Forecast:

- AQ Snapshot reports from the CDSP;
- Seasonal Normal Factors from the CDSP; and
- Annual Load Profiles from the CDSP.

Forecast Methodology

We used data from June 2017 to September 2020 to forecast consumption. Data older than October 2019 needed to have EUC bands 01 and 02 split to take account of UNC Modification 0711. We did this using backwards trends and apportioning so that all of our forecasting data had the same dimensions.

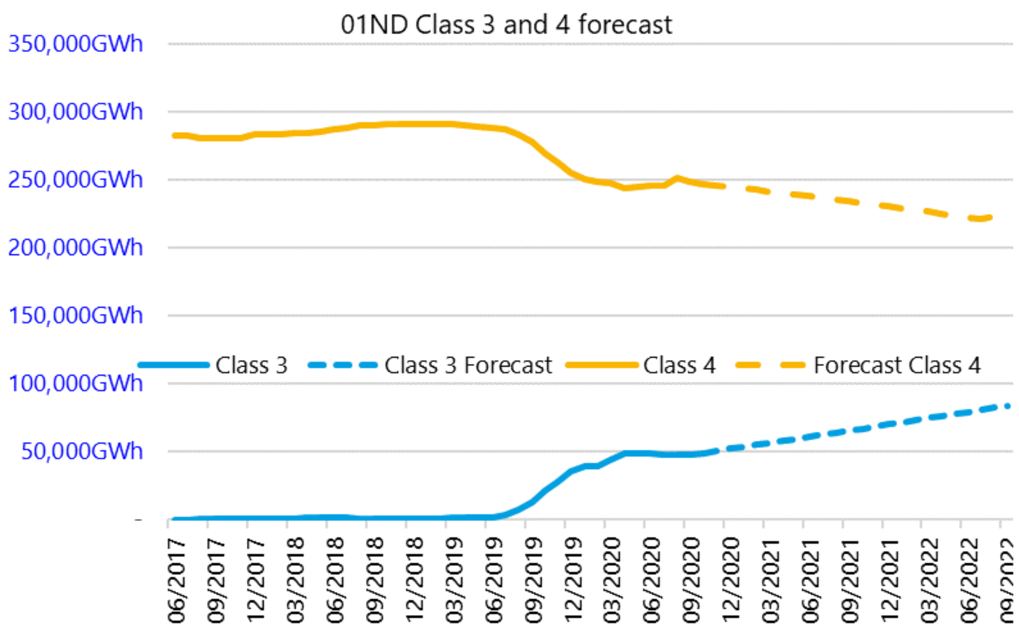
We used an Exponential Triple Smoothing (ETS) algorithm to forecast future AQ and Supply Meter Points counts for each LDZ, Matrix Position and month in the target Gas Year. This algorithm smooths minor deviations in past data trends by detecting seasonality patterns and confidence intervals. We prevented any forecasts going negative.

For each Matrix Position:

- We used the monthly AQ forecast (part of the Consumption Forecast), together with the sum of the Annual Load Profiles over each month and the Seasonal Normal Factors, to forecast the annual consumption in each LDZ in the target Gas Year;
- We used the monthly Supply Meter Point forecast (part of the Consumption Forecast), together with the sum of the Annual Load Profiles over each month, to forecast the annual Supply Meter Point count in each LDZ in the target Gas Year; and
- We aggregated these figures across LDZs to obtain the national consumption and Supply Meter Point count forecasts for the target Gas Year.

Initial Results

We found an increasing trend in Class 3 AQs and Supply Meter Points and a corresponding reducing trend in Class 4. We believe that this trend was driven by Shippers optimising their selection between Class 3 and Class 4, between July 2019 and March 2020, because of the differences in the relative Weighting Factors. The graph below shows this trend.



The current differential between these Weighting Factors is significantly less and so we are of the view that the level of migration from Class 3 to Class 4 will not continue at these rates going forwards. We therefore capped the count of Class 3 Supply Meter Points at 4 million in EUC bands 01ND and 01PD and updated the analysis for the AQ forecast accordingly.

We also considered that any COVID impacts on consumption from March 2020 are less likely to be enduring and apply to the target Gas Year for commercial and industrial Supply Meter Points. Whilst the forecasting algorithm we used is designed to dampen any seasonal or temporary effects, we decided to use data up to February 2020 for EUC bands 03-09, to eliminate any possibility of COVID having an impact.

Updated Results

The output from the forecast above is shown in tabular form below. Actual snapshots for September 2020 and September 2019 are provided in Appendix 3 by way of comparison.

Forecast Number of Supply Meter Points in the Target Gas Year

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	-	2	3,954,387	17,835,324
	1PD	-	-	45,613	2,173,084
	1NI	4	12	99,211	493,409
	1PI	-	-	34	3,513
	2ND	-	-	3,320	41,662
	2PD	-	-	26	1,613
	2NI	1	8	66,515	111,248
	2PI	-	-	22	52
	3	3	27	23,863	23,997
	4	1	45	7,817	11,544
	5	-	73	1,519	3,433
	6	20	257	266	1,183
	7	46	171	107	447
	8	72	212	26	360
	9	337	43	4	12
				Total	**24,904,945**

Forecast Consumption in the Target Gas Year (GWh)

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	-	0	50,901	246,446
	1PD	-	-	517	21,446
	1NI	0	0	2,905	10,174
	1PI	-	-	1	42
	2ND	-	-	475	4,455
	2PD	-	-	3	129
	2NI	0	2	10,015	14,008
	2PI	-	-	3	6
	3	1	15	10,283	10,675
	4	0	75	9,382	14,294
	5	-	332	4,950	11,807
	6	50	2,465	2,374	10,880
	7	1,050	3,523	2,400	9,373
	8	2,649	8,530	1,081	14,827
	9	83,064	4,644	302	650
				Total	**571,208**

MODIFICATIONS

Throughout the application of our overarching methodology, we considered Modifications that have been approved or are in the process of being considered and could impact our target Gas Year. These include:

- 0711 - Update of AUG Table to reflect new EUC bands;
- 0681S - Improvements to the quality of the Conversion Factor values held on the Supply Point Register;
- 0734S - Reporting Valid Confirmed Theft of Gas into Central Systems;
- 0672S - Target, Measure and Report Product Class 4 Read Performance;
- 0691S - CDSP to convert Class 2, 3 or 4 Supply Meter Points to Class 1 when G1.6.15 criteria are met; and
- 0693R - Treatment of kWh error arising from statutory volume-energy conversion.

These Modifications are referenced in the relevant sub-sections of Sections 5 and 6. Further information on the Modifications can be obtained from the Joint Office of the Gas Transporters (the Joint Office) website.

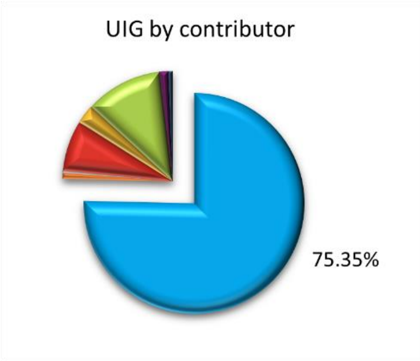
5 Detailed Investigations

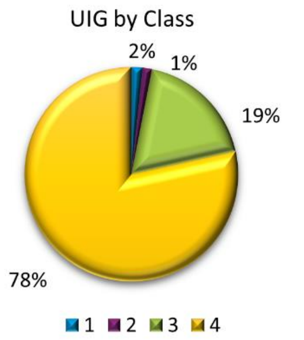
The four contributors listed below were selected for detailed investigation based on the results of the scoring process. The investigation sections are structured in the following manner:

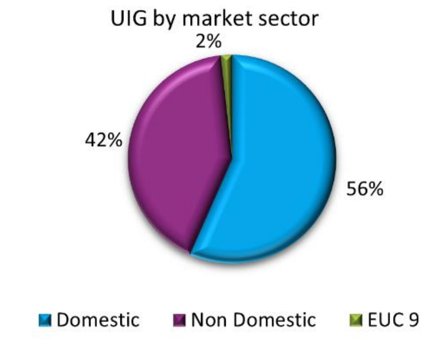
- Dashboard – provides a set of three pie charts which show the scale of the contributor when compared to the total UIG, the UIG split by Class and the UIG split by market sector;
- Description – provides details of the Settlement context, the definition of the contributor and how the contributor impacts UIG;
- Analysis and Resulting Methodology – provides details of our investigation, the analysis we undertook and the resulting methodology for calculating UIG, along with any COVID impact;
- Calculation – provides the data inputs, the assumptions we made, the calculation steps and the output;
- Results – provides the calculated UIG value, the value split by Matrix Position and a chart showing the UIG as a percentage of throughput; and
- Notable Observations – provides any notable observations including a comparison to the previous Statement and any other points we considered it relevant to make.

010 – THEFT OF GAS

DASHBOARD







DESCRIPTION

Settlement Context

Introduction

Theft is the use of gas from the LDZ or IGT gas networks, where steps have been taken to deliberately avoid paying for it. There are many ways in which gas is stolen – ranging from the elaborate to the rudimentary.

In many cases, the stolen gas is not metered. These cases include: bypassing the meter so that the gas used is not recorded, interfering with the meter so that it stops or under-records, and swapping out the correct meter for an alternative for a sub-set of the period between meter readings. In all these situations, the stolen gas is not allocated to a Shipper in Settlement and appears as UIG.

In other cases, the stolen gas is metered, but steps are deliberately taken to avoid paying for it. These cases are termed "fiscal theft" and include fraudulent vends for pre-payment meters. In these situations, the stolen gas is correctly allocated to a Shipper in Settlement and does not appear as UIG.

Gas is also stolen from the mains network. For LDZ networks this is estimated and accounted for in the determination of Shrinkage and does not appear as UIG (subject to the accuracy of the estimate).

Detection of Theft

There are a number of arrangements in place to identify theft. These include:

- The Theft Risk Assessment Service (TRAS) provided by Experian. This service enables Suppliers to assess the risk of energy theft at consumer premises to help target theft investigations. Experian uses data provided by Suppliers and augments it with third-party data such as credit history to derive potential consumption outliers;
- The Energy Theft Tip Off Service (ETTOS) provided by Crimestoppers. This service allows tip offs about suspected energy theft, received from the general public, to be sent to the relevant Supplier or DNO for investigation; and

- The Gas Theft Detection Incentive Scheme (GTDIS). This industry scheme currently operates under the Supply Point Administration Agreement (SPAA)[7] arrangements and is funded by all Suppliers. It sets targets for identifying theft and rewards Suppliers based on the number they detect.

Whilst these schemes are undoubtedly highly beneficial, they do not always result in the highest amounts of theft being detected. For example, the detection of certain types of theft is very time consuming and expensive, requiring site visits and access warrants to be obtained. This can lead to a disproportionate focus on detecting fiscal theft, which can be undertaken more readily as an office-based activity. Another example is that the GTDIS scheme is based around the number of thefts detected rather than the amount of gas stolen, which results in a disproportionate focus on the easier to detect cases. Another consideration, more generally, is that the consequence of a Shipper detecting theft is that the stolen gas is attributed to them rather than being shared across all Shippers via UIG. Shipper Licence Conditions and UNC obligations aside, this does not in itself provide a compelling incentive to detect theft.

Settlement Adjustments

Where Shippers or DNOs become aware of theft, they are obligated, through the terms of their Licence and the UNC to report and, where possible, adjust for it in Settlement. They do this via the Theft of Gas (TOG) regime provided by the CDSP. This mandates an investigation by the Shipper or DNO to determine the amount of theft and the period over which it took place. It also includes an adjustment being made in Settlement such that the stolen gas is attributed to the correct Shipper. In these cases, it ceases to appear as UIG (subject to the accuracy of the estimate).

Settlement Impacts

Despite the range of arrangements in place to identify theft, it is broadly accepted that only a small fraction is detected. This means that only a small fraction is adjusted for in Settlement via the TOG regime.

All non-fiscal theft that is not detected, or is detected and not adjusted for, remains as UIG at the Line in the Sand.

Definition

For the purposes of this Statement, theft of gas is considered to have taken place where any person deliberately tampers with (including removing) the gas metering equipment so that the amount of gas consumed is incorrectly measured at the Supply Meter Point.

Specifically excluded from this definition are:

- Theft of gas upstream of the Emergency Control Valve (ECV), including illegal connections to the mains network. This is accounted for within the relevant Transporter's Shrinkage calculations; and

- Fiscal theft from Pre-Payment meters, whereby the meter records the correct amount and the energy flows into Settlement, even though the Supplier does not receive payment.

UIG Impact

Theft of Gas (as defined above) creates positive UIG. If this is not identified and adjusted for in time (via the TOG regime), it remains at the Line in the Sand.

[7] Although it is due to be subsumed into the Retail Energy Code (REC) arrangements in 2021.

ANALYSIS AND RESULTING METHODOLOGY

Previous Methodology

We began our investigation by reviewing the methodologies and output from previous years.

It is broadly accepted that a very high proportion of gas theft goes undetected. This makes it particularly difficult to quantify and even more difficult to attribute. The previous methodology addressed this by estimating the overall theft as the difference between the total forecast UIG for the target Gas Year and the sum of the forecasts for all non-theft UIG for the target Gas Year. This balancing theft UIG varied in size from 3.77 TWh (98.5% of all UIG) in 2017 to 7.2 TWh in 2020 (89.3% of all UIG).

This quantified theft was then split across Matrix Positions based on TRAS data with Supplier identified theft removed.

Our Approach

We consider that the method of differencing results in the quantification of theft is too dependent on the accurate quantification of total UIG and the accurate quantification of all other contributors to UIG.

The current residual UIG for Gas Days almost fully reconciled would suggest that previous estimates of the total UIG were significantly too low. In addition, the quantification of non-theft UIG has varied considerably year to year. It is for these reasons that we chose not to follow the differencing methodology for theft.

Instead, we decided to quantify theft in isolation using the same "bottom-up" approach we have adopted for all other contributors.

Setting a Level for Total Theft

We considered ways in which total theft could be estimated. This is a particular challenge as its very nature is covert, meaning that there is no authoritative data that quantifies this with a high degree of confidence. We therefore considered more qualitative means of assessing the scale of theft, including both empirical and non-empirical means, along with the use of Fermi estimates[8].

We first of all considered the levels of the theft of electricity as this commodity shares many of the social, economic and supply characteristics as gas. It is also similar in terms of the techniques employed in theft, the inherent safety risks, the risks of being caught and the financial value of the commodity. This too had many of the same issues with the lack of availability of data and the difficulty in differentiating between line losses (similar to gas shrinkage), correction factors (similar to UIG) and theft. However, there are numerous qualitative assessments worldwide on the extent of electricity theft and these suggest that the level of theft in the western world is between 1.0% and 2.5%. A significant proportion of this theft is to support growing marijuana plants, which is a factor that is different to gas. This arguably provides a more ready means of monetising the stolen commodity.

We also considered the theft of water in jurisdictions where this is metered as this commodity also shares many of the social, economic and supply characteristics as gas, although arguably to a lesser extent than electricity. It is also similar in terms of the techniques employed in theft and the risks of being caught, although differs in terms of the inherent safety risks and the financial value of the commodity, which are less. Again, there was a lack of available data and issues in differentiating between leaks and theft. The studies that have been conducted suggest that the level of theft is between 1.0% and 3.0% in metered jurisdictions in the western world.

[8] https://brilliant.org/wiki/fermi-estimate/

We then looked more broadly at the retail sector as theft is common across this, although one could argue that being B2C[9], it is more reflective of the domestic and small business gas retail sectors than it is the large industrial and commercial sectors. We considered the following authoritative publications that address retail theft in the western world:

- National Retail Security Survey 2020 - National Retail Federation[10]; and
- Retail Crime Costs in the UK Report – Centre for Retail Research[11]

The National Retail Security Survey 2020 quantified the average theft levels across the American retail sector as 1.62% with nearly 70% of retailers reporting theft levels between 0.5% and 3%. It also concluded that organised crime[12] theft was becoming more prevalent, as was employee-related theft. The Retail Crime Costs in the UK Report quantified the figure as 1.1%. It too highlighted an increase in organised crime and suggested that this was 28.2% of non-employee related theft, and suggested employee-related theft was 22.1% of theft.

Our balanced judgement from this information is that non-fiscal theft of gas is likely to be in the range of 1.25% to 1.75%. We have therefore used a figure of 1.50%. From this we have netted off the 0.02% of overall throughput that is attributed to theft from the LDZ networks (as this is accounted for separately as a part of Shrinkage). Accordingly, the percentage we have used for theft resulting in UIG is: **1.48%.**

Detected Theft

The next stage in our approach was to estimate the amount of theft that will be detected for the target Gas Year from TOG and TRAS data. To do this we:

- Combined TOG and TRAS data to obtain a comprehensive dataset of detected theft by reported (detected) year;
- Established the relationship between theft year and reported (detected) year;
- Applied this relationship to the TOG and TRAS data to obtain detected theft by theft year;
- Used trend analysis on this to forecast detected theft that will take place in the target Gas Year;
- Used the TOG and TRAS data to determine the proportion of this that will be adjusted for in Settlement before the Line in the Sand;
- Applied this proportion to the forecast detected theft that will take place in the target Gas Year to establish the detected theft in that target Gas Year that will:
    - Be adjusted for in Settlement before the Line in the Sand; and
    - Not be adjusted for in Settlement before the Line in the Sand.

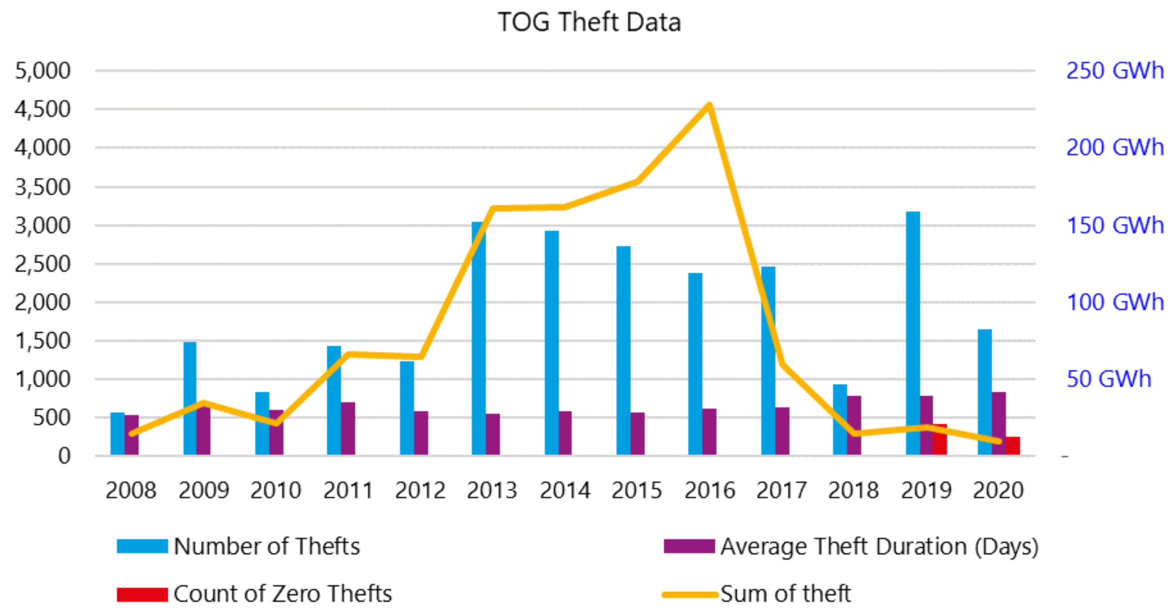
[9] Business to Customer.
[10] https://nrf.com/research/national-retail-security-survey-2020
[11] "What Is The Cost Of Retail Crime in the UK?" The Centre for Retail Research
[12] https://nrf.com/research/2020-organized-retail-crime-survey

These steps and the analysis that led to them are described in more detail in the following sections.

TOG Data

TOG data identified the amount of Shipper-responsible theft that has been reported for adjustment in Settlement. For reported cases, it provides: the Supply Meter Point, the estimated size of the theft, the duration of the theft, and when it was adjusted for in Settlement.

We plotted this data by the year it was reported, as shown in the graph below. It includes "zero-consumption thefts" separately. These are either fiscal thefts (which are out of our scope), thefts that are still being investigated or thefts that cannot be quantified.



The graph indicates:

- No significant change in average theft duration;
- A broadly similar number of reported cases of theft since 2013, except in:
  - 2018, where there was a known issue with the absence of reporting[13]; and
  - 2020, as this is part-year data and impacted by COVID;
- A year-on-year increase in amount of theft reported to Settlement up to 2016;
- A sharp reduction in the amount of theft reported and its average value from 2017 onwards; and
- A recent increase in the number of zero-consumption thefts reported.

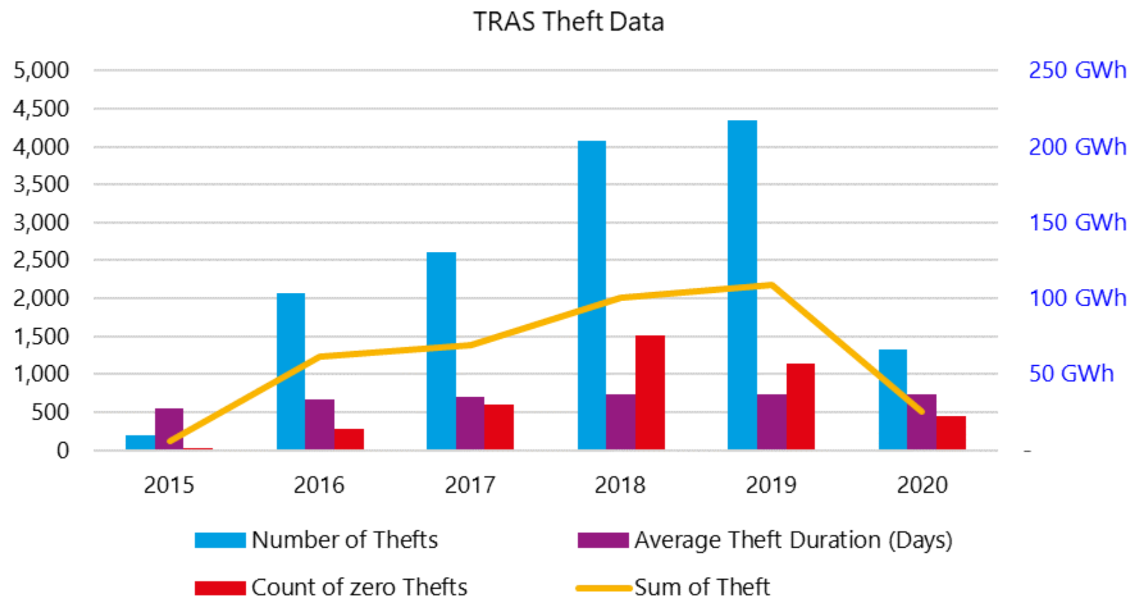
In addition, the graph suggests a rather inconsistent use of the TOG regime. Whilst it contains useful information it does not, in isolation, provide a sufficiently robust basis for our forecast of detected theft in the target Gas Year.

[13] This matter was considered at the Theft Investigation Group.

TRAS Data

TRAS data identifies the status of past and current theft investigations that have been triggered through the TRAS. For each case, it provides: the Supply Meter Point, the estimated size of the theft, the duration of the theft, the EUC band and details of the meter that was installed at the time of the theft.

We plotted confirmed thefts by the year the investigation was closed (as a proxy for the year that each was reported) as shown below. Again, it includes "zero-consumption thefts" separately.



The graph indicates:

- No significant change in average theft duration;
- A year-on-year increase in the number of cases and amount of theft reported to 2019; and
- A reduction in the number of cases and amount of theft reported in 2020, due to this being a part year dataset and the impacts of COVID.

The TRAS data only goes back to Q4 2015 and, again, whilst it contains useful information, it does not, in isolation, provide a sufficiently robust basis for our forecast of detected theft in the target Gas Year.

Combined TOG and TRAS Data

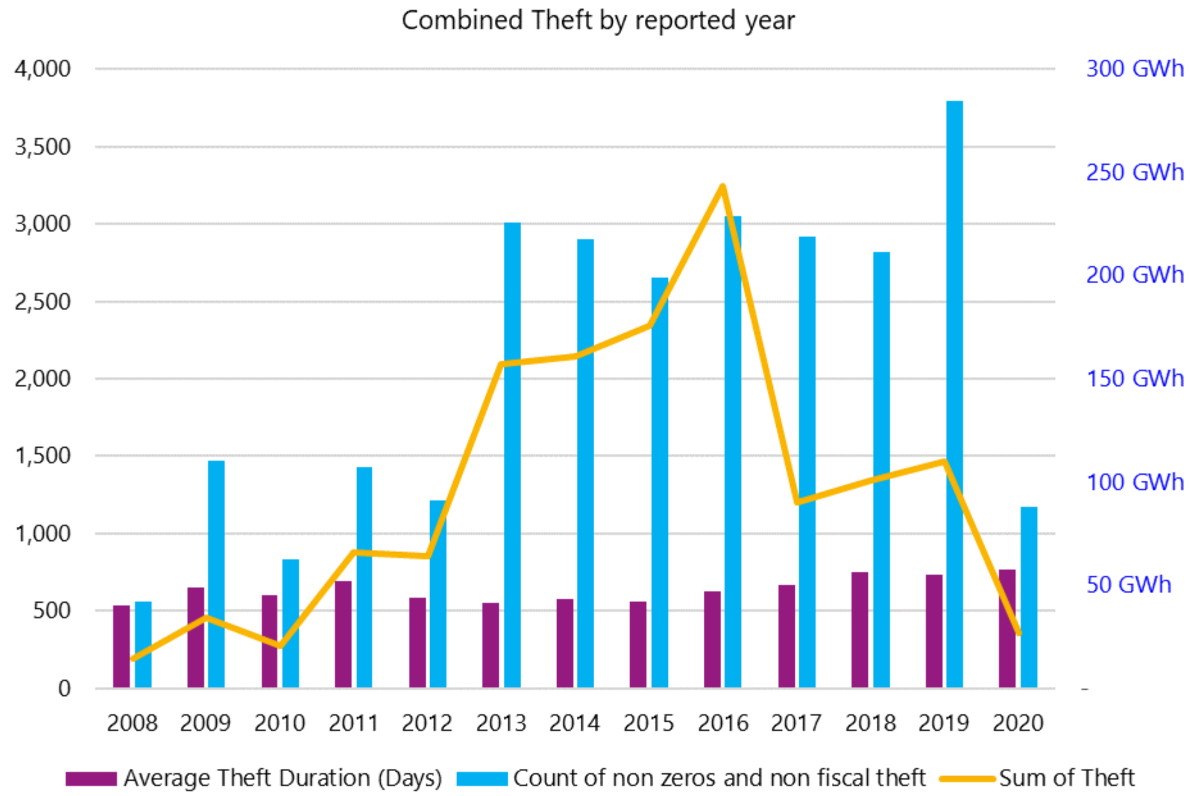
The TOG and TRAS datasets indicate that there has been inconsistent use of these regimes, with some Shippers using both and others using one more than the other. We suggest that this is likely to relate to changing Shipper practices resulting from the TRAS being introduced in February 2016, the GTDIS incentive scheme being introduced in June 2017 and the introduction of individual reconciliation for all Supply Meter Points from June 2017.

We therefore decided to combine these two datasets, on the basis that this would give the richest available data for the purposes of forecasting detected theft in the target Gas Year.

In combining the datasets, we sought to identify records common to TOG and TRAS by matching based on Supply Meter Points, theft size and duration; then matching based on size only; then based on duration only.

We then removed all records of fiscal theft. Supply Meter Points that had multiple thefts recorded were retained at multiple entries.

We plotted this combined data by the year it was reported as shown below.



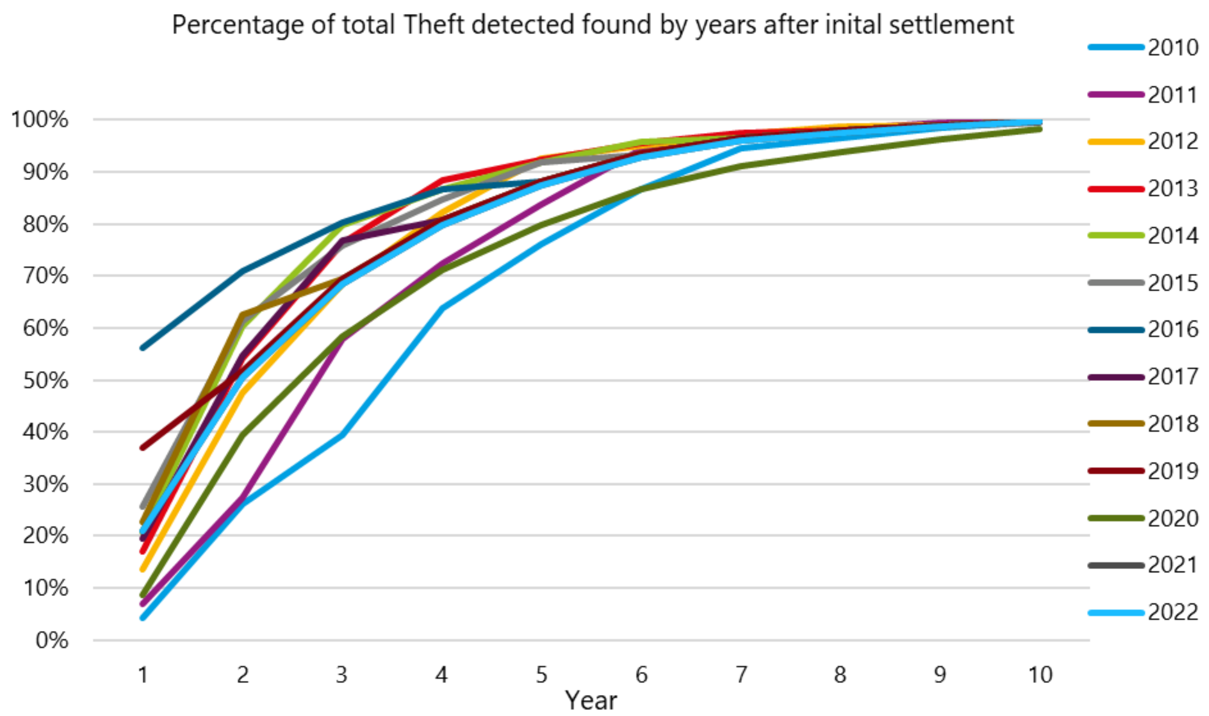
This dataset confirms that there is:

- No significant change in average theft duration;
- A broadly similar number of reported cases of theft from 2013, except in 2020 as this is part year data and impacted by COVID;
- A year-on-year increase in the amount of theft reported to Settlement up to 2016; and
- A sharp reduction in the amount of theft reported and its average value from 2017 onwards.

For data prior to October 2019, we reverse engineered data in main EUC bands 01 and 02 into the respective sub-EUC bands, such that all our data was at sub-EUC band level. To do this, we determined the domestic/non-domestic status based on the current sub-EUC band of the Supply Meter Point; and the pre-payment/non-prepayment status based on the meter type at the time of the theft.

<u>Relationship between Theft Year and Detected Year</u>

We assessed the combined dataset and, for each theft year, plotted the percentage of detected theft as a function of the period between the theft and the detection taking place. These plots are shown below.



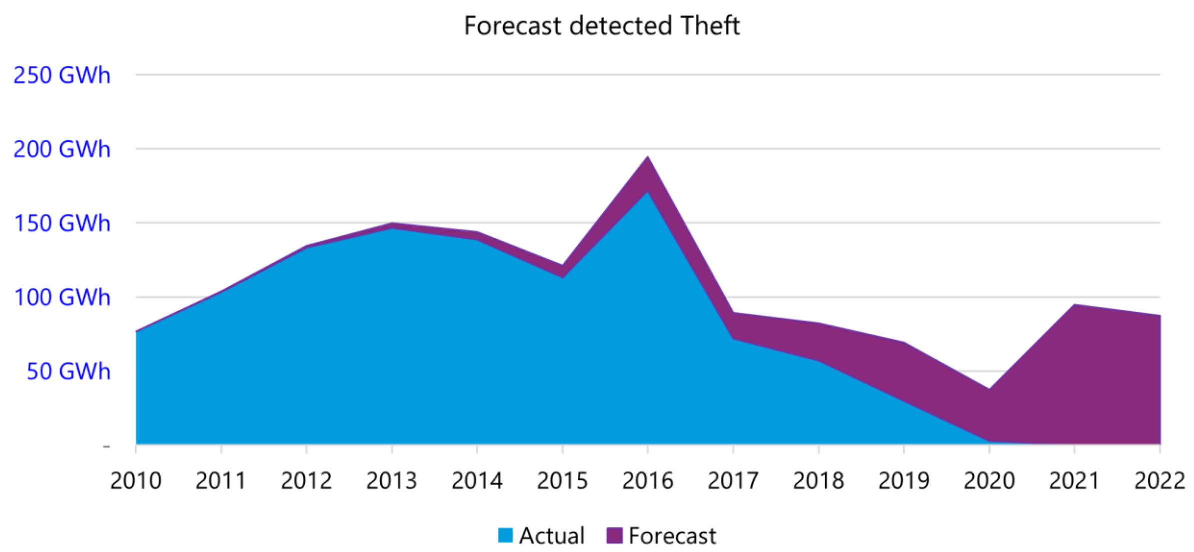
<u>Forecasting Detected Theft for the Target Gas Year</u>

The relationship between theft year and detected year was applied to:

- Establish the theft already detected by theft year (shown in blue in the graph below); and
- Scale to allow for the theft yet to be detected (shown in purple below for the current and past years).

