# Proposed Final Allocation of Unidentified Gas Statement (For Gas Year 2022-2023)

| | |
|---|---|
| **Prepared for:** AUG Sub-Committee | **Date:** 2nd March 2022 |
| | **Version:** 1.2 |
| | **Status:** For Approval |

# 1 Executive Summary

## INTRODUCTION

This document is the proposed final Allocation of Unidentified Gas (AUG) Statement for the Gas Year 2022-2023. It provides the proposed final Weighting Factors in the AUG Table for this Gas Year and sets out in detail how we determined these. Updates to the draft AUG Statement have been incorporated based on the consultation feedback and updated datasets. Appendix 7 provides a summary of these updates. After consideration of any further feedback we will publish the final Statement by 1st April 2022.

## UNIDENTIFIED GAS

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

The AUGE undertakes detailed analysis of the potential causes of UIG each year and produces a set of Weighting Factors that are used to allocate UIG between Shippers equitably and transparently.

## OUR APPROACH

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

- **Bottom-up Determination**: we quantify UIG for each identified contributor and add these together, rather than estimating the overall UIG and apportioning it or using it as a means of differencing;
- **'Polluter Pays**': we interpret "fair and equitable" to mean that UIG should be allocated in the same proportions as it is created. As the UNC does not permit the allocation of UIG at a Supply Point level, the best current attainment of this principle is that each position on the matrix of EUC Band and Class attracts its appropriate proportion; and
- **Line in the Sand**: we only include in our calculation of Weighting Factors the UIG that will exist at the Line in the Sand (the final Settlement position) and not UIG that exists temporarily prior to this.

Each year, we review our approach in light of the availability of new data sources, external developments, and feedback from stakeholder consultation. This includes a full reassessment of all identified potential UIG contributors, whether or not they have been subject to a previous detailed investigation. The intention is that our methodology does not remain static; reflecting instead the ongoing developments in gas Settlement and incorporating, with each iteration, a reasonable amount of additional investigation and refinement.

For the 2022-2023 Gas Year, we have augmented our approach by investigating two new potential contributors to UIG and refining our methodologies for two existing contributors. The other eight contributors investigated last year remain, but with refreshed datasets.

Additional UIG has been quantified for the first time from one of our new investigations (160 Isolated Sites), and one of our methodology refinements (090 No Read at the Line in the Sand). The second methodology refinement (010 Theft of Gas) results in a more equitable allocation of UIG.

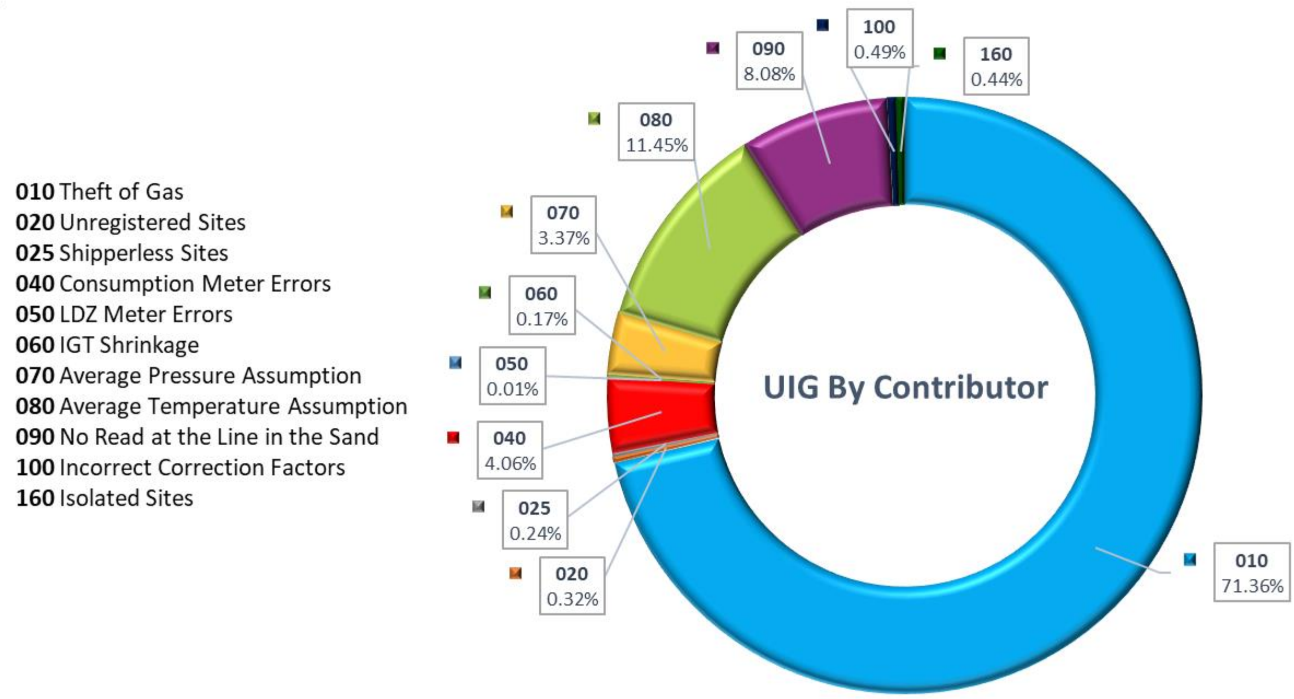
The second of our new investigations (140 Meters with a By-Pass Fitted) concluded with no reasonably quantifiable UIG output. This is not because we believe there is no UIG created by these sites, but because the available data proved insufficient to permit us to progress our methodology to its intended outcome. However, in the course of our investigation we were able to achieve sufficient insight in this area to warrant re-assessment for future investigation of alternative data sources and approaches.

We have produced the proposed final Weighting Factors using our harness model which combines the outputs of a number of contributor models with a forecast of consumption, and then smooths the results to produce the AUG Table.

## RESULTS

We quantified total UIG at the Line in the Sand for the target Gas Year 2022-2023 as 10,652 GWh.

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




[1] Movement in UIG noted in the table (Gas Year 2021-2022 vs the target Gas Year) is based on a tolerance threshold of more than 1% and 1 GWh change.

## Proposed Final Allocation of Unidentified Gas Statement (For Gas Year 2022-2023)

| Contributor | 2021-2022 Gas Year UIG Volume | Related UIG Volume | Change |
|---|---|---|---|
| **Theft of Gas** | 7,730 GWh | 7,602 GWh | ↓ |
| **Average Temperature Assumption** | 1,249 GWh | 1,220 GWh | ↓ |
| **No Read at the Line in the Sand** | 643 GWh | 861 GWh | ↑ |
| **Consumption Meter Errors** | 789 GWh | 432 GWh | ↓ |
| **Average Pressure Assumption** | 371 GWh | 359 GWh | ↓ |
| **Incorrect Correction Factors** | 48 GWh | 53 GWh | ↑ |
| **Isolated Sites** | - | 47 GWh | ↑ |
| **Unregistered Sites** | 101 GWh | 35 GWh | ↓ |
| **Shipperless Sites** | 32 GWh | 26 GWh | ↓ |
| **IGT Shrinkage** | 18 GWh | 18 GWh | → |
| **LDZ Meter Errors** | 0 GWh | 1 GWh | → |
| **Total** | **10,982 GWh** | **10,652 GWh** | ↓ |

Total UIG 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 | 775 | 4,774 |
| | **1PD** | - | - | 18 | 1,311 |
| | **1NI** | 0 | 0 | 105 | 1,398 |
| | **1PI** | - | - | 0 | 8 |
| | **2ND** | - | - | 5 | 195 |
| | **2PD** | - | - | 0 | 6 |
| | **2NI** | - | 0 | 99 | 544 |
| | **2PI** | - | 0 | 0 | 1 |
| | **3** | 0 | 0 | 60 | 139 |
| | **4** | 0 | 3 | 101 | 217 |
| | **5** | 0 | 2 | 42 | 106 |
| | **6** | 1 | 16 | 31 | 205 |
| | **7** | 2 | 38 | 30 | 114 |
| | **8** | 8 | 77 | 44 | 110 |
| | **9** | 61 | 1 | 0 | 3 |

[2] Note that a simple aggregation of the stated individual Matrix Position values may not equal total UIG value, due to rounding of those individual values. Zeros are rounded values. Dashes are where the Matrix Position is forecast to be empty.

**AUG Table**

The AUG Table containing the proposed final Weighting Factors is shown below. These proposed final Weighting Factors are subject to further change until the publication of the Final AUG Statement on 1st April 2022. The numbers have been normalised around an average of 100 so that they are comparable year on year. Doing this does not impact the relative proportions in any way.

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | **1ND** | 60.12 | 60.12 | 60.12 | 84.50 |
| | **1PD** | 64.11 | 64.11 | 64.11 | 382.64 |
| | **1NI** | 5.10 | 830.68 | 173.52 | 756.21 |
| | **1PI** | 173.52 | 295.06 | 173.52 | 756.21 |
| | **2ND** | 69.94 | 69.94 | 70.04 | 126.46 |
| | **2PD** | 70.04 | 91.22 | 70.04 | 126.46 |
| | **2NI** | 5.10 | 100.34 | 63.15 | 199.46 |
| | **2PI** | 26.18 | 26.18 | 63.15 | 199.46 |
| | **3** | 5.10 | 53.23 | 48.36 | 52.53 |
| | **4** | 5.10 | 60.64 | 54.07 | 58.44 |
| | **5** | 5.10 | 55.38 | 52.51 | 55.56 |
| | **6** | 5.10 | 58.76 | 53.69 | 71.81 |
| | **7** | 5.10 | 63.30 | 57.14 | 62.54 |
| | **8** | 5.10 | 50.85 | 60.52 | 46.14 |
| | **9** | 5.10 | 28.00 | 23.64 | 26.34 |

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# 2 Document Control

## PUBLICATION

| VERSION | ISSUE DATE | AUTHOR | REVIEWER |
|---|---|---|---|
| 0.1 | 10 Dec 2021 | David Speake/Jonathan Kiddle | Claire Everitt/Richard Cullen |
| 1.0 | 23 Dec 2021 | David Speake/Jonathan Kiddle | Claire Everitt/Richard Cullen |
| 1.1 | 23 Feb 2022 | David Speake/Jonathan Kiddle | Claire Everitt/Richard Cullen |
| 1.2 | 02 Mar 2022 | David Speake/Jonathan Kiddle | Claire Everitt/Richard Cullen |

## CHANGE HISTORY

| VERSION | REASON |
|---|---|
| 0.1 | Issued to CDSP for initial review |
| 1.0 | Draft AUG Statement for publication |
| 1.1 | Proposed Final AUG Statement for CDSP review |
| 1.2 | Proposed Final AUG Statement for publication |

# 3 Introduction

This document is the proposed final Statement for the Gas Year 1st October 2022 to 30th September 2023. It presents the proposed final Weighting Factors and explains the analysis undertaken and methodologies used to derive them.

We have produced this 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[3] 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 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 localised variation in 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 define the proportion of total 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).

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

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

## AUGE SCOPE

The scope of the AUGE includes:

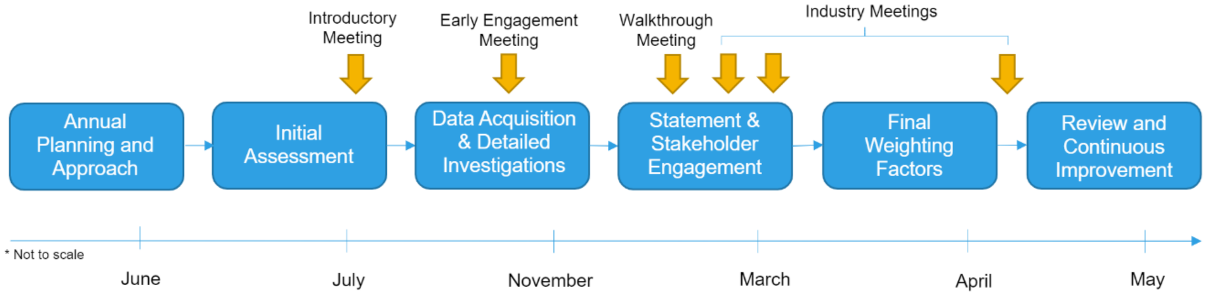
- Developing a methodology for determining annual Weighting Factors;
- Determining data sources for use in the calculation of the Weighting Factors; and
- Documenting the methodology and the Weighting Factors in the Statement and presenting these to industry.

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.




## STRUCTURE OF THIS DOCUMENT

The remainder of this document is structured as follows:

- Section 4 - Overarching Methodology: Details the stages we follow in our overarching methodology to determine the Weighting Factors for the target Gas Year;
- Section 5 - Investigations: Describes the two new contributors investigated for this proposed final Statement ("New Investigations"), and also describes how we have extended and refined the methodologies of two previous contributors ("Refinement Investigations"). We detail the data we used, the methodologies we established, and the output of these methodologies;
- Section 6 - Other Contributors: Describes the modelled output from contributors with no material changes to their methodology since last year, although datasets have been refreshed for the target Gas Year. The contributor descriptions have been streamlined in the body of the 2022-2023 Statement as there are no updates to their analysis or rationale. (The original rationale as described in the 2021-2022 Statement remains available for ease of reference in Appendix 5);

- Section 7 - Results: Provides a summary of the results and the process we undertook to validate them;
- Section 8 - Weighting Factor Determination: Explains the calculation and the process of smoothing the Weighting Factors;
- Section 9 - AUG Table: Sets out the proposed final Weighting Factors;
- Section 10 - Glossary: Explains terms and acronyms used in this proposed final Statement;
- Appendix 1 - Compliance with the Generic Terms of Reference;
- Appendix 2 - List of Data Sources;
- Appendix 3 - Actual Annual Quantities and Supply Meter Points;
- Appendix 4 – Pressure and Temperature Impact on Energy Content;
- Appendix 5 – Previous Analysis and Rationale;
- Appendix 6 – Future Considerations; and
- Appendix 7 – Changes made following Consultation on the Draft Statement.

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# 4 Overarching Methodology

## SUMMARY

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:

- **Bottom-up Determination**: we quantify UIG for each identified contributor and add these together, rather than estimating the overall UIG and apportioning it or using it as a means of differencing;
- **'Polluter Pays**': we interpret "fair and equitable" to mean that UIG should be allocated in the same proportions as it is created. As the UNC does not permit the allocation of UIG at a Supply Point level, the best current attainment of this principle is that each position on the matrix of EUC Band and Class attracts its appropriate proportion; and
- **Line in the Sand**: we only include in our calculation of Weighting Factors the UIG that will exist at the Line in the Sand (the final Settlement position) and not UIG that exists temporarily prior to this.

Our overarching methodology progressed through the stages below, described further under the headings that follow:

- Identifying the potential UIG contributors and undertaking an initial assessment of each one;
- Selecting the set of contributors to be subject to our analysis, including any not investigated in detail before and any refinements to previous contributor methodologies;
- Determining a reasonable Consumption Forecast for the target Gas Year;
- Acquiring data to support the investigations as well as the quantification and allocation of UIG;
- Investigating the selected contributors:
  a. Deriving methodologies for quantifying and allocating UIG in relation to contributors which have not previously been subject to a detailed investigation; and
  b. Undertaking additional analysis and augmenting the methodology for those previously investigated contributors identified for refinement;
- Updating the model inputs to all contributors with no changes to their methodologies;
- Combining the outputs of each contributor's sub-model with the 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 and normalising these Weighting Factors to produce the AUG Table.

# IDENTIFICATION AND INITIAL ASSESSMENT OF CONTRIBUTORS

This year we identified 20 candidate contributors[4] for assessment based on:

- Topics identified in the 2021-2022 Statement;
- Topics identified by expert industry stakeholders; 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.

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

| Contributor ID | Contributor | Score | Existing Methodology | Recommendation |
|---|---|---|---|---|
| **140** | Meters with By-pass Fitted | 44 | N | Y |
| **160** | Isolated Sites | 35 | N | Y |
| **10** | Theft of Gas (AMR only) | 33 | Y | Y |
| **90** | No Meter Read at the Line in the Sand | 32 | Y | Y |
| **130** | Consumption Adjustments | 24 | N | N |
| **41** | Consumption Meter Errors - Faulty Meter | 22 | N | N |
| **70** | Average Pressure Assumption | 21 | Y | N |
| **170** | Incorrect Meter Technical Details on UK Link | 20 | N | N |
| **40** | Consumption Meter Errors - Inherent Bias | 19 | Y | N |
| **120** | Meter Exchanges | 14 | N | N |
| **80** | Average Temperature Assumption | 13 | Y | N |
| **10** | Theft of Gas (full re investigation) | 12 | Y | N |
| **150** | Meterless Sites | 9 | N | N |
| **42** | Consumption Meter Errors - Extremes of Use | 9 | N | N |
| **180** | Unfound Unidentified Gas Contributors | 7 | N | N |
| **100** | Incorrect Correction Factors | 6 | Y | N |
| **60** | IGT Shrinkage | 5 | Y | N |
| **50** | LDZ Meter Errors | 5 | Y | N |
| **20** | Unregistered Sites | 4 | Y | N |
| **25** | Shipperless Sites | 3 | Y | N |
| **110** | CV Shrinkage | 2 | N | N |

[4] Of the 20 identified, theft was split into two elements, hence 21 entries in the table.

## SELECTION OF CONTRIBUTORS TO PROGRESS

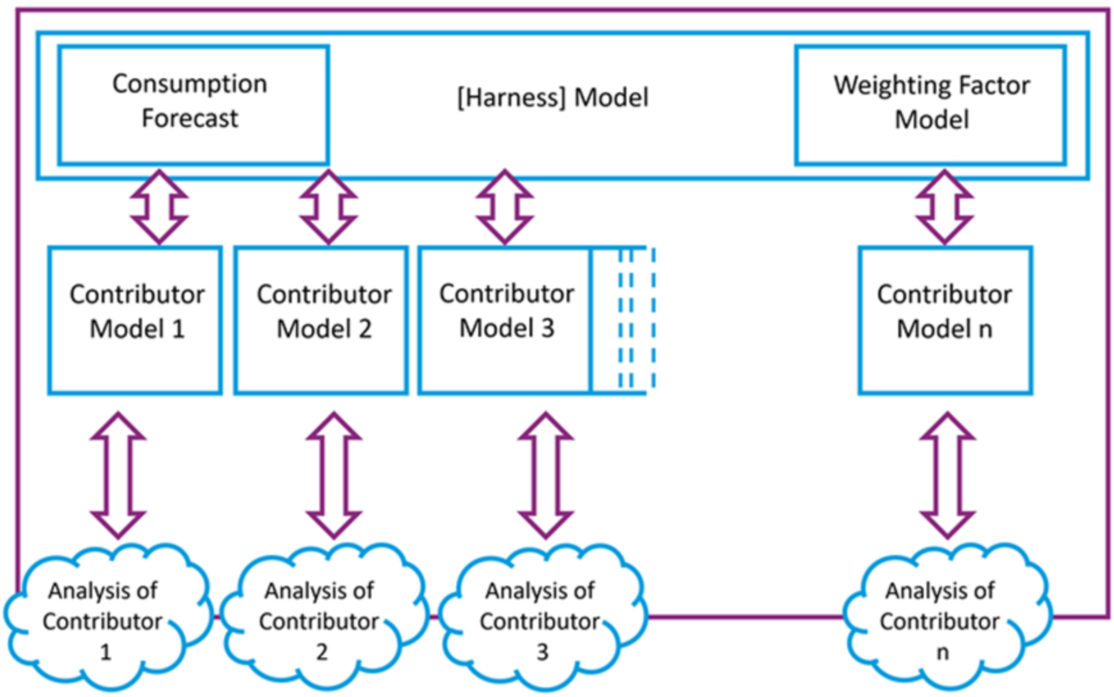
We used the output of the initial assessment to determine the following approach to defining the Weighting Factors for the target Gas Year. We presented this to the AUG Sub-Committee, taking into account any feedback received. The outcome was as follows:

- The four contributors receiving the highest scores were designated for investigation:
  a. The two without an existing methodology were subject to a new and detailed investigation; and
  b. The two with an existing methodology were subject to a refinement investigation in a specific aspect of that methodology.
- The other contributors that have existing methodologies had their data refreshed and UIG calculated.

## CONTRIBUTOR MODEL

We continued with our contributor-based model developed for the 2021-2022 Gas Year. This comprises an overarching harness model, which calculates the Weighting Factors by linking the separate contributor sub-models with our Consumption Forecast.

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. This 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 nationally for the target Gas Year based on trends in the numbers of Supply Meter Points in each class, AQs for each Class and new and lost Supply Meter Points in each Class including movements between Classes.

### Inputs

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

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

### Forecast Methodology

We used CDSP data from June 2017 to January 2022  to forecast consumption, including the actual Class and EUC bands with which Supply Meter Points are associated for Settlement purposes. 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 Point counts for each 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, together with the sum of the Annual Load Profiles over each month to forecast the annual consumption in the target Gas Year;
- We used the monthly Supply Meter Point forecast, together with the sum of the Annual Load Profiles over each month, to forecast the annual Supply Meter Point count in the target Gas Year; and
- We split the annual consumption forecast across LDZs based on current AQ proportions to obtain the LDZ specific consumption forecasts for the target Gas Year.

We then made the following updates to the consumption forecast after analysis of the initial results:

- For Class 1 EUC band 9 we determined that the latest combined AQ was a better estimate of future consumption than the trend forecast, owing to the highly predictable future population size in this Matrix Position.

### Results

The output from the forecast detailed above is shown in the tables below. Actual snapshots for September 2021 and September 2020 are provided in Appendix 3 by way of comparison.

Forecast Number of Supply Meter Points[5] in the Target Gas Year:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | 1 | 4,609,419 | 17,766,851 |
| | 1PD | - | - | 112,655 | 1,617,991 |
| | 1NI | 0 | 13 | 96,751 | 471,474 |
| | 1PI | - | - | 36 | 2,145 |
| | 2ND | - | - | 2,808 | 61,406 |
| | 2PD | - | - | 16 | 1,541 |
| | 2NI | - | 16 | 45,794 | 85,917 |
| | 2PI | - | 0 | 24 | 97 |
| | 3 | - | 37 | 16,075 | 26,293 |
| | 4 | 0 | 139 | 6,795 | 11,300 |
| | 5 | 6 | 56 | 1,329 | 2,803 |
| | 6 | 37 | 112 | 319 | 1,054 |
| | 7 | 52 | 124 | 134 | 404 |
| | 8 | 87 | 134 | 58 | 233 |
| | 9 | 369 | 13 | 5 | 26 |
| | | | | | 24,942,949 |

[5] Zeros are rounded values. Dashes are where the Matrix Position is forecast to be empty.