We then undertook trend analysis on the aggregate curve to forecast the detected theft that will take place in 2021 and 2022 (shown in purple below for these years).

In this process, we made adjustments to allow for the fact that 2020 was only nine months complete and to scale for the supressed detections in 2020 due to COVID.



This analysis established forecast detected theft for the target Gas Year of 89 GWh.

However, we also obtained data from Energy UK which provided details of theft detected since January 2019 for a sub-set of its members. We correlated this with our combined dataset and found that circa 20% of the cases of theft were not reflected in this, indicating that they were missing from both TOG and TRAS data.

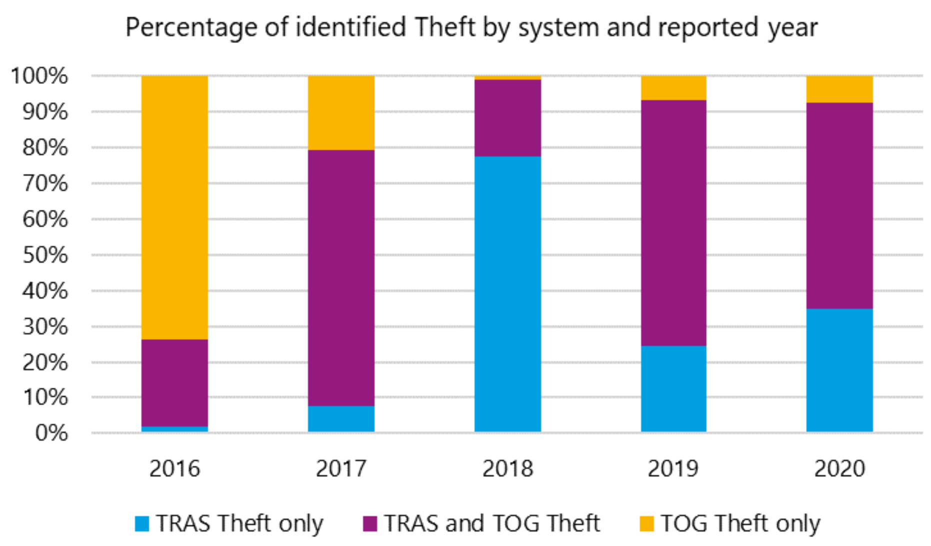
We therefore increased our forecast of detected theft for the target Gas Year by (100/80-1) = 25% to **111 GWh.**

Detected Theft Adjusted for in Settlement

We further analysed the combined TOG and TRAS dataset and determined the amount of theft:

- Reported in TOG data only;
- Reported in both TOG and TRAS data; and
- Reported in TRAS data only.

The results are shown in the graph below.



From this, we determined the proportion adjusted for in Settlement (TOG only data and TOG and TRAS data) along with the proportion not adjusted for in Settlement (TRAS only data). These proportions were 65.3% and 34.7% respectively.

We applied the 34.7% to the forecast of 89 GWh of theft that will be detected in the target Gas Year (determined from the TOG and TRAS combined dataset) to give the amount not adjusted for in Settlement. This gave 31 GWh. We then added in the difference between 111 GWh and 89 GWh = 22 GWh, this being the amount attributable to detected theft not in the TOG or TRAS data (established from the Energy UK data as described above). This gives forecasts for the target Gas Year of:

- **53 GWh** of detected theft not adjusted for in Settlement; and
- **58 GWh** of detected theft adjusted for in Settlement.

Note that Modification 0734S[14] would impact the above numbers, as it seeks to ensure that adjustments are made in Settlement for TRAS reported theft and would therefore alter the respective proportions. However, as no decision has yet been made about implementation, we have not taken account of it within our methodology.[15]

Detected Theft Forecast Summary

Our forecast for the target Gas Year is that:

- Theft will comprise 1.48% of throughput which, based on our Consumption Forecast, is 8,454 GWh;
- 111 GWh or 1.31% of this 8,454 GWh will be detected before the Line in the Sand; and
- 58 GWh or 0.69% of this 8,454 GWh will be adjusted for in Settlement before the Line in the Sand.

Undetected Theft

It follows from the calculations above that the forecast of undetected theft for the target Gas Year is:

8,454 GWh – 111 GWh = 8,343 GWh.

We believe that the majority of this is akin to detected theft, it is just that it has not been detected. We also believe that there is a smaller sub-set where the theft is more advanced, operating across the market, which is very difficult to detect.

Organised crime is more likely to fit into this category, where the perpetrators are professional criminals, as opposed to just being opportunist/dishonest individuals with access to the necessary "DIY skills" to steal gas.

Employee crime is also more likely to fit into this category, as these individuals are likely to have detailed knowledge about systems and processes, the theft detection procedures in place, and the technical (systems and/or engineering) skills to undertake theft and avoid detection.

Retail Crime Costs in the UK – Centre for Retail Research[16] estimated organised crime as 21.97% of all theft across the retail sector and employee related crime as 22.10%.

We believe that it is reasonable to assume that the levels of advanced and very difficult to detect theft that exist across the gas sector are equivalent to at least half of the organised crime theft percentage above.

We have therefore categorised and quantified undetected theft as:

- Theft that is akin to detected theft = 7,414 GWh or 87.70% of 8,454 GWh; and
- Theft that is more advanced and very hard to detect = 928 GWh or 10.98% of 8,454 GWh.

[14] UNC Modification 0734S: "Reporting Valid Confirmed Theft of Gas into Central Systems".
[15] However, we will have the ability to account for this change if it is implemented in early 2021.

[16] "What Is The Cost Of Retail Crime in the UK?" The Centre for Retail Research

Summary of Theft Type

The table below summarises the results of the analysis of detected and undetected theft.

Type of Theft	Sub Type	Settlement Allocation	Proportion of Total Theft	
Adjusted for Theft	Theft in TOG (and optionally TRAS also)	Correct	0.69%	1.32%
	Theft has not yet but will be detected and put into TOG	Correct		
Unadjusted for Theft	Theft in TRAS but not in TOG	UIG	0.63%	
	Theft detected but not put in TRAS or TOG	UIG		
	Theft has not yet but will be detected, but will not be put into TOG	UIG		
Undetected Theft	Akin to detected theft	UIG	87.70%	98.68%
	Advanced, harder to detect theft	UIG	10.98%	

Allocating Theft Across Matrix Positions

For each of the various types and sub-types of theft that we identified and quantified, we considered how best to allocate these across the Matrix Positions. The table below summarises our conclusions.

Type of Theft	Sub type	Basis of Matrix Allocation
Adjusted for Theft		N/A
Unadjusted for Theft		The forecast quantity of Unadjusted for Theft. Allocated across Matrix Positions in proportion to the TRAS only reported Theft from 2019.
Undetected Theft	Typical Theft akin to detected theft	Traditional Meters The forecast quantity of Undetected Typical Theft, less the amount of this attributable to smart meters (see below).

Type of Theft	Sub type	Basis of Matrix Allocation
		Allocated across sub-EUC bands in proportion to the combined TOG and TRAS data over the last 10 years, excluding theft attributable to smart meters, considering EUC bands 03-08 together because of the limited data for these. Then sub-allocated across Classes as in proportion to our Consumption Forecast for traditional meters (see below). Smart Meters The forecast quantity of Undetected Typical Theft attributable to smart meters (see below). Allocated in proportion to our Consumption Forecast for smart meters.
	Advanced, harder to detect theft	The forecast quantity of Undetected Advanced Theft. Allocated in proportion to throughput for all Matrix Positions.

Unadjusted for Theft

The allocation of Unadjusted for Theft was in the following percentages[17] (only non-zero Matrix Positions are shown):

		CLASS	
		3	4
EUC BAND	1ND	18%	30%
	1NI	0%	15%
	1PD	0%	29%
	2ND	0%	1%
	2NI	4%	3%
	2PD	0%	0%
	3	0%	1%

Undetected Theft

For smart meters, the smart theft percentage in the combined TOG and TRAS datasets is as follows, with the Smart AQ percentage in the market overall as a comparator:

[17] Note that due to rounding the total is greater than 100.

Year	2017	2018	2019
Smart Theft Percentage	5.55%	7.48%	10.22%
Smart AQ Percentage	5.6%	10%	15%

This shows that the percentage throughput on smart meters is increasing at a higher rate than theft detected on smart meters. This is consistent with them having additional theft protection mechanisms. Based on this data, we used 15% as an estimate of Undetected Typical Theft attributable to smart meters in the target Gas Year.

For traditional meters, the allocation of Undetected Typical Theft was in the following percentages:

EUC	Traditional Theft Percentage	EUC	Traditional Theft Percentage
1BND	29%	**3**	3%
1BNI	28%	**4**	3%
1BPD	17%	**5**	2%
1BPI	0%	**6**	2%
2BND	3%	**7**	2%
2BNI	9%	**8**	2%
2BPD	0%	**9**	0%
2BPI	0%		

We used the same percentages for Classes 2-4, due to the very limited populations of Classes 2 and 3 in the TOG and TRAS dataset, and split between these Classes in proportion to our Consumption Forecast for traditional meters.

We did not allocate any Undetected Typical Theft to Class 1 and EUC band 09 as no theft attributable to these was in the combined TOG and TRAS dataset.

COVID Impact

The economic impacts of COVID could increase the propensity to steal gas. However, there is no data available to substantiate or quantify this at present and so we have not adjusted for it.

COVID is also likely to result in limited theft detections with fewer inspections taking place. We adjusted for this to a limited extent, when scaling 2020 from a part to a whole year, as described in the sections above.

CALCULATION

Methodology Summary

The methodology is described in detail in the Analysis and Resulting Methodology Section above but is outlined here to provide context for the detailed calculation below.

The overall approach to is to:

- Estimate the total theft for the target Gas Year based on an assessment of the available information on retail theft in various like sectors;
- Determine the levels of detected theft, from TOG and TRAS data, and the proportion of this that is adjusted for in Settlement. Use this to determine a forecast for the detected theft that will be adjusted for in the target Gas Year and the detected theft that will not;
- Determine the level of undetected theft in the target Gas Year and the proportion of this that is typical (akin to detected theft) and the proportion that is advanced (more likely to be undertaken by organised criminals); and
- Allocate these different categories of theft to the Matrix Positions using the selected allocation approach.

Inputs

- TOG Theft Information from the CDSP;
- TRAS Theft Information report (provided annually by Electralink via the CDSP);
- Theft Data report provided by Energy UK (obtained from a sub-set of their members);
- Overall theft percentage determined as described in the Setting a Level for Total Theft section above;
- Undetected Advanced Theft percentage as described in the Undetected Theft section above; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Assumptions

- Changes to the TRAS arrangements will not affect the number of thefts identified by Suppliers;
- Detected theft trends are a reasonable indicator of typical undetected theft;
- There is a proportion of undetected theft that is advanced and undertaken by organised criminals that operate across all market sectors; and
- Modification 0734S[18] will not be implemented in time to affect UIG for the target Gas Year.

[18] 0734S: "Reporting Valid Confirmed Theft of Gas into Central Systems".

Calculation

Calculate the total theft forecast for the target Gas Year

1. Obtain the overall theft percentage, as described in the Setting a Level for Total Theft section above; and
2. Apply this to the total Consumption Forecast for the Gas Year to get the total theft for the Gas Year.

Combine TOG and TRAS data and rationalise to obtain the fullest theft dataset

3. Combine TOG and confirmed theft TRAS data to obtain a single superset of theft data;
4. Rationalise instances in both datasets (eliminating duplicates) by matching on Supply Meter Points, theft size and duration; then matching based on size only; then based on duration only;
5. For each instance of theft in the dataset record whether it was in TOG only, TRAS only or both TOG and TRAS; and
6. Remove all records of fiscal theft.

Determine a forecast of detected (non-fiscal) theft for the target Gas Year

7. Determine the relationship between the theft period and the detection taking place, from the combined and rationalised TOG and TRAS dataset;
8. Apply this relationship to the TOG and TRAS dataset to determine the theft:
    a. Already detected by theft year; and
    b. Yet to be detected by theft year;
9. Adjust the 2020 figures to allow for the fact that 2020 was only nine months complete and to scale for the supressed detections in 2020 (compared to previous years) due to COVID;
10. Aggregate theft detected and theft to be detected by theft year;
11. Forecast the detected theft that will take place in 2021 and 2022 using trend extrapolations of the aggregate data;
12. Establish the theft reported in the Energy UK dataset that was not in the TOG or TRAS dataset and determine what proportion this was of the TOG and TRAS reported theft; and
13. Increase the forecast of the detected theft that will take place in 2021 and 2022 by this proportion.

Determine a forecast of detected (non-fiscal) theft that will be adjusted/not adjusted for in Settlement, for the target Gas Year

14. Determine the proportion of theft in the combined and rationalised TOG and TRAS dataset that was in TRAS only. This is the proportion of theft not adjusted for in Settlement;
15. Apply this proportion to the forecast of theft for the target Gas Year determined in step 11 (pre the adjustment made because of Energy UK data) to obtain a forecast of the TOG and TRAS reported theft that will not be adjusted for in Settlement;
16. Difference the forecast of theft for the target Gas Year determined in step 13 (post the adjustment made because of Energy UK data) and the forecast of theft for the target Gas Year determined in step 11 (pre the adjustment made because of Energy UK data). This is the difference because of the theft data not in TOG or TRAS, which will not be adjusted for in Settlement;

17. Add the forecast theft in steps 15 and 16 to get a final forecast of the theft that will not be adjusted for in Settlement in the target Gas Year; and
18. Difference this to the overall forecast of theft for the target Gas Year, determined in step 13, to get a final forecast of the theft that will be adjusted for in Settlement in the target Gas Year.

Determine a forecast of undetected theft for the target Gas Year

19. Obtain the overall theft forecast for the target Gas Year from step 2; and
20. Difference this to the forecast of detected theft for the target Gas Year from step 13 to get a forecast of the undetected theft for the target Gas Year.

Categorised undetected theft for the target Gas Year

21. Obtain the Undetected Advanced Theft percentage, as determined in the Setting a Level for Total Theft section above;
22. Apply this to the undetected theft to obtain a forecast of Undetected Advanced Theft for the target Gas Year; and
23. Difference this to the forecast of undetected theft for the target Gas Year from step 20 to obtain a forecast of Typical Undetected Theft for the target Gas Year.

Allocated detected unadjusted for theft, undetected typical theft and undetected advanced theft to the Matrix Positions

24. Allocate detected Unadjusted for Theft, Typical Undetected Theft and Undetected Advanced Theft across Matrix Positions as described in the table above in the Allocating Theft Across Matrix Positions section.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **8,396 GWh**. This excludes the **58 GWh** adjusted for theft which will enter Settlement.

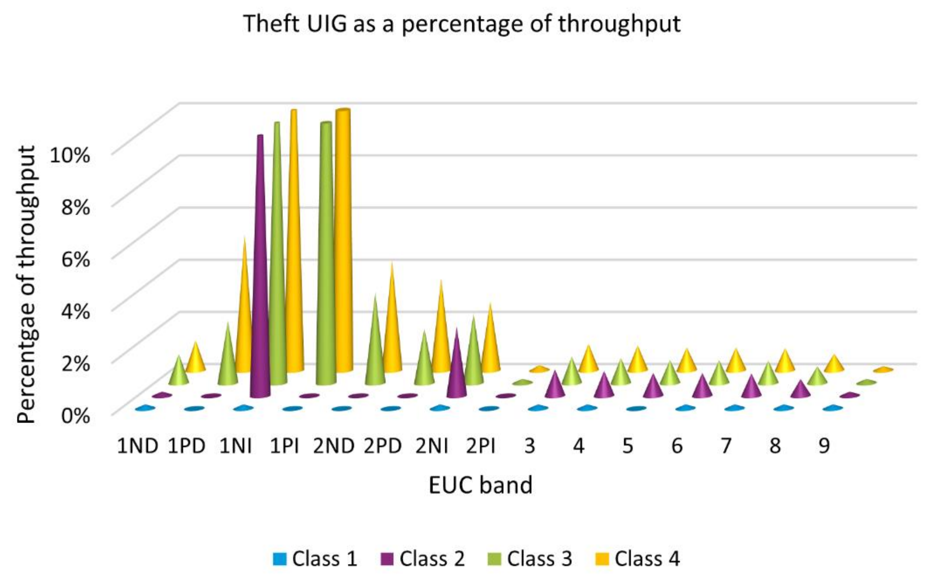
This is broken down as follows:

- Unadjusted for theft (theft detected and not adjusted for in Settlement) was calculated to be **53 GWh;**
- Undetected theft was calculated to be **8,343 GWh**, split as follows:
  - Typical theft (theft akin to detected theft): **7,414 GWh**
  - Advanced theft (theft using advanced techniques that are very difficult to detect): **928 GWh**

The total theft is allocated across Matrix Positions as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	568	2,844
	1PD	0	0	12	1,121
	1NI	0	0	397	1,418
	1PI	0	0	0	15
	2ND	0	0	17	188
	2PD	0	0	0	5
	2NI	0	0	267	371
	2PI	0	0	0	0
	3	0	0	105	109
	4	0	1	90	137
	5	0	3	44	105
	6	0	22	21	96
	7	2	30	21	81
	8	4	55	7	96
	9	135	8	0	1

The graph below shows UIG as a percentage of throughput for each Matrix Position:



NOTABLE OBSERVATIONS

Comparison to Previous Statement

The previous AUGE Statement quantified the UIG for this contributor as 7,159 GWh (compared to our quantification of 8,396 GWh).

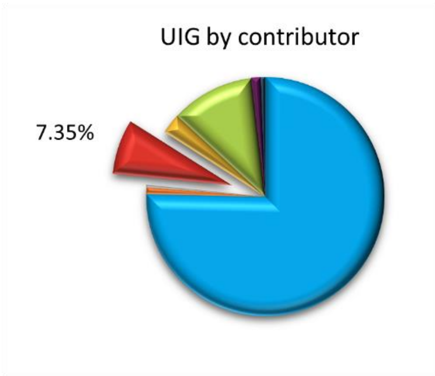
This difference is due to the contrasting methodology we used to calculate total theft. The main difference in the proportions between Matrix Positions is due to our methodology to split undetected theft into more typical theft, akin to detected theft, and advanced theft, which is very difficult to detect.

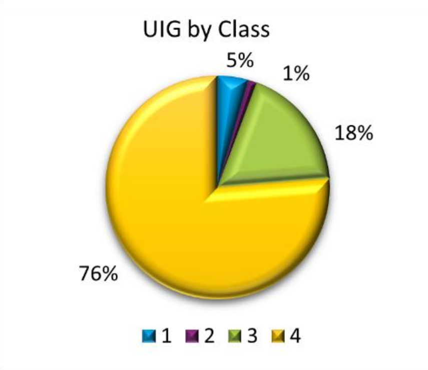
Changes to the Theft Regime

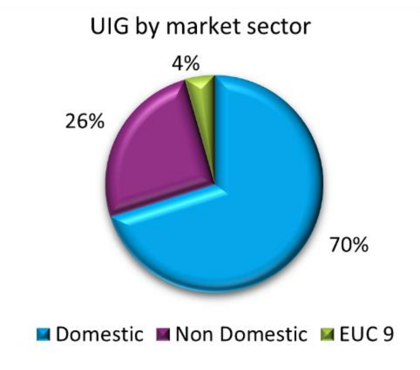
Changes to the theft arrangements will take place in the next couple of years as a result of Ofgem's Retail Energy Code (REC) v1.1 consultation. This does not affect this Statement but could impact the available data in future years and the actions Suppliers take in the future to investigate and address theft.

040 – CONSUMPTION METER ERRORS

DASHBOARD







DESCRIPTION

Settlement Context

Meters are used to measure and record the volume of gas consumed at Supply Meter Points. There are several types of meters that are used to do this, including diaphragm, turbine, ultrasonic and rotary meters.

Shippers are allocated volumes of gas based on the AQ of the Supply Meter Points to which they are registered. This allocation is reconciled as valid meter readings are obtained. In this way, Shippers are charged for the volume of gas that has been measured. Within Settlement, it is assumed that meters measure the volume of gas accurately.

There are three potential sources of meter error:

- Meters manufactured with an inherent bias to slightly over or under-record;
- Meters becoming faulty over time, causing them to record inaccurately; and
- Meters recording inaccurately at the throughput extremes of their specified use.

Incorrect meter volumes due to extremes of use or an inherent bias give rise to UIG at the Line in the Sand.

In the case of faulty meters, the Shipper can submit a consumption adjustment before the Line in the Sand, such that the volume reconciled is correct and the Shipper is charged for the correct volume of gas. In situations where a meter fault is not detected or a consumption adjustment is not submitted, the fault also gives rise to UIG at the Line in the Sand.

Definition

This contributor relates to meters that over or under-record the volume of gas consumed at Supply Meter Points.

UIG Impact

Any error in the measurement of the volume of gas consumed contributes to UIG. Meters that under-record create positive UIG; meters that over-record create negative UIG. This UIG remains at the Line in the Sand, save for errors arising from meter faults where the Shipper submits a suitable consumption adjustment.

ANALYSIS AND RESULTING METHODOLOGY

Background

Meters were approved under GB national legislation until October 2006. Under this regime, all fiscal meters had to operate within a specific accuracy range as per Section 17 of the Gas Act 1986. For domestic meters, this was typically in the range +/-2.0%. This requirement applied in-service as well as at the point of installation.

Since October 2006, all new designs of fiscal meters are approved under the European Measuring Instruments Directive (MID). This requires that meters operate within a specific accuracy range at installation and a (different) specific accuracy range in service. For domestic meters, this is typically in the range +/-1.5% at installation and +/-3.0% in service. Meters designed and manufactured under the MID directive started to be rolled out at scale circa 2011.

The Office for Product Safety and Standards (OPSS), part of the Department for Business, Energy and Industrial Strategy (BEIS), is responsible for the metrological accuracy of gas meters. This responsibility transferred from Ofgem in April 2009.

There is no defined in-service "life" for gas meters. Both GB-approved and MID-approved meters can remain in-service indefinitely as long as they conform to a range of different requirements, including those relating to accuracy. Suppliers also have Licence obligations to ensure meters are kept in proper order so that they correctly measure the quantity of gas supplied.

OPSS administers an In-Service Testing scheme (IST)[19]. This is a statistically based sampling scheme that assesses the compliance of MID approved "domestic type" meters (i.e. U6/G4/E6) with the relevant legal requirements, including those relating to accuracy. IST takes place at 3-year intervals throughout a meter's life. All major energy Suppliers participate in IST and this enables them to demonstrate compliance with the requirements for the meter populations that they are responsible for.

Inherent Bias

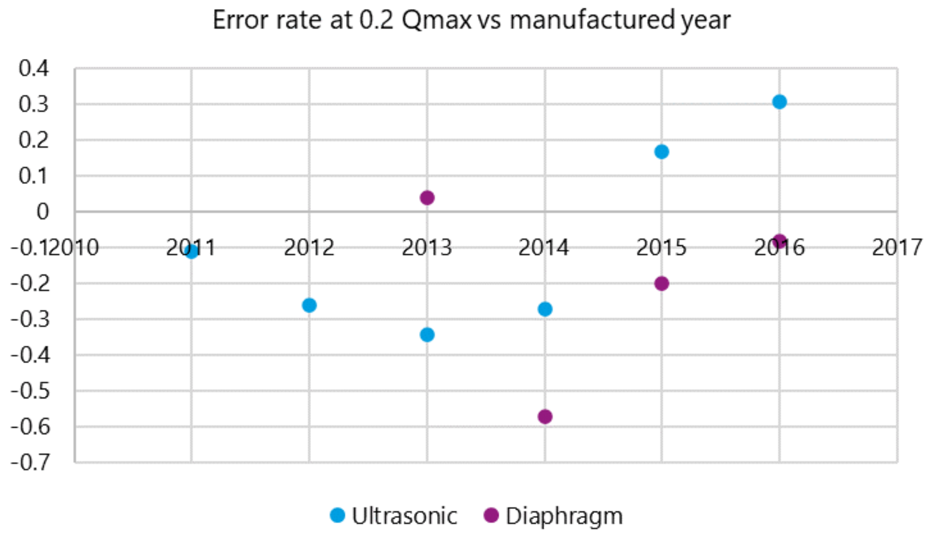
We obtained the three most recent years' IST results from OPSS and used these to investigate inherent bias. The results are summarised below.

[19] https://www.gov.uk/government/publications/in-service-testing-handbook-for-gas-and-electricity-meters

						EXTREME VALUE (%)				MEAN ERROR (%)		STANDARD DEVIATION	
						0.2Qmax		Qmax					
YEAR TESTED	Manufacture Year	Meter Type	Meter Type and Manufacture Year	Sample Tested	Outliers removed	Greatest Error (+)	Greatest Error (-)	Greatest Error (+)	Greatest Error (-)	0.2Qmax	Qmax	0.2Qmax	Qmax
2017	2011	Ultrasonic	2011 Ultrasonic	334	1	0.84	-2.16	1.64	-2.64	-0.11	0.07	0.43	0.43
2017	2014	Ultrasonic	2014 Ultrasonic	219	0	1.8	-1.95	1.6	-1.77	-0.27	-0.17	0.39	0.42
2017	2014	Diaphragm	2014 Diaphragm	319	0	1.34	-2.73	1.66	-1.9	-0.57	-0.22	0.64	0.62
2018	2012	Ultrasonic	2012 Ultrasonic	232	0	1.14	-1.79	2.48	-1.24	-0.26	0	0.34	0.37
2018	2015	Ultrasonic	2015 Ultrasonic	209	0	1.33	-0.63	1.81	-1.08	0.17	0.07	0.31	0.39
2018	2015	Diaphragm	2015 Diaphragm	516	0	2.11	-2.5	2.08	-1.98	-0.2	-0.15	0.59	0.55
2019	2013	Ultrasonic	2013 Ultrasonic	178	0	0.93	-1.32	1.64	-1.66	-0.34	-0.21	0.4	0.5
2019	2013	Diaphragm	2013 Diaphragm	52	0	2.05	-1.41	1.16	-1.94	0.04	-0.36	0.71	0.73
2019	2016	Ultrasonic	2016 Ultrasonic	338	0	1.37	-0.65	1.7	-1.28	0.31	0.04	0.33	0.37
2019	2016	Diaphragm	2016 Diaphragm	513	1	1.64	-3.19	2.8	-3.53	-0.08	-0.18	0.62	0.66

Qmax is the Maximum Flow Rate. This is the highest flow rate at which the meter accuracy is within its permitted error tolerance. Qt is known as the Transitional Flow Rate. This is representative of typical flow rates for ordinary use. 0.2Qmax is included in the table above as it is representative of Qt for domestic-sized meters.

The average under-recording error across all meters tested over these three years is 0.17%. For ultrasonic meters it is 0.05%; and for diaphragm meters it is 0.23%. However, the average error also differs by year of manufacture, but without any apparent trend. This is shown in the plot graph below.

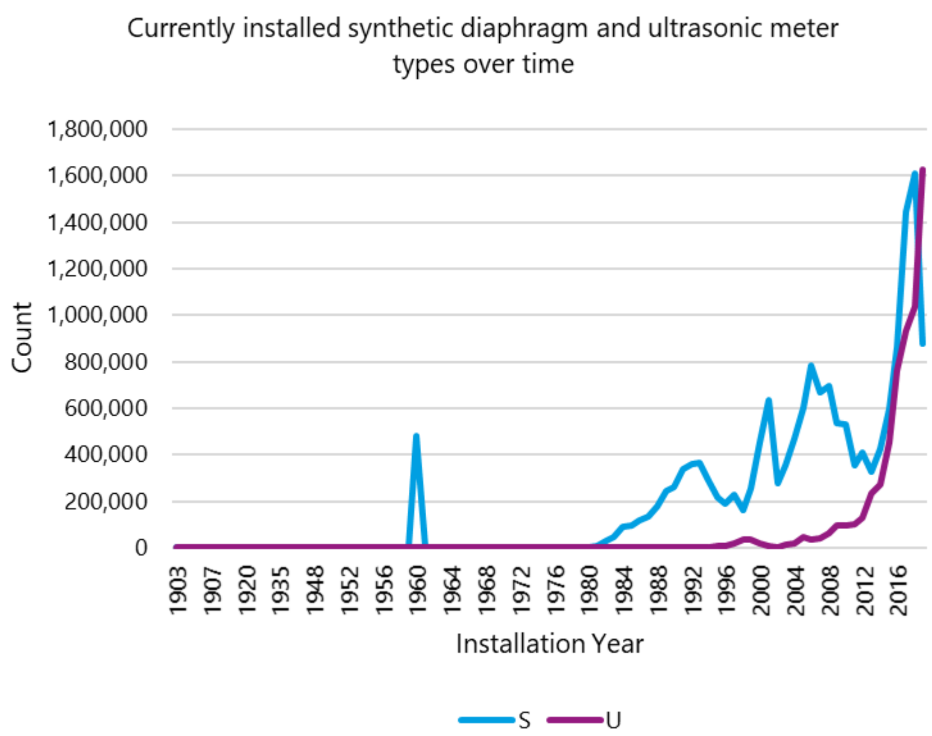


As there did not appear to be any trend across year of manufacture, we decided to use the average under-recording error of 0.05% for all ultrasonic meters in our analysis and 0.23% for all diaphragm meters. This assumes that meters manufactured prior to 2017, including those manufactured under GB legislation (rather than the more recent European MID approval regime), exhibit the same under-recording characteristics. We were unable to obtain any data for rotary or turbine meters. We therefore decided to assume that there was not any bias on these (rather than assuming a bias based on ultrasonic and diaphragm meters).

Forecast of the Population of Meter Types

We obtained a Meter Type report from the CDSP. This enabled us to determine the number of meters of each type (ultrasonic, diaphragm, rotary and turbine) currently in service by Matrix Position. It also enabled us to determine the number and type of meters being installed of each type by Matrix Position.

We plotted the number of ultrasonic and diaphragm meters (as shown below) and identified that the types of meters being installed have changed in recent years, with 61% currently being ultrasonic and 39% diaphragm.



To forecast the number of meters in service in the target Gas Year, we obtained forecasts for:

- The number of meter exchanges – based on the BEIS forecast for smart meter installations; and
- New installs – based on our Supply Meter Point Forecast (as described in Section 4 of this Statement) less the current number of meters.

For meter exchanges, we checked that there was a consistent starting point between the BEIS smart installation forecast and the number of smart meters currently installed. We also made an allowance for the impact of COVID by reducing our forecast slightly. In addition, we predicted the proportion of old and new meter type combinations for these meter exchanges. For the new meters, we assumed 61% would be ultrasonic and 39% diaphragm. For the old meters, we assumed that no meter post 2015 would be exchanged and that all meters prior to this are equally as likely as each other to be exchanged.

For new installs, we assumed 61% would be ultrasonic and 39% diaphragm for all EUC bands 01-02; and that current meter type proportions continue for all other bands.

Based on these two forecasts, we calculated our estimate number of the meters per meter type for the target Gas Year by Matrix Position.

Determine the UIG by Matrix Position

From our Supply Meter Points forecast for the target Gas Year, we determined the proportion of each meter type for each Matrix Position.

We then determined the UIG attributable to inherent meter bias for each Matrix Position by:

$UIG = \sum$ Forecast Consumption x Proportion of Meter Type x % under recording for the Meter Type

Where:

- The forecast of consumption values is from our Consumption Forecast (described in Section 4 of this Statement) for the target Gas Year; and
- The under-recording percentage values are those values described above, these being: 0.05% for ultrasonic meters; 0.23% for diaphragm meters and 0% for both rotary and turbine meters.

Faulty Meters

We analysed the results of tests on meters where customers and Suppliers were in dispute about whether the meter was faulty, to look for trends or insight into the nature and impact of meter faults.

We also analysed the number of meter faults recorded in the industry Settlement systems and the number of these for which corrective Settlement adjustments were made.

Disputed Meters

In the event of a dispute between a customer and a Supplier relating to meter accuracy, legislation provides for meters to be tested by an independent Meter Examiner appointed by BEIS. This disputed gas meter testing service (OFMAT) has been outsourced to SGS (UK) Ltd since 2002.

We obtained the OFMAT disputed meter testing results for 2019 for domestic meters from SGS and used these to investigate the bias in faults. The results are summarised below.

	No of Tests	Accurate	Below 5% Slow	Below 5% Fast	Above 5% Slow	Above 5% Fast	% Accurate
Domestic Diaphragm (U6/G4)	631	566	16	44	2	3	89.70%
Domestic Ultrasonic (E6)	230	229	0	0	1	0	99.60%

This data indicates that:

- There was only a very limited number of domestic meters that were disputed (less than 1,000);
- A limited, but statistically significant, percentage of diaphragm meters tested were inaccurate (10.3%);
- Only a very small percentage of ultrasonic meters tested were inaccurate (0.4%); and

- Meters over-recording were more prevalent than meters under-recording (although this feature of the data almost certainly relates, to some extent, to the fact that customers are more inclined to dispute an over-recording).