Forecast Consumption in the Target Gas Year (GWh):

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | 0 | 0 | 56,461 | 247,405 |
| | 1PD | - | - | 1,228 | 15,009 |
| | 1NI | 0 | 0 | 2,651 | 8,114 |
| | 1PI | - | - | 1 | 28 |
| | 2ND | - | - | 307 | 6,799 |
| | 2PD | - | - | 1 | 161 |
| | 2NI | - | 3 | 6,845 | 11,945 |
| | 2PI | - | 0 | 5 | 10 |
| | 3 | 0 | 19 | 7,200 | 11,895 |
| | 4 | 0 | 192 | 8,079 | 13,552 |
| | 5 | 32 | 192 | 4,418 | 9,378 |
| | 6 | 405 | 1,029 | 2,834 | 9,498 |
| | 7 | 1,142 | 2,560 | 2,727 | 8,285 |
| | 8 | 4,476 | 5,654 | 2,337 | 9,346 |
| | 9 | 55,614 | 857 | 334 | 2,110 |
| | | | | | 521,139 |

**Modifications**

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

- **0734S - Reporting Valid Confirmed Theft of Gas into Central Systems** - The imminent implementation of this modification will remove any unreported theft and so this element has been removed from our estimate in Theft of Gas (010);
- **0763R – Review of Gas Meter By-Pass Arrangements** – Although no findings have been published, this has been considered as part of the review for Meters with a By-pass Fitted (140);
- **0723 (Urgent) – Use of the Isolation Flag to identify sites with abnormal load reduction during COVID-19 period** – This has been implemented and we have reviewed this modification. This has had no impact on the UIG calculation for Isolated Sites (160); and
- **0691S – CDSP to convert Class 2, 3 or 4 Supply Meter Points to Class 1 when G1.6.15 criteria are met** – This has been implemented and we have reviewed this modification. This has had no impact on the Consumption Forecast for the target Gas Year.
- **0664VS - Transfer of Sites with Low Valid Meter Reading Submission Performance from Classes 2 and 3 into Class 4** – This will be implemented in the target Gas Year. Due to the low number of potentially impacted Supply Meter Points, this has had no impact on the Consumption Forecast for the target Gas Year.

This list is non-exhaustive. Further information on these Modifications can be obtained from the Joint Office of the Gas Transporters (the Joint Office) website.

# 5 Investigations

Each year, we assess all identified potential contributors to UIG, including those previously investigated, on the basis of the likely level of UIG and the likely availability of data.

During this year's assessment process, two new potential contributors to UIG were selected for detailed investigation. A further two existing contributors were selected for additional analysis and refinement of their methodologies.

The new 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;
- **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 Statement for Gas Year 2021-2022 and any other points we considered it relevant to make.

The refinement investigations are structured the same as above save for the following:

- **Dashboard** – along with the three pie charts also provides a table summarising the refinements made and compares total UIG to last year's at a glance; and
- **Refinement Analysis** – Replaces the Analysis and Resulting Methodology and provides details of the scope for refinement, the additional analysis we undertook and the resulting methodology for calculating UIG.

# 140 – METERS WITH A BY-PASS FITTED (NEW)

## DASHBOARD

We do not include any UIG from this contributor in the output for the target Gas Year.

## DESCRIPTION

**Settlement Context**

For gas to be recorded at a Supply Meter Point it must flow through a functioning meter. When this meter requires maintenance or replacement, the gas to the Supply Meter Point will be interrupted. In a small number of cases – for example industrial process sites reliant on a continuous gas supply – the meter installation includes additional pipework which can be used to bypass the meter and maintain gas flow.

If the by-pass is operated (opened), and if for the period it is in operation the gas consumed at the Supply Meter Point is likely to have exceeded 10,000 kWh, then a Consumption Adjustment is required once the by-pass has been closed again[6]. This is done by notifying the CDSP of an estimate of consumption for the period that the meter was not recording, to ensure that the correct energy is reflected within Settlement. If the site is estimated to have consumed less than 10,000 kWh while the by-pass was open, there is no obligation on the Shipper to submit a Consumption Adjustment.

**Definition**

This contributor relates to occasions when a meter by-pass has been opened at a Supply Meter Point, and the actual energy consumed while the by-pass was open has not entered Settlement by way of a Consumption Adjustment. To be clear, this includes cases where no Consumption Adjustment is required under UNC rules.

**UIG Impact**

Gas consumed at Supply Meter Points with a by-pass fitted creates positive UIG when the by-pass is operated, gas is consumed whilst open and this consumption is not entered in Settlement. If this consumption is not identified and accounted for in time, this UIG remains at the Line in the Sand.

## ANALYSIS AND RESULTING METHODOLOGY

In line with our definition above, to determine potential UIG attributable to this contributor we looked to identify the co-existence of two outcomes or conditions at a Supply Meter Point:

- The operation (opening) of a meter by-pass; and

[6] In accordance with UNC Section M 2.4.4(b)

- A Consumption Adjustment NOT being made to accompany that by-pass operation.

By identifying instances where both conditions are true, we can then take a view of the likelihood of UIG remaining at the Line in the Sand, and the aggregate of this UIG split according to Matrix Position.

Our intended methodology was therefore as follows:

- Gather available data;
- Validate all datasets for completeness and credibility;
- Identify the occasions when a meter by-pass had been operated;
- Match records of Consumption Adjustments against identified meter by-pass operations;.
- Determine meter by-pass operations with no matching Consumption Adjustment. Of these:
  a. Determine likely consumption while the by-pass was open; and
  b. Determine the likelihood that this consumption will not be adjusted for before the Line in the Sand;
- Aggregate the UIG associated with missing Consumption Adjustments; and
- Allocate the total UIG to Matrix Position.

**Working Assumptions**

As we undertook the methodology steps above, we applied a set of high-level operational assumptions to our interpretation of data and the results of our analysis. Our intention was that these assumptions would be validated - to the extent possible - as we came to determine the frequency of missing Consumption Adjustments at these sites[7]). The assumptions are as follows:

- A meter by-pass is in situ for a reason, and so its existence at a Supply Meter Point is indicative that it will be used;
- When a meter by-pass is operated, consumption continues at the Supply Meter Point at normal levels for that site;
- A by-pass cannot be 'partially' operated so that the meter continues to record some, but not all, actual consumption;
- A by-pass is operated for meter maintenance and exchange;
- Meter maintenance is undertaken reasonably frequently, given the nature of the meter population associated with larger and continuously consuming sites; and
- Meter exchange is undertaken only occasionally.

**Data Inputs**

We gathered the following data from the CDSP to facilitate the above methodology:

- The population of Supply Meter Points with a by-pass fitted;
- The recorded status of the meter by-pass – whether it is currently set to 'open' (in operation with gas by-passing the meter) or 'closed' (not in operation with gas flowing via the meter);

[7] In the end, we did not progress to this step in our methodology given the outcome of analysis at the earlier stages.

- Historical changes to the status of the meter by-pass;
- Consumption Adjustments carried out for sites with a by-pass fitted;
- AQ history for sites with a by-pass fitted; and
- Accepted and rejected read history for sites with a by-pass fitted.

**Identifying and Validating Baseline Population**

A pre-condition of a meter by-pass being operated is the existence of a meter by-pass at the Supply Meter Point. We identified these Supply Meter Points using a dataset comprising all records of a meter by-pass on the CDSP system.

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 37 | 2,341 |
| | 1PD | - | - | - | 57 |
| | 1NI | - | - | 174 | 6,355 |
| | 1PI | - | - | - | 1 |
| | 2ND | - | - | 6 | 213 |
| | 2PD | - | - | - | - |
| | 2NI | - | 3 | 112 | 1,676 |
| | 2PI | - | - | - | - |
| | 3 | 1 | 2 | 95 | 603 |
| | 4 | - | 6 | 87 | 391 |
| | 5 | - | 6 | 13 | 135 |
| | 6 | 1 | 7 | 6 | 67 |
| | 7 | 2 | 9 | 6 | 27 |
| | 8 | 4 | 10 | - | 8 |
| | 9 | 28 | - | - | 2 |

Whilst this is the best available view of meter by-pass population, the dataset could be justifiably questioned:

- There are a material number of domestic sites with a meter by-pass recorded as present. This is surprising as there are limited reasons why a by-pass would be required at a domestic premises; and
- Review group 0763 has concluded that there are sites where by-passes have been fitted but are not recorded on the CDSP system.

Notwithstanding the above, we concluded that this was a reasonable baseline dataset for our methodology, but that we would consider at later stages in the methodology whether some further validation or scaling might be required to account for the anomalies above. We also thought that our analysis during subsequent methodology steps would inform our view on this.

**Identifying the Operation of Meter By-passes**

Condition 1 for the creation of UIG requires that a by-pass is operated and consumption continues at the site while the by-pass is open. For the purpose of our investigation we assume that every time a meter by-pass is operated, consumption continues. We also assume that consumption continues at normal consumption levels; and that no situations occur whereby a by-pass can be partially operated so that the meter continues to record some, but not all consumption.

Our next step was to identify instances of meter by-pass operation within our baseline population of sites described above, by analysing the meter by-pass status indicator (which records the by-pass as being either open or closed).

There are two potential categories of by-pass operation identifiable using the meter by-pass status indicator:

- **Ongoing by-pass operations** – the status indicator is currently recorded as open on the CDSP system. There may also be completed by-pass operations recorded for these sites – see below; and
- **Completed by-pass operations** – the by-pass status indicator is currently recorded as closed; but at some point in the past it has been set to open. This may have happened more than once at the same Supply Meter Point.

To identify these by-pass operations, we used the current and historical meter by-pass status indicator records from the CDSP.

**Ongoing By-pass Operations**

We identified only a small number of sites with a current by-pass status indicator set to open.

Initial validation based on the age of the status indicator (the date when the current status of 'open' was set on the CDSP system) was immediately indicative of incorrect records:

| Year | Count of Supply Meter Points |
|---|---|
| **Pre 1970** | 2 |
| **1970-1980** | 1 |
| **1980-1990** | 4 |
| **1990-2000** | 47 |
| **Post 2000** | 2 |

We validated this further by analysing meter read history at these sites. We did this by analysing read information to determine whether meters were not advancing (as should be the case for an open by-pass), and advancing (as should be the case for a closed by-pass)[8]. This suggested that the majority of these sites have meters that are advancing, and that the by-pass status indicator has not been accurately maintained.

[8] The status indicator of 'open' proved generally to be inaccurate i.e. not reflective of the actual by-pass status, and the status indicator of 'closed' proved generally to be accurate. Because our investigation is interested in identifying completed by-pass operations, this point-in-time validation of current by-pass status indicator is not presented in any further detail.

We therefore decided to progress no further with investigating the potential UIG specifically related to sites with a by-pass currently open, but continued to include these sites in our baseline dataset for investigating completed by-pass operations and Consumption Adjustments.

**Completed Meter By-pass Operations**

Among all sites with a by-pass fitted, we looked for past changes to the by-pass status indicator from open to closed. We call this a "completed by-pass operation".

We identified the following completed by-pass operations according to the by-pass status indicator records spanning the life of each installed meter by-pass.

| EUC Band | Count of sites with a meter by-pass fitted | Count of known completed by-pass operations | Proportion of sites |
|---|---|---|---|
| **1ND** | 2,378 | 1 | 0.0% |
| **1PD** | 57 | - | - |
| **1NI** | 6,529 | 12 | 0.2% |
| **1PI** | 1 | - | - |
| **2ND** | 219 | - | - |
| **2PD** | - | - | - |
| **2NI** | 1,791 | 7 | 0.4% |
| **2PI** | - | - | - |
| **3** | 701 | 10 | 1.4% |
| **4** | 484 | 12 | 2.5% |
| **5** | 154 | 1 | 0.6% |
| **6** | 81 | 3 | 3.7% |
| **7** | 44 | 3 | 6.8% |
| **8** | 22 | 3 | 13.6% |
| **9** | 30 | 4 | 13.3% |

We call these "known completed by-pass operations", on the assumption that there is no other reason for a Shipper to set the by-pass status indicator from open to closed.