No further detail was provided on the meter installation year. Therefore, we were unable to investigate any correlation to meter age.

We also obtained the OFMAT disputed meter testing results for 2017-2019 for industrial type and commercial type meters from OPSS. These results are summarised below.

Industrial

Year	No of Tests	Accurate	±1-2%		±2-3%		±3-4%		±4-5%		Over ±5%		% Accurate
			Fast Qmax Fail	Slow Qmax Fail	Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	
2017	4	3	0	0	1	0	0	0	0	0	0	0	75.00%
2018	14	10	0	0	1	1	0	1	0	0	0	1	71.40%
2019	9	2	3	1	0	1	1	0	0	0	0	1	22.20%

Commercial

Year	No of Tests	Accurate	±2-3%		±3-4%		±4-5%		Over ±5%		% Accurate
			Fast	Slow	Fast	Slow	Fast	Slow	Fast	Slow	
2017	63	51	3	5	1	0	0	0	1	2	81.00%
2018	61	51	1	4	1	0	0	0	3	1	83.60%
2019	58	43	1	5	0	2	1	1	1	4	74.10%

Here, industrial type meters are defined as all being Rotary Positive Displacement meters and turbine meters (of all sizes) and commercial type meters are defined as diaphragm meters (U16 – U160).

Again, only a very limited number of meters were disputed over the three-year period (less than 15 per year for industrial and circa 60 per year for commercial). A higher percentage were found to be inaccurate compared to domestic (circa 45% for industrial and 20% for commercial). Of those found to be inaccurate, there was again an overall skew towards over-recording.

We conclude that there are too few tests arising from meter faults for these, in themselves, to be the source of significant volumes of UIG.

<u>Meter Faults</u>

We then obtained a Meter Fault report from the CDSP. This detailed the Supply Meter Points that have had a meter fault flag set at any stage since June 2017, whether this flag application was set in error and, for those meters that did have a fault, whether any subsequent consumption adjustment was submitted by the Shipper.

There were only 96 distinct meters that were faulty and had a fault flag set over this period and, of these, only three had a consumption adjustment submitted by the Shipper. We consider that there are likely to be significantly more faulty meters than this suggests.

We therefore conclude from these low numbers that Shippers are not routinely setting fault flags on meters when there is a fault and that they are not routinely submitting consumption adjustments for meters that are found to have faults.

Conclusion

There is likely to be a significant number of meter faults nationally per year. It would appear that Shippers are rarely setting the fault flag in Settlement for these (which is designed to limit the impact of the error) and that they are rarely submitting a consumption adjustment (which is designed to correct the error before the Line in the Sand).

This means that the UIG at the Line in the Sand associated with meter faults could be material, but that there is no way of establishing this and quantifying the impact from information that is currently available. This is a performance issue that, in the interests of reducing UIG, should be addressed – and one that we suggest is considered further in future AUG Years.

Extremes of Use

Meter calibration curves show meter accuracy as a function of various parameters that relate to the environment or use of the meter. The accuracy curves that relate to gas throughput for diaphragm and rotary/turbine meters have similar characteristics. They both show:

- A consistent under-measurement of 1.0%-1.5% when operating at or below Qmin (the Minimum Flow Rate – this being the lowest flow rate at which the meter accuracy is within its permitted error tolerance);
- Unbiased measurement around Qt (the Transitional Flow Rate – this being representative of typical flow rates for ordinary use); and
- A consistent over-measurement of 0.5% at or close to Qmax (the Maximum Flow Rate – this being the highest flow rate at which the meter accuracy is within its permitted error tolerance).

We were unable to obtain such curves for ultrasonic meters.

Meters are designed to operate at or around Qt so that measurements are unbiased. However, some meters frequently operate close to Qmin or Qmax. This can occur if, for example, a customer changes their pattern of gas consumption.

To investigate consumption at extremes of use, we considered ways to establish the volumes used above Qmax and the volumes used below Qmin.

In previous AUG Statements, volumes below Qmin were determined from AQs on the assumption that gas is used at a constant rate for a fixed number of hours per day for all Supply Meter Points. We do not consider this a reasonable assumption. We confirmed this by analysing the spread in the number of hours meters would need to run per day, over a year, to reach their AQ and established that the hours required varied significantly. There was no quantification of UIG for operation above Qmax in previous Statements.

We considered using intra-day load factors as a proxy for the "peakiness" of gas usage and to use this, in conjunction with the AQ and meter type, to determine an estimate of the volumes in excess of Qmax and volumes below Qmin. However, such intra-day load factors do not exist.

We also considered whether there were any broader-brush approaches that could be used. We identified and assessed several possibilities but, for each, the results were highly sensitive to the underlying assumptions relating to the peakiness of intra-day gas usage – with results ranging from negligible to significant depending on what assumption was used.

Conclusion

We concluded that extremes of use could be material in the context of UIG, but that we would need information relating to the peakiness of gas usage to prove/disprove and quantify this.

This could be achieved by obtaining intra-day usage for a sample of domestic and non-domestic Supply Meter Points. From this, volumes above Qmax and volumes below Qmin could be estimated and the results extrapolated across the full meter population. We suggest that this is considered in advance of the next AUG Year.

COVID Impact

We did not identify or adjust for any COVID impacts, other than a slight downward adjustment to the smart meter installation rate published by BEIS that was highlighted in the Inherent Bias section above.

CALCULATION

Methodology Summary

The methodology is described in detail in the Analysis and Resulting Methodology Section above but is outlined here to provide context for the detailed calculation below.

The overall approach is to:

- Determine the inherent error bias for each meter type from in service testing results;
- Forecast the number of meters of each type for each EUC band 01-02 Matrix Position for the target Gas Year, using the current numbers and meter type proportions, the rate of meter exchanges and the proportions of each meter type being fitted, and the rate of new installations and the proportions of each meter type being fitted;
- Determine the proportion of meters of each type in each Matrix Position. For EUC bands 01-02, use the numbers determined above; for EUC bands 03-09, use the current numbers; and
- Apply these meter type proportions and the relevant error bias to our Consumption Forecast to determine the UIG for each Matrix Position.

Inputs

- Our Consumption Forecast (as described in Section 4 of this Statement);
- Our Supply Meter Point Forecast (also described in Section 4 of this Statement);
- Meter Types report from the CDSP;
- IST Results report from OPSS;
- Smart Meter Data report from BEIS; and

- Smart meters installed – derived from information contained within the Meter Types report from the CDSP.

Assumptions

- The proportion of newly installed meter types will follow the recent trend for EUC bands 01-02;
- Meters typically operate at close to 0.2 Qmax;
- There is no error for rotary or turbine meters; and
- There are no significant regional differences in the types of meters installed throughout the country.

Calculation

The detailed calculation is described below.

Establish the error bias for meter types, from IST results

1. Obtain the error bias at 0.2 Qmax for ultrasonic and diaphragm meter types for each of the most recent three years' in-service testing. Determine the average error bias for each of these meter types, weighted by the number of meters tested. For rotary and turbine meters, assume the bias is zero.

Determine the number of meters of each type currently in service

2. Determine the number of meters of each meter type currently in service for each Matrix Position from the Meter Type report.

Forecast the number of EUC band 01-02 meter exchanges and new installations prior to the target Gas Year

3. Determine the number of EUC band 01-02 meter exchanges that are likely to take place between the Meter Type report being obtained and the mid-point of the target Gas Year, from the BEIS smart meter installation projections; and
4. Determine the number of EUC band 01-02 new installs likely to take place, between the Meter Type report being obtained and the mid-point of the target Gas Year, by differencing the numbers in our Supply Meter Point Forecast for the target Gas Year and the meters currently in service (from step 2).

Determine the number of EUC band 01-02 meters of each type that are likely to be installed or removed prior to the target Gas Year

5. Determine the proportion of EUC band 01-02 meters of each type installed (as part of meter exchanges or new installations) over the last year, from the Meter Type report;
6. Apply these proportions to the sum of the number of meter exchanges (from step 3) and the number of new installations (from step 4), for EUC bands 01-02, to get a forecast of the number of new EUC 01-02 meters of each meter type to be put in service before the target Gas Year;
7. Determine the proportion of EUC band 01-02 meters of each type installed during or prior to 2015 from the Meter Type report; and
8. Apply these proportions to the number of meter exchanges (from step 3), for EUC bands 01-02, to get a forecast of the number of old EUC band 01-02 meters of each type to be taken out of service before the target Gas Year.

Forecast the population of each meter type for each EUC band 01-02 Matrix Position in the target Gas Year

9. Determine the number of meters of each type for each EUC band 01-02 Matrix Position as: the current number of meters of each type (from step 2), plus the new meters of each type to be put in service (from step 6), less the old meters of each type to be taken out of service (from step 8).

Forecast the error bias consumption (UIG) by meter type for each Matrix Position (using forecast meter type proportions for EUC band 01-02 and the current proportions for EUC band 03-09)

10. Determine the forecast proportion of each meter type in each EUC band 01-02 Matrix Position from the number of meters of each type in each Matrix Position (from step 9). Apply this to the consumption forecast for each Matrix Position (from our Consumption Forecast) to obtain a consumption forecast per meter type per EUC band 01-02 Matrix Position;
11. Determine the (current) proportion of each meter type in each EUC band 03-09 Matrix Position from the number of meters of each type in each Matrix Position (from step 2). Apply this to the consumption forecast for each Matrix Position (from our Consumption Forecast) to obtain a consumption forecast per meter type per EUC band 03-09 Matrix Position;
12. Determine the error bias consumption per Matrix Position as: the error bias for each meter type (from step 1), multiplied by the consumption forecast for each meter type (from steps 10 and 11). Add these across meter types for each Matrix Position to get the error bias consumption (UIG) per Matrix Position; and
13. Sum the UIG across Matrix Positions to get the overall UIG for this contributor.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

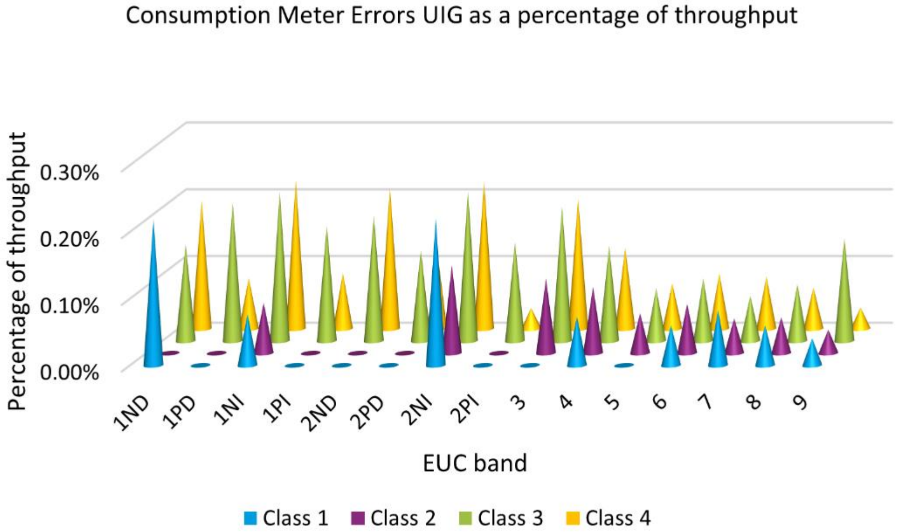
RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **819 GWh**.

This is allocated across Matrix Positions as follows:

EUC BAND	CLASS 1	CLASS 2	CLASS 3	CLASS 4
1ND	0	0	74	473
1PD	0	0	1	16
1NI	0	0	7	23
1PI	0	0	0	0
2ND	0	0	1	9
2PD	0	0	0	0
2NI	0	0	22	31
2PI	0	0	0	0
3	0	0	21	21
4	0	0	13	17
5	0	0	4	8
6	0	2	2	9
7	1	2	2	7
8	2	5	1	9
9	34	2	0	0

The graph below shows UIG as a percentage of throughput for each Matrix Position:



NOTABLE OBSERVATIONS

Observations noted during our analysis of this contributor are detailed in the Analysis and Resulting Methodology section above.

Comparison to Previous Statement

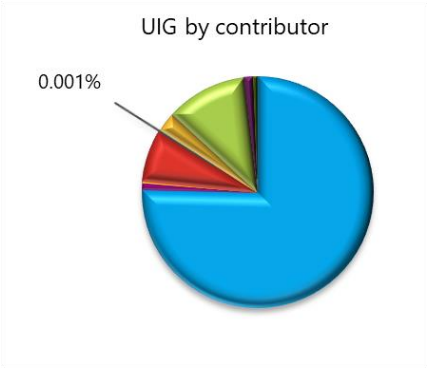
The previous Statement quantified the UIG for this contributor as 25 GWh (compared to our quantification of 819 GWh). However, these values are the result of very different approaches.

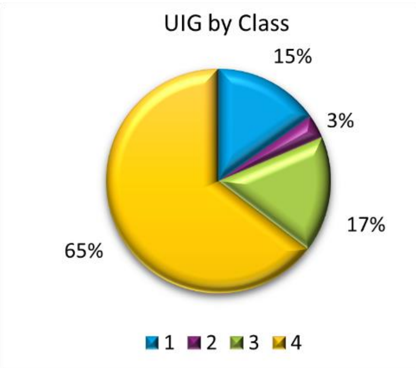
Our value came exclusively from the inherent bias in meter accuracy and this was not considered in previous Statements. The value in the previous Statement came exclusively from meters operating at their extreme throughput specifications.

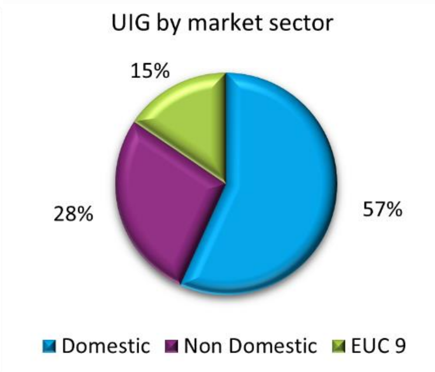
As described above in the Extremes of Use section, we believe that there could be material UIG due to meters operating at the extreme of their throughput specifications, but without intra-day usage data, we do not believe that there is any reasonable means of establishing whether this is the case and of quantifying it. As described in the Faulty Meters section above, we also believe that there could be material UIG due to meter faults but, again, there is insufficient data currently available to establish whether this is the case and to quantify it. We suggest that both these matters are considered further in future AUG Years.

050 – LDZ METER ERRORS

DASHBOARD







DESCRIPTION

Settlement Context

In summary, UIG is the gas entering LDZs from the NTS[20], less an allowance for gas lost in the LDZ networks (shrinkage), less the gas allocated directly to Shippers in Settlement (based on reads or the AQs of the Supply Meter Points to which they are registered).

Most causes of UIG relate to errors in the direct allocation of gas to Shippers in Settlement. However, any errors associated with the quantification of gas entering the LDZs from the NTS[20] also gives rise to UIG.

The injection points of gas from the NTS[20] to LDZs are all metered. These meters are termed LDZ meters. They are also sometimes referred to as "offtake meters" as the gas is offtaken from the NTS.

Where LDZ meter errors are detected before the Line in the Sand, an adjustment can be submitted to Settlement to correct for this. In extreme cases it is also possible for adjustments to be submitted after the Line in the Sand, but this is very unusual.

Definition

This contributor relates to inaccurate measurement of the volume of energy entering the system at LDZ level from the NTS.

Specifically, it includes:

- LDZ meters manufactured with an inherent bias to slightly over or under-record; and
- LDZ meters developing a fault, causing them to record inaccurately; and
- Incorrect calibration of the meters (taking into consideration their location).

UIG Impact

If LDZ meters under-record, this creates negative UIG. Conversely, if they over-record, positive UIG is created.

[20] Along with a relatively small amount from sources embedded within LDZ networks.

ANALYSIS AND RESULTING METHODOLOGY

Background

There are fewer than 200 LDZ meters nationally but the energy that flows through them is over 500 TWh per annum.

Assurance Regime

Distribution Network Operators (DNOs) are required to validate the accuracy of the measurement equipment for all LDZ meters once a year. They also provide the Performance Assurance Committee (PAC) with information on the operation of this regime. These validation checks are audited. Each LDZ meter will be validated at least three times before the Line in the Sand occurs.

In addition, there are a range of other controls in place, such as an annual maintenance schedule agreed with National Grid (who operate the NTS) and inspection of a random sample of LDZ meters by an independent body appointed by Ofgem.

Any error over 50 GWh is deemed to be significant and must be assessed by two independent experts. A meter error report must be raised for any error under 50 GWh.

Regulatory Targets

Ofgem RIIO-1 introduced targets for meter errors of <0.1% of throughput. DNOs provide Ofgem with the Volume of Offtake Meter Error (GWh) and Throughput (GWh) to measure performance against these targets.

Meter Types

Orifice meters contain a measurement plate and a differential pressure transmitter that measures the pressure across the orifice plate. Under ideal conditions, orifice plate meters can be accurate to +/- 0.75-1.5% of total throughput; however, the absolute error can exceed 1.5%. Turbine meters have an accuracy range of +/- 1.0% and ultrasonic meters have an accuracy range of +/- 0.3%.

The current split across meter types is:

- Orifice 38%;
- Turbine 33%; and
- Ultrasonic 29%.

Orifice meters are gradually being replaced with ultrasonic meters.

Inherent Bias

The analysis we undertook into the Consumption Meter Errors (040) contributor found an inherent bias in the accuracy of domestic diaphragm and ultrasonic meter types and concluded that this is the source of material UIG. It is entirely possible that an inherent bias exists for LDZ meters. If it does, the UIG associated with this could be significant. For example, a hypothetical bias of a modest 0.10%, would result in circa 500 GWh of UIG per annum.

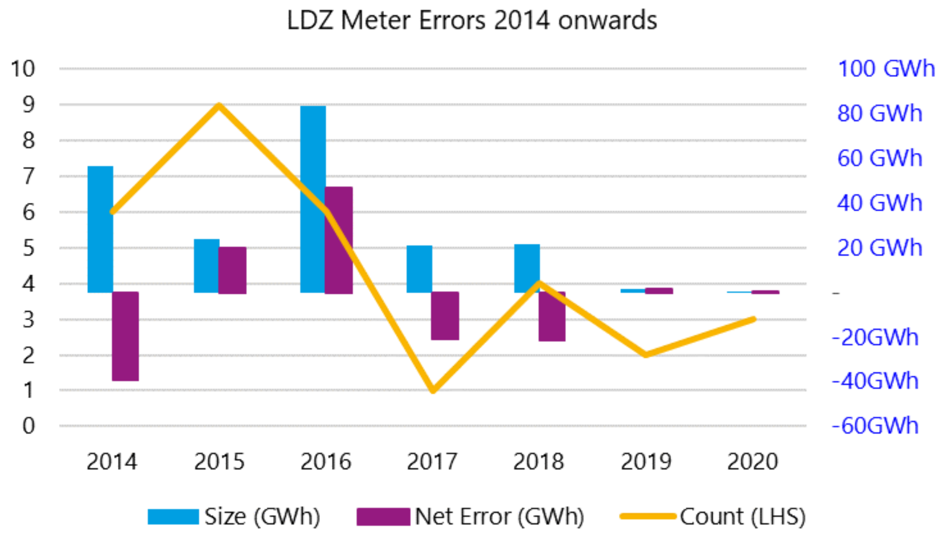
However, we were unable to find any data or studies that informed this further. We have therefore assumed, for the purposes of this Statement, that UIG is not caused by an inherent bias in LDZ meters.

We suggest this matter is considered further in future AUG Years, along with options for commissioning or obtaining data that will prove/disprove and quantify this.

Faulty LDZ Meters and Calibration Errors

The Joint Office maintains a list of reported LDZ meter errors. These include errors arising from meter faults and those arising from calibration errors. We therefore decided to assess these meter errors collectively.

We obtained these details from the Joint Office and plotted the number and energy error identified per year. This data is shown on the following graph.



The trend over the last five years has been reasonably static, with between one and seven errors being reported each year. This is consistent with there being a robust and effective assurance regime in place.

Methodology

The methodology we used to quantify the UIG associated with this contributor for the target Gas Year was to:

- Determine the average identified energy error over the last five years arising from meter errors at LDZ meters using data from the Joint Office (described above);
- Use the Performance Assurance Working Group (PAW) risk assessment to estimate the proportion of LDZ meters errors that are not detected before the Line in the Sand;
- Forecast the average undetected energy error each year using the average annual identified error and the estimated proportion of unidentified error; and
- Split this across each Matrix Position in accordance with the respective proportions in our Consumption Forecast for the target Gas Year.

COVID Impact

We considered the possibility of industry colleagues working below normal capacity leading to more limited identification or processing of LDZ meter errors. However, the low activity identified for 2020 was already present during 2019 and so we drew no further conclusions and made no COVID-related adjustments for this contributor.

CALCULATION

Methodology Summary

The methodology is described in detail in the Analysis and Resulting Methodology Section above but is outlined here to provide context for the detailed calculation below.

The overall approach to is to:

- Determine the average number and annual energy error across all identified LDZ meter errors over the last five years;
- Estimate the probability of an LDZ meter error going undetected from the PAW risk assessment model;
- From the identified annual energy error and the probability of an error being undetected, determine the annual error across all undetected LDZ meters errors; and
- Allocate this error to the Matrix Positions in the respective consumption proportions in our Consumption Forecast for the target Gas Year.

Inputs

- Measurement Error Register from the Joint Office website. This provides the LDZ meter errors that have been reported;
- Error percentage from the PAW risk assessment model from the Joint Office website. This provides an estimate of the likelihood of LDZ meter errors not being detected before the Line in the Sand; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Assumptions

- All identified LDZ meter errors are reported and therefore are accounted for in Settlement; and
- LDZ meters all have a suitably sized throughput specification, such that there are no inaccuracies with them operating at their extremes of use.

Calculation

The detailed calculation is described below.

Identify reported LDZ meter errors

1. Identify the reported meter errors over the last 5 years from the Measurement Error Register.

Determine the average annual energy error for LDZ meters

2. Sum the net energy error over the last five years and divide by 5.

Identify the likelihood of an LDZ meter error going undetected

3. Obtain the estimated likelihood of an LDZ meter error being undetected prior to the Line in the Sand from the PAW risk assessment model. This is 10%.

Determine the UIG for the forecast Gas Year

4. Multiply the average net energy error (from step 2) by 1/9.

$$U = D(\frac{P}{1-P})$$

Where U is the undetected error; D is the detected error; and P is the probability of an error being undetected = 0.1.

Determine the UIG at the Line in the Sand for each Matrix Position

5. Allocate this across each Matrix Position in accordance with the respective consumption proportions in our Consumption Forecast for the target Gas Year.

6. Sum across Matrix Positions to determine the overall UIG associated with this contributor.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

RESULTS

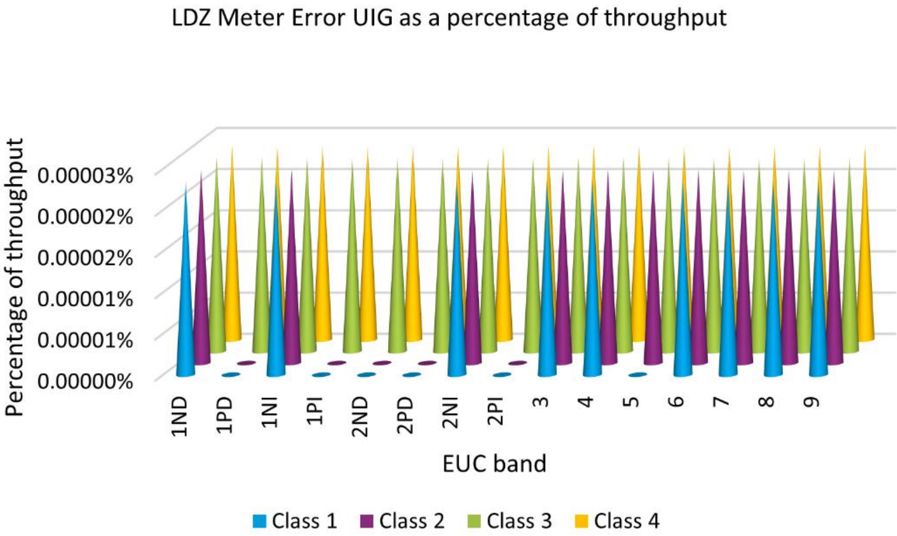
The forecast UIG associated with this contributor at the Line in the Sand for the target Gas year is: **134 MWh**

This is allocated across Matrix Positions as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	0	0
	1PD	0	0	0	0
	1NI	0	0	0	0
	1PI	0	0	0	0
	2ND	0	0	0	0
	2PD	0	0	0	0
	2NI	0	0	0	0
	2PI	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0
	5	0	0	0	0
	6	0	0	0	0
	7	0	0	0	0
	8	0	0	0	0
	9	0	0	0	0

Whilst rounded UIG shows as zero GWh across every Matrix Position, relevant allocations are included in total UIG

The graph below shows UIG as a percentage of throughput for each Matrix Position:



NOTABLE OBSERVATIONS

Observations noted during our analysis of this contributor are detailed in the Analysis and Resulting Methodology section above.

Comparison to Previous Statement

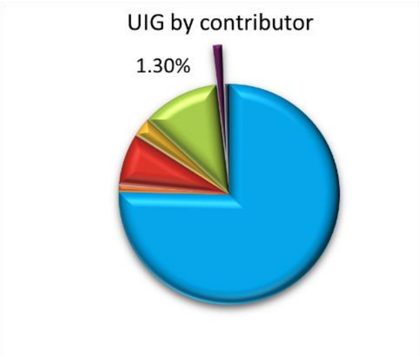
The previous Statement did not quantify this contributor, so no comparison is available.

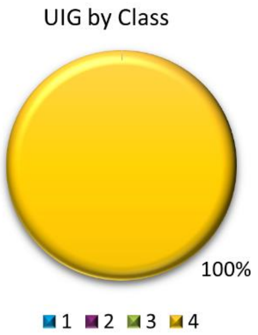
Scale of Error

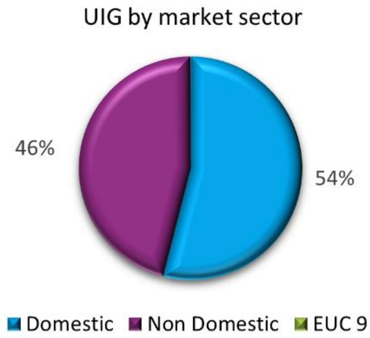
The UIG quantified for this contributor is negligible. However, this assumes that there are no errors associated with an inherent LDZ meter bias. If there is an inherent meter bias, the error could be significant at the Line in the Sand. In addition, the energy throughput for these meters is so high, that there is the potential for a single undetected fault to create a significant error.

090 – NO READ AT THE LINE IN THE SAND

DASHBOARD







DESCRIPTION

Settlement Context

Gas allocation is the process of attributing a daily amount of energy for each Supply Meter Point to the relevant Shipper. It is undertaken up to five days after the relevant Gas Day.

For NDM Supply Meter Points, it is estimated based on a rolling AQ. For DM Supply Meter Points, it is normally based on actual meter reads but, where these do not exist, it is estimated based on a recent read or, failing that, an AQ. By its very nature, allocation comprises much estimation.

For gas consumption to be settled correctly, the allocated energy that is based on estimates must subsequently be reconciled against the actual energy used. Accordingly, when a valid actual read is accepted by the CDSP for a Supply Meter Point, the energy used since the valid previous meter read is calculated and compared to the energy that was allocated over the same period. The difference is reconciled, with an adjustment made up or down (as the case may be) for the relevant Shipper.

For reconciliation to take place, a meter read must be obtained, validated and accepted. When a read is accepted, the previous read is typically less than 12 months in the past. In some cases though, the previous read can be much further in the past.

Within Settlement there is the concept of the Line in the Sand. This is the point in time that Settlement is closed off for a Gas Day with no further reconciliations being made. It is three to four years after the Gas Day[21].

[21] Close off occurs at the end of March for the 1st April – 31st March year ending three years earlier. This means that the Line in the Sand ranges from three years for each 31st March to four years for each 1st April.

In cases where a valid read is accepted and the previous read is prior to the Line in the Sand, the proportion of energy used since the Line in the Sand is determined and reconciled, but the portion prior to the Line in the Sand is not. Instead, this unreconciled portion remains as UIG.

Definition

This contributor relates to consumption at a Supply Meter Point that is not reconciled to the relevant Shipper prior to the Line in the Sand, because a timely valid meter read is not accepted into Settlement.

This includes situations where:

- The Line in the Sand has passed for the date of the previous valid read accepted into Settlement for a Supply Meter Point and there has not been a subsequent valid read accepted into Settlement; and
- The Line in the Sand has passed for the date of the previous valid read accepted into Settlement for a Supply Meter Point and, since this Line in the Sand passed, a valid subsequent read has been accepted into Settlement.

UIG Impact

In situations where the Line in the Sand passes for a period of time before a valid subsequent read is accepted into Settlement, UIG is created. This is the difference between the allocated energy determined from AQs over this period of time and the actual energy used.

In cases where the allocated energy determined from AQs is understated, positive UIG is created. In cases where the energy determined from AQs is overstated, negative UIG is created.

ANALYSIS AND RESULTING METHODOLOGY

We decided to divide our investigation into the following two stages.

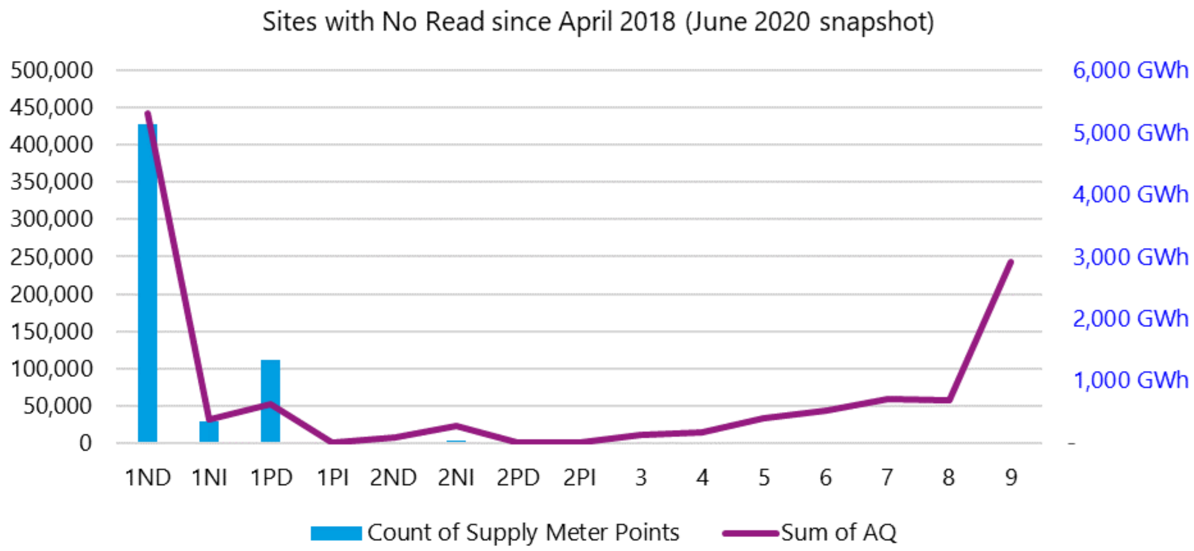
- To investigate how much consumption is likely to remain unreconciled to valid meter reads at the Line in the Sand; and
- To investigate how closely the consumption derived from AQs and used in allocation is reflective of the actual consumption.

These investigation stages are described in the following sections.

Determining Unreconciled Consumption Forecast

<u>Supply Meter Points without a Read</u>

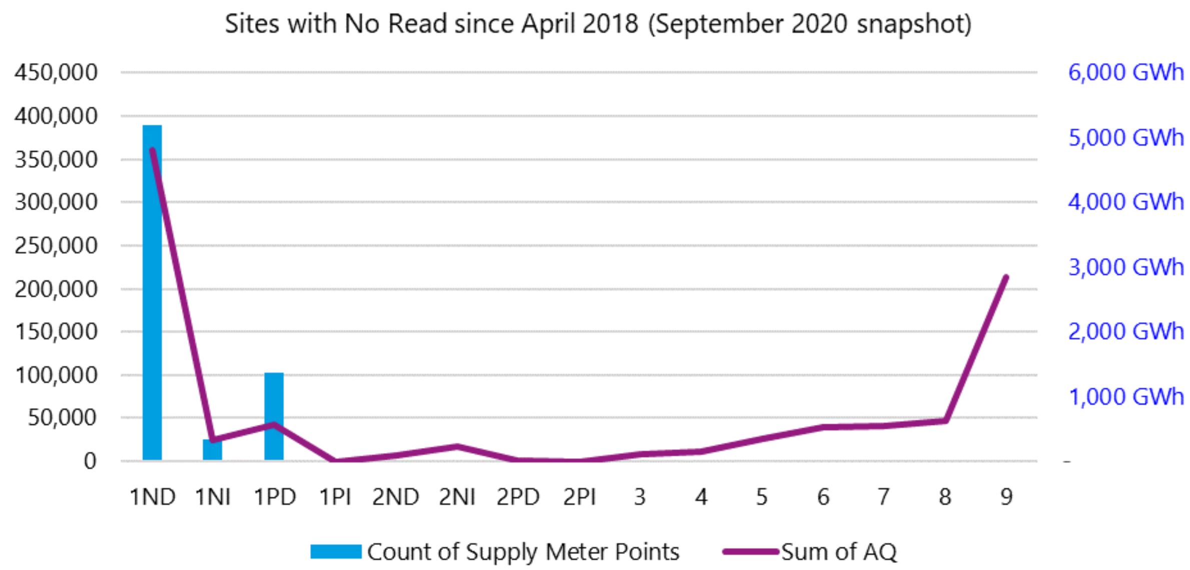
We obtained a snapshot of all Supply Meter Points that had not had a meter read since April 2018, as at June 2020. We assessed this and derived the count of Supply Meter Points and the sum of AQs for each LDZ and sub-EUC band. The results are summarised below.



We noted that:

- There is a significant number of Supply Meter Points that have not had a valid read accepted in the 27 month period;
- The consumption (sum of the AQs) across these Supply Meter Points is significant;
- Most of the Supply Meter Points are in 01ND and 01PD sub-EUC bands; and
- Most of the consumption (AQs) is in 01ND or 09 sub-EUC bands.

We also obtained a snapshot of all Supply Meter Points that had not had a meter read since April 2018, as at September 2020. The results for this are summarised below.



The difference between these two graphed datasets above, is due to reads being accepted in the three months between June 2020 and September 2020.

Rates of Reconciliation

We compared the June 2020 and September 2020 snapshots, for the Supply Meter Points without a read accepted since April 2018. We considered only the Supply Meter Points that had not had a read accepted since April 2017, and determined, for each LDZ and sub-EUC band, the rate at which:

- Reads are being accepted; and
- Unreconciled energy is being reconciled.

We also assumed that the respective rates will have plateaued so long after the last read took place, such that the rates determined above will be constant over the following six months, until the Line in the Sand occurs for the year April 2017 to March 2018 (on 1st April 2021).

Percentage of Unreconciled Energy at the Line in the Sand

We obtained the allocated energy for Classes 3 and 4 combined (by LDZ and main EUC band) and the sub-set of this that has since been reconciled for Class 3 and 4 separately (by LDZ and main EUC band), for each month since June 2017[22]. From this, we determined the percentage of allocated consumption for each month that had been reconciled to a valid meter read for each LDZ and main EUC band.

We determined the unreconciled energy that will be reconciled over the next six months using the rate of reconciliation (determined above) and converted this to a percentage by dividing by the allocated energy.

We added the percentage that will be reconciled in the next six months to the percentage that has already been reconciled, to determine a reconciliation percentage by LDZ and main EUC band (and Class 3 and 4 combined) at the Line in the Sand, for each month from June 2017 to March 2018.

We converted the monthly reconciled percentages at the Line in the Sand to an annual percentage, by taking their allocation energy weighted average. We then determined the annual unreconciled percentage by subtracting this figure from 100.

Unreconciled Consumption Forecast

For Class 4, we applied the percentage consumption unreconciled at the Line in the Sand to our Consumption Forecast for the target Gas Year, to determine the forecast unreconciled consumption at the Line in the Sand, for each LDZ and main EUC band.

For Class 1-3, we determined the forecast unreconciled consumption for the target Gas Year as the sum of the AQs from the September 2020 snapshot of all Supply Meter Points that had not had a meter read since April 2018, considering only Supply Meter Points that had not had a read accepted since April 2017.

Determining the AQ Error Percentage

The second stage of our investigation was to determine the error associated with AQs used in allocation and not subsequently reconciled to a valid meter read before the Line in the Sand.

[22] April and May 2017 were excluded on the basis that the Settlement rules changed significantly on 1 June 2017.

We investigated four areas:

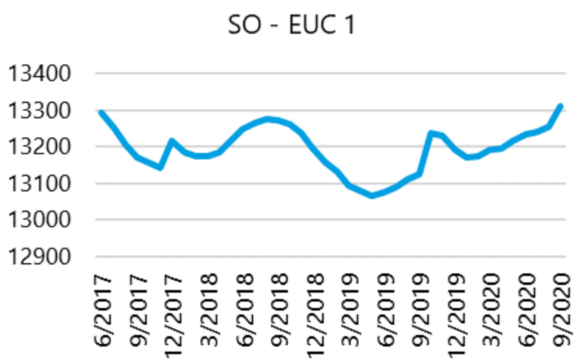
- AQ change trend – to determine if increases in average consumption over time lead to AQs used in allocation (and not subsequently reconciled to a valid meter read) being out of date and so not reflective of the actual consumption;
- Read rejection reasons – to determine if the reasons for rejected meter reads could provide any insight into the extent to which AQs used in allocation (and not subsequently reconciled to a valid meter read) are reflective of the actual consumption;
- AQ corrections – to determine if the corrections Shippers make to AQs could provide any insight into the extent to which AQs used in allocation (and not subsequently reconciled to a valid meter read) are reflective of the actual consumption; and
- Must Reads – to determine if the process Transporters are obligated to follow for monthly read Supply Meter Points that have not had a read accepted for four months, could provide any insight into the extent to which AQs used in allocation (and not subsequently reconciled to a valid meter read), are reflective of the actual consumption.

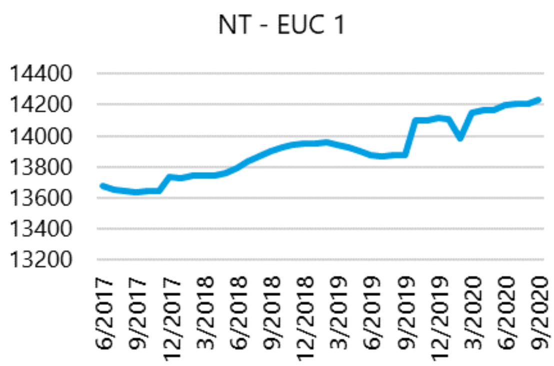
AQ Change Trends

In order to quantify the increase of AQs over time, we obtained a snapshot of the number of Supply Meter Points and the total AQ for each LDZ and Matrix Position, for every month since June 2017. From this we subtracted the number of Supply Meter Points and their AQ obtained from the snapshot of Supply Meter Points without a read since April 2018. This was on the basis that the AQ for Supply Meter Points without a read since April 2018 could mask any underlying AQ trends. This left the number of Supply Meter Points and the total AQ for each LDZ and Matrix Position, for the set of Supply Meter Points that have had one or more reads since April 2018.

We used this dataset to analyse changes in average AQs. We assessed changes at LDZ and Matrix Position level to begin with but found that there were too many positions with too few Supply Metering Points for averages to be statistically valid. We therefore assessed changes at LDZ and main-EUC band level and this enabled us to identify trends.

Examples of two LDZs for EUC band 01 are shown below. The first, for the SO LDZ, shows limited change across the three years and three month period. The second, for the NT LDZ, shows an upward trend over this period.





We concluded that changes in average consumption over time will have led to AQs used in allocation (and not subsequently reconciled to a valid meter read) being out of date and so not reflective of the actual consumption, for some LDZ and Matrix Positions.

We determined a percentage error for AQs used in allocation (and not subsequently reconciled to a valid meter read), by LDZ and main EUC band as:

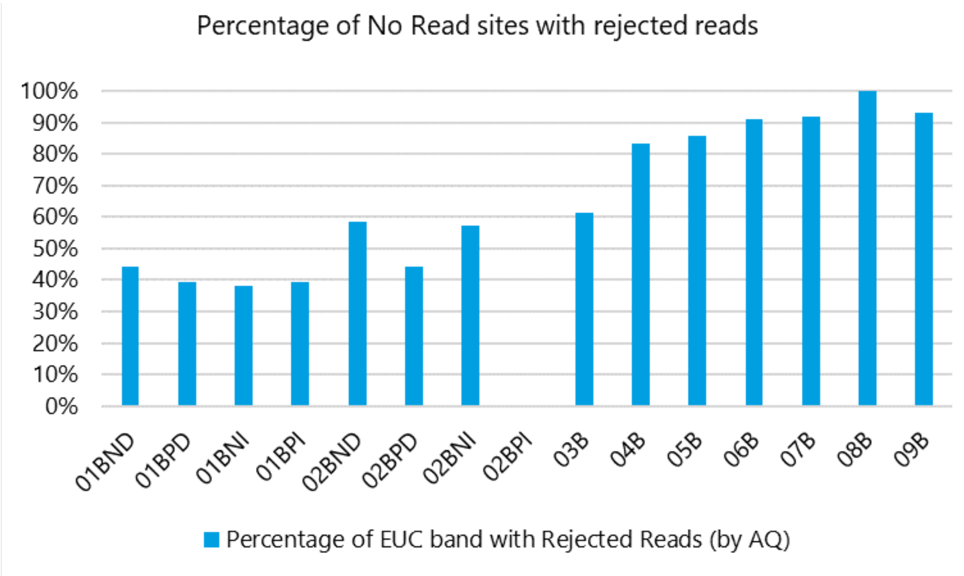
$$100 \ast \frac{\text{recent average AQ} - \text{original average AQ}}{\text{original average AQ}}$$

<u>Read Rejections</u>

We obtained a data extract of all the Shipper rejected reads (along with the rejection reason) for Supply Meter Points that appeared on the snapshot of Supply Meter Points without a read since April 2018.

We analysed this report and noted:

- The report contained over 2.1 million rejected reads;
- There were rejected reads for almost all Matrix Positions where there was a Supply Meter Point without an accepted read since April 2018;
- Approximately 40% of Supply Meter Points without an accepted read since April 2018 had at least one rejected read;
- Larger Supply Meter Points had proportionally more rejected reads (evident in the graph below); and
- Over 10% of rejected reads were due to the resulting AQ being outside the upper tolerance.



We investigated the reads rejected due to the resulting AQ being outside the upper tolerance. We identified the Supply Meter Points that had multiple such rejections and investigated a random sample of these (over 20) in detail.

All of the sample rejections fell into one of two categories:

- Where the last accepted read appeared too low but the AQ appeared reasonable (based on the rejected reads); and
- Where the last accepted read appeared reasonable but the AQ appeared too low (based on the rejected reads).

In all cases sampled, correcting the previous read or updating the AQ using standard AQ correction processes would enable all subsequent reads in the dataset for these Supply Meter Points to pass validation and be accepted.

We concluded that this issue, where Supply Meter Points become "trapped" and unable to have reads pass validation and be accepted, will have led to AQs used in allocation (and not subsequently reconciled to a valid meter read) being out of date and so not reflective of the actual consumption, for some LDZ and Matrix Positions.

We determined a percentage error for AQs used in allocation (and not subsequently reconciled to a valid meter read), as follows.

For each sub-EUC band we:

- Calculated a new average AQ for the set of Supply Meter Points with multiple reads that were rejected due to the resulting AQ being outside the upper tolerance (using reads rejected for this reason as close to a year apart as possible).
- Determined the percentage error on the original AQs as:

$$100 * \frac{\text{new average AQ} - \text{original average AQ}}{\text{original average AQ}}$$

- Determined the proportion of Supply Meter Points that had multiple reads that were rejected due to the resulting AQ being outside the upper tolerance, from the set that had one or more rejections (of any type);
- Applied this proportion to the total AQs for Supply Meter Points that had no read rejections (on the basis that a proportion of these are likely to encounter this issue when a read is finally obtained and submitted for them);
- Applied the percentage error above to all: original AQs for Supply Meter Points with multiple reads that were rejected due to the resulting AQ being outside the upper tolerance; and the proportion of the total AQ for Supply Meter Points without a read rejected at all, as determined above. This gave a revised total AQ; and
- Determined the aggregate percentage error as:

$$100 * \frac{\text{revised total AQ} - \text{orginal total AQ}}{\text{original total AQ}}$$

We noted that errors in AQs due to read rejections were particularly prevalent in the industrial 01 sub-EUC bands, suggesting that larger Supply Meter Points are trapped in the EUC band by a combination of the read tolerances and the relevant Shipper is either not updating the AQ or resolving the erroneous meter reads. We suggest that this is considered further by the appropriate industry group. This is because a failure to have reads accepted has the potential to impact UIG, as it results in the AQs not being updated to reflect the actual consumption.

AQ Corrections

We obtained a data extract of all the AQ corrections made since January 2020 for Supply Meter Points that appeared on the snapshot of Supply Meter Points without a read since April 2018. We anticipated that such adjustments could inform whether AQs in this set were reflective of the actual consumption. A significant skew towards increases would indicate that the original AQs are, on average, understated, creating positive UIG; and, conversely, a significant skew towards decreases would indicate that the original AQs are, on average, overstated, creating negative UIG.

The report contained details of 1,167 AQ corrections. The majority of these were decreases in AQ and the net reduction was 68 GWh, although there was one single reduction of 54 GWh.

However, it was impossible to determine whether the original or revised AQ was more reflective of the actual consumption as there was little or no meter read history associated with the changes, and so this line of investigation was closed.

Nonetheless, this revealed that material adjustments are being made to AQs without meter reads to support the change. We suggest that the rules and controls surrounding this are considered further by the appropriate industry group, as such changes have the potential to impact UIG if the revised AQs do not reflect the actual consumption.

Must Reads

Monthly read Supply Meter Points require a Must Read (a special instruction to the Transporter to acquire a read outside of the routine schedule and process) if a read has not been acquired for a Supply Meter Point for four months. This would apply to all Supply Meter Points in EUC band 04 and above.

We obtained a data extract of all the Must Reads for Supply Meter Points that appeared on the snapshot of Supply Meter Points without a read since April 2018. We anticipated that details associated with these Must Reads could inform whether AQs in this set were reflective of the actual consumption.

However, there were very few Must Reads for the set of Supply Meter Points without a read accepted since April 2018, and insufficient for us to draw any conclusions about the accuracy of AQs.

Nonetheless, this revealed that Must Reads do not appear to be being obtained. We suggest that this is considered further by the appropriate industry group, as a failure to obtain reads, particularly for large Supply Meter Points, has the potential to impact UIG as it results in the AQs not being updated to reflect the actual consumption.

Error Percentage Calculation

The overall error percentage was calculated for each LDZ and sub-EUC band by summing the relevant resulting error percentages for the Read Rejections and for the AQ Corrections (as described above).

COVID Impact

We considered the impact COVID could have had on the integrity of the inputs to our calculations. We used the period June-September 2020 to determine the rate at which reads are being accepted for the set of Supply Meter Points previously without a read accepted since April 2018. It is possible that COVID supressed the acquisition rate of meter reads in this period. However, the rate we determined was only applied to September 2020 to March 2021, which is likely to have had/have similarly suppressed read rates because of COVID. Accordingly, we did not make any COVID related adjustments.

CALCULATION

Methodology Summary

The methodology is described in detail in the Analysis and Resulting Methodology Section above but is outlined here to provide context for the detailed calculation below.

The overall approach is to:

- Determine how much consumption is likely to remain unreconciled to valid meter reads at the Line in the Sand for the target Gas Year;
- Determine how closely the consumption derived from AQs and used in allocation is reflective of the actual consumption, and establish an error percentage; and
- Apply the resulting error percentage to the residual unreconciled consumption forecast.

To determine unreconciled consumption at the Line in the Sand, the historical unreconciled allocation approaching the Line in the Sand is considered along with the rate at which it is being reconciled. These are used to derive a percentage that will be unreconciled at the Line in the Sand and this is applied to the Consumption Forecast.

To determine the percentage error in AQs, the error arising from AQ trends not being followed is considered, along with the error arising from correct reads being rejected due to tolerance validation and data issues.

Inputs

- Supply Meter Points with no Reads after April 2018 report from the CDSP;
- Changes in AQ report from the CDSP;
- Allocation and Allocation Reconciled report from the CDSP;
- Our Consumption Forecast (as described in Section 4 of this Statement); and
- Read Rejection report from the CDSP.

Assumptions

- There is no material change to the NDM allocation methodology before the target Gas Year;
- There is no change to read incentives for the target Gas Year; and

- Read performance for the target Gas Year is equivalent to the years used in our trend analysis.

Calculation

The detailed calculation is described below.

Determining Unreconciled Consumption Forecast

Determine the Supply *Meter Points without a reading approaching the Line in the Sand*

1. Obtain details of Supply Meter Points without a reading since April 2018, in snapshots taken in June 2020 and September 2020;
2. Determine the set of Supply Meter Points in the June 2020 snapshot without a reading since April 2017;
3. Determine the set of Supply Meter Points that are also not in the September 2020 snapshot. This is the set that have had a valid reading accepted in the three months between June and September.

Determine the rate at which readings are being obtained and unreconciled energy is being reconciled approaching the Line in the Sand

4. Using the set of Supply Meter Points determined in step 2 and the sub-set determined in step 3, determine the rate at which readings are being accepted (approaching the Line in the Sand) for each LDZ and sub-EUC band, along with the rate at which unreconciled energy is being reconciled.

Determine the percentage of unreconciled energy at the Line in the Sand

5. Obtain details of allocated energy and the amount of this that has since been reconciled to a valid meter reading as at September 2020 for each month since June 2017, for each main EUC band in Class 3 and 4;
6. Determine the percentage of allocated energy for each month that has been reconciled to a valid meter read for each LDZ and main EUC band;
7. Determine the unreconciled energy that will be reconciled over the following six months (October – March), for each LDZ and main EUC band, using the rate of reconciliation (from step 4) and convert this to a percentage by dividing by the allocated energy;
8. Add the percentage that will be reconciled in the next six months (from step 7) to the percentage that has already been reconciled (from step 6), to determine a reconciliation percentage by LDZ and main EUC band (and Class 3 and 4 combined) at the Line in the Sand, for each month from June 2017 to March 2018; and
9. Convert the monthly reconciled percentages at the Line in the Sand to an annual percentage, by taking their allocation energy weighted average. Then determine the annual unreconciled percentage by subtracting this figure from 100.

Forecast the unreconciled energy at the Line in the Sand for the target Gas Year

10. For Class 4, apply the unreconciled percentage at the Line in the Sand (from step 9) to our Consumption Forecast for the target Gas Year, to determine the forecast unreconciled consumption at the Line in the Sand, for each LDZ and main EUC band; and
11. For Class 1-3, determine the forecast unreconciled consumption for the target Gas Year as the sum of the AQs from the September 2020 snapshot of all Supply Meter Points that had not had a meter read

since April 2018, considering only Supply Meter Points that had not had a read accepted since April 2017.

Determining the AQ Error Percentage

Determine the percentage error due to AQ trend changes

12. Obtain a snapshot of the number of Supply Meter Points and the total AQ for each LDZ and Matrix Position, for every month since June 2017;
13. From this, subtract the number of Supply Meter Points and total AQ in the snapshot of Supply Meter Points without a read since April 2018 (from step 1);
14. From the resulting dataset, determine a percentage error for AQs used in allocation (and not subsequently reconciled to a valid meter read), by LDZ and main EUC band as:

$$100 * \frac{\text{recent average AQ} - \text{original average AQ}}{\text{original average AQ}}$$

Determine the percentage error due to read rejections

15. Obtain all the Shipper rejected reads (along with the rejection reason) for Supply Meter Points without a read since April 2018 (from step 1), as at September 2020.

For each sub EUC-band (steps 16-21):

16. Calculate a new average AQ for the set of Supply Meter Points with multiple reads that were rejected due to the resulting AQ being outside the upper tolerance (using reads rejected for this reason as close to a year apart as possible);
17. Determine the percentage error on the original AQs as:

$$100 * \frac{\text{new average AQ} - \text{original average AQ}}{\text{original average AQ}}$$

18. Determine the proportion of Supply Meter Points that had multiple reads that were rejected due to the resulting AQ being outside the upper tolerance, from the set that had one or more rejections (of any type);
19. Apply this proportion to the total AQs for Supply Meter Points that had no read rejections (on the basis that a proportion of these are likely to encounter this issue when a read is finally obtained and submitted for them);
20. Apply the percentage error from step 17 to all: original AQs for Supply Meter Points with multiple reads that were rejected due to the resulting AQ being outside the upper tolerance; and the proportion of the total AQ for Supply Meter Points without a read rejected at all, as determined in step 19 above. This gives a revised total AQ; and
21. Determine the aggregate percentage error (for each sub EUC-band) as:

$$100 * \frac{\text{revised total AQ} - \text{orginal total AQ}}{\text{original total AQ}}$$

Determine the overall percentage error

22. Determine the overall error percentage for each LDZ and sub-EUC band by summing the error percentages for the Read Rejections (from step 21) and for the AQ Corrections (from step 14).

Determining the UIG

Apply the overall percentage error to the forecast unreconciled consumption

23. Apply the error percentages determined in step 22 to the forecast unreconciled consumptions (from steps 10 and 11) to determine the error (UIG) in the target Gas Year.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **144 GWh**.

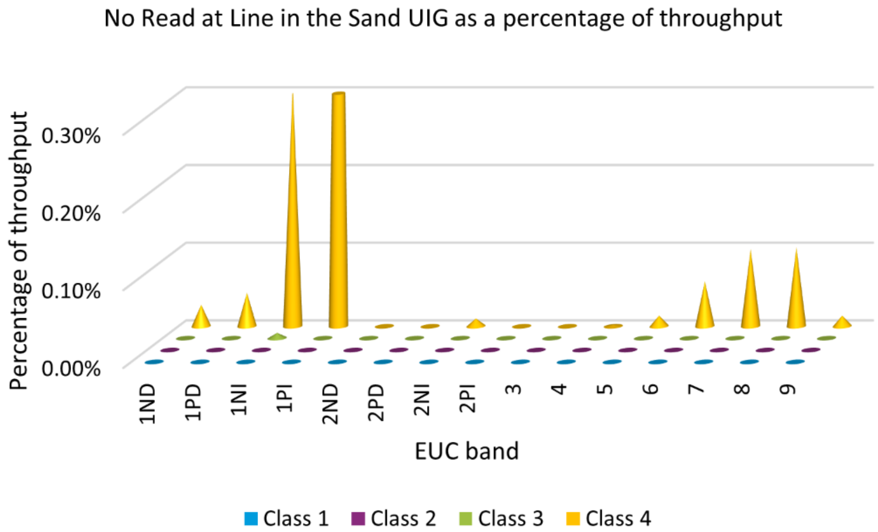
This is allocated across Matrix Positions[23] as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	0	69
	1PD	0	0	0	9
	1NI	0	0	0	32
	1PI	0	0	0	0
	2ND	0	0	0	0
	2PD	0	0	0	0
	2NI	0	0	0	1
	2PI	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0
	5	0	0	0	2
	6	0	0	0	6
	7	0	0	0	9
	8	0	0	0	15
	9	0	0	0	0

Note that the predominance of zeros in this matrix is because there were very few Supply Meter Points without a read at the Line in the Sand for Classes 1-3; and there was not an AQ trend increase for the Supply Meter Points without a read at the Line in the Sand for EUC band 09.

[23] Note that due to rounding the sub-EUC band values in aggregate may not equal total UIG value.

The graph below shows UIG as a percentage of throughput for each Matrix Position:



NOTABLE OBSERVATIONS

Observations noted during our analysis of this contributor are detailed in the Analysis and Resulting Methodology section above.

Comparison to previous Statement

The previous Statement did not quantify this contributor, so no comparison is available.

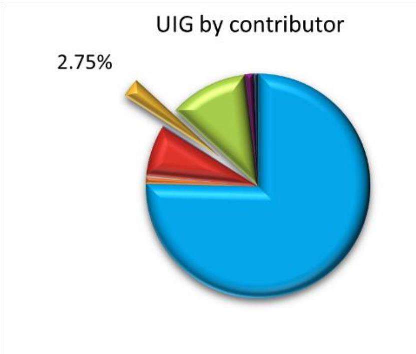
6 Other Contributors

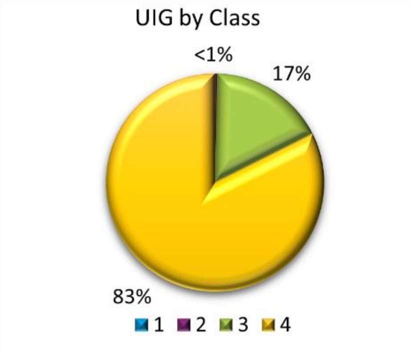
The other six contributors had been assessed in previous Statements but did not score highly enough in the initial assessment to warrant a detailed investigation in the same manner as those discussed in Section 5. The other contributors are structured in the following manner:

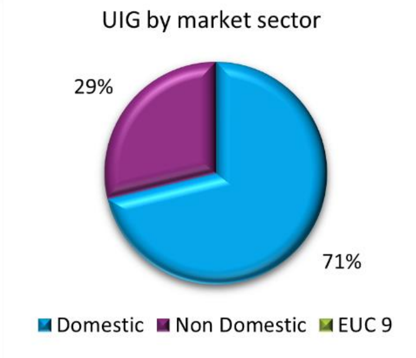
- Dashboard – provides a set of three pie charts which show the scale of the contributor when compared to the total UIG, the UIG split by Class and the UIG split by market sector;
- Description – provides details of the Settlement context, the definition of the contributor and how the contributor impacts UIG;
- Methodology – provides the methodology we used to determine the level of UIG associated with the contributor and for allocating this across Matrix Positions, along with any assumptions we made;
- Methodology Derivation and Rationale – provides our derivation of the methodology, based on what was used in the previous Statement, highlights any changes we made, along with our rationale, and describes any COVID impacts;
- Calculation – provides the data inputs, the calculation steps and the data output;
- Results – provides the calculated UIG value, the value split by Matrix Position and a chart showing the UIG as a percentage of throughput; and
- Notable Observations – provides any notable observations including a comparison to the previous Statement and any other points we considered it relevant to make.

070 – AVERAGE PRESSURE ASSUMPTION

DASHBOARD







DESCRIPTION

Settlement Context

The Settlement calculations assume that meters measure gas volumes that are at a standard temperature of 15°C and a standard atmospheric pressure. The altitude along with localised weather and atmospheric conditions result in the actual atmospheric pressure at the location of meters being different to the standard.

There is a small number of meters that have correction equipment fitted and dynamically adjust for this according to the actual atmospheric pressure and temperature of the gas. They provide volumes that are consistent with the standard atmospheric pressure and temperature. These are typically high-capacity meters. The vast majority of meters do not do this.

In addition, there are some meters for which a location dependent Specific Correction Factor[24] is applied to the advance between two meter readings as part of the Settlement calculations. These factors are designed to adjust for variances from standard atmospheric pressure that are due to the altitude of the meter. They do not adjust for variances that are due to the prevailing atmospheric conditions. They ensure that the volume processed in Settlement is more consistent with the standard atmospheric pressure. This occurs for Supply Meter Points that typically use over 732,000 kWh.

The remaining set of meters have a Standard Correction Factor applied to the advance between two meter readings as part of the Settlement calculations. This factor is also designed to adjust for variances from standard atmospheric pressure that are due to the altitude of the meter. However, it assumes that all meters to which it is applied are at the national average altitude of 66m. They do not adjust for variances that are due to the prevailing atmospheric conditions. They ensure that the volume processed in Settlement is more consistent with the standard atmospheric pressure, but do not adjust for the fact that most meters do not sit at the national average altitude of 66m.

[24] Also known as Conversion Factor.

The number of gas moles (the amount of gas) in a cubic metre is proportional to the gas pressure. A 1 millibar change in the gas pressure results in there being approximately 0.1% more gas in the same space[25]. Meters measure based on the relative difference between the atmospheric pressure and the pressure of the gas. This means that a lower atmospheric pressure has the same effect as a higher gas pressure and vice versa.

Meters that do not have correction equipment fitted, over or under-record the amount of gas used when the actual pressure differs from that implicitly assumed in the Correction Factor that is applied for them in Settlement (Standard or Specific as appropriate). This over or under-recording of the amount of gas used creates UIG. There is no means for correcting for this in Settlement and so such UIG remains at the Line in the Sand.

Review group 0693R[26] is considering various ways to better account for temperature and atmospheric pressure differences at Supply Meter Points. None of the options being considered are approved for implementation. Therefore, we have assumed that the current rules will be in place in the target Gas Year.

Definition

This contributor relates to meters that over or under-record the amount of gas consumed at Supply Meter Points because the actual atmospheric pressure is not that implicitly assumed in the applicable Correction Factors applied in Settlement (Standard or Specific).

For the avoidance of doubt, this does not include cases where meters have correction equipment fitted as they dynamically adjust for variances with the standard atmospheric pressure and provide measurement consistent with this.

UIG Impact

If the atmospheric pressure at the location of the meter is less than that implicitly assumed in the applicable Correction Factor used in Settlement (Standard or Specific), the meter will over-record the amount of gas and create negative UIG.

If the atmospheric pressure at the location of the meter is more than that implicitly assumed in the applicable Correction Factor used in Settlement (Standard or Specific), the meter will under-record the amount of gas and create positive UIG.

This excludes cases where the meter has correction equipment fitted.

There is no means for correcting for this in Settlement and so such UIG remains at the Line in the Sand.

METHODOLOGY

UIG Forecast

The UIG associated with this contributor for the target Gas Year is determined by:

- Using weather station data to derive an average weather-related pressure variance from the pressure assumptions inherent in the Settlement calculations for each LDZ;
- Using altitude data by postcode to derive an average altitude related pressure variance from the pressure assumptions inherent in the Settlement calculations for each LDZ;

[25] Further technical explanation can be found in Appendix 4.

[26] UNC Modification 0693R: "Treatment of kWh error arising from statutory volume-energy conversion".

- Using these pressure variances and the Pressure Volume Error Rate (the incremental volume change due to a 1 millibar variance in pressure) to calculate a Weather Pressure Error Factor for each LDZ, and an Altitude Pressure Error Factor for each LDZ;
- Identifying the AQ proportions, for each LDZ and Matrix Position, of Supply Meter Points that:
  - Have meters with correction equipment fitted; and
  - Do not have meters with correction equipment fitted but do have a Specific Correction Factor used in Settlement;
- Applying these AQ proportions to our Consumption Forecast for each LDZ and Matrix Position, to obtain a consumption forecast where there is neither correction equipment fitted, nor a Specific Correction Factor used in Settlement; and a consumption forecast where correction equipment is not fitted but where a Specific Correction Factor is used in Settlement;
- Applying the Weather Pressure Error Factor and the Altitude Pressure Error Factor (both explained above) to the consumption forecast for Supply Meter Points that have neither correction equipment fitted or a Specific Correction Factor used in Settlement;
- Applying only the Weather Pressure Error Factor to the consumption forecast for Supply Meter Points where correction equipment is not fitted but where a Specific Correction Factor is used in Settlement; and
- Summing these two results for each LDZ and Matrix Position to derive an estimate of the UIG. Summing these across LDZ to obtain the UIG by Matrix Position; and across Matrix Positions to get the overall UIG for this contributor.

Matrix Allocation

The UIG by Matrix Position is determined as part of the method for calculating the overall UIG for this contributor.

Assumptions

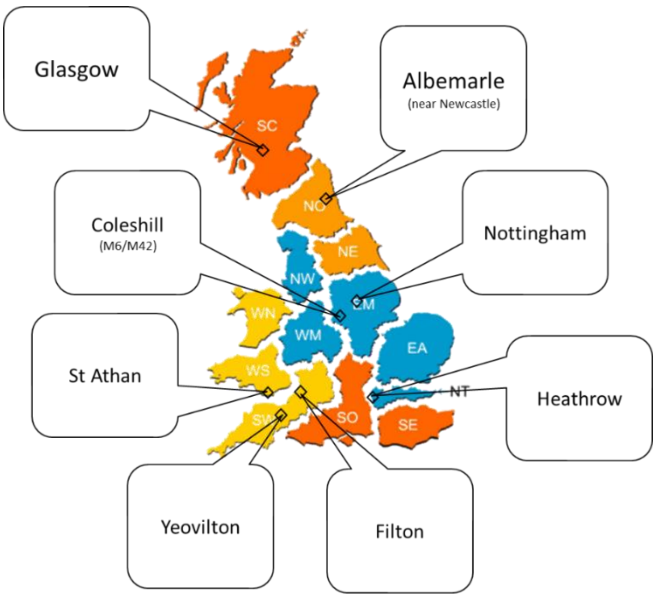
- There are no material changes to the average atmospheric pressure in each LDZ over time (due to climate change for example);
- Weather station atmospheric pressure readings (which are corrected to Mean Sea Level) are a good proxy for the atmospheric pressure within the same LDZ (after it has also been corrected to Mean Sea Level);
- There is no correlation between altitude and the average amount of gas used at Supply Meter Points; and
- The proportion of Supply Meter Points that have correction equipment fitted will be the same in the target Gas Year as it has been in previous years.

METHODOLOGY DERIVATION AND RATIONALE

We assessed the method used in the previous Statement to quantify this contributor. Our assessment was that the method was reasonable but that there was scope for a small number of improvements, which we applied. These are described below.

Weather Stations

We assessed the location of the weather station in each LDZ that was used in the preparation of the previous Statement. We concluded that the stations chosen are a reasonable proxy for the latitude of the Supply Meter Points in the relevant LDZ. Accordingly, we did not make any changes to the set of weather stations used.