We note that none of the sites in our baseline population showed more than one known completed by-pass operation since the installation date of the by-pass.

Using the history of the by-pass status indicator alone suggests that only a handful of meter by-passes have been operated since they were installed. With an ongoing working assumption that meter by-passes are installed because they are required; and a complementary assumption that by-passes are operated for reasonably regular meter maintenance and exchange, we concluded that the above set of known completed meter by-pass operations would not serve as a robust basis upon which to estimate the frequency of "missing" Consumption Adjustments.

We also concluded that the CDSP system is generally not being notified of a change in meter by-pass status.

**Consumption Adjustments as an Indicator of Completed By-pass Operations**

Having discounted using the by-pass status indictor history to identify completed meter by-pass operations, we considered alternatives. Specifically, we considered whether Consumption Adjustments records might themselves be indicative of the operation of a meter by-pass.

A crucial piece of information not held in the CDSP system is the reason why a Consumption Adjustment was submitted. There is currently no requirement to provide a reason. We investigated other ways to use the available data to identify completed by-pass operations.

We first identified all Consumption Adjustments undertaken for sites in our baseline population since 2017 (the extent of the available Consumption Adjustment records):

| EUC Band | Count of sites with a meter by-pass fitted | Count of sites with Consumption Adjustments 2017-2021 | Count of sites with multiple Consumption Adjustments 2017-2021 |
|---|---|---|---|
| **1ND** | 2,378 | 54 | 7 |
| **1PD** | 57 | - | - |
| **1NI** | 6,529 | 225 | 13 |
| **1PI** | 1 | - | - |
| **2ND** | 219 | 11 | 2 |
| **2PD** | - | - | - |
| **2NI** | 1,791 | 125 | 11 |
| **2PI** | - | - | - |
| **3** | 701 | 106 | 9 |
| **4** | 484 | 81 | 9 |
| **5** | 154 | 32 | 5 |
| **6** | 81 | 17 | 7 |
| **7** | 44 | 11 | 5 |
| **8** | 22 | 7 | 3 |
| **9** | 30 | 12 | 6 |

We then considered four aspects of a Consumption Adjustment record that might be of use in identifying whether it relates to a completed by-pass operation:

- The timing of the adjustment: do these timing match a known by-pass operation?;
- The direction of the adjustment: negative adjustments should not occur if reflecting a meter by-pass being opened;
- The duration of the adjustment: does the span of dates for the adjustment resemble what we would expect to see for a by-pass operation (i.e. days/weeks rather than months/years); and
- The amount of the adjustment: does the consumption estimated reflect all expected consumption for the duration, or only some?

The results of our analysis were no more conclusive for the purposes of our UIG methodology.

For timing, we compared Consumption Adjustment records against the known completed by-pass operations we had identified above using by-pass status indicator.

| EUC Band | Count of known completed by-pass operations | Consumption Adjustment matches to a known by-pass operation period 2017-2021 | Consumption Adjustment overlaps known by-pass operation period 2017-2021 |
|---|---|---|---|
| **1ND** | 1 | - | - |
| **1PD** | - | - | - |
| **1NI** | 12 | - | 2 |
| **1PI** | - | - | - |
| **2ND** | - | - | - |
| **2PD** | - | - | - |
| **2NI** | 7 | - | 1 |
| **2PI** | - | - | - |
| **3** | 10 | - | 2 |
| **4** | 12 | - | 5 |
| **5** | 1 | - | 1 |
| **6** | 3 | - | 2 |
| **7** | 3 | - | 1 |
| **8** | 3 | - | 1 |
| **9** | 4 | - | 1 |

The results show that no Consumption Adjustment records exist with dates that match a known completed by-pass operation. Only a small handful of Consumption Adjustment records exist with dates that overlap known meter by-pass events. Instead, the majority of Consumption Adjustments have been submitted for periods during which there was no known by-pass operation. For the purposes of identifying completed meter by-pass events, the results of the analysis are inconclusive. However, they do suggest that Consumption Adjustments are not being submitted following a completed by-pass operation.

Analysing the direction of the Consumption Adjustment records showed the majority being positive adjustments:

| Total Consumption Adjustments | Positive Adjustments | Negative Adjustments | Blank (No Adjustment) |
|---|---|---|---|
| **681** | 566 | 109 | 6 |

Whilst this might have proved useful in discounting records that do not relate to a completed by-pass operation, this information is of limited use in the context of the inconclusive outcomes across the broader investigation.

With regards to the duration of Consumption Adjustments, the results also precluded the identification of completed by-pass operations:

| EUC Band | Average Volume (kWh) | Average Length of Time (Days) | Unique Count |
|---|---|---|---|
| **1ND** | 226 | 40 | 42 |
| **1PD** | - | - | - |
| **1NI** | 580 | 59 | 244 |
| **1PI** | - | - | - |
| **2ND** | 1,188 | 14 | 9 |
| **2PD** | - | - | - |
| **2NI** | 1,620 | 18 | 136 |
| **2PI** | - | - | - |
| **3** | 7,065 | 22 | 98 |
| **4** | 13,501 | 28 | 86 |
| **5** | 281,357 | 105 | 32 |
| **6** | 63,010 | 6 | 16 |
| **7** | 745,211 | 74 | 12 |
| **8** | 406,484 | 29 | 9 |
| **9** | 266,360 | 1 | 11 |

These average duration values in the table above do not align with our expectation of the duration of a meter by-pass operation[9].

Finally, we considered the size of Consumption Adjustments made, with the hypothesis that by-pass related Consumption Adjustments should be reasonably obvious given the estimated consumption would amount to the entire daily consumption, multiplied by the number of days the Consumption Adjustment was for.

At a high level, the average consumption being adjusted does not seem indicative of completed by-pass operations, except for perhaps in the higher EUC Bands, notwithstanding that a Consumption Adjustment may be submitted seeking simultaneously to adjust consumption for other reasons. We note that there are several other circumstances in which a Consumption Adjustment is permitted or even required, including but not limited to:

- Identification that a meter has been recording inaccurately;
- An Incorrect Correction Factor has been recorded; and
- A corrective meter exchange has occurred.

The results of our analysis led us to conclude that Consumption Adjustment data is not sufficient to identify completed meter by-pass operations, at the same time as further reinforcing the view that

[9] We assume around two weeks for complex meter maintenance or replacement activity; probably significantly less for routine maintenance.

Consumption Adjustments are generally not being submitted to account for completed by-pass operations.

**Meters With a By-pass Fitted: Summary and Conclusions**

As a reminder of the intended outcome of our investigation, our methodology sought to identify:

- The operation (opening) of a meter by-pass; and
- A Consumption Adjustment NOT being made to accompany that by-pass operation in advance of the Line in the Sand

With the data available to us, we have been unable to identify those occasions on which a meter by-pass has been operated at the Supply Meter Points in our dataset. Without any reasonable output from this fundamental step in our methodology, we cannot progress to subsequent steps, including estimating the extent (if any) of missing Consumption Adjustments.

At the highest level, the obstacles are that:

- **The meter by-pass status indicator is not properly maintained**. This indicator is the primary means by which our methodology identifies completed meter by-pass operations[10] that might be giving rise to unadjusted-for consumption (UIG);
- **There is no reason given when a Consumption Adjustment is submitted**, and we have been unable to identify any reasonable alternative approach to matching Consumption Adjustments with completed meter by-pass operations. We therefore have no way to identify the frequency of the "missing" Consumption Adjustments that would contribute to positive UIG.

We have therefore not identified UIG relating to sites with a meter-by-pass for the Gas Year 2022-2023. Furthermore, we do not expect that the availability and quality of the data required for this methodology will be sufficient at any time in the foreseeable future.

However, as well as concluding that meter by-pass status is not maintained in the CDSP system, our investigation makes it quite clear that there is very limited Consumption Adjustment activity being undertaken at sites with a recorded meter by-pass. There are three possible reasons for this:

- **CDSP meter by-pass records are wrong**: these sites do not in fact have meter by-passes installed;
- **Consumption Adjustments are not required to be made**: current rules impose a threshold of 10,000 kWh of estimated consumption when the by-pass was open, below which the obligation to submit an adjustment does not apply; or
- **Shippers are not submitting Consumption Adjustments** for completed meter by-pass operations in cases when they would be required.

We think that a combination of all three reasons is a plausible explanation of our findings, and this view is strongly supported by the initial findings of Review Group 0763, among which:

- **The open by-pass status is currently an unreliable indicator**: The majority of the open statuses investigated by Shippers have been set in error;

[10] The alternative means being the use of records of Consumption Adjustment timing, duration and estimated consumption value – which we have now discounted as inconclusive.

- **Very few Consumption Adjustments on "open" sites are unactioned**: Only two of the open statuses investigated actually required Consumption Adjustments to be submitted. The rest of the cases had been properly actioned or did not require a Consumption Adjustment; and
- **System records of meter by-passes are generally poor**: Industry by-pass records are not properly maintained. By-pass information is not being shared. Transporters are not being informed of some Supply Meter Points having by-passes fitted.

At face value, the outcome of our methodology, based on the data available, would conclude that meter by-passes are not being used. In our remit to apply expert judgment, we think this is sufficiently counter-intuitive as to be a highly questionable conclusion. As such it warrants continued investigation.

**Next Steps and Future Methodology**

In accordance with our overarching annual AUGE process, this contributor will be re-assessed alongside all others identified in early 2022.

It is likely to score highly in our assessment – as it did this year – based on the potential scale of UIG, but also based on a clear view of the limited Consumption Adjustment records among this year's baseline dataset, and the other findings of the detailed investigation above.

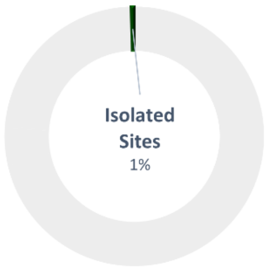
However, the methodology followed in this proposed final Statement has been proven unviable on the basis of the data available. We do not consider that the usefulness of this data will improve with a further year of industry operation. Therefore an alternative approach will be necessary using data that we did not request this year, but that we believe is realistic to acquire with the support of industry.

To that end we will be collaborating with industry – through the ongoing Review Group 0763 and the AUG Sub-Committee – to discuss the development of this alternative methodology for investigation for the 2023-2024 Gas Year. These discussions will inform our assessment process in the Spring.

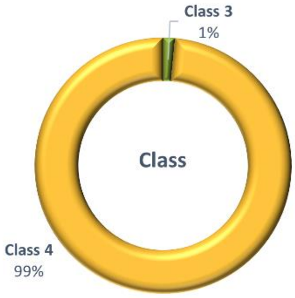
# 160 – ISOLATED SITES (NEW)

## DASHBOARD

*% Share of total UIG*




*UIG split by Class*




*UIG split by Sector*


| GAS YEAR 2022-2023 UPDATES |
|---|
| This is a new contributor for the 2022-2023 Gas Year. |

| UIG | Gas Year 2021-2022 | Gas Year 2022-2023 |
|---|---|---|
| 160 Isolated Sites | n/a | **47 GWh** |

## DESCRIPTION

**Settlement Context**

Any Supply Meter Point with a status set to “isolated” in the UK Link central industry database is excluded from allocation as part of standard Settlement processes. The isolation flag indicates the presence of equipment fitted to the Supply Meter Point to prevent gas from flowing. In such cases, the site remains registered to a Shipper but the Shipper is not allocated any energy.

If the site is recorded as isolated, but for any reason gas is consumed, this consumption will not be directly allocated to a Shipper but will instead contribute to UIG.

**Definition**

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

- Have a Shipper currently registered;
- Have an isolation flag set within UK Link; and
- Are consuming gas.

This contributor does not consider cases where the Supply Meter Point has never been, or is no longer registered to, a Shipper. This is considered in the Unregistered Sites (020) and Shipperless Sites (025) contributors respectively.

Meterless Sites is also not analysed as part of this contributor. This would be covered in Meterless Sites (150) should this be selected for Initial Assessment in the future.

Any consumption that is due to theft is considered within Theft of Gas (010).

**UIG Impact**

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

## ANALYSIS AND RESULTING METHODOLOGY

**Establishing Current Population of Isolated Sites**

We identified the total number of Isolated Sites, by date of isolation. This confirmed a broad spread of isolation dates, but with the majority of affected sites being isolated in the last three years.

| Year of Isolation | Count of Sites | Year of Isolation | Count of Sites | Year of Isolation | Count of Sites |
|---|---|---|---|---|---|
| **1983** | 1 | **2001** | 92 | **2012** | 131 |
| **1989** | 1 | **2002** | 215 | **2013** | 168 |
| **1992** | 1 | **2003** | 160 | **2014** | 236 |
| **1993** | 2 | **2004** | 288 | **2015** | 205 |
| **1994** | 1 | **2005** | 537 | **2016** | 395 |
| **1995** | 1 | **2006** | 145 | **2017** | 376 |
| **1996** | 3 | **2007** | 159 | **2018** | 476 |
| **1997** | 11 | **2008** | 137 | **2019** | 1,064 |
| **1998** | 32 | **2009** | 90 | **2020** | 1,649 |
| **1999** | 21 | **2010** | 103 | **2021** | 9,569 |
| **2000** | 39 | **2011** | 181 | **2022** | 1,659 |

We then identified the Matrix Position of the Isolated Sites. This showed that almost all EUC Bands currently contain such sites.

| | CLASS | | | | |
|---|---|---|---|---|---|
| | Count | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 607 | 13,449 |
| | 1PD | - | - | 13 | 621 |
| | 1NI | - | - | 197 | 2,607 |
| | 1PI | - | - | 4 | 44 |
| | 2ND | - | - | 5 | 123 |
| | 2PD | - | - | - | 1 |
| | 2NI | - | - | 15 | 364 |
| | 2PI | - | - | - | 4 |
| | 3 | - | - | 8 | 60 |
| | 4 | - | - | 1 | 15 |
| | 5 | - | - | 1 | 6 |
| | 6 | - | - | - | 3 |
| | 7 | - | - | - | - |
| | 8 | - | - | - | - |
| | 9 | - | - | - | - |

### Identifying UIG Among Isolated Sites

To determine which of these Supply Meter Points might be consuming gas which will not be allocated due to the isolation status, we investigated the accepted and rejected reads for the current snapshot of Isolated Sites. For both these datasets we split the sites into three categories:

- Those with advancing meters (75% or more of read periods since isolation showed a meter advance);
- Those with non-advancing meters (no read advance or fewer than 25% of read periods showing consumption); and
- Those with insufficient reads to determine whether the meter is advancing.

Our investigation identified that a significant number of Isolated Sites had advancing meter reads. If none of these Supply Meter Points have their current isolated status corrected before the Line in the Sand then an estimated 34 GWh of positive UIG would be created.

However, rather than assume that this will be the case, we continued our investigation to determine the likely eventual outcome at the Line in the Sand.

### Determining the Future Status of the Currently Isolated Sites

By examining past movements between snapshots of data, it is possible to model a likely future state of the current snapshot of Isolated Sites. However, because this is the first time Isolated Sites have been assessed, the snapshot data available to us spans a relatively short period. In essence, we have been tracking movements in Isolated Sites data for six months only.

It is therefore necessary to establish a proxy for the future state we are interested in (the Line in the Sand for Gas Year 2022-2023). To do this, we identified the Isolated Sites that have an isolation date before 2019. These sites are likely to have already created UIG at the Line in the Sand. For our investigation, we assumed therefore that the size and nature of this historic isolated portfolio would be a reasonable proxy for that which will create positive UIG in the target Gas Year[11].

We cross referenced the Isolated Sites with our theft of gas dataset to check if there were any which had a theft of gas subsequent to the isolation date. We identified 3 instances where this occurred and in these instances we removed the Isolated Sites from the dataset.

The Supply Meter Point counts and the sum of AQs (MWh) of this portfolio are:

| | | CLASS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 Count | 1 AQ | 2 Count | 2 AQ | 3 Count | 3 AQ | 4 Count | 4 AQ |
| EUC BAND | **1ND** | - | - | - | - | 10 | 71 | 1,155 | 13,243 |
| | **1PD** | - | - | - | - | 1 | 21 | 60 | 343 |
| | **1NI** | - | - | - | - | 1 | 4 | 46 | 577 |
| | **1PI** | - | - | - | - | - | - | 1 | 14 |
| | **2ND** | - | - | - | - | - | - | 5 | 586 |
| | **2PD** | - | - | - | - | - | - | - | - |
| | **2NI** | - | - | - | - | 2 | 240 | 8 | 1,124 |
| | **2PI** | - | - | - | - | - | - | - | - |
| | **3** | - | - | - | - | 1 | 331 | 3 | 1,392 |
| | **4** | - | - | - | - | - | - | 2 | 2,364 |
| | **5** | - | - | - | - | - | - | - | - |
| | **6** | - | - | - | - | - | - | - | - |
| | **7** | - | - | - | - | - | - | - | - |
| | **8** | - | - | - | - | - | - | - | - |
| | **9** | - | - | - | - | - | - | - | - |

**Extrapolation of Initial Results to Include Sites with Insufficient Read Data**

Not all Supply Meter Points within the dataset have either an accepted or rejected read. It is reasonable to assume that a proportion of the Isolated Sites with insufficient reads are consuming gas. Therefore to calculate the UIG at the Line in the Sand we added the AQ of the pre 2019 Advancing Isolated Sites to the AQ of the proportion of Isolated Sites with insufficient reads that are likely to be advancing.

[11] With each subsequent year that this methodology is applied our ability to forecast the likely isolated portfolio at the Line in the Sand will improve.

For the Supply Meter Points that were isolated before 2019, the proportion of Advancing, Non-advancing and sites with insufficient reads within the isolation period are:

| EUC Band | Advancing | Not Advancing | Insufficient Reads |
|---|---|---|---|
| **1ND** | 32% | 7% | 61% |
| **1PD** | 44% | 17% | 38% |
| **1NI** | 14% | 13% | 73% |
| **1PI** | 50% | 50% | 0% |
| **2ND** | 26% | 11% | 63% |
| **2PD** | - | - | - |
| **2NI** | 18% | 11% | 71% |
| **2PI** | - | - | - |
| **3** | 36% | 0% | 64% |
| **4** | 50% | 0% | 50% |
| **5** | 0% | 0% | 100% |
| **6** | - | - | - |
| **7** | - | - | - |
| **8** | - | - | - |
| **9** | - | - | - |

**Methodology**

The overall approach is to:

- Identify the Isolated Sites and associated AQ that have an isolated date before 2019 and do not have a theft record within the TRAS/TOG dataset;
- Identify the pre 2019 Isolated Sites and associated AQ that are Advancing, Non-advancing and those with insufficient reads using the accepted and rejected read files ;
- Calculate the proportion and associated AQ of pre 2019 Isolated Sites with insufficient reads that are likely to be advancing; and
- Calculate the UIG by adding the AQ of the pre 2019 Advancing Isolated Sites to the proportion of AQ of the Isolated Sites with insufficient reads that are likely to be advancing.

## CALCULATION

**Inputs**

- Isolated Sites report from CDSP;
- Isolated Meter Reads from CDSP; and
- Isolated Meter Read rejections from CDSP.

### Assumptions

- Isolated Sites with reads showing advancement have consumed since the date of isolation;
- Isolated Sites with insufficient reads advance in the same proportion as those that can be determined;
- The portfolio of Isolated Sites will not undergo significant characteristic change in the coming years; and
- Supply Meter Points that are no longer isolated by the Line in the Sand are in fact reconciled properly for any energy used during the period when the isolation status was set.

### Calculation

The detailed calculation is described below.

*Identify the pre 2019 Isolated Sites*

1. For each Matrix Position identify the Supply Meter Points and calculate the total AQ for sites isolated pre 2019; and
2. Cross reference this data with the theft of gas master dataset and remove any that had theft of gas past the isolation date.

*Identify reads and calculate the advancing proportions*

3. Obtain all the isolated meter reads and meter read rejections for Isolated Sites in isolation pre 2019, as at July 2021;
4. Identify the count of Isolated Sites, associated AQ and whether they are
    a. Advancing (75% or more of read periods since isolation showed a meter advance);
    b. Non-advancing (no read advance or fewer than 25% of read periods showing consumption); and
    c. Those with insufficient reads to determine whether they are advancing;
5. From the Isolated Sites data identified in step 4, calculate for each Matrix Position the
    a. Sum of the AQ of Advancing Isolated Sites;
    b. Sum of the AQ of Non-Advancing Isolated Sites; and
    c. Sum of the AQ of Isolated Sites with insufficient reads to identify if the site is advancing;
6. Calculate the pre 2019 “Isolated Sites Advancing Proportion” for each Matrix Position by dividing the sum of the Advancing Sites AQ (step 5a) by the sum of Advancing and Non-advancing AQ (steps 5a and 5b); and
7. Calculate the pre 2019 “Insufficient Reads Advancing AQ” for each Matrix Position by multiplying the sum of the Isolated Sites with insufficient reads AQ (step 5c) by the Isolated Sites Advancing proportion (step 6).

*Determine the UIG*

8. For each Matrix Position, extrapolate UIG by adding the sum of the AQ for Advancing Isolated Sites (step 5a) to the Insufficient Reads Advancing AQ (step 7).

**Output**

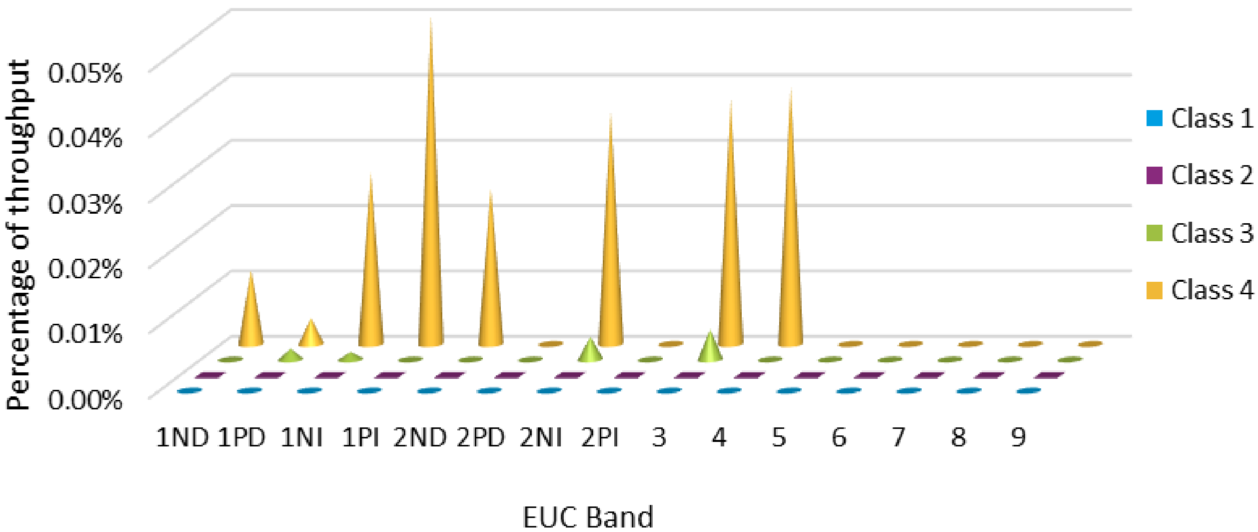
Forecast UIG values for the target Gas Year, at the Line in the Sand, for this contributor, by Matrix Position.

## RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **47 GWh**. This is broken down by Matrix Position as follows[12]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 0 | 28 |
| | 1PD | - | - | 0 | 1 |
| | 1NI | - | - | 0 | 2 |
| | 1PI | - | - | - | 0 |
| | 2ND | - | - | - | 2 |
| | 2PD | - | - | - | - |
| | 2NI | - | - | 0 | 4 |
| | 2PI | - | - | - | - |
| | 3 | - | - | 0 | 4 |
| | 4 | - | - | - | 5 |
| | 5 | - | - | - | - |
| | 6 | - | - | - | - |
| | 7 | - | - | - | - |
| | 8 | - | - | - | - |

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

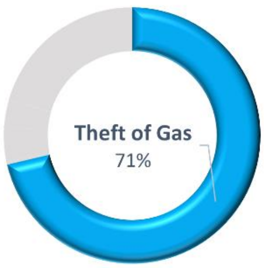



[12] Note that due to rounding the individual Matrix Position values in aggregate may not equal total value. Zeros are rounded values. Dashes are where the Matrix Position is forecast to be empty.

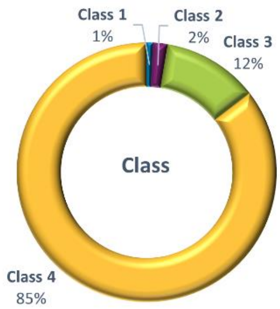
# 010 – THEFT OF GAS – AMR INVESTIGATION (REFINEMENT)

## DASHBOARD

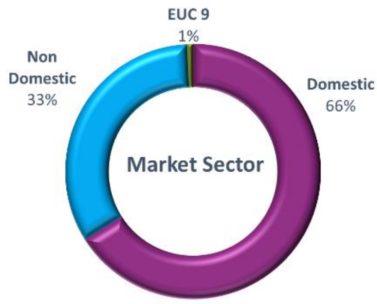
*% Share of total UIG*




*UIG split by Class*




*UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES |
|---|
| • This is a refinement of our 2021-2022 methodology to consider additional data on theft at AMR sites only. This allows us to more fairly allocate undetected theft across the Matrix Positions.<br>• Existing data inputs updated to reflect an additional year of industry data.<br>• The implementation of 0734S will remove any unreported theft and so this element has been removed from our estimate. |

| UIG | Gas Year 2021-2022 | Gas Year 2022-2023 |
|---|---|---|
| 010 Theft of Gas | 7,730 GWh | **7,602 GWh** |

## 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 part 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 have been several industry schemes in place to identify theft in recent years. These are:

- The Theft Risk Assessment Service (TRAS) which enables Suppliers to assess the risk of energy theft at consumer premises to help target theft investigations. The service 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), previously operated 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) which sets targets for identifying theft and rewards Suppliers based on the number they detect.

All three schemes have now been incorporated under Retail Energy Code arrangements, noting that TRAS is currently on hold as part of this transition (with data available up to March 2021).

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 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 incentivised based on 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. This does not in itself provide a compelling incentive to detect theft.

Settlement Adjustments

Where Shippers or DNOs become aware of theft, they are required to report this 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.

## REFINEMENT ANALYSIS

Our initial assessment process for the 2022-2023 Gas Year identified and prioritised the refinement of this contributor's methodology by expanding our analysis of theft at Supply Meter Points with AMR equipment fitted. The previous analysis and resultant methodology for Theft of Gas described in the AUG Statement for Gas Year 2021-2022 remains applicable for this year – full details can be found in Appendix 5. The additional analysis is described here.

**Additional Analysis Undertaken**

The focus of the analysis described below is the theft associated with AMR meters.

We first focussed on getting a report of all the sites that have an AMR fitted. When validating the original AMR report with the industry, the numbers were lower than we and the industry expected. We therefore added the telemetered sites to the AMR report, we asked for a history of AMRs fitted and asked for embedded AMR data. We identified meter types with embedded AMR functionality using the start of their Serial Numbers: those starting E016, 25, 40, 65, 100 and 160.

From this master dataset we were able to determine the percentage[13] of AMR sites for each Matrix Position:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 0% | 0% |
| | 1PD | - | - | - | 0% |
| | 1NI | - | - | 79% | 32% |
| | 1PI | - | - | 50% | 4% |
| | 2ND | - | - | 16% | 10% |
| | 2PD | - | - | - | 0% |
| | 2NI | - | 65% | 82% | 53% |
| | 2PI | - | - | 59% | 11% |
| | 3 | - | 67% | 75% | 59% |
| | 4 | - | 69% | 75% | 62% |
| | 5 | 83% | 41% | 75% | 57% |
| | 6 | - | 17% | 68% | 55% |
| | 7 | - | 15% | 46% | 43% |
| | 8 | 2% | 14% | 49% | 37% |
| | 9 | 4% | 58% | 78% | 14% |

We compared our AMR dataset with our master theft dataset to identify the Supply Meter Points that had a theft while the AMR was fitted and Supply Meter Points that had a theft prior to the AMR equipment being registered as in situ.

From the AMR data and the theft master dataset we identified that only 1% of the detected theft was carried out when AMR equipment was fitted.

Due to the small population of AMR thefts we were not able to identify any trends in the changing number of AMR thefts year on year. We therefore assumed 1% as our forecast for AMR theft for the target Gas Year, which is split between the EUC bands using the same principle applied in splitting traditional theft, i.e. by the percentage of detected theft in each EUC band[14].

[13] Zeros are rounded values. Dashes are where the Matrix Position is empty.
[14] Note that smart theft is split instead by the proportion of smart meters in each EUC band because this meter population is changing so quickly.

The table below provides the percentage of AMR theft by EUC band.

| EUC Band | Theft whilst AMR fitted |
|---|---|
| 1ND | 0.1% |
| 1PD | - |
| 1NI | 37.1% |
| 1PI | - |
| 2ND | 1.2% |
| 2PD | - |
| 2NI | 44.4% |
| 2PI | - |
| 3 | - |
| 4 | 17.3% |
| 5 | - |
| 6 | - |
| 7 | - |
| 8 | - |
| 9 | - |

This AMR theft was then removed from the traditional theft data, resulting in updated traditional theft percentages for the last ten years as follows:

| EUC Band | Traditional Theft Percentage |
|---|---|
| 1ND | 35.3% |
| 1PD | 21.6% |
| 1NI | 20.8% |
| 1PI | 0.1% |
| 2ND | 2.3% |
| 2PD | 0.1% |
| 2NI | 7.2% |
| 2PI | - |
| 3 | 1.8% |
| 4 | 1.9% |
| 5 | 1.5% |
| 6 | 1.7% |
| 7 | 2.3% |
| 8 | 3.3% |
| 9 | - |

**Resulting Methodology**

The overall approach to calculating UIG associated with Theft of Gas remains as per last year:

- 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 sophisticated (more likely to be undertaken by organised criminals); and
- Allocate these different categories of theft to the Matrix Positions using the selected allocation approach.

## CALCULATION

**Inputs**

- TOG Theft Information from the CDSP;
- TRAS Theft Information report[15] (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 in Appendix 5;
- Undetected Sophisticated Theft percentage as described in the Undetected Theft section in Appendix 5;
- Our Consumption Forecast (as described in Section 4 of this Statement); and
- AMR Supply Meter Point information from CDSP.

**Assumptions**

- Changes to the TRAS arrangements will not affect the number of thefts identified by Suppliers in advance of the Line in the Sand;
- Detected theft trends are a reasonable indicator of typical undetected theft;
- There is a proportion of undetected theft that is sophisticated and undertaken by organised criminals operating across all market sectors; and
- The imminent implementation of Modification 0734S[16] will increase the amount of reported theft and eliminate unreported theft.

[15] Available data covers the period June 2015 to March 2021

[16] 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 in Appendix 5; 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 a comprehensive 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. Aggregate theft detected and theft to be detected by theft year;
10. Forecast the detected theft that will take place in 2022 and 2023 using trend extrapolations of the aggregate data;
11. 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
12. Increase the forecast of the detected theft that will take place in 2022 and 2023 by this proportion.

*Determine a forecast of undetected theft for the target Gas Year*

13. Obtain the overall theft forecast for the target Gas Year from step 2; and
14. Difference this to the forecast of detected theft for the target Gas Year from step 12 to get a forecast of the undetected theft for the target Gas Year.

*Categorised undetected theft for the target Gas Year*

15. Take the Undetected Sophisticated Theft percentage, as determined in the Setting a Level for Total Theft section in Appendix 5;
16. Apply this to the undetected theft to obtain a forecast of Undetected Sophisticated Theft for the target Gas Year; and

17. Difference this to the forecast of undetected theft for the target Gas Year from step 14 to obtain a forecast of Typical Undetected Theft for the target Gas Year.

*Allocate detected Unadjusted For Theft, Undetected Typical Theft and Undetected Sophisticated Theft to the Matrix Positions*

18. Allocate Typical Undetected Theft and Undetected Sophisticated Theft across Matrix Positions on the basis described in the table below:

| Type of Theft | Sub type | Basis of Matrix Allocation |
|---|---|---|
| **Adjusted For Theft** | | N/A |
| **Undetected Theft** | Undetected Typical Theft | <u>Traditional Meters</u><br><br>The forecast quantity of Undetected Typical Theft, less the amount of this attributable to smart meters and AMR meters (see below).<br><br>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.<br><br>Then sub-allocated across Classes as in proportion to our Consumption Forecast for traditional meters (as described in Appendix 5).<br><br><u>Smart Meters</u><br><br>The forecast quantity of Undetected Typical Theft attributable to smart meters (as described in Appendix 5).<br><br>Allocated in proportion to our Consumption Forecast for smart meters.<br><br><u>AMR Meters</u><br><br>The forecast quantity of Undetected Typical Theft attributable to AMR.<br><br>Allocated in proportion to identified AMR theft. |
| **Undetected Theft** | Undetected Sophisticated Theft | The forecast quantity of Undetected Sophisticated Theft.<br><br>Allocated in proportion to throughput for all Matrix Positions. |

**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: **7,602 GWh**. This excludes the **101GWh** adjusted for theft which will enter Settlement.