LDZ	Weather Station
EA	Heathrow
EM	Nottingham
NE	Average of Nottingham and Albemarle
NO	Albemarle
NT	Heathrow
NW	Nottingham
SC	Glasgow
SE	Heathrow
SO	Filton
SW	Yeovilton
WM	Coleshill
WN	Nottingham
WS	St Athan

We analysed the pressure data from all these weather stations and could not identify any material year-on-year changes in pressure and observed no significant seasonal trends. Therefore, we did not make any changes to the pressure data obtained for previous years and instead took a simple mean of the values from each weather station to apply to the relevant LDZ.

LDZ Altitude

The previous Statement did not take into consideration the variation in average altitude of LDZs and the fact that a Standard Correction Factor used in Settlement assumes that the Supply Meter Points to which they apply are all at the national average altitude of 66m above Mean Sea Level.

We determined an average altitude of the Supply Meter Points in each LDZ from the elevation of each postcode in each LDZ. We included boundary postcode sectors on both sides of the boundary. Postcodes have similar numbers of properties in them, up to a maximum of 80, and so they are an appropriate basis for determining these averages. The postcode and altitude data we obtained[27] was under the Open Government Licence[28].

Altitude Averages by LDZ

LDZ	Weather Station	Average Elevation	Count of Postcodes	Max Elevation	Min Elevation
EA	Heathrow	50.2	163,376	430	0
EM	Nottingham	72.9	160,129	500	0
NE	Average of Nottingham and Albemarle	86.2	111,127	520	0
NO	Albemarle	72.3	93,055	570	0
NT	Heathrow	38.7	179,960	390	-10
NW	Nottingham	71.5	190,728	500	0
SC	Glasgow	65.9	151,291	720	0
SE	Heathrow	47.8	196,524	300	-10
SO	Filton	61.8	150,781	420	0
SW	Yeovilton	69.9	159,956	440	0
WM	Coleshill	115.6	141,798	520	0
WN	Nottingham	84.7	35,223	450	0
WS	St Athan	89.2	61,620	450	0

We used these average altitudes to determine the UIG associated with Supply Meter Points that have a Standard Correction Factor applied in Settlement (which assumes the meters are all at the national average altitude of 66m above Mean Sea Level).

Pressure Volume Error Rate

The previous Statement used a formula based on the Thermal Regulations to estimate the error due to variances from the pressure assumptions that are inherent in the Settlement calculations. We decided to determine a Pressure Volume Error Rate for use in our calculations, from the Ideal Gas Law[29], this being the volume change per millibar change in pressure.

This is so that we could apply this rate to any pressure variances from the assumptions inherent in the Settlement calculations to determine the associated volume error. From the Ideal Gas Law and the linear relationship between pressure and volume, we determined that this Pressure Gas Volume Error Rate is 0.00098692 m^3 per millibar.

We were then able to apply this rate to the pressure variances attributable to weather and those variances attributable to altitude, for each LDZ separately.

[27] https://www.getthedata.com/downloads/open_postcode_elevation.csv.zip

[28] Attribution: Contains OS data © Crown copyright and database right 2017; Contains Royal Mail data © Royal Mail copyright and database right 2017; Contains National Statistics data © Crown copyright and database right 2017.

[29] See Appendix 4 for calculation details.

COVID Impact

We did not identify any COVID related impacts for this contributor.

CALCULATION

Inputs

- Pressure Data for the Gas Years 2012-2017 from the CDSP;
- Conversion Equipment Fitted report from the CDSP;
- Postcode and Elevation Data from Open Data[29];
- Correction Factors report from the CDSP; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

The detailed calculation is described below.

Weather Pressure Difference: determine the difference in the average atmospheric pressure in each LDZ (corrected to Mean Sea Level) and standard atmospheric pressure (which is at Mean Sea Level)

1. Identify the weather station(s) used for each LDZ;
2. Determine the average atmospheric pressure, corrected to Mean Sea Level, for each LDZ, from the respective weather station data; and
3. Difference these values to standard atmosphere pressure for each LDZ.

Altitude Pressure Difference: determine the difference in the average atmospheric pressure in each LDZ and standard atmospheric pressure (corrected to the national average altitude of 66m above Mean Sea Level)

4. Determine the average altitude of Supply Meter Points in each LDZ from postcode elevation data, giving equal weightings to each postcode (on the basis that they each contain approximately the same number of Supply Meter Points). Where a postcode spans multiple LDZs, include it in the averaging for each of these LDZs; and
5. For each LDZ, calculate the pressure at the average LDZ altitude, determine the pressure difference between standard atmospheric pressure corrected to the average altitude for the LDZ (as determined above) and standard atmospheric pressure corrected to the national average altitude (66m above Mean Sea Level).

Identify the Pressure Gas Volume Error Rate, this being the volume change per millibar of pressure change

6. Use the Ideal Gas Law to determine the volume change for every 1 millibar change in pressure. This is 0.00098692m^3 per millibar. Call this the Pressure Gas Volume Error Rate.

Calculate the Volume Error Factors

7. Multiply the weather-related pressure variance for each LDZ from step 3 by the Pressure Gas Volume Error Rate from step 6, to calculate the Weather Pressure Volume Error Factor; and

8. Multiply the altitude related pressure variance for each LDZ from step 5 by the Pressure Gas Volume Error Rate from step 6, to calculate the Altitude Pressure Volume Error Factor.

Determine the AQ proportion of the Supply Meter Points for each LDZ and Matrix Position, that require application of the error rates

9. For each LDZ and Matrix Position, determine the AQ proportion of Supply Meter Points that do not have correction equipment fitted but do have a Specific Correction Factor used in Settlement (from the Conversion Equipment Fitted report and the Correction Factor report); and
10. For each LDZ and Matrix Position, determine the AQ proportion of Supply Meter Points that do not have correction equipment fitted and do not have a Specific Correction Factor used in Settlement (from the Conversion Equipment Fitted report and the Correction Factor report).

Determine the weather-related error (UIG) and the altitude related error (UIG) for the target Gas Year for each LDZ and Matrix Position

11. For each LDZ and Matrix Position, determine the weather-related error as: the product of step 7, step 9 and the Consumption Forecast for the LDZ and Matrix Position for the target Gas Year; and
12. For each LDZ and Matrix Position, determine the altitude related error as: the product of step 8, step 10 and the Consumption Forecast for the LDZ and Matrix Position for the target Gas Year.

Determine UIG

13. Sum the result of step 11 and step 12 for each LDZ and Matrix Position to determine the UIG by LDZ Matrix Position;
14. Sum the results of step 13 across LDZs to obtain the UIG by Matrix Position; and
15. Sum the results of step 14 across Matrix Positions to obtain the overall UIG for this contributor.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

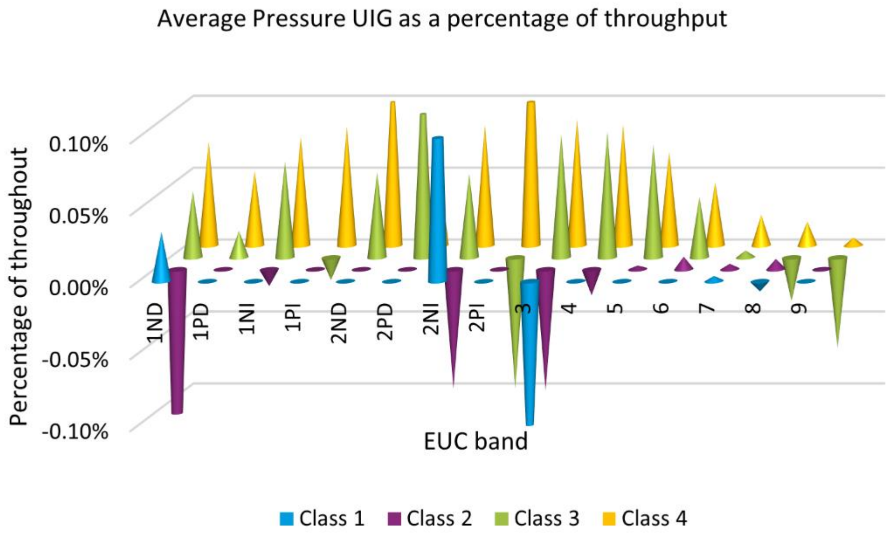
RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **307 GWh**.

This is broken down by Matrix Position as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	23	178
	1PD	0	0	0	11
	1NI	0	0	2	8
	1PI	0	0	0	0
	2ND	0	0	0	6
	2PD	0	0	0	0
	2NI	0	0	6	12
	2PI	0	0	0	0
	3	0	0	9	9
	4	0	0	8	12
	5	0	0	4	8
	6	0	0	1	5
	7	0	0	0	2
	8	0	1	0	2
	9	0	0	0	0

The graph below shows UIG as a percentage of throughput for each Matrix Position[30].



[30] Note this graph shows negatives for Matrix Positions with minimal throughput and these round to zero in terms of the GWh in the table above.

NOTABLE OBSERVATIONS

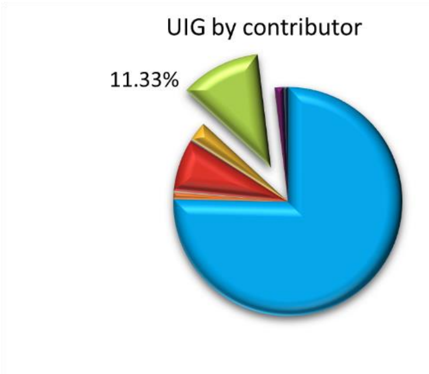
Comparison to Previous Statement

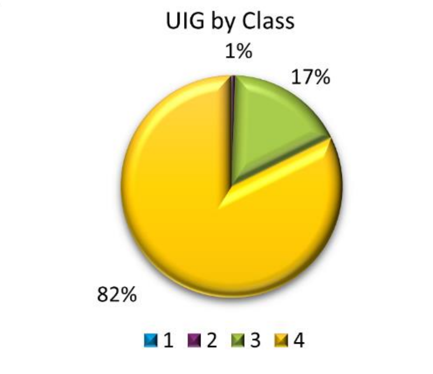
The previous Statement quantified the UIG for this contributor to be 55.3 GWh (compared to our quantification of 307 GWh).

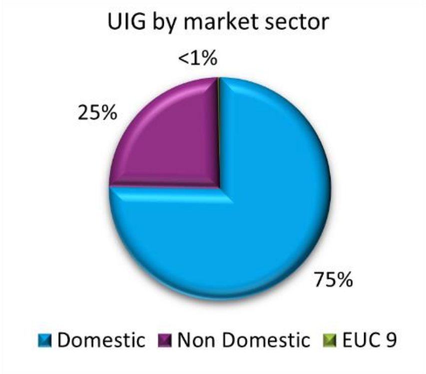
This is because we have identified and quantified a material impact of the average altitude of Supply Meter Points in LDZs being different from the national average altitude (66m above Mean Sea Level) assumption inherent in the Settlement calculations.

080 – AVERAGE TEMPERATURE ASSUMPTION

DASHBOARD







DESCRIPTION

Settlement Context

The Settlement calculations assume that meters measure gas volumes that are at a standard temperature of 15°C and a standard atmospheric pressure. Actual temperature conditions will in most cases be different to these assumptions.

There is a small number of meters that have correction equipment fitted and dynamically adjust for this according to the actual atmospheric pressure and temperature of the gas. They provide volumes that are consistent with the standard atmospheric pressure and temperature. These are typically high-capacity meters. The vast majority of meters do not have this correction equipment fitted.

In addition, there are some meters for which a location dependent Specific Correction Factor[31] is applied to the advance between two meter readings as part of the Settlement calculations. These factors are designed to adjust for variances between the average actual temperature of gas at the meter's location and the standard temperature of 15°C. They ensure that the volume processed in Settlement is more consistent with this standard temperature. This occurs for Supply Meter Points that typically use over 732,000 kWh.

The remaining set of meters have a Standard Correction Factor applied to the advance between two meter readings as part of the Settlement calculations. This factor is also designed to adjust for variances between the average actual temperature of the gas and the standard temperature of 15°C. However, it assumes that the temperature of the gas for all meters to which it is applied is the temperature in the Thermal Regulations of 12.2°C. It ensures that the volume processed in Settlement is more consistent with the standard temperature of 15°C, but does not adjust for the fact that, for most meters, the average temperature of gas is not that in the Thermal Regulations.

[31] Also known as Conversion Factor.

The number of gas moles (the amount of gas) in a cubic metre is inversely proportional to the temperature. This means that the amount of gas is less per unit volume the higher the temperature and vice versa[32]. Meters that do not have correction equipment fitted, over or under-record the amount of gas used when the actual gas temperature differs from that implicitly assumed in the Correction Factor that is applied for them in Settlement (Standard or Specific as appropriate). This over or under-recording of the amount of gas used creates UIG. There is no means for correcting for this in Settlement and so such UIG remains at the Line in the Sand.

Review group 0693R[33]is considering various ways to better account for temperature and atmospheric pressure differences at Supply Meter Points. None of the options being considered are approved for implementation. Therefore we have assumed that the current rules will be in place in the target Gas Year.

Definition

This contributor relates to meters that over or under-record the amount of gas consumed at Supply Meter Points because the temperature is not that implicitly assumed in the applicable Correction Factors applied in Settlement (Standard or Specific).

For the avoidance of doubt, this does not include cases where meters have correction equipment fitted as they dynamically adjust for temperature variances with the standard temperature of 15°C and provide measurement consistent with this.

UIG Impact

If the average temperature at the location of the meter is more than that implicitly assumed in the Correction Factor used in Settlement, the meter will over-record the amount of gas and create negative UIG.

If the average temperature at the location of the meter is less than that implicitly assumed in the Correction Factor used in Settlement, the meter will under-record the amount of gas and create positive UIG.

This excludes cases where the meter has correction equipment fitted.

There is no means for correcting for this in Settlement and so such UIG remains at the Line in the Sand.

METHODOLOGY

UIG Forecast

The UIG associated with this contributor for the target Gas Year is determined by:

- Identifying a flow-weighted[34] average temperature for internal meter locations for each LDZ and Matrix Position from the previous temperature studies (using the same for internal and external meters if the study did not break these down);

[32] Further technical explanation can be found in Appendix 4.
[33] UNC Modification 0693R: "Treatment of kWh error arising from statutory volume-energy conversion".
[34] A weighted average is one that takes account of varying degrees of importance. As gas demand is not static and more is used in the winter, when compared to the summer, the temperature has to be weighted as per the flow profile.

- Identifying a flow-weighted average temperature for external meter locations for each LDZ and Matrix Position from the previous temperature studies (using the same for internal and external meters if the study did not break these down);
- Calculating an Internal Meter Error Factor and an External Meter Error Factor, arising from the variances to 12.2°C (the temperature in the Thermal Regulations), for each LDZ and Matrix Position using the Ideal Gas Law;
- Allocating each Supply Meter Point to one of the following three categories based on the meter location code: Internal, External and Unknown;
- Determining the numbers of Supply Meter Points and the total AQ, for each LDZ, Matrix Position for:
  - Meters that have any correction equipment fitted;
  - Internal meters that do not have any correction equipment fitted;
  - External meters that do not have any correction equipment fitted; and
  - Unknown meter locations that do not have any correction equipment fitted.
- Splitting the unknown meter total AQ above, across the internal meter total AQ and the external meter total AQ in proportion to the internal meter number and the external meter number above, for each LDZ and Matrix Position;
- Determining the total AQ for internal meters as a proportion of the total AQ, and the total AQ for external meters as a proportion of the total AQ, for each LDZ and Matrix Position;
- Applying the AQ proportions to our Consumption Forecast for each LDZ and Matrix Position, to obtain a consumption forecast where the meter is internal; and a consumption forecast where the meter is external;
- Applying the Internal Meter Error Factor to the internal consumption forecast for each LDZ and Matrix Position; and the External Meter Error Factor to the external consumption forecast for each LDZ and Matrix Position; and
- Summing these two results for each LDZ and Matrix Position to derive an estimate of the UIG. Summing these across each LDZ to obtain the UIG by Matrix Position; and across Matrix Positions to get the overall UIG for this contributor.

Matrix Allocation

The UIG by Matrix Position is determined as part of the method for calculating the overall UIG for this contributor.

Assumptions

- The flow-weighted average gas temperatures from the temperature studies are the most appropriate estimate of the temperature of gas for the purposes of calculating UIG;

- The relative proportion of internal and external meters does not change materially year on year; and
- The proportion of Supply Meter Points that have temperature correction equipment installed does not change materially year on year.

METHODOLOGY DERIVATION AND RATIONALE

We reviewed the previous methodology and have replicated it with minor updates and enhancements.

Temperature Studies

Two studies were carried out in the early 2000s by BG Technology[35]. These calculated the temperature of the gas flowing through meters. One study was for domestic Supply Meter Points (Domestic Meters Temperature Study (DMTS)), while the other was for Industrial and Commercial Supply Meter Points (Industrial and Commercial Temperature Study (ICTS)).

The DMTS was split into two groups – one for meters located internally and the other for meters located externally. The ICTS meter locations were predominantly external.

We were not provided with the raw data from either study but did have access to the flow-weighted results of the surveys published in the previous Statement.

We decided to undertake our calculations broken down by EUC sub-bands to reflect the implementation of Modification 0711[36]. This meant that we did not need to estimate the proportion of domestic and I&C Supply Meter Points in EUC bands 01 and 02, as has been the case with previous Statements.

The vast majority of the meters within the ICTS were located externally. Therefore, we decided to use the DMTS for internal meters for the commercial sub-bands within EUC bands 01, 02 and 03, which was also the approach adopted for the previous Statement.

The table below shows which temperature study we used by Matrix Position.

		CLASS			
		1	2	3	4
EUC BAND	01BND	ICTS (DM)	ICTS (DM)	DMTS	DMTS
	01BPD	ICTS (DM)	ICTS (DM)	DMTS	DMTS
	01BNI	ICTS (DM)	ICTS (DM)	ICTS(S) E DMTS I[37]	ICTS(S) E DMTS I
	01BPI	ICTS (DM)	ICTS (DM)	ICTS(S) E DMTS I	ICTS(S) E DMTS I
	02BND	ICTS (DM)	ICTS (DM)	DMTS	DMTS
	02BPD	ICTS (DM)	ICTS (DM)	DMTS	DMTS
	02BNI	ICTS (DM)	ICTS (DM)	ICTS(S) E DMTS I	ICTS(S) E DMTS I
	02BPI	ICTS (DM)	ICTS (DM)	ICTS(S) E DMTS I	ICTS(S) E DMTS I
	03B	ICTS (DM)	ICTS (DM)	ICTS(S) E DMTS I	ICTS(S) E DMTS I
	04B	ICTS (DM)	ICTS (DM)	ICTS (L)	ICTS (L)
	05B	ICTS (DM)	ICTS (DM)	ICTS (L)	ICTS (L)

[35] Now part of DNV GL Group.
[36] UNC Modification 0711: "Update of AUG Table to reflect new EUC bands".
[37] (S) Small, (L) Large, E external, I internal.

	06B	ICTS (DM)	ICTS (DM)	ICTS (L)	ICTS (L)
	07B	ICTS (DM)	ICTS (DM)	ICTS (L)	ICTS (L)
	08B	ICTS (DM)	ICTS (DM)	ICTS (L)	ICTS (L)
	09B	ICTS (DM)	ICTS (DM)	ICTS (DM)	ICTS (DM)

The tables below show the flow-weighted average temperatures for each LDZ (in °C) contained within the studies that we decided to use in our methodology.

DMTS	Internal	External
EA	15.12	9.37
EM	13.70	9.11
NE	13.47	8.79
NO	13.19	8.50
NT	16.43	10.13
NW	13.07	9.01
SC	16.92	7.95
SE	16.10	10.16
SO	15.42	9.74
SW	13.56	9.53
WM	12.86	9.26
WN	12.60	9.33
WS	14.66	9.86

ICTS	Domestic (derived)	Small I&C	Large I&C	DM
EA	9.4	9.6	10.1	11.1
EM	10.1	10.1	10.9	12.1
NE	9.4	9.3	9.9	11.2
NO	9.0	8.8	9.4	10.5
NT	12.8	13.3	13.4	14.8
NW	9.7	9.7	10.4	11.4
SC	8.3	8.4	8.8	9.9
SE	10.7	11.2	11.5	13.0
SO	9.7	9.7	10.6	11.8
SW	10.1	10.1	11.0	12.1
WM	8.9	8.9	10.0	10.7
WN	9.0	9.0	9.9	10.7
WS	10.6	10.4	11.3	12.6

Internal/External Split

There are 35 location codes contained within the CDSP's UK Link system. We decided to split these into three categories: internal, external and unknown. Below is our assessment of each location code.

Code	Description	Assessment	Code	Description	Assessment
0	Unknown	Unknown	**18**	External WC	External
1	Cellar	Internal	**19**	Pantry	Internal
2	Under Stairs	Internal	**20**	Porch	External
3	Hall	Internal	**21**	Public Bar	Internal
4	Kitchen	Internal	**22**	Rear of Shop	Internal
5	Bathroom	Internal	**23**	Saloon Bar	Internal
6	Garage	External	**24**	Shed	External
7	Canteen	Internal	**25**	Shop Front	External
8	Cloakroom	Internal	**26**	Shop Window	Internal
9	Cupboard	Internal	**27**	Staff Room	Internal
10	Domestic Science	Internal	**28**	Store Room	Internal
11	Front Door	External	**29**	Toilet	Internal
12	Hall Cupboard	Internal	**30**	Under Counter	Internal
13	Kitchen Cupboard	Internal	**31**	Waiting Room	Internal
14	Kitchen under sink	Internal	**32**	Meter box (External)	External
15	Landing	Internal	**98**	Other	Unknown
16	Office	Internal	**99**	External	External
17	Office Cupboard	Internal			

From this assessment, we calculated the proportion of domestic Supply Meter Points with internal and external meters; and assumed the Supply Meter Points in the unknown category followed the same internal/external proportions.

Temperature Error Calculation

Our methodology calculates UIG as a positive number and so the formula that we decided to use for our calculation is:

$$\text{Temperature Error Factor} = \left(\frac{288.15}{(273.15 + \text{Temperature °C}) \times 1.0098}\right) - 1$$

This provides the error factor for the average temperature (in °C) of the gas being measured. At the Thermal Regulations temperature of 12.2°C, there is no error. At other temperatures there is error.

Matrix Allocation

Our methodology allocates UIG by LDZ and Matrix Position, taking into consideration the respective numbers of internal and external meters. The methodology adopted for the previous Statement was to determine the overall UIG and then allocate it across Matrix Positions based on AQs of sites without correction equipment.

The allocation in this latter methodology does not take into account the differing proportions of internal and external meters across Matrix Positions.

COVID Impact

COVID has impacted the pattern of gas usage with more people working from home than has previously been the case. It is possible that this has had an impact on the average temperature of gas flows, by altering the average time that gas sits in the various sections of pipes. There is insufficient data available to determine if there has been any such impact and so we did not make any adjustments for it.

CALCULATION

Inputs

- Flow-Weighted Gas Temperature studies from BG Technology;
- Meter Location report from the CDSP;
- Conversion Equipment Fitted report from the CDSP; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

The detailed calculation is described below.

Identify the temperature values to be used for each Matrix Position

1. Identify the flow-weighted average temperature for internal meters and for external meters for each LDZ Matrix Position using the relevant study (as per the table in the Temperature Studies section above). Where the relevant study does provide temperatures separately for internal and external meters, use the value it does provide for both the internal and external meters.

Calculate internal and external temperature error factors for each LDZ and Matrix Position

2. Calculate the internal and external temperature error factor for each LDZ and Matrix Position as follows, using the temperatures for these positions determined in step 1:

$$\text{Temperature Error Factor} = \left(\frac{288.15}{(273.15 + \text{Temperature °C}) \times 1.0098}\right) - 1$$

Call these the Internal Meter Error Factor and External Meter Error Factor, respectively.

Determine internal and external meter numbers and total AQs for each LDZ and Matrix Position

3. Allocate each Supply Meter Point to one of three categories, based on its meter location (as described in the Internal/External Split section above);
4. Determine the numbers of Supply Meter Points and the total AQ, for each LDZ, Matrix Position and:
    a. Meters that have any correction equipment fitted;
    b. Internal meters that do not have any correction equipment fitted;
    c. External meters that do not have any correction equipment fitted; and

   d. Unknown meter locations that do not have any correction equipment fitted.

5. Split the unknown meter total AQ above, across the internal meter total AQ and the external meter total AQ in proportion to the internal meter number and the external meter number above, for each LDZ and Matrix Position; and
6. Determine the total AQ for internal meters as a proportion of the total AQ, and the total AQ for external meters as a proportion of the total AQ, for each LDZ and Matrix Position;

Apply the internal and external error factors to the appropriate consumption values to determine the error for each LDZ and Matrix Position

7. Apply the AQ proportions to our Consumption Forecast for each LDZ and Matrix Position, to obtain a consumption forecast where the meter is internal; and a consumption forecast where the meter is external; and
8. Apply the Internal Meter Error Factor to the internal consumption forecast for each LDZ and Matrix Position; and the External Meter Error Factor to the external consumption forecast for each LDZ and Matrix Position.

Determine UIG

9. Sum the two values in step 8 to get the error (UIG) for each LDZ and Matrix Position;
10. Sum the results of step 9 across LDZs to obtain the UIG by Matrix Position; and
11. Sum the results of step 10 across Matrix Positions to obtain the overall UIG for this contributor.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

RESULTS

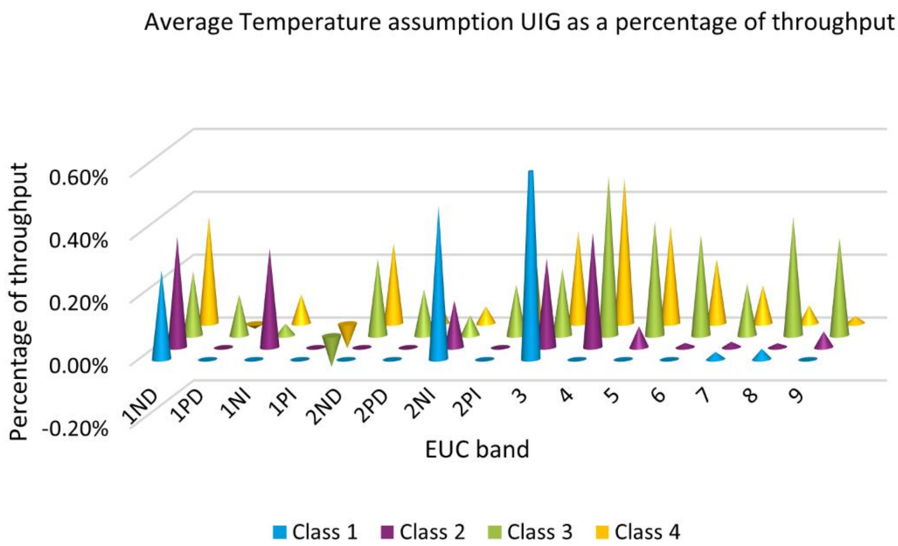
We have calculated the total estimated UIG associated with the average temperature assumption for the target Gas Year to be **1,263 GWh**.

This is broken down by Matrix Position as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	104	837
	1PD	0	0	1	-4
	1NI	0	0	1	10
	1PI	0	0	0	0
	2ND	0	0	1	11
	2PD	0	0	0	0
	2NI	0	0	6	8
	2PI	0	0	0	0
	3	0	0	22	31
	4	0	0	48	66
	5	0	0	18	36
	6	0	0	8	22
	7	0	1	4	11
	8	1	1	4	9
	9	0	2	1	0

There are some Matrix Positions that create negative UIG[38]. This is due to those positions having a higher proportion of meters that are internal, where the temperature of the gas is higher (on average) than the 12.2°C in the Thermal Regulations.

The graph below shows UIG as a percentage of throughput for each Matrix Position:



[38] Notwithstanding that all but one of these round to zero GWh in the table below.

NOTABLE OBSERVATIONS

Comparison to Previous Statement

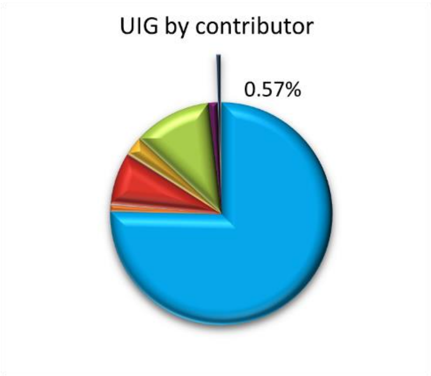
The previous Statement quantified the UIG for this contributor to be 555 GWh (compared to our quantification of 1,263 GWh).

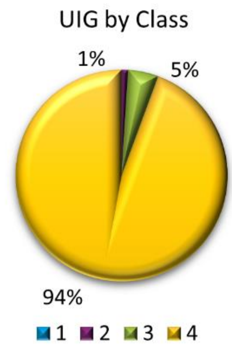
The magnitude of this difference is slightly surprising given the relatively modest differences in the methodologies used for quantifying the overall UIG associated with this contributor. We have not been provided with access to the detail of the calculation used for the previous Statement and therefore cannot explain this further.

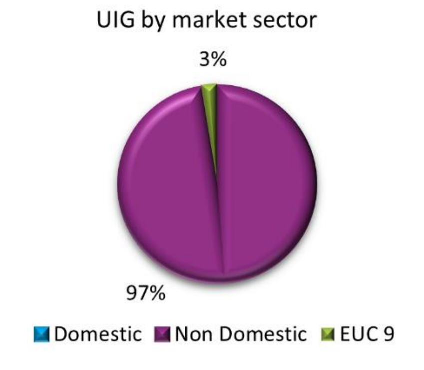
The difference in the allocation across Matrix Positions is due to the different methodologies used to do this (as explained in the Methodology Derivation and Rationale section).

100 – INCORRECT CORRECTION FACTORS

DASHBOARD







DESCRIPTION

Settlement Context

Meters are designed to measure at a standard pressure of 1 atmosphere at Mean Sea Level and a standard temperature of 15°C. Any variances from this results in an inaccuracy in the measurement.

There is a small number of meters that have correction equipment fitted and dynamically adjust for this according to the actual atmospheric pressure and temperature of the gas. They provide volumes that are consistent with the standard atmospheric pressure and temperature. These are typically high-capacity meters. The vast majority of meters do not have this correction equipment fitted.

In addition, there are some meters for which a location dependent Specific Correction Factor[39] is applied to the advance between two meter readings as part of the Settlement calculations. These factors are designed to adjust for variances from standard pressure and the standard temperature of gas, and take into consideration the meter's location, the inlet pressure and the compressibility. They ensure that the volume processed in Settlement is more consistent with the standard pressure and temperature. This occurs for Supply Meter Points that typically use over 732,000 kWh.

The remaining set of meters have a Standard Correction Factor applied to the advance between two meter readings as part of the Settlement calculations. This factor is also designed to adjust for variances from the standard pressure and standard temperature of gas, but it is not location specific and so does not achieve this as well as Specific Correction Factors.

Some Supply Meter Points are large enough to require either meters with correction equipment fitted or the application of Specific Correction Factors in Settlement. However, some of these are settled on the basis of Standard Correction Factors. In other cases, an incorrect Specific Correction Factor is applied in Settlement. In both situations, the consequential inaccuracy in the measurements results in UIG.

[39] Also known as Conversion Factor.

Definition

This contributor relates to meters that over or under-record the amount of gas consumed at Supply Meter Points with AQs greater than 732,000 kWh as a result of the Correction Factor being incorrect.

For the purposes of quantifying UIG associated with this, only the following cases are considered:

- The Supply Meter Point has an AQ of more than 732,000 kWh;
- The meter does not have correction equipment fitted; and
- A Standard Correction Factor is used in Settlement; or a Specific Correction Factor is used in Settlement that is less than the lowest value possible in GB[40].

For the avoidance of doubt, this contributor does not consider errors arising from other types of incorrect Specific Correction Factors. Nor does it consider any errors that occur due to variances from the standard atmospheric pressure or temperature of the gas (assuming a correct Correction Factor is applied). These are considered as part of the Average Pressure Assumption (070) and Average Temperature Assumption (080) contributors, respectively.

UIG Impact

If the Correction Factor used in Settlement is lower than it should be, the measured volume will be less than the amount of gas consumed. This will create positive UIG.

Conversely, if the Correction Factor used in Settlement is higher than it should be, the measured volume will be more than the amount of gas consumed. This will create negative UIG.

There is no means of correcting for this in Settlement and so such UIG remains at the Line in the Sand.

METHODOLOGY

UIG Forecast

The UIG associated with this contributor for the target Gas Year is established by:

- Determining an average Specific Correction Factor for Supply Meter Points with an AQ greater than 732,000 kWh that use a Specific Correction Factor and do not have a meter with correction equipment fitted, for each LDZ and Matrix Position;
- Determining a Correction Error Factor[LM41] for each LDZ and Matrix Position as the difference between the average Specific Correction Factor and the Standard Correction Factor;
- Determining the proportion of Supply Meter Points with an AQ greater than 732,000 kWh that use a Specific Correction Factor and do not have meters with correction equipment fitted, for each LDZ and Matrix Position;

[40] A Correction Factor of 0.995088 corresponds to a Mean Sea Level altitude (assuming a typical inlet pressure of 21 mbar and compressibility of 1).