This is broken down as follows:

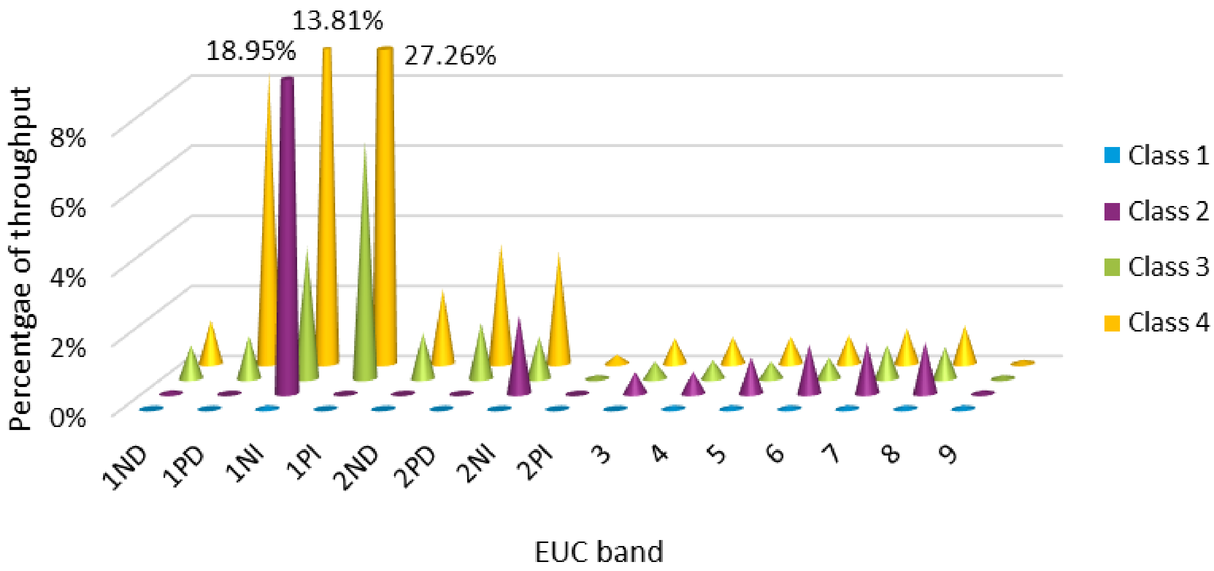
- Undetected theft was calculated to be **7,602 GWh**, split as follows:
    a. Undetected Typical Theft (theft akin to detected theft): **7,087 GWh**; and
    b. Undetected Sophisticated Theft (theft using sophisticated techniques that are very difficult to detect): **514 GWh.**

The total theft is allocated across Matrix Positions as follows[17]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | 0 | 0 | 542 | 3,058 |
| | 1PD | - | - | 15 | 1,250 |
| | 1NI | 0 | 0 | 100 | 1,121 |
| | 1PI | - | - | 0 | 8 |
| | 2ND | - | - | 4 | 145 |
| | 2PD | - | - | 0 | 5 |
| | 2NI | - | 0 | 82 | 381 |
| | 2PI | - | 0 | 0 | 0 |
| | 3 | 0 | 0 | 35 | 86 |
| | 4 | 0 | 1 | 43 | 103 |
| | 5 | 0 | 2 | 22 | 73 |
| | 6 | 0 | 14 | 17 | 78 |
| | 7 | 1 | 37 | 26 | 83 |
| | 8 | 4 | 83 | 21 | 102 |
| | 9 | 55 | 1 | 0 | 2 |

[17] 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.

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




## NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor as 7,730 GWh (compared to this year's quantification of 7,602 GWh).

This difference is due to the relative decrease in consumption forecast for the target Gas Year compared to the Statement for Gas Year 2021-2022, and the upcoming implementation of 0734S should ensure that all identified theft will enter Settlement. The difference in allocation of UIG between Matrix Positions is a result of the refinement of our methodology to separately consider sites with AMR equipment and due to the refreshed data within the TOG and TRAS dataset.

**Future Changes to the Theft Detection and Reporting Regime(s)**

Changes to the theft detection arrangements are likely as a result of being included within the Retail Energy Code (REC). Also, we expect ongoing work within REC to establish an estimate of total energy theft for electricity and gas.

These developments do not impact the theft UIG methodology used in this Statement but may affect both the information available for consideration, and the actions that Suppliers take to investigate theft.

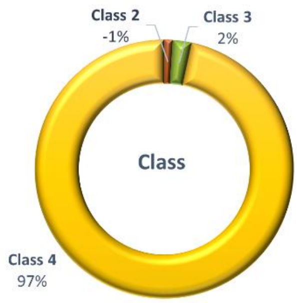
In keeping with the defined annual AUGE process, the merits of all such developments will be assessed when further information becomes available, and our methodologies may be refined where appropriate.

# 090 – NO READ AT THE LINE IN THE SAND (REFINEMENT)

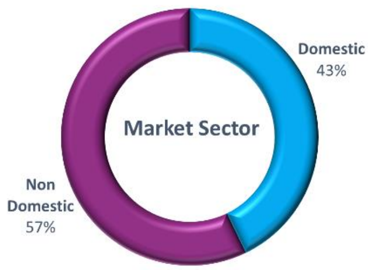
## DASHBOARD

*% Share of total UIG*


*UIG split by Class*




*UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES |
|---|

- The methodology for Gas Year 2021-2022 has been expanded to consider a number of additional relevant read rejection reasons when calculating the percentage error in reconciliation attributable to a lack of accepted meter read.
- Existing data inputs updated to reflect an additional year of industry data.

| UIG | Gas Year 2021-2022 | Gas Year 2022-2023 |
|---|---|---|
| 090 No Read at the Line in the Sand | 643 GWh | **861 GWh** |

## 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, allocation is estimated based on a rolling AQ. For DM Supply Meter Points, it is normally based on actual meter reads. Where these are not available, it is estimated based on a recent read or, failing that, an AQ. So, by its very nature, the process for allocation relies on 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 older than the accepted read. 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 permitted. The Line in the Sand for any Gas Day falls three to four years after that Gas Day[18].

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.

## REFINEMENT ANALYSIS

Our initial assessment process for the 2022-2023 Gas Year identified and prioritised the refinement of this contributor's methodology. This refinement is an extension of the 2021-2022 analysis, and so the previous analysis and resultant methodology for No Read at Line in the Sand described in the 2021-2022 AUG Statement remains applicable for this year - full details can be found in Appendix 5. Only the additional analysis is described here.

[18] 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.

**Additional Analysis Undertaken**

The refinements to this contributor identified by the initial assessment process for this proposed final Statement were:

- An updated method to determine the unreconciled percentages - based on actual reconciliation percentages at the Line in the Sand; and
- The use of additional read rejection reasons not previously considered.

The datasets for each refinement were specified and requested from the CDSP. However, in the case of the reconciliation percentages, and contrary to the assumptions made during initial assessment, it was not ultimately possible to procure the data necessary to undertake the proposed additional analysis. It remains our intention to include this refinement in the Statement for Gas Year 2023-2024, pending further work by the CDSP.

The refinement analysis now focusses only on the consideration of additional read rejection reasons.

We consider rejected reads data in order to understand the extent of consumption that is unreconciled before the Line in the Sand (and the positive or negative UIG that this might create). By analysing this data, we can identify cases where a meter did indeed advance, but this consumption was not taken into account given the lack of valid meter reads used for Settlement. Comparing the output site AQs from these cases with the assumed AQs that would actually be used at the Line in the Sand, we derive a percentage error that can be used to propose an overall level of UIG associated with this contributor.

In last year's Statement for Gas Year 2021-2022, only two read rejection reasons were used to determine the error percentage. During this year's initial analysis we identified an additional list of read rejection reasons which we considered should be included within scope of our investigation. The existing methodology was applied to this additional group of rejection codes: we sought a pair of reads approximately a year apart, calculated the energy associated with the reads and then compared that with the current AQ to identify the potential Settlement error.

As there may now be multiple rejected reads and reasons for a Supply Meter Point, our methodology identifies and uses the most recent rejection pair to reflect an up-to-date consumption value.

Incorporating these additional read rejection reasons allowed us to calculate and include 16,671 meter advances that would not otherwise have been taken into account in our calculation of UIG. This in turn identified an additional 26% of net positive UIG, compared to using the previous set of read rejection codes.

| Rejection Reason | Count of Cases |
|---|---|
| A convertor serial number has been supplied where no convertor is fitted | 1 |
| Asset Status is not live | 3 |
| Convertor corrected read has been supplied where no convertor is fitted | 2 |
| Convertor round the clock count should not be provided where a convertor is not fitted | 2 |
| Convertor uncorrected read has been supplied where no convertor is fitted | 1 |
| Meter not found for Meter Point | 1 |
| Meter Point has no read to be replaced | 175 |
| Meter read reason invalid for a Shipper Provided Estimated read | 2 |
| Meter serial number provided is for previous meter | 127 |
| MPRN received in an incorrect file based on its class on the read date | 29 |
| New corrected reading is less than previous corrected reading | 2 |
| New Meter Reading is less than previous Meter reading | 12,509 |
| Non-opening reading received outside the read receipt window | 214 |
| Overide tolerance passed and override flag provided | 79 |
| Read date lies within a consumption adjusted period | 1 |
| Reading breached the Lower Outer Tolerance | 12,843 |
| Reading breached the Upper Inner Tolerance value and no overide flag provided | 880 |
| Reading Breached the Upper Outer Tolerance | 2,845 |
| Reading is higher than a subsequent actual valid Meter reading | 1 |
| The convertor corrected read has not been supplied where there is a convertor fitted and the convertor reads are usable | 5 |
| The convertor round the clock count has not been supplied | 7 |
| The convertor serial number has not been supplied where there is a convertor is fitted | 4 |
| The convertor serial number on the read does not agree with the convertor serial number held on the Transporter Database | 5 |
| The Meter Point already has a read for this date | 5 |
| The Meter Point has no previous read | 19 |
| The Meter read has a future read date | 1 |
| The Meter read reason is invalid | 3 |
| The Meter serial number on the read does not agree with the Meter serial number held on the Transporter Database | 3,473 |

### Resulting Methodology

The methodology approach is as follows:

- 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.

# CALCULATION

**Inputs**

- Supply Meter Points with no Reads after April 2019 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;
- Read performance for the target Gas Year is equivalent to the years used in our trend analysis; and
- The energy calculated from the most recent read rejection pair reflects the likely consumption in the target Gas Year

**Calculation**

The detailed calculation is described below.

<u>Determining Unreconciled Consumption Forecast</u>

*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 2019, in snapshots taken in April 2021, July 2021 and October 2021;
2. Determine the set of Supply Meter Points in the July 2021 snapshot without a reading since April 2019; and
3. Identify the set of Supply Meter Points within the data from step 2 that are not in the October 2021 snapshot. This is the set that have had a valid reading accepted in the three months between July and October.

*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 October 2021 for each month since October 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 April 2018 to March 2019; 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[19], 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 October 2021 snapshot of all Supply Meter Points that had not had a meter read since April 2019, considering only Supply Meter Points that had not had a read accepted since April 2018.

<u>Determining the AQ Error Percentage</u>

*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 2018;
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 2019 (from step 1); and
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 2019 (from step 1), as at October 2021;

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

[19] Where there is no data with which to undertake this step 10, Class 4 is instead included in calculation step 11 with Classes 1-3.

16. Calculate the 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;
21. Determine the aggregate percentage error (for each sub-EUC band) as:

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

22. Repeat steps 16-21 for Supply Meter Points with multiple reads that were rejected, applying the methodology in the case of any relevant read rejection reason (see table above). If there is more than one new AQ calculated owing to multiple read rejection reasons, then use the most recent new AQ.