[41] This represents the difference between the average Correction Factor for the Matrix Position and the Standard Correction Factor actually applied.

- Determining the error due to incorrect use of Standard Correction Factors, for each LDZ and Matrix Position as the product of: the proportion (determined above), the Correction Error Factor^{LM} (determined above) and our Consumption Forecast for these Matrix Positions (described in Section 4 of this Statement);
- Determining a Correction Error Factor^{SP}[42] as the difference between the lowest feasible Correction Factor (0.995088) and the actual Specific Correction Factor, for each Supply Meter Point:
  - With an AQ greater than 732,000 kWh;
  - That does not have a meter with correction equipment fitted; and
  - Has a Specific Correction Factor less than the value of 0.995088; and
- Determining the error due to unfeasibly low Specific Correction Factors, for each LDZ and Matrix Position as: the sum across Supply Meter Points, of the product of: the Correction Error Factor^{SP} (determined above) and the AQ associated with the Supply Meter Point.

Assumptions

- The Specific Correction Factors are correct for all Supply Meter Points with an AQ greater than 732,000 kWh which are not unfeasibly low (i.e. are more than 0.995088);
- The proportion of Supply Meter Points with correction equipment fitted will not change before the target Gas Year;
- The proportion of Supply Meter Points using the Standard Correction Factor will not change before the target Gas Year;
- The number of Supply Meter Points that will update their Correction Factors before the end of the target Gas Year is negligible;
- The Supply Meter Points with unfeasibly low Specific Correction Factors (less than 0.995088) will not have these factors updated before the target Gas Year; and
- The AQ of Supply Meter Points with an unfeasibly low Specific Correction Factor is a reasonable estimate of consumption for the target Gas Year.

METHODOLOGY DERIVATION AND RATIONALE

We reviewed the methods used in previous years to quantify this contributor. Our assessment was that the methods were reasonable but that there was scope for a small number of improvements, which we applied. These are:

[42] This represents the difference between the Specific Correction Factor for the Supply Meter Point and the lowest feasible Correction Factor.

- We considered the altitude error not fully addressed by Standard Correction Factors as part of the Average Pressure Assumption (070) contributor. Accordingly, we excluded altitude error from our assessment of this contributor so that it wasn't double counted;
- We included the effect of Specific Correction Factors that were less than the lowest feasible value; and
- We calculated an average Specific Correction Factor for each LDZ and Matrix Position and differenced this from the Standard Correction Factor to determine the error associated with the use of Standard Correction Factors instead of Specific Correction Factors. Previously, this average was calculated nationally.

COVID Impact

UNC Modification 0681S[43] was implemented in July 2020. This resulted in Supply Meter Points having their Standard Correction Factor replaced with the Specific Correction Factor previously used for them (if one was previously used). Our data was obtained after this had concluded so that our analysis and results were reflective of it.

CALCULATION

The detailed calculation is described below.

Inputs

- Correction Factors report from the CDSP;
- Conversion Equipment Fitted report from the CDSP; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

Determine average Specific and Standard Correction Factors for each LDZ and Matrix Position

1. Identify all Supply Meter Points with an AQ greater than 732,000 kWh that have a Standard Correction Factor and do not have a meter with correction equipment fitted;
2. Identify all Supply Meter Points with an AQ greater than 732,000 kWh that have a Specific Correction Factor and do not have a meter with correction equipment fitted;
3. Identify all Supply Meter Points with an AQ greater than 732,000 kWh that have a meter with correction equipment fitted;
4. Determine an average Standard Correction Factor and an average Specific Correction Factor for those Supply Meter Points in step 1 and 2, respectively, for each LDZ and Matrix Position. Where there are no Supply Meter Points upon which to base an average for a LDZ and Matrix Position, use the national average for the Matrix Position; where there are still no Supply Meter Points upon which to base an average, use the national Class average;

[43] UNC Modification 0681S: "Improvements to the quality of the Conversion Factor values held on the Supply Point Register".

Calculate Altitude-Adjusted Standard Correction Factor for each LDZ

5. For each LDZ, calculate the Altitude-Adjusted Standard Correction Factor based on the average altitude within that LDZ[44] and an assumed pressure of 21 mbar (using the Thermal Regulations).

Calculate the Correction Error Factor^{LM} for each LDZ and Matrix Position

6. Determine Correction Error Factor^{LM} as the Average Specific Correction Factor (from step 4) less the Altitude-Adjusted Standard Correction Factor (from step 5), for each LDZ and Matrix Position.

Determine the error due to the incorrect use of Standard Correction Factors, for each LDZ and Matrix Position

7. Determine the AQ proportion of Supply Meter Points with an AQ greater than 732,000 kWh that use a Specific Correction Factor and do not have meters with correction equipment fitted (from steps 1, 2 and 3), for each LDZ and Matrix Position; and
8. Determine the error for each LDZ and Matrix Position as the product of: the proportion (from step 7), the Correction Error Factor^{LM} (from step 6) and our Consumption Forecast for these Matrix Positions.

Identify Supply Meter Points with an unfeasibly low Specific Correction Factor

9. Identify all Supply Meter Points with an AQ greater than 732,000 kWh that have a Specific Correction Factor below 0.995088 and do not have a meter with correction equipment fitted.

Calculate the Correction Error Factor^{SP} for each LDZ and Matrix Position

10. For each Supply Meter Point identified in step 9, determine Correction Error Factor^{SP} as: 0.995088 less its Specific Correction Factor.

Determine the error due to unfeasibly low Specific Correction Factors, for each LDZ and Matrix Position

11. Determine the error associated with each Supply Meter Point determined in step 9 as the product of: the Correction Error Factor^{SP} (from step 10) and the AQ for the Supply Meter Point; and
12. Sum the Supply Meter Point errors (from step 11) for each LDZ and Matrix Position.

Determine the UIG at the Line in the Sand for each Matrix Position

13. Sum the values in steps 8 and 12 to obtain error (UIG) for each LDZ and Matrix Position;
14. Sum the results of step 13 across LDZs to obtain the UIG by Matrix Position; and
15. Sum the results of step 14 across Matrix Positions to obtain the overall UIG for this contributor.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

RESULTS

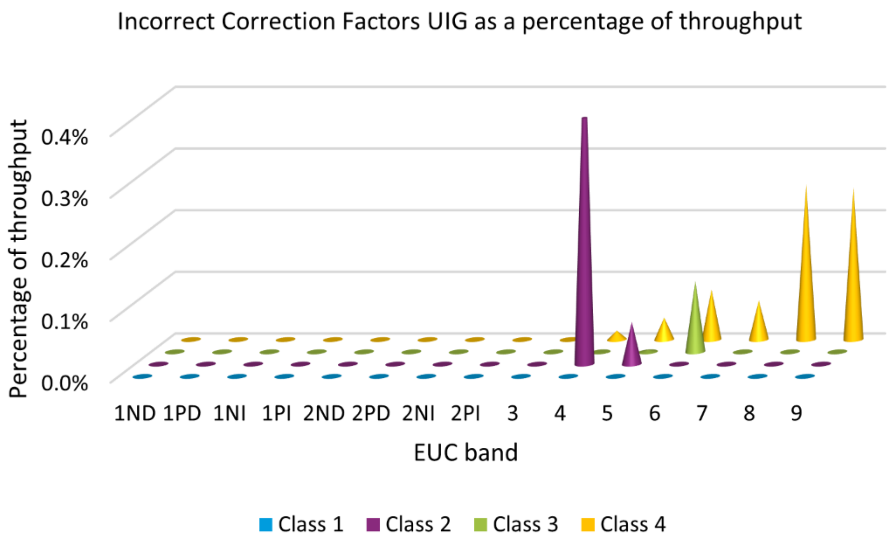
The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **64 GWh,** comprising 63.18 GWh due to incorrect (but feasible) Correction Factors and 414 MWh due to unfeasibly low Correction Factors.

[44] See Average Pressure Assumption (070) contributor for more details on average LDZ altitudes.

This is allocated across Matrix Positions as follows:

		CLASS			
		1	2	3	4
EUC BAND	1ND	0	0	0	0
	1PD	0	0	0	0
	1NI	0	0	0	0
	1PI	0	0	0	0
	2ND	0	0	0	0
	2PD	0	0	0	0
	2NI	0	0	0	0
	2PI	0	0	0	0
	3	0	0	0	0
	4	0	0	0	2
	5	0	0	0	4
	6	0	0	3	9
	7	0	0	0	6
	8	0	0	0	37
	9	0	0	0	2

The graph below shows UIG as a percentage of throughput for each Matrix Position:



NOTABLE OBSERVATIONS

Comparison to Previous Statement

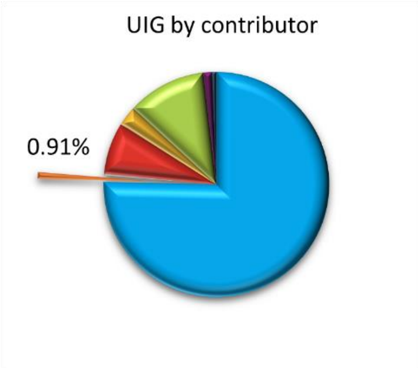
The previous Statement quantified the UIG for this contributor to be 32 GWh (compared to our quantification of 64 GWh).

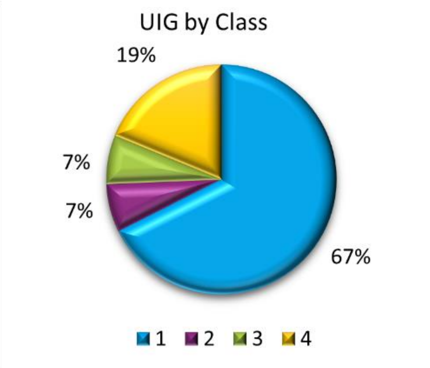
This difference is because we:

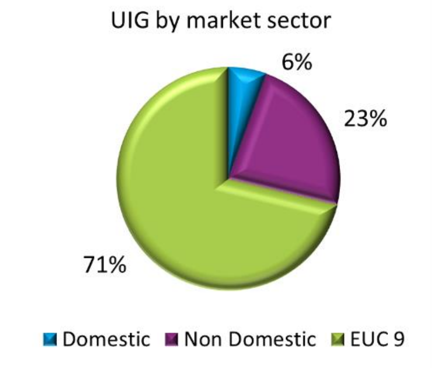
- Excluded the altitude error not fully addressed by the Standard Correction Factor, to avoid it being double counted (as it is already quantified in the Average Pressure Assumption (070) contributor), whereas this was previously included; and
- Calculated an average Specific Correction Factor for each LDZ and Matrix Position in our determination of the error associated with the use of Standard Correction Factors instead of Specific Correction Factors, whereas this average was previously calculated nationally.

020 – UNREGISTERED SITES

DASHBOARD







DESCRIPTION

Settlement Context

For gas consumed at a Supply Meter Point to be correctly allocated in the Settlement process, the Supply Meter Point must be registered to a Shipper in the UK Link central industry database.

If this is not the case, any gas consumed at the Supply Meter Point will not be directly allocated to a Shipper and will instead contribute to UIG. Unregistered Sites are the sub-set of these Supply Meter Points that have never been registered to a Shipper.

There are several industry processes to identify such Unregistered Sites. This is so the CDSP can back bill the appropriate Shipper for the gas consumed before the Line in the Sand is reached. There are circumstances where the CDSP cannot do this. In these cases, the UIG remains at the Line in the Sand.

Definition

This contributor relates to Supply Meter Points that have never been registered to a Shipper but where gas is being consumed.

There are situations where Supply Meter Points are not registered to a Shipper but have been at some point in the past. These can also create UIG but are not considered here. They are dealt with under the Shipperless Sites (025) contributor instead.

It is also worth noting that there are several situations where Supply Meter Points are legitimately unregistered, such as when new premises have been built and the service has yet to be physically installed. These do not create UIG as they do not consume any gas.

The cases considered as part of this contributor are Supply Meter Points that:

- Have never had a Shipper registered; and
- Are consuming gas.

UIG Impact

Gas consumed at such Unregistered Sites creates positive UIG. If this is not identified and accounted for in time, this UIG remains at the Line in the Sand.

METHODOLOGY

UIG Forecast

The UIG associated with this contributor for the target Gas Year is determined by:

- Using trend analysis to forecast the number of Supply Meter Points per main EUC band that will consume gas whilst they are unregistered (as defined above) in the target Gas Year, along with the sum of their AQs;
- Using trend analysis to forecast the number of these Supply Meter Points that are legitimately unregistered and discounting these from the dataset;
- Using trend analysis to forecast the number of remaining Supply Meter Points that will be registered to a Shipper and be capable of being back billed (thereby eliminating the associated UIG) before the Line in the Sand occurs for the target Gas Year and discounting these from the dataset; and
- Determining the UIG per main EUC band at the Line in the Sand for the target Gas Year by applying a national annual load profile to the sum of the AQs per main EUC band in the residual dataset.

Matrix Allocation

The forecast UIG for each main EUC band is split across the associated Matrix Positions, in proportion to the consumption for these Matrix Positions in our Consumption Forecast for the target Gas Year.

Assumptions

- The back bill rules are applied to Unregistered Sites as per modification 0410V[45]; and
- The Unregistered Site AQ is a sound indication of the future consumption of the relevant Supply Meter Point.

METHODOLOGY DERIVATION AND RATIONALE

We reviewed the methods used in previous years to quantify this contributor. Our assessment was that the methods were reasonable but that there was scope for a small number of improvements, which we applied. These are as follows:

- We rationalised certain aspects of the methodology to focus on the residual UIG at the Line in the Sand;

[45] UNC Modification 0410V: "Responsibility for gas off-taken at Unregistered Sites following New Network Connections".

- We found that there were too few Supply Meter Points to undertake statistically valid trend analysis by LDZ. There is no inherent reason this contributor should vary materially by LDZ, so we adopted a more robust statistical approach and undertook our trend analysis at a national level;

- We found positive trends using the most recent three years' data and so did not consider earlier, less representative, data;

- We determined the proportion of legitimate Unregistered Sites and the proportion of Supply Meter Points that could be back billed, dynamically, to reflect current trends, rather than using fixed proportions that have been used historically; and

- We processed EUC band 09 in our calculations in the same way as other EUC bands. In the past EUC band 09 was treated differently, with any Unregistered Sites in EUC band 09 being spread over EUC bands 02-08. This was on the basis that extreme and incorrect AQs for Unregistered Sites could have incorrectly led to these being placed in EUC band 09. We validated that this was not the case for Unregistered Sites in EUC band 09 in the source datasets that were used for our trend analysis.

COVID Impact

We also considered the impact COVID could have had on the integrity of the inputs to our calculations. We considered the possibility of Shipper staff working below normal capacity leading to fewer business processes being undertaken and fewer data flows. However, upon further investigation we identified no material impact on data flow volumes and so made no COVID-related adjustments for this contributor.

CALCULATION

Inputs

- Orphaned Sites report from the CDSP;

- Legitimate Unregistered Sites Details report from the CDSP;

- Connection Details for Orphaned Sites report from the CDSP;

- Annual Load Profiles for the West Midlands (WM) LDZ from the CDSP, aggregated to monthly level, as a proxy for the national profile; and

- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

The detailed calculation is described below.

Forecast the number of Supply Meter Points that have never been registered to a Shipper and have an indication of meter activity (suggesting the meter is consuming) along with the sum of their AQ, for each month in the target Gas Year

1. For each successive month's Orphaned Sites report over the last three years, identify the number of:
    a. Supply Meter Points and the sum of their AQ per main EUC band;

b. Supply Meter Points added to the report (compared to the previous month) and the sum of their AQ per main EUC band; and

c. Supply Meter Points removed[46] from the report (compared to the previous month) and the sum of their AQ per main EUC band; and

2. From step 1, forecast the number of Supply Meter Points and the sum of their AQ for each main EUC band that will meet the criteria for being on the Orphaned Sites report for each month of the target Gas Year. This is the base dataset to take forward.

Determine composition of records removed because they were deemed to be legitimate

3. Using the Legitimate Unregistered Site Details reports, determine the percentage of the removed Supply Meter Points identified in the last two years in step 1.c that are due to those Supply Meter Points being deemed to be legitimate. Do this for each main EUC band;
4. Note that the remainder of removed Supply Meter Points are due to registration by a Shipper.

Adjust the dataset to remove those that are legitimate

5. Adjust the dataset in step 2 by removing the percentage of Supply Meter Points determined in step 3.

Determine the composition of those removed because they were registered by a Shipper

6. Using Connection Details for Orphaned Sites reports from the last two years, determine the percentage of removed Supply Meter Points in step 1.c that are not legitimate (as determined in step 3) and that can be back billed. Do this for each main EUC band. The Supply Meter Points that can be back billed are those that are registered by the Shipper that first requested the Supply Meter Point, where the meter reading at the effective point of this registration is zero;
7. Note that the remainder of the removed Supply Meter Points cannot be back billed and create UIG at the Line in the Sand.

Adjust the dataset to remove those that are back billed

8. Adjust the dataset created in step 5 by removing the percentage of Supply Meter Points determined in step 6.

Determine the UIG at the Line in the Sand for each sub-EUC band

9. Note that the dataset in step 8 now represents the number of Supply Meter Points, broken down by main EUC band, that are forecast to create UIG at the Line in the Sand for each month in the target Gas Year, along with the sum of their AQs;
10. Sum the product of these monthly AQs and the respective month's annual load profile for the West Midlands LDZ, over the target Gas Year, for each main EUC band, to determine the UIG for each of these EUC bands over the target Gas Year;
11. Split these annual UIG values for each main EUC band into the respective Matrix Positions. Use the annual ratio of consumption in these Matrix Positions in our Consumption Forecast of the target Gas Year to do this; and

[46] These are likely either to have been registered by Xoserve or a Shipper, or confirmed to be legitimate Unregistered Sites.

12. Sum these values across Matrix Positions to get the overall UIG for this contributor for the target Gas Year.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

RESULTS

The forecast UIG associated with this contributor at the Line in the Sand for the target Gas year is: **101 GWh**.

This is attributable across the main EUC bands as follows[47]:

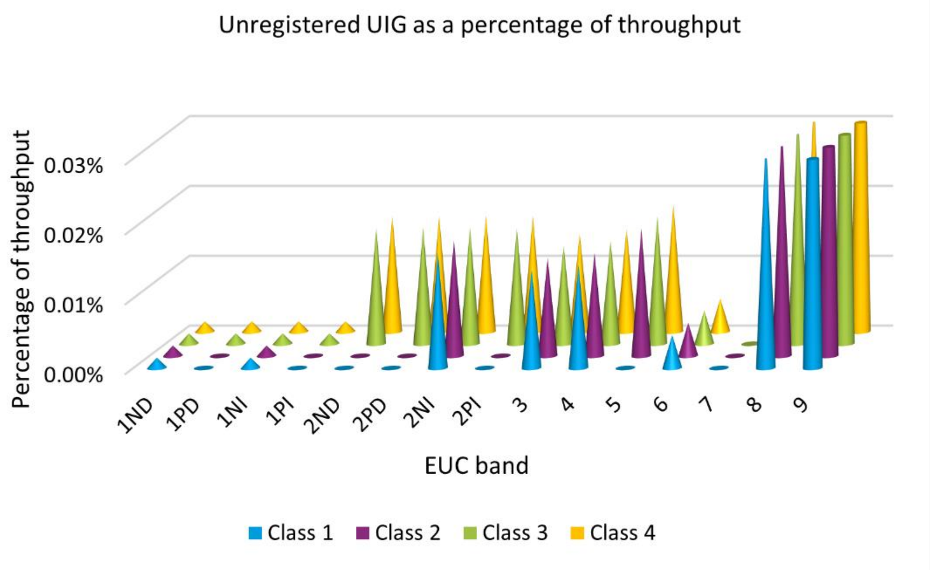
EUC	Unregistered UIG
1	5
2	5
3	3
4	4
5	3
6	1
7	-
8	9
9	72
Total	101

It is further broken down[48] across the sub-EUC bands as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	1	4
	1PD	0	0	0	0
	1NI	0	0	0	0
	1PI	0	0	0	0
	2ND	0	0	0	1
	2PD	0	0	0	0
	2NI	0	0	2	2
	2PI	0	0	0	0
	3	0	0	1	1
	4	0	0	1	2
	5	0	0	1	2
	6	0	0	0	1
	7	0	0	0	0
	8	1	3	0	5
	9	68	4	0	1

[47] Note that due to rounding the sum of the individual EUC totals does not match the total.
[48] Note that due to rounding the sub-EUC band values in aggregate may not equal main EUC band values.

The graph below shows UIG as a percentage of throughput for each Matrix Position:

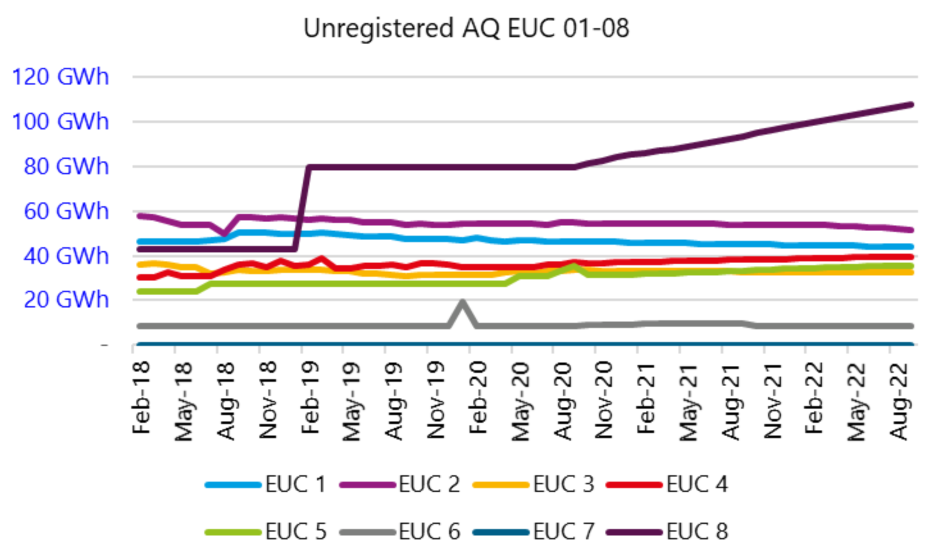


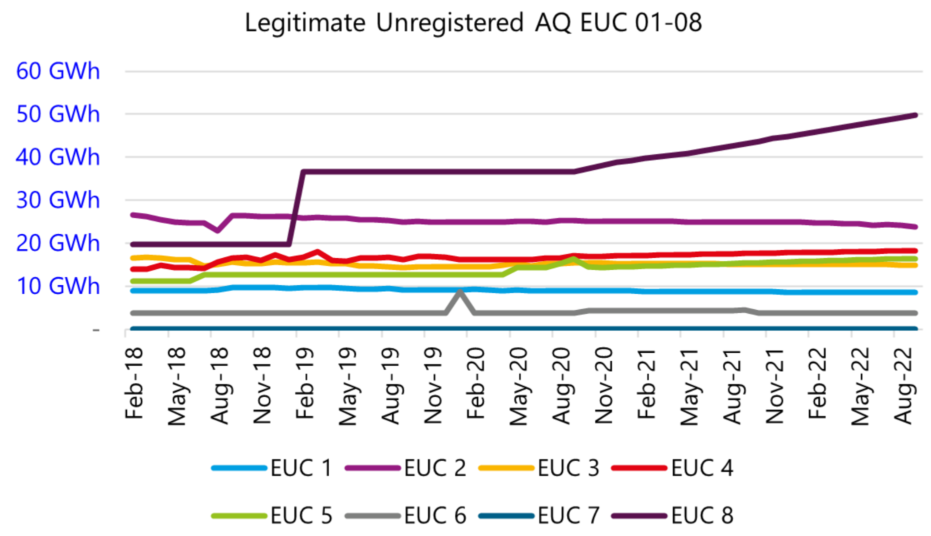
NOTABLE OBSERVATIONS

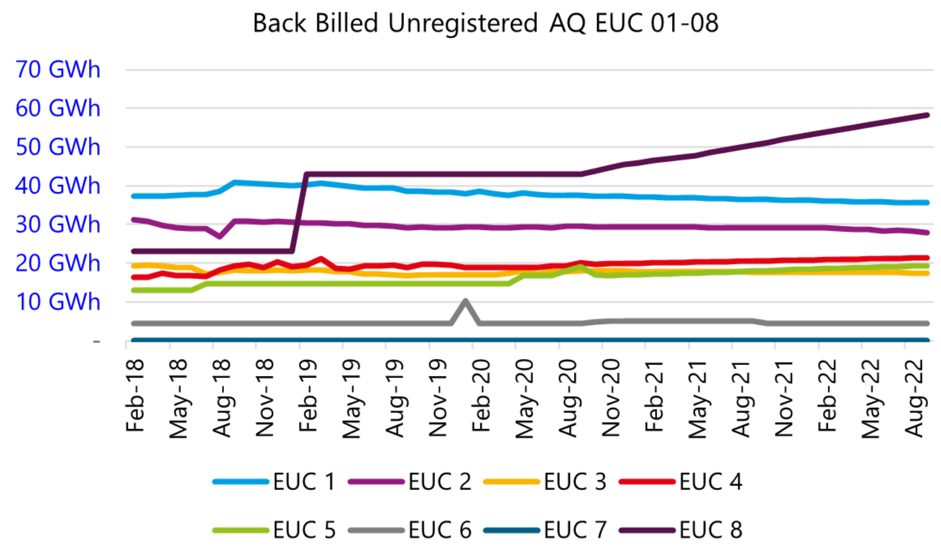
Trends Observed

The three graphs below show the trends and forecasts relevant to the methodology and determined in step 1 of the calculation. These are the total AQ associated with:

- Unregistered Sites that have never had a Shipper and where there is indication of meter activity (suggesting that the meter is consuming);
- The Supply Meter Points that became or will become legitimately unregistered; and
- The remaining Supply Meter Points that were or will be back billed.







The trends have been reasonably static over the last few years, with the exception of EUC band 08. This has only a small number of Supply Meter Points in the underlying data, each with a relatively large AQ. Consequently, its trend is sensitive to small variations in the underlying data.

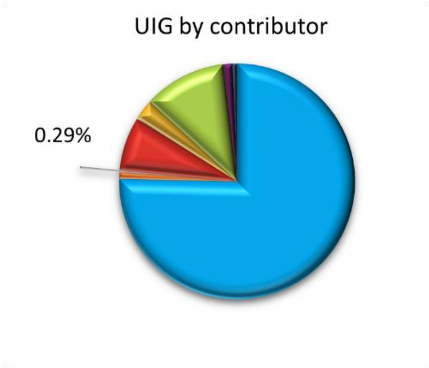
Comparison to Previous Statement

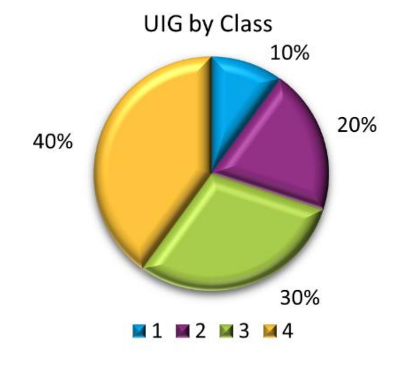
The previous Statement quantified the UIG for this contributor as 2.2 GWh (compared to our much higher quantification of 101 GWh). There would not appear to be any material change in the underlying volume of consumption at Unregistered Sites. However, our analysis considers far fewer of these cases to be legitimate Unregistered Sites, which gives rise to a larger amount of UIG.

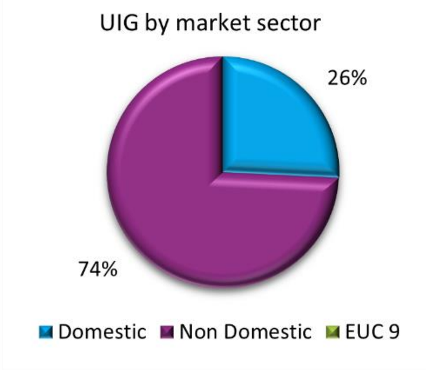
We also note that most of the variance is due to the different way EUC band 09 is treated in the respective methodologies (as described in the Methodology Derivation and Rationale section above).

025 – SHIPPERLESS SITES

DASHBOARD







DESCRIPTION

Settlement Context

For gas consumed at a Supply Meter Point to be correctly allocated in the Settlement process, the Supply Meter Point must be registered to a Shipper in the UK Link central industry database.

If this is not the case, any gas consumed at the Supply Meter Point will not be directly allocated to a Shipper and will instead contribute to UIG. Shipperless Sites are the sub-set of these Supply Meter Points that have been registered to a Shipper at some point in the past.

Supply Meter Points are left without a Shipper when the registered Shipper records the meter as being removed and the supply isolated in the central industry UK Link system and withdraws from the registration. It is in situations where the supply has not actually been isolated that the issue of Shipperless Sites occurs. Such issues are often identified during the relevant Transporter's Gas Safety Regulations (GSR) visit which happens approximately 12 months after an isolation has been recorded.

If the same meter is found on site (and the supply is not isolated), the Supply Meter Point is "Passed to Shipper" (PTS), defined as a PTS Shipperless Site, and the previous Shipper is asked to register it using the reading at the recorded isolation date. This ensures that all the consumption can be accounted for. If the Shipper fails to do this and the recorded isolation date is after 1st April 2013, the CDSP re-registers it to the previous Shipper, using the reading at the recorded isolation date.

If a different meter is found on site (and the supply is not isolated), the Supply Meter Point is defined as a "Shipper Specific rePort (SSrP) Shipperless Site" and is reported to all Shippers, so that the relevant Shipper can register it using a reading that is reflective of the point in time that they should have registered it (so that all the consumption they are liable for can be accounted for).

UIG created after the recorded isolation date is back billed if the next Shipper registration uses the meter reading at this recorded isolation date. Otherwise, the UIG created between the recorded isolation date and the date of the meter reading used in the next Shipper registration cannot be back billed and remains in place at the Line in the Sand.

Definition

This contributor relates to Supply Meter Points that are not currently registered to a Shipper but have been at some point in the past, where gas is also being consumed.

There are situations where Supply Meter Points have never been registered to a Shipper. These can also create UIG but are not considered here. These are dealt with under the Unregistered Sites (020) contributor instead.

The cases considered as part of this contributor are Supply Meter Points that:

- Have no Shipper currently registered;
- Have had a Shipper registered at some point in the past; and
- Are consuming gas.

UIG Impact

Gas consumed at such Shipperless Sites creates positive UIG. If this is not identified and accounted for in time, this UIG remains at the Line in the Sand.

METHODOLOGY

UIG Forecast

The UIG associated with this contributor for the target Gas Year is determined by:

- Using trend analysis to forecast the number of Supply Meter Points per main EUC band that will consume gas whilst they are Shipperless (PTS and SSrP as defined in the Settlement Context section above) in the target Gas Year, along with the sum of their AQs;
- Using trend analysis to forecast the number of these Supply Meter Points that are found to be data errors rather than Shipperless Sites, and discounting these from the dataset;
- Using trend analysis to forecast the number of remaining Supply Meter Points that will be registered to a Shipper and back billed (thereby eliminating the associated UIG), before the Line in the Sand occurs for the target Gas Year, and discounting these from the dataset; and
- Determining the UIG per main EUC band at the Line in the Sand for the target Gas Year by applying a national annual load profile to the sum of the AQs per main EUC band in the residual dataset.

Matrix Allocation

The forecast UIG for each main EUC band is split across the associated Matrix Positions, in proportion to the consumption for these Matrix Positions in our Consumption Forecast for the target Gas Year.

Assumptions

- The back bill rules are applied to PTS Shipperless Sites as per Modification 0424[49] and SSrP sites as per Modification 0425V[50];
- The consumption for Shipperless Sites (where the supply is not isolated) is consistent with their AQ before they became Shipperless;
- The domestic/non-domestic status of Shipperless Sites (where the supply is not isolated) is the same as it was before they became Shipperless; and
- SSrP Shipperless Sites were not shipperless prior to the new meter being installed.

METHODOLOGY DERIVATION AND RATIONALE

We reviewed the methods used in previous years to quantify this contributor. Our assessment was that the methods were reasonable but that there was scope for a small number of improvements, which we applied. These are as follows:

- We rationalised certain aspects of the methodology to focus on the residual UIG at the Line in the Sand;
- We found that there were too few Supply Meter Points to undertake a statistically valid trend analysis by LDZ. There is no inherent reason this contributor should vary materially by LDZ, so we adopted a more robust statistical approach and undertook our trend analysis at a national level;
- We found positive trends using the most recent three years' data and so did not consider earlier, less representative data; and
- We determined the proportion of these Supply Meter Points that (upon investigation) are found to be data errors (rather than Shipperless Sites), dynamically, to reflect current trends, rather than using fixed proportions that have been used historically.

COVID Impact

We also considered the impact COVID could have had on the integrity of the inputs to our calculations. We considered the possibility of Shipper staff working below normal capacity leading to fewer business processes being undertaken and fewer data flows. However, upon further investigation we identified no material impact on data flow volumes and so made no COVID-related adjustments for this contributor.

CALCULATION

Inputs

- Shipperless Sites PTS report from the CDSP;

[49] UNC Modification 0424: "Re-establishment of Supply Meter Points – prospective measures to address shipperless sites".
[50] UNC Modification 0425V: "Re-establishment of Supply Meter Points – Shipperless sites".

- Shipperless Sites SSrP report from the CDSP;
- Connection Details for Shipperless Sites report from the CDSP;
- Annual Load Profiles for the West Midlands (WM) LDZ from the CDSP, aggregated to monthly level, as a proxy for the national profile; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

The detailed calculation is described below.

Forecast the number of PTS Shipperless Sites for each main EUC band, along with the sum of their AQ, for each month in the target Gas Year

1. For each successive month's Shipperless Sites PTS report over the last three years, identify:
    a. The number of Supply Meter Points isolated before 1st April 2013 and the sum of their AQ for each main EUC band; and
    b. The number of Supply Meter Points removed[51] from the report (compared to the previous month's report) and the sum of their AQ for each main EUC band; and
2. From step 1, forecast the number of Supply Meter Points and the sum of their AQ for each main EUC band that will meet the criteria for being on the Shipperless Sites PTS report for each month in the target Gas Year.

Calculate the proportion of these that will not subsequently be back billed

3. Determine the Supply Meter Points that appear on the Shipperless Sites PTS report two years ago and do not appear on the latest Shipperless Sites PTS report;
4. From these, determine those that were not back billed and were not confirmed to be non-issues. This is the set that appear on a Connection Details for Shipperless Sites report (indicating that they have now been registered) with a different read to the isolation date read (indicating that consumption whilst they were Shipperless was not corrected for); and
5. Determine the number that were not back billed and not confirmed to be non-issues (from step 4) as a proportion of those of those that were removed from the Shipperless Sites PTS report over the last two years (from step 3).

Forecast the UIG for each main EUC band in the target Gas Year, that is due to PTS Shipperless Sites

6. Apply the proportion of PTS Shipperless Sites determined in step 5 to the forecast of total AQ of PTS Shipperless Sites for each month in the target Gas Year (from step 2), for each main EUC band; and
7. Sum the product of these monthly total AQs and the respective month's annual load profile for the West Midlands LDZ, over the target Gas Year, for each main EUC band, to determine the UIG due to PTS Shipperless Sites for each of these EUC bands over the target Gas Year.

[51] These are likely either to have been registered by a Shipper or by Xoserve on behalf of a Shipper.

Forecast the number of SSrP Shipperless Sites for each main EUC band, along with the sum of their AQ, for each month in the target Gas Year

8. For each successive month's Shipperless Sites SSrP report over the last three years, identify the number of:
    a. Supply Meter Points and the sum of their AQ for each main EUC band; and
    b. Supply Meter Points removed from the report (compared to the previous month) and the sum of their AQ for each main EUC band; and
    c. Supply Meter Points added to the report (compared to the previous month) and the sum of their AQ for each main EUC band; and
9. From step 8, forecast the number of Supply Meter Points and the sum of their AQ for each main EUC band that will meet the criteria for being on the Shipperless Sites SSrP report for each month in the target Gas Year.

Calculate the proportion of these that will not subsequently be back billed

10. Determine the Supply Meter Points that have been removed from a Shipperless Sites SSrP report over the last two years by comparing successive months' reports;
11. From these, determine those that were not back billed and were not confirmed to be non-issues. This is the set that appear on a Connection Details for Shipperless Sites report (and so have now been registered) with a non-zero read (indicating that consumption whilst they were Shipperless was not accounted for); and
12. Determine the number that were not back billed and not confirmed to be non-issues (from step 11) as a proportion of those of those that were removed from Shipperless Sites PTS reports over the last two years (from step 10).

Forecast the UIG for each main EUC band in the target Gas Year, that is due to SSrP Shipperless Sites

13. Apply the proportion of SSrP Shipperless Sites determined in step 12 to the forecast of total AQ of SSrP Shipperless Sites for each month in the target Gas Year (from step 9), for each main EUC band;
14. Sum the product of these monthly total AQs and the respective month's annual load profile for the West Midlands LDZ, over the target Gas Year, for each main EUC band, to determine the UIG due to SSrP Shipperless Sites for each of these EUC bands over the target Gas Year.

Determine the UIG at the Line in the Sand for each Matrix Position

15. Sum the forecast PTS UIG in the target Gas Year (from step 7) and the forecast SSrP UIG in the target Gas Year (from step 14) to get the total UIG by main EUC band;
16. Split these annual UIG values for each main EUC band into the respective Matrix Positions. Use the annual ratio of consumption in these Matrix Positions in our Consumption Forecast of the target Gas Year to do this; and
17. Sum these values across Matrix Positions to get the overall UIG for this contributor for the target Gas Year.

Output

Forecast UIG values for the target Gas Year, at Line in the Sand, for this contributor, by Matrix Position.

RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **32 GWh,** comprising 4 GWh due to PTS Shipperless Sites and 28 GWh due to SSrP Shipperless Sites.

This is broken down by main EUC band as follows:

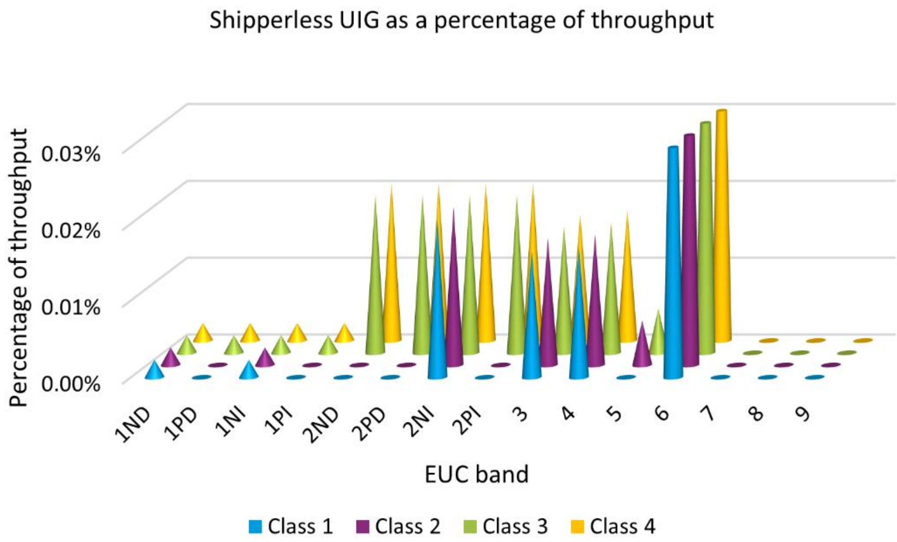
EUC	PTS	SSrP	Total
1	1	7	8
2	1	5	6
3	0	3	3
4	1	3	4
5		1	1
6		10	10
7			-
8			0
9			0
Total	4	28	32

It is further broken down[52] across the sub-EUC bands as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	1	6
	1PD	0	0	0	0
	1NI	0	0	0	0
	1PI	0	0	0	0
	2ND	0	0	0	1
	2PD	0	0	0	0
	2NI	0	0	2	3
	2PI	0	0	0	0
	3	0	0	2	2
	4	0	0	2	2
	5	0	0	0	1
	6	0	2	2	7
	7	0	0	0	0
	8	0	0	0	0
	9	0	0	0	0

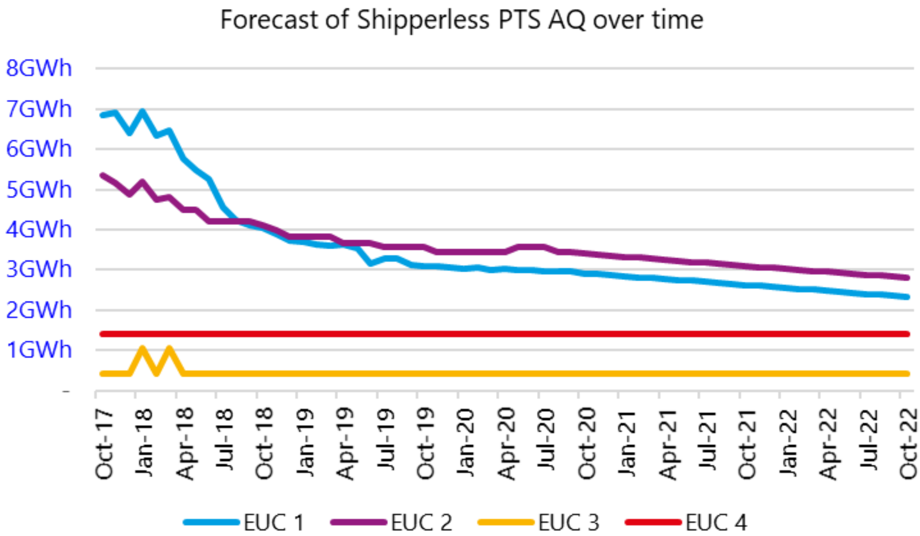
[52] Note that due to rounding the sub-EUC band values in aggregate may not equal main EUC band values.

The graph below shows UIG as a percentage of throughput for each Matrix Position:

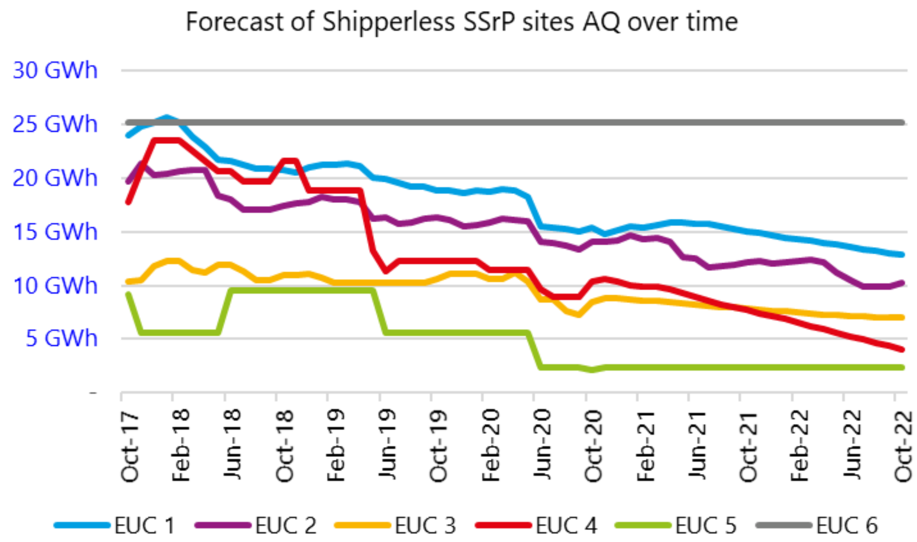


NOTABLE OBSERVATIONS

The graph below shows the annual consumption associated with PTS Shipperless Sites. This reflects the numbers arising from steps 1 and 2 in the calculation.



The graph below shows the annual consumption associated with SSrP Shipperless Sites. This reflects the numbers arising from steps 8 and 9 in the calculation.

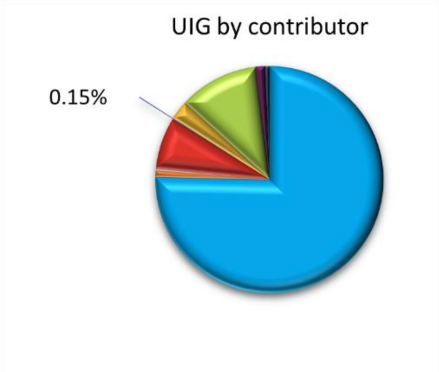


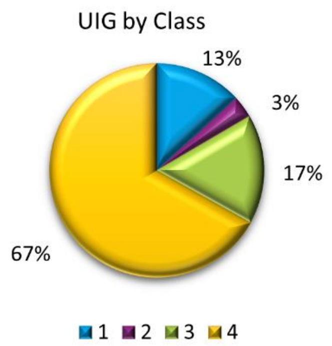
Comparison to Previous Statement

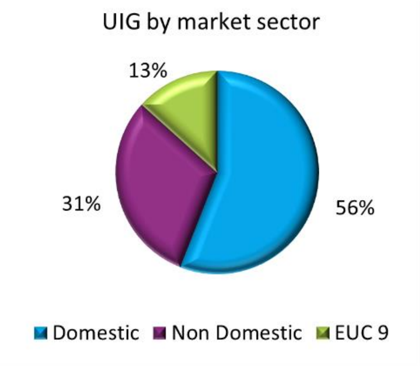
The previous Statement quantified the UIG for this contributor to be 29 GWh (compared to our quantification of 32 GWh). This is reflective of the fact that the methodologies used are very similar.

060 - IGT SHRINKAGE

DASHBOARD







DESCRIPTION

Settlement Context

Shrinkage is any gas that the gas network loses during transportation. There are three different areas of shrinkage: NTS shrinkage, LDZ shrinkage and IGT shrinkage.

NTS shrinkage does not affect Settlement as its inputs (and therefore the outputs) are external to the Settlement regime. LDZ shrinkage is quantified using an industry-approved methodology and engineering model, and this quantity is directly accounted for in Settlement. This means that such LDZ shrinkage does not contribute to UIG (other than by virtue of any error in its quantification). LDZ shrinkage is explicitly outside of the AUGE remit and, as such, we do not consider it further here.

Independent Gas Transporters Arrangements Document (IGTAD), Section C, governs IGT Shrinkage. It is not directly accounted for in Settlement. Instead, it contributes to (and is accounted for via) UIG.

Definition

This contributor relates only to IGT shrinkage. This is any gas lost during transportation between entering the IGT network and the ECV of Supply Meter Points.

UIG Impact

IGT shrinkage is not directly accounted for in Settlement and therefore creates positive UIG.

METHODOLOGY

UIG Forecast

The UIG associated with this contributor for the target Gas Year is determined by:

- Estimating the length of IGT mains in each LDZ for the target Gas Year, based on a forecast number of Supply Meter Points (from trend analysis) and the average length of main per Supply Meter Point (from the Independent Gas Networks Association);

- Forecasting the associated leakage volume for these IGT mains by applying the leakage rate for polyethylene (PE) mains (from the National Leakage Test (NLT) programme) by the forecast lengths of IGT main; and
- Converting these leakage volumes into energy values using the LDZ Calorific Value (CV).

Matrix Allocation

The forecast IGT shrinkage UIG for each LDZ is split across the EUC bands and Classes, in proportion to the consumption for the EUC bands and Classes in our Consumption Forecast for the target Gas Year. We then sum these LDZ values to get a national value for each Matrix Position.

Assumptions

- IGT shrinkage will not be accounted for in Settlement before the target Gas Year is over (for example, due to ongoing evaluation in IGTAD meetings);
- All IGT mains are PE and there is no leakage from existing services connected to PE mains;
- All IGT shrinkage is due to leakage. That is, gas lost in the purging of new mains and services, own use gas and network theft of gas can all be ignored for the purposes of quantifying IGT shrinkage;
- The main leaks at the same rate whether it is located at the start or end of a network; and
- The current average length of main per Supply Meter Point will be the same for the target Gas Year and will be the same across LDZs.

METHODOLOGY DERIVATION AND RATIONALE

The previous Statement used a network engineering model to quantify IGT shrinkage. This was only available to us under licence at a cost of circa £30,000 p.a. We judged that, given the relative scale of this contributor, it would not be cost effective for the industry to fund this licence.

Instead, we concluded that an approach that quantified the length of IGT main and applied the appropriate leakage rate(s) would be a suitable basis for quantifying IGT shrinkage.

We considered that using trend analysis to determine the number of Supply Meter Points in each IGT network would be reasonable; and that this could be used alongside the actual length of main per Supply Meter Point per IGT (obtained directly from IGTs) to determine the length of main in each IGT network. Unfortunately, IGTs were not able to provide these values this year and so we used a single value, based on anecdotal information. We hope to use bespoke average main lengths from IGTs in future years.

IGTs suggested that IGT mains leakage rates are lower than the average values provided in the NLT programme undertaken in 2002-2003. However, they were not able to provide any information to substantiate this, so we chose to retain the values from the national survey.

The methodology for quantifying shrinkage in previous years included a shrinkage reduction factor, determined from reductions in LDZ shrinkage. This assumed that the observed reductions in shrinkage in LDZ networks also occurs in IGT networks. However, we did not consider this a reasonable assumption as much of the shrinkage reduction in LDZ networks is due to old mains being replaced by PE mains. This does not apply to IGT networks as they are exclusively PE mains already.

COVID Impact

Finally, we considered the impact COVID could have had on the integrity of our methodology. It is likely that COVID has had an impact on the number of new build properties and therefore on the number of new Supply Meter Points. The source data behind our market growth trend included data to June 2020 and therefore will reflect the change rate of new Supply Meter Points to a limited extent.

It is not clear how COVID will impact housebuilding between now and the end of the target Gas Year and so we concluded that the limited extent to which the rate change was already reflected in our source data was a reasonable way to reflect the impact of COVID on this contributor. Consequently, we did not include any further COVID-related adjustments.

CALCULATION

Inputs

- Average Main Length provided by IGTs;
- IGT Sites report from the CDSP;
- NLT leakage rates from the public domain. This provides the leakage rates for each type of main and service;
- CV from National Grid's data explorer. Latest CVs for each LDZ for each Gas Day from 1st October 2018 to 30th September 2020; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

The detailed calculation is described below.

Identify the current number of Supply Meter Points by LDZ on IGT networks

1. Using CDSP records, determine total IGT Supply Meter Points in each LDZ.

Use historical trends to forecast the number of IGT Supply Meter Points for the target year

2. Use a snapshot of CDSP records at two appropriate points in history and compare to today's records to determine historic growth trends in IGT Supply Meter Points for each LDZ.
3. Project this growth trend to the target Gas Year to forecast the total IGT Supply Meter Points for each LDZ for 1st April 2022 (as a mid-year average).

Calculate the total IGT main length per LDZ

4. Multiply the average length of main per Supply Meter Point by the forecast total number of Supply Meter Points per LDZ from step 3.

Calculate the total annual leakage volume in IGT networks per LDZ

5. Multiply the total length of IGT mains from step 4 by the annual leakage rate for PE mains, as per the national leakage survey.

For each LDZ, calculate average CV

6. Calculate the mean CV per LDZ based on the values for the two most recent complete Gas Years.

Calculate the total UIG associated with IGT shrinkage for each LDZ for the target Gas Year

7. Multiply the total annual leakage volume from step 5 by the average CV from step 6.
8. Divide the resulting value by 3.6 to derive an energy value in kWh.

Determine the UIG at the Line in the Sand for each sub-EUC band

9. For each LDZ, split the UIG value across each sub-EUC band and Class by using the annual ratio of consumption in those sub-EUC bands and Classes for that LDZ in our Consumption Forecast of the target Gas Year.
10. Sum all UIG values to determine the national UIG value for this contributor.

Output

Forecast UIG values for the target Gas Year, at the Line in the Sand, by Matrix Position.

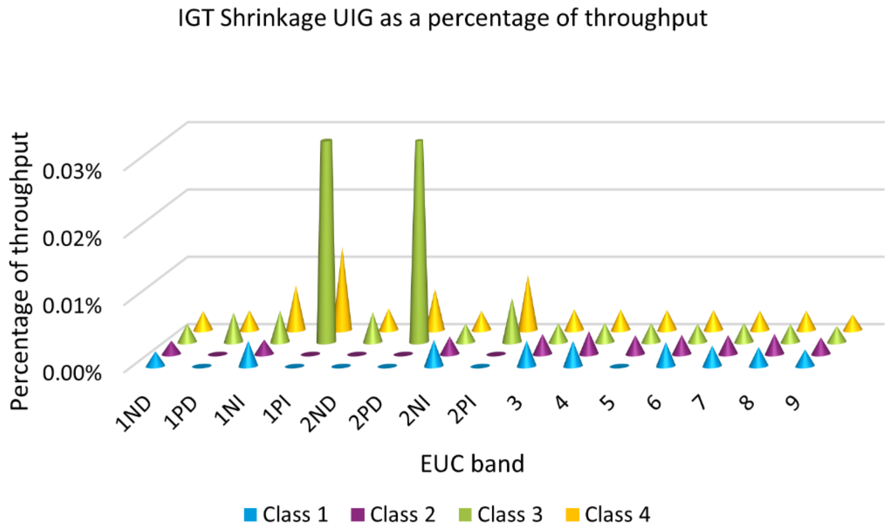
RESULTS

The UIG calculated for the target Gas Year is **16 GWh**.

This is broken down by Matrix Position as follows:

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	1	7
	1PD	0	0	0	1
	1NI	0	0	0	1
	1PI	0	0	0	0
	2ND	0	0	0	0
	2PD	0	0	0	0
	2NI	0	0	0	0
	2PI	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0
	5	0	0	0	0
	6	0	0	0	0
	7	0	0	0	0
	8	0	0	0	0
	9	2	0	0	0

The graph below shows UIG as a percentage of throughput for each Matrix Position:



NOTABLE OBSERVATIONS

Comparison to Previous Statement

The previous Statement quantified the UIG for this contributor as 11.4 GWh (compared to our quantification of 16 GWh).

The variation is due to the different average main length, the growth in the number of IGT Supply Meter Points, the forecast consumption for the target Gas Year and the fact that we did not reduce the forecast IGT shrinkage in line with the reduction trends in LDZ shrinkage.

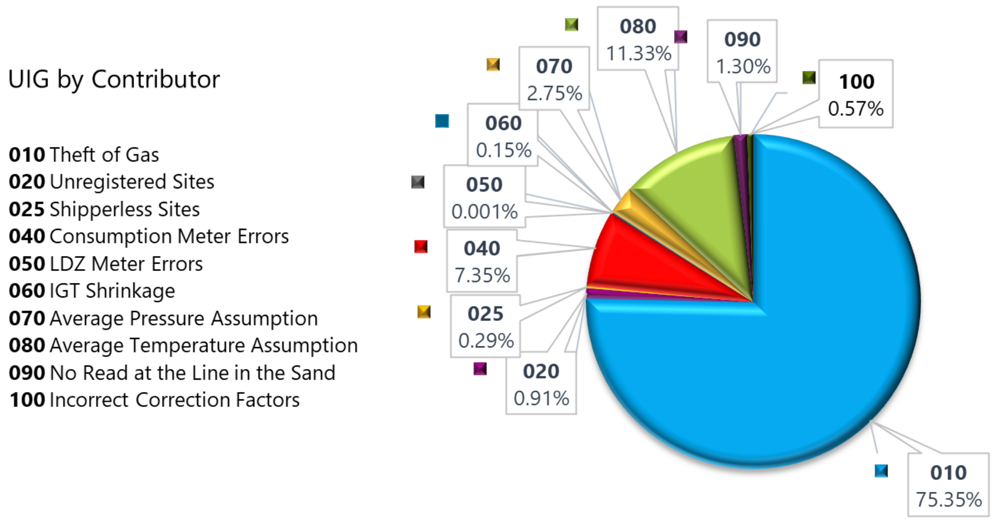
7 Results

UIG

We quantified UIG to be **11,143 GWh**, across the ten contributors we considered, at the Line in the Sand for the target Gas Year. This compares to 7,846 GWh in the previous Statement.

UIG BY CONTRIBUTOR

This 11,143 GWh of UIG is broken down across the ten contributors as shown in the diagram and table[53] below. The table also provides a comparison against the values from the previous Statement, along with an indication of the material movements up or down.



Contributor	Related UIG Volume (GWh)	Previous AUGE (GWh)	Change
Theft of Gas	8,396	7,159	↑
Average Temperature Assumption	1,263	555	↑
Consumption Meter Errors	819	25	↑
Average Pressure Assumption	307	55.3	↑
No Read at the Line in the Sand	144	-	↑
Unregistered Sites	101	2.2	↑
Incorrect Correction Factors	64	32	↑
Shipperless Sites	32	29	→
IGT Shrinkage	16	11.4	↑
LDZ Meter Errors	0	-	→
Total UIG	**11,143**	**7,846**	↑

[53] Note that due to rounding the individual contributor values in aggregate may not equal total contributor values.

Theft of Gas (010) remains by far the largest single contributor to UIG. Average Temperature Assumption (080), Consumption Meter Errors (040) and Average Pressure Assumption (070) have all increased substantially since the last Statement, and now each make a significant contribution. Other contributors have also increased in general, but still remain relatively minor.

UIG BY MATRIX POSITION

The 11,143 GWh of UIG we quantified across the ten contributors is allocated across Matrix Positions as shown in the table[54] below.

		CLASS			
		1	2	3	4
EUC BAND	**1ND**	0	0	773	4,417
	1PD	-	-	14	1,156
	1NI	0	0	407	1,491
	1PI	-	-	0	15
	2ND	-	-	19	216
	2PD	-	-	0	5
	2NI	0	0	306	429
	2PI	-	-	0	0
	3	0	0	159	174
	4	0	1	163	240
	5	-	4	71	166
	6	0	26	36	155
	7	3	33	26	117
	8	8	64	12	174
	9	239	16	2	4

COMPARISON TO OBSERVED LEVELS OF UIG

We compared our results with a forecast of UIG for the target Gas Year, based on observed levels of UIG since June 2017. This was for benchmarking purposes only. The method we used to do this is described below along with our assessment of the comparison.

Inputs

The following datasets were used to forecast total UIG at the Line in the Sand in the target Gas Year:

- UIG values at allocation from the Throughput report from the CDSP;
- UGR values from the Monthly Reconciliation and Offline Adjustment reports from the CDSP;

[54] Note that due to rounding the individual Matrix Position values in aggregate may not equal total value. Zeros are rounded values. Dashes are where the Matrix Position is forecast to be empty.

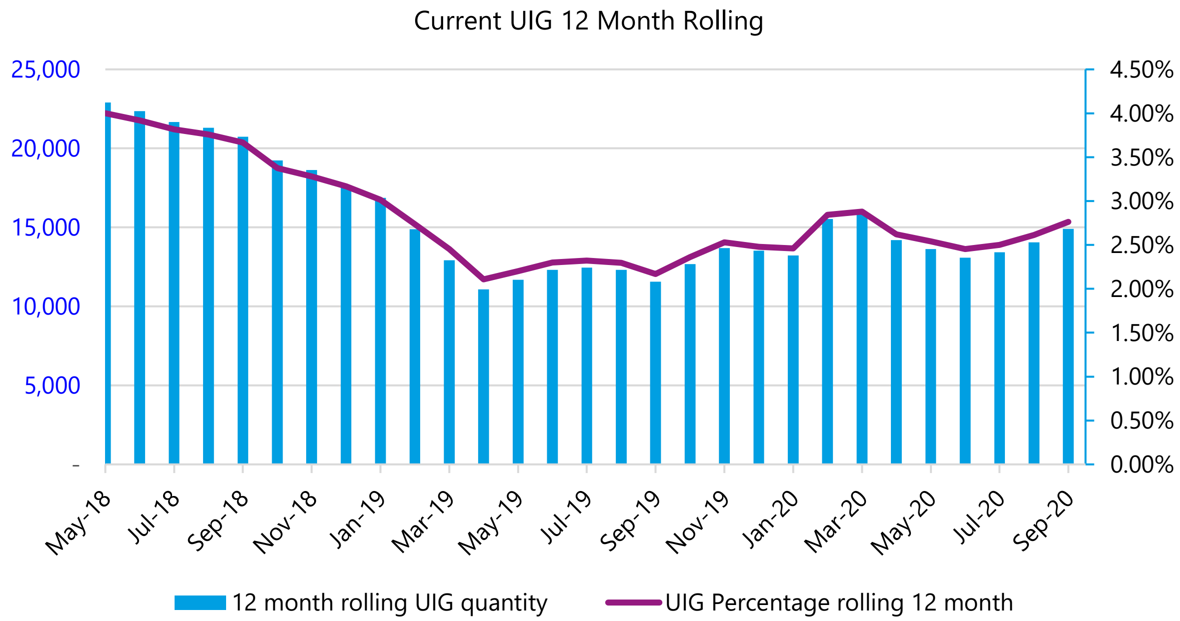
- Total throughput values from the Throughput report from the CDSP; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

Calculation

We combined the UIG allocation values with the UGR values to calculate a best view of the current UIG position by supply month for each month since June 2017. We converted this to a percentage UIG for each month by dividing by the throughput.

We then determined a 12-month rolling average percentage of the best view UIG.

Results



The graph shown above provides the output of the analysis. Over the latest 18 months, the average 12 month rolling UIG percentage is 2.47%.

We considered the fact that more recent months were less reconciled than earlier months and undertook sensitivity analysis on this by looking at earlier months that were further through their reconciliation process. This did not change the average 12-month rolling UIG percentage materially. From this we concluded that 2.47% was an appropriate value to use for benchmarking purposes.

Using this 2.47% and our Consumption Forecast, we calculated a benchmark UIG for the target Gas Year as 14,109 GWh.

Comparison of Results

Our quantification of UIG, based on the ten contributors we considered, is circa 79% of the benchmark UIG we forecast for the target Gas Year. This suggests that there is a proportion of UIG that, as yet, has an unknown cause.

We anticipate that many of these causes will be identified and the UIG associated with them will be quantified in future AUG years.

8 Weighting Factor Determination

WEIGHTING FACTOR CALCULATION

We calculated the Weighting Factors as a proportion of UIG relative to throughput in our Consumption Forecast for each Matrix Position within the AUG Table.

We then scaled these factors around the average of all Matrix Positions and multiplied them by 100. We did this to normalise the factors, without altering their relative values, so that the value will be comparable year on year. This approach means that:

- A Matrix Position with an average UIG to throughput ratio has a Weighting Factor of 100;
- A Matrix Position with a higher-than-average UIG to throughput ratio has a Weighting Factor greater than 100;
- A Matrix Position with a lower-than-average UIG to throughput ratio has a Weighting Factor lower than 100.

Within the matrix, some positions had zero consumption in our Consumption Forecast; other positions had a consumption based on a forecast of a very small number of Supply Meter Points. For these positions, we determined the factors would not be statistically sound and that they required adjustment on a case-by-case basis.

Accordingly, we made the following updates to the AUG Table, using our reasoned judgement:

- For Class 1 and Class 2 EUC bands 01ND, 01PD, 01PI and 02ND, 02PD, 02PI Matrix Positions, we used the Weighting Factor from the nearest Class that was not itself subject to an adjustment;
- For each of the following Class and EUC band Matrix Position combinations (considered separately), we combined the UIG and total throughput in order to calculate a single Weighting Factor and applied this to the respective combinations:
  - Class 1; all EUC bands except those sub-bands listed above;
  - Class 3 and 4; EUC bands 02NI and 02PI;
  - Class 3; EUC bands 02ND and 02PD; and
  - Class 4; EUC bands 02ND and 02PD.

We then normalised the factors once more by scaling them around the revised average of all Matrix Positions and multiplying by 100.

SMOOTHING

We judged it unreasonable for adjacent Matrix Positions, representing Supply Meter Points with similar characteristics, to have significantly different Weighting Factors. We therefore smoothed Weighting Factors across these positions.

We assessed various methods to undertake this smoothing and judged that the method that provided the most reasonable results was to set these Weighting Factors to the average of the relevant Matrix Position and the average of the surrounding Matrix Positions.

We considered that adjacent Matrix Positions in Class 2, 3 and 4 and EUC bands 03-09 represent Supply Meter Points with similar characteristics and so applied the smoothing algorithm to these.

Once again, we normalised the factors by scaling them around the revised average of all Matrix Positions and multiplying by 100.

9 AUG Table

The draft AUG Table for the 2021-2022 Gas Year is shown below:

		CLASS			
		1	2	3	4
EUC BAND	1ND	53.76	53.76	53.76	63.48
	1PD	97.39	97.39	97.39	190.93
	1NI	10.20	508.78	496.53	518.99
	1PI	791.19	791.19	791.19	1298.17
	2ND	141.85	142.18	141.85	170.80
	2PD	92.60	92.60	141.85	170.80
	2NI	10.20	102.11	108.27	108.27
	2PI	15.06	15.06	108.27	108.27
	3	10.20	55.27	57.22	58.24
	4	10.20	60.88	57.69	57.27
	5	10.20	47.13	51.87	52.51
	6	10.20	40.31	48.58	49.09
	7	10.20	36.29	39.96	44.58
	8	10.20	28.04	34.72	37.34
	9	10.20	20.80	25.49	27.41

These numbers have been normalised around an average of 100 so that they are comparable year on year. This does not impact the relative proportions in any way. For this reason, whilst the relative numbers are comparable with previous Statements, the absolute numbers are not.

10 Glossary

ALP – Annual Load Profile. A measure used for demand attribution, AQ and opening read estimation purposes.

AQ – Annual Quantity. The estimated annual seasonal normal consumption of a Supply Meter Point based on historical consumption.

AUGE – Allocation of Unidentified Gas Expert. The party appointed by the CDSP to develop an AUGS and calculate a table of Weighting Factors, which are used to share out daily Unidentified Gas.

AUGS or Statement – Allocation of Unidentified Gas Statement. The document describing the process followed by the AUGE to determine the AUG Table of Weighting Factors.

AUG Table – the table containing the Weighting Factors for each Matrix Position.

Back Billing – A charge made to reflect an adjustment to the energy values in a previous Settlement period.

BEIS – Department for Business, Energy and Industrial Strategy. The government department responsible for the energy industry.

CDSP – Central Data Services Provider (Xoserve). The party appointed by the Transporters to operate central gas industry functions including Settlement and Supply Point registration and the billing of Shippers for these services.

Class – Categories into which gas end consumers are divided based on their AQ, the frequency of reads provided and Settlement arrangements. Often referred to as "Product Class".

CMS – Contact Management System. A secure two-way communication system used by the CDSP and industry parties for operational and invoicing contacts.

Consumption Forecast – Our estimate of gas consumption in the 2021-2022 Gas Year.

Correction Factor – Used to convert measured gas volumes (m^3) to volumes in Standard Cubic Metres. This takes account of differences in temperature and pressure at the meter. See also Standard Correction Factor.

COVID – Covid-19. A disease (SARS-CoV-2) caused by a virus. An ongoing pandemic.

CV – Calorific Value. The amount in energy (MJ) in a cubic meter of gas as defined in the UNC.

DCC – Data Communications Company. The holder of the DCC Licence for the operation of the smart meter communications network.

DNO – Distribution Network Operator. The owner or operator of one or more LDZs.

DSC – Data Services Contract. The contract between industry parties and the CDSP.

ECV – Emergency Control Valve. An isolation valve that denotes the point where the network connects the Supply Meter Point.

Energy UK – The trade association for the GB energy industry with over 100 members spanning every aspect of the energy sector.

ETTOS – Energy Theft Tip-Off Service. A service allowing tip-offs regarding suspected energy theft, received from the general public, to be sent to the relevant Supplier, Transporter or IGT for investigation.

EUC Band – End User Category Band. A category of Supply Meter Points based on factors such as AQ.

EUC Main Band – EUC bands 01 to 09.

Fiscal Theft – A type of theft restricted to pre-payment meters, where the meter is interfered with so that no payment is made to the Supplier, but gas is still recorded by that meter as being consumed. Fiscal theft does not contribute to UIG at Line in the Sand.

Gas Year – 1st October to 30th September.

GSR – Gas Safety (Installation and Use) Regulations 1998 (GSIUR).

IGT – Independent Gas Transporter.

IGTAD – Independent Gas Transporters Arrangements Document. The document which sets out the rights and obligations between DNOs and IGTs in relation to the connections between their respective networks and is the basis of implementation of certain provisions of the UNC in relation to CSEPs.

IST – In-Service Testing. A national sampling scheme for gas and electricity meters run by the OPSS, designed to ensure that only meters that operate within the prescribed limits of accuracy are used for consumer billing.

LDZ – Local Distribution Zone. A pipeline system owned or operated by a DNO, covering a defined area for which the total gas input and consumption demand can be measured each day. There are 18 of these, which between them cover the total land area of Great Britain.

Line in the Sand – Gas Settlement Cut-Off (defined more fully in the No Read at Line in the Sand (090) contributor). It is the point in time that Settlement is closed off for a Gas Day with no further reconciliations being made. It is three to four years after the Gas Day.

Matrix Position – A sub-EUC band and Class cell within the AUG Table.

MID – Measuring Instruments Directive. A directive of the European Parliament and Council harmonising the laws of EU member states in relation to the making available on the market of measuring instruments.

Modification – A proposal for a change in the UNC, overseen by the Modification Panel.

Must Read – A read procured by a Transporter when the Shipper has not obtained a valid read.

National Grid NTS – The owner and operator of the NTS.

NDM – Non-Daily Metered. A Supply Point in Class 3 or 4.

NTS – National Transmission System. The network owned and operated by National Grid NTS which is connected to the LDZs owned or operated by the DNOs.

Ofgem – The regulator for Gas and Electricity energy markets in Great Britain.

OPSS – Office for Product Safety and Standards. Part of the Department for Business, Energy and Industrial Strategy.

PAFA – Performance Assurance Framework Administrator. The party appointed by the CDSP to determine the levels of performance of specific LDZ Settlement-related obligations by the CDSP, DNOs and Shippers.

PE – Polyethylene. A material that most modern gas pipes are made of.

Pre-Payment Meter – A meter where payment for the gas consumed is made on a pay as you go basis.

PTS – Passed to Shipper.

REC – Retail Energy Code. The proposed industry code designed to govern the new switching arrangements, as well as amalgamating and updating the governance of existing gas and electricity retail arrangements.

Seasonal Normal – Gas demand expected under normal weather conditions for the relevant time of year.

Settlement – The combined term for the nomination, allocation and reconciliation processes.

Shipper – An industry party which has title to and causes gas to be delivered to Supply Meter Points on the network and which is liable for certain charges in relation to the Transporters' provision of this service and for related services provided by the CDSP.

Shipperless Site – A Supply Meter Point that is currently unregistered but was previously registered to a Shipper.

Shrinkage – Gas lost from the network as a result of leakage, own use gas or theft.

Smart Meter – A meter which allows the remote provision of meter reads in accordance with the Smart Metering Equipment Technical Specifications.

Specific Correction Factor – A specific correction for a Supply Meter Point with an AQ greater than 732,000 kWh calculated based on the thermal regulations, the altitude, the inlet pressure and the compressibility.

SSrP – Shipper Specific rePort.

Standard Atmosphere – A pressure of 1.01325 bar.

Standard Correction Factor – The correction factor applied to all sites with a rolling AQ of less than 732,000 kWh (1.02264).

Standard Cubic Meter – Is a cubic meter of gas at a temperature of 15C and at a pressure of one Standard Atmosphere.

Sub-EUC Band – The EUC bands including the 8 bands in EUC 01 and 02 which were implemented in October 2019 as a result of Modification 0711.

Supplier – An industry party which provides gas to end consumers and bills them for this. This is often, but not always, the same party which acts as the Shipper and provides the gas to the Supplier at the ECV. The two functions are performed under different licences issued by Ofgem.

Supply Meter Point – A metered exit point from an LDZ or IGT network that supplies gas to an end consumer.

Supply Point Register – A register of all Supply Meter Points and Supply Point premises that is maintained by the CDSP.

Target Gas Year – The Gas Year that the Weighting Factors will be applicable. For this statement it is the Gas Year 2021-2022.

Thermal Regulations – The Gas (Calculation of Thermal Energy) Regulations 1996.

Throughput – The amount of gas that flows within a defined period.

Throughput Extremes – The minimum and maximum capacity of a meter.

TOG – Theft of Gas. A regime provided by the CDSP that utilises a contact management system (CMS) to address theft. It mandates an investigation by the Shipper or DNO to determine the amount of theft and the period over which it took place, and includes an adjustment being made in Settlement such that the stolen gas is attributed to the correct Shipper.

Transporter – National Grid NTS or a DNO.

TRAS – Theft Risk Assessment Service. A service placing a requirement on Suppliers to submit defined data items for the purposes of assessing the risk of energy theft at consumer premises to help target theft investigations.

UGR – Unidentified Gas Reconciliation. The equal and opposite value of all direct reconciliations that arise as meters are read and the amount of UIG is revised.

UIG – Unidentified Gas. Explained in more detail in the Introduction section.

UNC – Uniform Network Code. A legal and contractual framework to supply and transport gas in Great Britain.

Unregistered Site - A Supply Meter Point that has never been registered to a Shipper.

Weighting Factors – The factors contained within the AUG Table and used to share UIG between Classes and EUC bands.

Appendices

APPENDIX 1 – COMPLIANCE WITH THE GENERIC TERMS OF REFERENCE

This table below details the way we have complied with the Generic Terms of Reference contained within Section 5 of the AUGE Framework document.

AUGE Framework Document Requirement	Evidence of Fulfilment
The AUG Expert will create the AUG Statement and AUG Table by developing appropriate, detailed methodologies and collecting necessary data.	We created a detailed, bottom-up holistic methodology, as described in Section 4 of this AUG Statement, for the estimation of UIG at the Line in the Sand in the target Gas Year and collected the necessary data.
The decision as to the most appropriate methodologies and data will rest solely with the AUG Expert taking account of any issues raised during the development and compilation of the AUG Statement and AUG Table. For the avoidance of doubt although UIG includes any LDZ Shrinkage Error, the AUG Expert acknowledges that the process for determining LDZ Shrinkage is laid out in the relevant DNO Licences. To avoid dual governance of any LDZ Shrinkage Error, the AUG Expert's role in respect of any LDZ Shrinkage Errors is therefore limited to confirming that there are controls in place to ensure that DNOs discharge their Licence obligation (that is that there is a methodology and that it is periodically reviewed for confirmation that the methodology remains relevant). The AUGE will present any comments or observations on the LDZ Shrinkage model through the annual consultation carried out by the DNOs.	We, in our sole discretion, decided the appropriate methodologies for all contributors and other aspects of determining UIG. These are detailed further in Sections 5 and 6 of this AUG Statement. We did not make any investigation into, nor comment in relation to, LDZ Shrinkage Error.
The AUG Expert will determine what data is required from Code Parties (and other parties as appropriate) in order to ensure it has sufficient data to support the evaluation of Unidentified Gas.	We determined the data required from Code Parties, where this was deemed necessary by us, in our sole view. We were unable to obtain one dataset from the IGTs in relation to IGT Shrinkage. However, we made use of an alternate methodology to circumvent the issue of unobtainable data.
The AUG Expert will determine what data is necessary from parties in order to ensure it has	Please see above.

AUGE Framework Document Requirement	Evidence of Fulfilment
appropriate data to support the evaluation of Unidentified Gas.	
The AUG Expert will determine what relevant questions should be submitted to Code Parties in order to ensure appropriate methodologies and data are used in the evaluation of unidentified error.	No questions were formally posed to Code Parties, although we did seek feedback in relation to the monthly reports and from the AUG Sub-Committee. This includes regular progress updates to industry via the monthly report and the extraordinary AUG Sub-Committee meeting held at our request on 11th November 2020.
The AUG Expert will use the latest data available where appropriate.	In all cases where data has been requested from the CDSP or any other industry party, we have ensured that the data provided is the most up to date version available. Updated datasets have been requested where required.
Where multiple data sources exist the AUG Expert will evaluate the data to obtain the most statistically sound solution, will document the alternative options and provide an explanation for its decision.	Where we encountered multiple data sources, we evaluated that data to obtain the most statistically sound solutions and have provided an explanation of this process within this AUG Statement.
Where data is open to interpretation the AUG Expert will evaluate the most appropriate methodology and provide an explanation for the use of this methodology.	Where data was open to interpretation, we evaluated that data to obtain the most statistically sound methodologies and have provided an explanation of this process within this AUG Statement.
Where the AUG Expert considers using data collected or derived through the use of sampling techniques, then the AUG Expert will consider the most appropriate sampling technique and/or the viability of the sampling technique used.	In cases where data has been collected or derived through sampling techniques, we have considered the most appropriate in each case, along with the viability of this.
The AUG Expert will present at a meeting the AUG Statement, including the AUG Table, in draft form (the "proposed AUG Statement"), to Code Parties seeking views and will review all the issues identified submitted in response.	We will present the draft AUG Statement to industry at the AUG Sub-Committee meeting scheduled to take place on 15th January 2021. We welcome any feedback submitted by stakeholders during the relevant consultation period and will take full consideration of this, although our final conclusions remain within our own discretion.
The AUG Expert will provide the AUG Statement, including the AUG Table, to the Gas Transporters for publication who will then	The Proposed AUG Statement for 2021-2022 will be provided to the Gas

AUGE Framework Document Requirement	Evidence of Fulfilment
provide the AUG Statement and Table to the CDSP.	Transporters for publication on 31st December 2020.
The AUG Expert will ensure that all data that is provided to it by parties will not be passed on to any other organisation or used for any purpose other than the creation of the methodology and the AUG Statement and Table.	All data received from any external party in relation to our role as AUGE has not been shared with any other party, nor used for any purpose other than that of the creation of the methodology and the AUG Statement and Table.
The AUG Expert shall ensure that all data provided by Code Parties will be held confidentially, and where any data, as provided or derived from that provided, is published then it shall be in a form where the source of the information cannot be reasonably ascertained.	Engage's policies in relation to protecting information ensure that all AUGE data is kept safe. As AUGE we have treated all confidential data appropriately and only used this for the purpose provided.
The AUG Expert will act with all due skill, care and diligence when performing of its duties as the AUG Expert and shall be impartial when undertaking the function of the AUG Expert, ensuring that any values derived will be equitable in their treatment of Code Parties.	We have performed our duties as AUGE with a high level of skill, care and diligence and in a completely impartial manner, seeking to allocate UIG to the Matrix Positions contained in the AUG Table on as equitable a basis as possible. To ensure an impartial approach, we have also maintained a record of all our contacts with external parties in relation to the AUGE service.
The AUG Expert will compile the methodology and AUG Statement and AUG Table in accordance with this Framework.	Our Quality Assurance processes have ensured that all the work that we have undertaken in our role as AUGE has been conducted in accordance with the AUGE Framework.

APPENDIX 2 – LIST OF DATA SOURCES

Report Name	Report Description	Source	Frequency	Use
Allocation and Allocation Reconciled	Historical allocation energy and allocation reconciled energy by month for each EUC band	CDSP	Annual	No Read at the Line in the Sand (090)
Annual Load Profile	Annual Load Profiles for Gas Year 2020-2021	CDSP	Annual	Shipperless Sites (025) Unregistered Sites (020) Consumption Forecast
AQ Corrections	Details of the AQ Corrections carried out on the Supply Meter Points with no Reads after April 2018 report	CDSP	One Off	No Read at the Line in the Sand (090)
AQ Snapshot	The number of Supply Meter Points and associated AQ for each Matrix Position for each LDZ	CDSP	Monthly	Consumption Forecast
Average Main Length	The average length of main for IGT Supply Meter Points	IGTs	n/a	IGT Shrinkage (060)
Calorific Values (CV)	The daily CV used in Settlement for each LDZ	Public Domain (National Grid Website)	Annual	IGT Shrinkage (060)
Change in AQ since June 2017	A report by Matrix Position of the change in rolling AQ for each month since June 2017	CDSP	Quarterly	No Read at the Line in the Sand (090)
Connection Details for Orphaned Sites	A report of Supply Meter Points that used to appear on the Orphaned Sites report but which have since been registered to a Shipper	CDSP	Monthly	Unregistered Sites (020)
Connection Details for Shipperless Sites	A report of the Supply Meter Points that used to appear on either the SSrP report or the PTS report, but which have	CDSP	Annual	Shipperless Sites (025)

Report Name	Report Description	Source	Frequency	Use
	since been registered to a Shipper			
Conversion Equipment Fitted	A report of the Supply Meter Points that have volume conversion equipment fitted and their associated AQ	CDSP	Annual	Average Pressure Assumption (070) Average Temperature Assumption (080) Incorrect Correction Factors (100)
Correction Factor	Correction factors for all Supply Meter Points with an AQ greater than 732,000 kWh	CDSP	Annual	Average Pressure Assumption (070) Incorrect Correction Factors (100)
Flow Weighted Gas Temperatures	Gas Temperature Data from DMTS & ICTS	DNV (BG Technologies)	n/a	Average Temperature Assumption (080)
IGT Sites	A snapshot of the number of Supply Meter Points Connected to IGTs	CDSP	Annual	IGT Shrinkage (060)
In-service Testing (IST) Results	In service testing results of domestic sized meters	BEIS (OPSS)	Annual	Consumption Meter Errors (040)
Leakage Rates	Leakage rates from the NLT	Public Domain	n/a	IGT Shrinkage (060)
Legitimate Unregistered Sites Details	A report of Supply Meter Points that have never been registered to a Shipper where this is legitimate	CDSP	Monthly	Unregistered Sites (020)
Measurement Error Register	The register of the LDZ Meter Errors	Public Domain (Joint Office)	n/a	LDZ Meter Errors (050)

Report Name	Report Description	Source	Frequency	Use
Meter Capacity	A report of the meter capacity for all Supply Meter Points with an annual consumption above 73,200 kWh	CDSP	Annual	Consumption Meter Errors (040)
Meter Errors	This file provides details of the meter errors that have taken place and their associated energy	Xoserve	Annual	Consumption Meter Errors (040)
Meter Location	Snapshot providing the number of Supply Meter Points and Associated AQ split by meter location and by LDZ Matrix Position	CDSP	Annual Snapshot	Average Temperature Assumption (080)
Meter Type	Details of the meter types and installation year for each LDZ Matrix Position	CDSP	Annual	Theft of Gas (010) Consumption Meter Errors (040)
Monthly Reconciliation	Monthly report of direct reconciliations since June 2017	CDSP	Monthly	Comparison to Observed Levels of UIG
Must Read	Details of the Must Reads carried out on the Supply Meter Points with no Reads after April 2018 report	CDSP	One Off	No Read at the Line in the Sand (090)
Offline Adjustment	Summary of offline adjustments provided by supply month and reconciliation month	CDSP	Annual	Comparison to Observed Levels of UIG
Orphaned Sites	A report of Supply Meter Points that have been unregistered for at least 12 months, have never been registered to a Shipper and where there has been an indication of meter activity	CDSP	Monthly	Unregistered Sites (020)
PAW Risk Assessment Model	The risk model provided to the Performance Assurance Workgroup	Public Domain (Joint Office)	n/a	LDZ Meter Errors (050)

Report Name	Report Description	Source	Frequency	Use
Post Code and Elevation Data	The altitude of each postcode in Great Britain	Open Data[55]	n/a	Average Pressure Assumption (070)
Pressure Data	Historical Pressure information by Weather Station	CDSP	n/a	Average Pressure Assumption (070)
Read Rejections	Details of the read rejections carried out on the Supply Meter Points with no Reads after April 2018 report	CDSP	One Off	No Read at the Line in the Sand (090)
Seasonal Normal Factors	Seasonal normal factors that are applied in the AQ calculation forecast to take account of seasonal normal changes	CDSP	Every five years	Consumption Forecast
Shipperless Sites PTS	A report of the Supply Meter Points that have been identified as Shipperless Sites on a GSR visit where the meter is the same as that previously in place	CDSP	Monthly Snapshot	Shipperless Sites (025)
Shipperless Sites SSrP	A report of the Supply Meter Points that have been identified as Shipperless Sites on a GSR visit where the meter is different to that previously in place	CDSP	Monthly Snapshot	Shipperless Sites (025)
Smart Meter Data	Smart Meter Installation data by quarter from BEIS	Public Domain (BEIS)	n/a	Consumption Forecast Consumption Meter Errors (040)

[55] Attribution: Contains OS data © Crown copyright and database right 2017; Contains Royal Mail data © Royal Mail copyright and database right 2017; Contains National Statistics data © Crown copyright and database right 2017.

Report Name	Report Description	Source	Frequency	Use
Supply Meter Points with no Reads after April 2018	Details of the Supply Meter Point ID, their AQ and the last read for Supply Meter Points with no actual read after April 2018	CDSP	Quarterly Snapshots	No Read at the Line in the Sand (090)
Theft Data	A report of the thefts from Smart and Traditional meters provided by a sub-set of EUK members	EUK	n/a	Theft of Gas (010)
TRAS Theft Information	The data outcome file from TRAS	Electralink (via CDSP)	Annual	Theft of Gas (010)
Throughput	Daily Total throughput, DM allocation, NDM allocation and UIG by LDZ and EUC	CDSP	Monthly	Comparison to Observed Levels of UIG
TOG Theft Information	Details of theft provided to Xoserve within CMS	CDSP	Annual with monthly updates	Theft of Gas (010)

APPENDIX 3 – ACTUAL ANNUAL QUANTITIES AND SUPPLY METER POINTS

The tables below provide the sum of the AQs and the number of Supply Meter Points broken down by Matrix Position for two points in time (September 2019 and September 2020). These have been included as reference points against which our Consumption Forecast can be compared.

Previous AQ Tables for Reference (GWh)

		CLASS			
	SEP-19	1	2	3	4
EUC BAND	**1ND**	-	0	2,130	277,106
	1PD	-	-	48	21,695
	1NI	0	0	288	10,833
	1PI	-	-	0	43
	2ND	-	-	17	4,696
	2PD	-	-	0	211
	2NI	0	2	463	17,113
	2PI	-	-		6
	3	-	9	6,220	14,523
	4	3	31	4,972	18,089
	5	5	216	2,745	13,616
	6	78	1,681	1,390	12,076
	7	91	3,150	1,228	9,818
	8	2,368	9,055	1,326	10,779
	9	96,856	2,241	238	561
				Total	**548,013**

		CLASS			
	SEP-20	1	2	3	4
EUC BAND	**1ND**	-	-	47,389	248,388
	1PD	-	-	424	20,211
	1NI	0	0	1,808	10,438
	1PI	-	-	1	42
	2ND	-	-	249	4,626
	2PD	-	-	424	20,211
	2NI	0	2	6,316	15,510
	2PI	-	-	2	6
	3	1	8	5,348	14,434
	4	4	57	4,557	17,439
	5	30	245	2,289	12,580
	6	313	1,322	1,552	11,529
	7	657	2,553	1,447	9,611
	8	3,511	5,194	973	9,390
	9	91,109	880	263	1,725
				Total	**575,068**

Previous Number of Supply Meter Points Tables for Reference

		CLASS			
	SEP-19	1	2	3	4
EUC BAND	**1ND**	-	1	884,863	20,405,094
	1PD	-	-	16,374	2,339,399
	1NI	1	11	37,290	477,287
	1PI	-	-	7	3,987
	2ND	-	-	2,352	42,310
	2PD	-	-	14	1,982
	2NI	1	9	39,767	122,769
	2PI	-	-	13	56
	3	-	17	14,045	32,301
	4	2	21	4,273	14,978
	5	1	51	826	3,992
	6	6	164	159	1,339
	7	5	150	61	485
	8	46	225	35	274
	9	348	15	3	9
				Total	**24,447,420**

		CLASS			
	SEP-20	1	2	3	4
EUC BAND	**1ND**	-	1	3,474,822	17,945,562
	1PD	-	-	46,277	2,098,800
	1NI	3	10	61,784	494,103
	1PI	-	-	27	3,640
	2ND	-	-	2,830	42,023
	2PD	-	-	22	1,652
	2NI	1	5	42,785	111,399
	2PI	-	-	10	56
	3	1	24	14,315	31,880
	4	2	37	4,456	14,546
	5	7	46	764	3,696
	6	30	143	162	1,277
	7	33	115	68	471
	8	76	187	27	236
	9	338	15	2	24
				Total	**24,398,790**

APPENDIX 4 – PRESSURE AND TEMPERATURE IMPACT ON ENERGY CONTENT

A number of the contributors we investigated relate to the pressure and/or temperature and the impact these can have on the measurement of the amount of gas used.

The information provided below is designed to summarise the relationship between pressure, temperature and volume – and to demonstrate the significant impact pressure and temperature can have on the volume.

Relationship between Pressure, Volume and Temperature

Gas meters record the volume of gas that passes through them. There are various criteria that affect the amount of gas (moles) contained within a unit volume of gas and hence the energy.

The Ideal Gas Law describes these relationships. This law is expressed as:

$$PV = nRT$$

Where:

P is the pressure;

V is the volume;

n is the number of moles;

R is the Gas constant; and

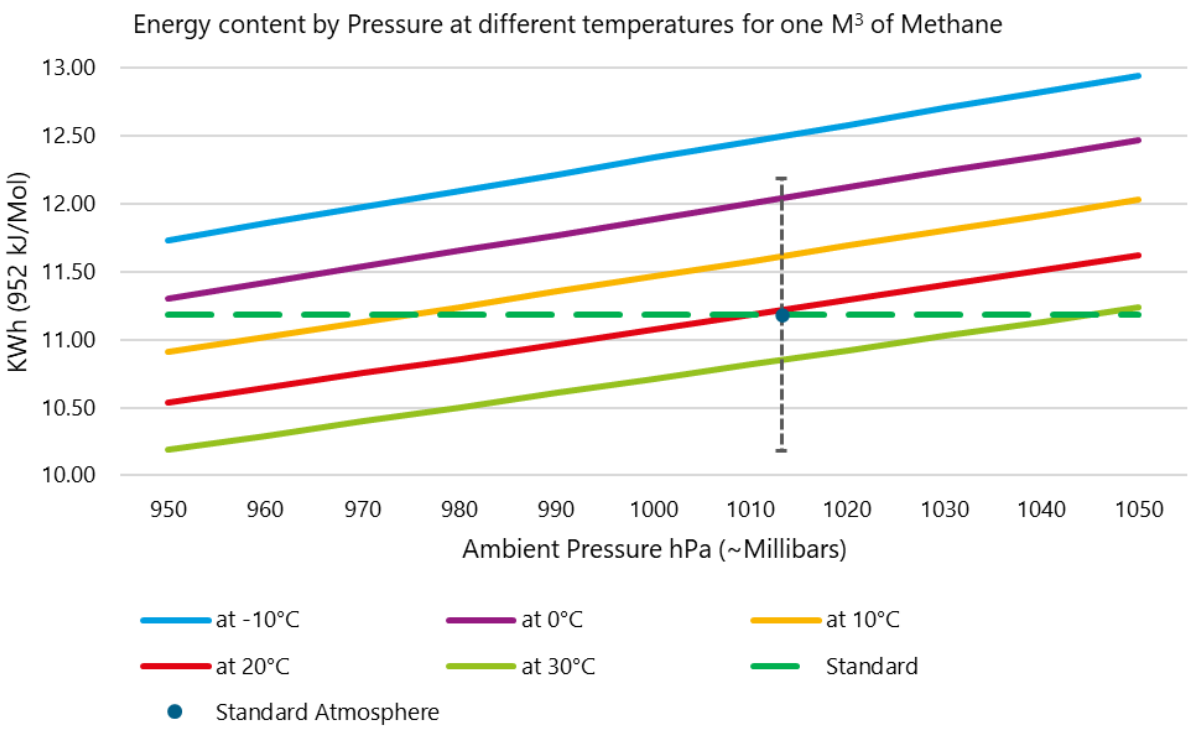
T is the temperature.

Therefore, the amount of gas (moles) is affected by the pressure, the temperature and the volume as follows:

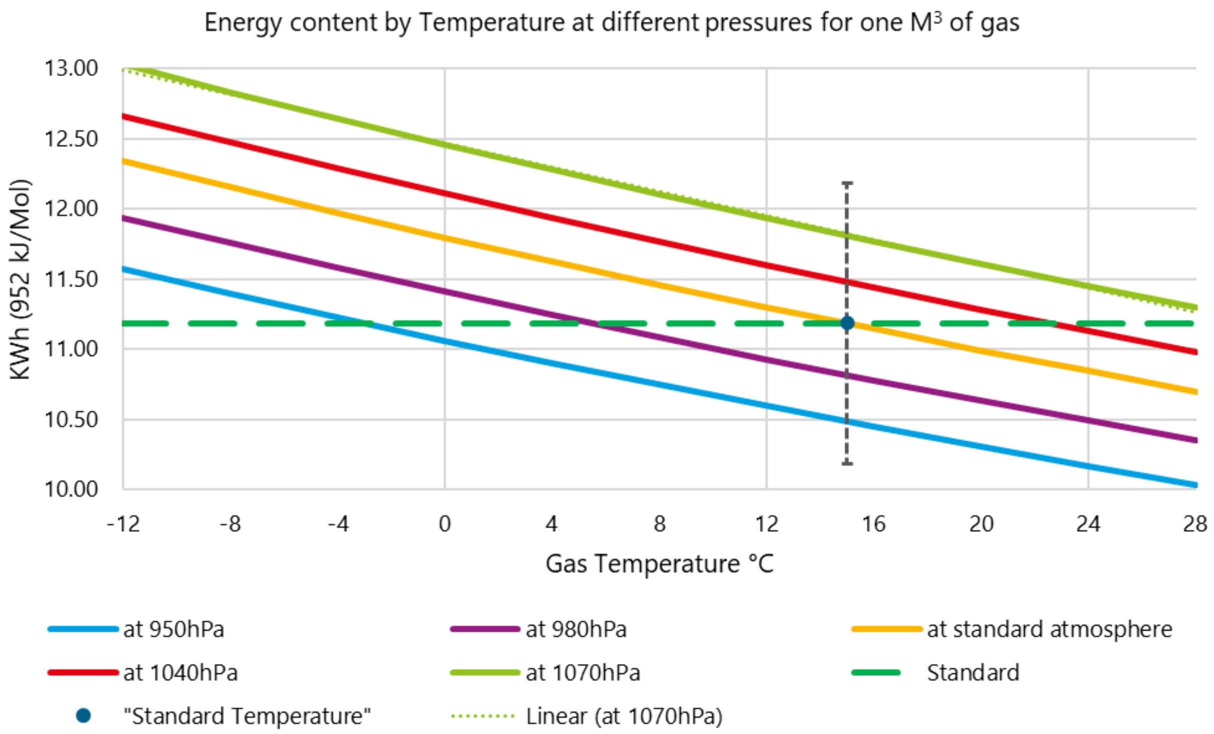
- If the volume and the temperature stay the same and the pressure increases, the number of gas moles will increase.
- If the volume and the pressure stay the same and the temperature decreases, the number of gas moles will increase.
- If the temperature and the pressure stay the same and the volume increases, the number of gas moles will increase.

Impact on the Energy Value of a Unit Volume of Gas

The graphs show energy content of a unit volume of gas as a function of temperature and pressure, within the bounds of normal weather variations in Great Britain. They demonstrate the material impact both temperature and pressure can have on this.



Note the graph shows ambient atmospheric pressure rather than gas pressure. For this example, the gas pressure is 21 millibars.



APPENDIX 5 – FUTURE CONSIDERATIONS

We note throughout this Statement areas of investigation which we did not pursue because they were perceived as low materiality or priority, and elements of our calculations that we abandoned due to lack of input data, or data that we considered insufficiently robust for our purposes.

In this Appendix we have collated for reference a list of potential considerations for future UIG assessments. We will assess these, along with any other points we identify, as part of our planning in future years.

Contributor	Future Considerations
010 Theft of Gas	Our experience and discussion with industry parties indicates that the approach to detecting theft varies greatly between Shippers. On this basis, overlaying Shipper identities to theft datasets would validate this view and allow us to predict the likelihood of theft being detected according to the trend of market share among Shippers. This is not possible using only anonymised datasets.
050 LDZ Meter Errors	The analysis we undertook under the Consumption Meter Errors (040) contributor found an inherent bias in the accuracy of domestic diaphragm and ultrasonic meter types and concluded that this is the source of material UIG. It is entirely possible that an inherent bias exists for LDZ meters. If it does, the UIG associated with this could be significant. For example, a hypothetical bias of a modest 0.10%, would result in circa 500 GWh of UIG per annum. However, we were unable to find any data of studies that informed this. We suggest this matter is considered further in future AUG Years, along with options for commissioning or obtaining data that will prove/disprove and quantify this.
060 IGT Shrinkage	We considered the impact of gas lost in the purging of new mains and services; own use gas; and network theft of gas, on IGT shrinkage. Whilst the impact of the first two of these is almost certainly minimal in comparison to overall IGT shrinkage, the impact of network theft might not be. We also hope to use bespoke average main lengths from IGTs in our analysis in future years.
090 No Read at the Line in the Sand	Further enhancements to our calculation include more accurately calculating the AQ at risk. Because of the dataset available to us, our method only tracked the sites with no read for a limited amount of time. If these sites are tracked for an extended period, the accuracy of our estimation of AQ at risk will increase. This will require an extended dataset.

Contributor	Future Considerations
090 No Read at the Line in the Sand	The error percentage calculation for inaccurate AQs could be enhanced by identifying further drivers. Over half of the sites in our no valid read dataset did not even have a rejected read. This could mean that Shipper systems may be preventing reads from being submitted. Understanding in more detail the causes of missing meter reads would require investigation, but could lead to a more accurate estimation of UIG, or a new source of data to be used in future methodologies.
090 No Read at the Line in the Sand	Most Supply Meter Points that were subject to an AQ adjustment had no accompanying read to allow us to assess the validity of those adjustments. For this reason we have assumed no UIG impact in the current methodology. The industry process could be improved by requiring Shippers to submit an accompanying recent valid read when identifying a change in site use. This would enhance the dataset that we use to assess the impact of incorrect AQs and allow a more accurate estimate of UIG.
090 No Read at the Line in the Sand	Our investigation into must reads provided very limited results. Therefore, we would suggest a more detailed review into why must reads for monthly read sites were not being completed before the Line in the Sand. Recent outcome of must reads could also be used as a feed into the error percentage.
100 Incorrect Correction Factors	Our Correction Factor calculations are based on applying averages and assumed deviation from those averages. We did not identify on an individual basis those Supply Meter Points with incorrect Correction Factors set. We will investigate the possibility of reviewing the exact values applied at each Supply Meter Point. Additionally, the industry could consider organising an audit of all Correction Factors.
UIG Calculation	Our calculation of UIG provides a single value for each contributor. A confidence rating could be added to our UIG calculation to display how certain we are with the calculated UIG value.
070 Average Pressure Assumption	Our pressure calculation is based on a small number of weather stations and an average altitude. Accuracy could be increased by using a larger set of weather data.
080 Average Temperature Assumption	Our calculation uses temperature studies that are almost 20 years old and little information is provided on how common the dataset used. An updated study could be commissioned to get some more up to date information.