*Determine the overall percentage error*

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

<u>Determining the UIG</u>

*Apply the overall percentage error to the forecast unreconciled consumption*

24. Apply the error percentages determined in step 23 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.

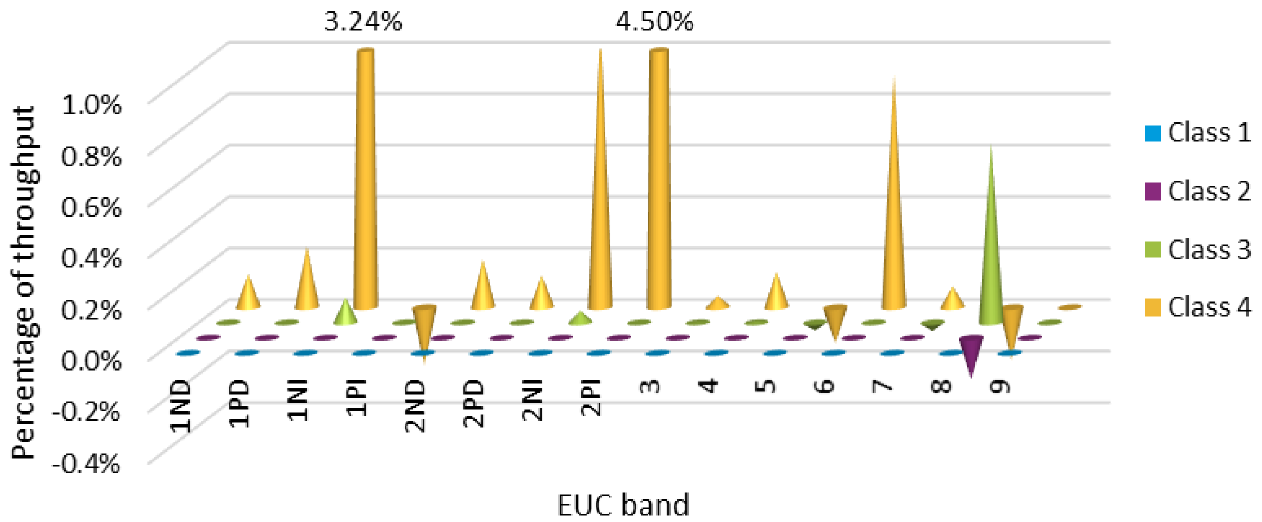
## RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **861 GWh**.

This is allocated across Matrix Positions[20] as follows:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 0 | 321 |
| | 1PD | - | - | 0 | 35 |
| | 1NI | - | - | 3 | 263 |
| | 1PI | - | - | - | -0 |
| | 2ND | - | - | - | 13 |
| | 2PD | - | - | - | 0 |
| | 2NI | - | - | 3 | 132 |
| | 2PI | - | - | - | 0 |
| | 3 | - | - | 0 | 5 |
| | 4 | - | - | 1 | 19 |
| | 5 | - | - | -1 | -13 |
| | 6 | - | - | - | 86 |
| | 7 | - | - | -1 | 7 |
| | 8 | - | -9 | 16 | -19 |
| | 9 | - | - | - | - |

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




## NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

[20] 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.

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor to be 643 GWh (compared to this year's quantification of 861GWh). This difference is due to the increased number of rejection codes that were included within the read rejection error percentage, identified as part of our refinement analysis.

The greater percentage of throughput associated with the 01NI EUC bands is due to there being more Supply Meter Points that have become "trapped" as their reads repeatedly fail validation. This has 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.

# 6 Other Contributors

Each year, we assess previously identified contributors in light of any new information, including suggestions made during industry consultation and the availability of potential additional data inputs. The following eight contributors to UIG were investigated last year and are repeated this year with no material updates to their methodology. Dataset refreshes have occurred for all eight contributors. In some cases, small improvements have been made to a step in the methodology or calculations, and we highlight these instances.

For these contributors, the detailed description of supporting analysis and rationale is unchanged from last year, and so has not been reproduced in the body of the Statement. Instead, we have moved this additional detail to Appendix 5 for reference if needed.

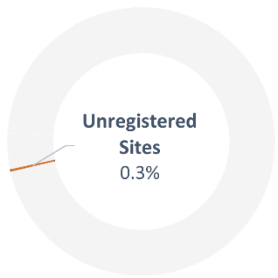
Each of these contributors is described with the following structure:

- **Dashboard**: three charts showing the scale of the contributor when compared to the total UIG, the UIG split by Class and the UIG split by market sector, provides a table summarising any small improvements made and compares total UIG to last year's at a glance;
- **Description**: details of the Settlement context, the definition of the contributor and how the contributor impacts UIG;
- **Methodology**: how we determined the level of UIG associated with the contributor and allocated this across Matrix Positions;
- **Calculation**: a detailed description of the data inputs, the calculation steps, and the data output;
- **Results**: the calculated UIG value, the value split by Matrix Position and a chart showing the UIG as a percentage of throughput; and
- **Notable Observations**: our observations, including a comparison to the output of the Statement for Gas Year 2021-2022, with our considered reasons.

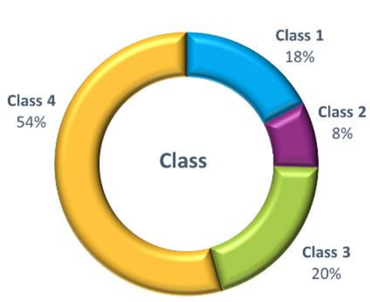
# 020 – UNREGISTERED SITES

## DASHBOARD

*% Share of total UIG*




*UIG split by Class*




*UIG split by Sector*


| GAS YEAR 2022-2023 UPDATES |
|---|
| An additional step added to the methodology: For Unregistered Sites that are eventually registered by the Shipper, registered AQs are often different to their initial default values. Using newly sourced data, we now reflect actual AQ values post-registration, rather than assuming they adopt default values. This improves the accuracy of the scaling factor we use to determine UIG. See Steps 3 and 4 in the calculation. |
| Data inputs updated to reflect an additional year of industry data. |
| The reduction in the UIG associated with Class 1 is due to the reduced probability of a Supply Meter Point in Class 1 EUC 9 creating UIG in the target Gas Year. |

| UIG | Gas Year 2021-2022 | Gas Year 2022-2023 |
|---|---|---|
| 020 Unregistered Sites | 101 GWh | **35 GWh** |

## 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 could consume gas whilst they are unregistered (as defined above) in the target Gas Year, along with the sum of their AQs;
- Using trend analysis of AQ changes subsequent to registration, scale the unregistered AQs to reflect the likely post-registration AQs more accurately[21];
- 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.

[21] This additional step has been added to the methodology this year.

### Assumptions

- The back bill rules are applied to Unregistered Sites as per modification 0410V[22].

## 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;
- Our Consumption Forecast (as described in Section 4 of this Statement); and
- Unregistered AQ History Report from CDSP.

### 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[23] 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 the likely actual AQs subsequent to registration[24]*

3. Using the Unregistered AQ History Report, determine the post-unregistered scaling factor by dividing registered AQ by unregistered AQ. Do this for three bands:
    a. Sites with AQ of 1;

[22] UNC Modification 0410V: "Responsibility for gas off-taken at Unregistered Sites following New Network Connections".
[23] These are likely either to have been registered by Xoserve or a Shipper, or confirmed to be legitimate Unregistered Sites.
[24] This is a new methodology step introduced this year.

  b. Sites with an AQ greater than 1 and less than 73,200; and
  c. Sites with an AQ greater than 73,200 (median for unregistered); and

4. Apply the post-unregistered scaling factor to the Supply Meter Points determined in step 2.

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

5. Using the Legitimate Unregistered Site Details reports, determine the percentage of the removed Supply Meter Points identified in the last two years in step 1c that are due to those Supply Meter Points being deemed to be legitimate. Do this for each main EUC band; and
6. 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*

7. Adjust the dataset in step 4 by removing the percentage of Supply Meter Points determined in step 5.

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

8. Using Connection Details for Orphaned Sites reports from the last two years, determine the percentage of removed Supply Meter Points in step 1c that are not legitimate (as determined in step 5) 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; and
9. 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*

10. Adjust the dataset created in step 7 by removing the percentage of Supply Meter Points determined in step 8.

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

11. Note that the dataset in step 10 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;
12. 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, and divide by 12 to determine the UIG for each of these EUC bands over the target Gas Year;
13. 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
14. 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.

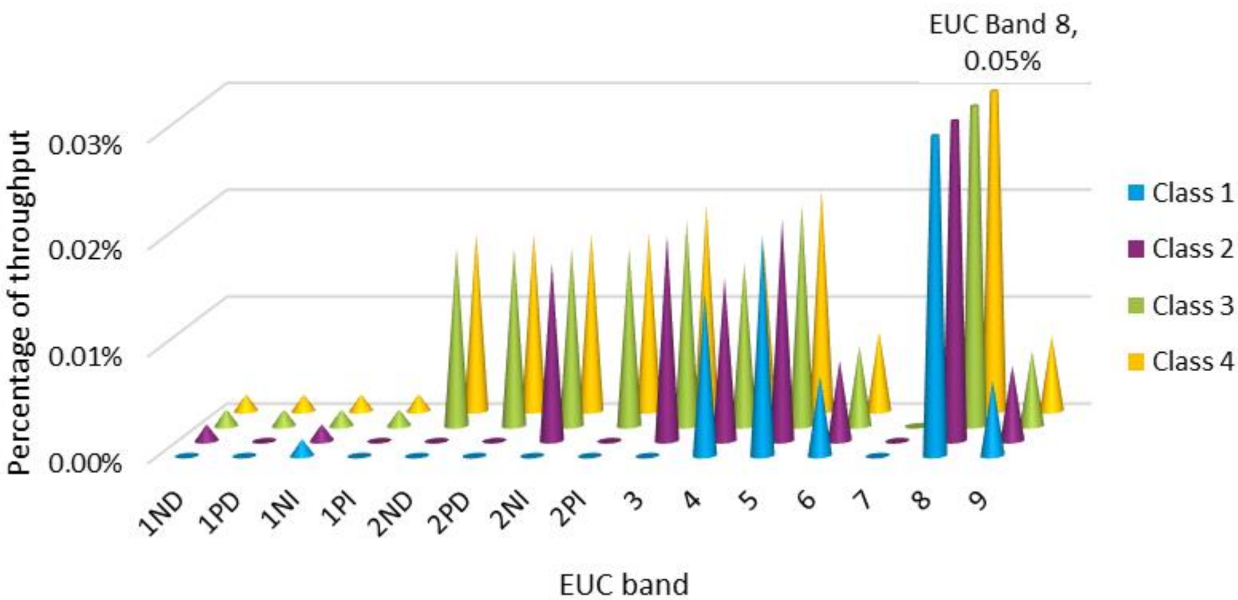
## RESULTS

The forecast UIG associated with this contributor at the Line in the Sand for the target Gas year is: **35 GWh**.

It is broken down[25] across the sub-EUC bands as follows:

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

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




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

# NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

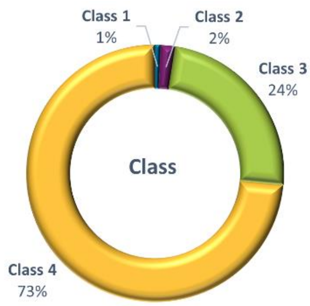
The Statement for Gas Year 2021-2022 quantified the UIG for this contributor as 101 GWh (compared to this year's quantification of 35 GWh). The reduction is due to the reduced probability of a Supply Meter Point in Class 1 EUC 9 creating UIG in the target Gas Year.

# 025 – SHIPPERLESS SITES

## DASHBOARD

*% Share of total UIG*


*UIG split by Class*




*UIG split by Sector*


| GAS YEAR 2022-2023 UPDATES |
|---|
| ▸ An additional step added to the methodology: For Shipperless Sites that are subsequently registered by the Shipper, registered AQs are often different to their initial default values. Using newly sourced data, we now reflect actual AQ values post-registration, rather than assuming they adopt a default value. This improves the accuracy of the scaling factor we use to determine UIG. See Steps 3 and 4 in the calculation.<br>▸ Data inputs updated to reflect an additional year of industry data. |

| UIG | Gas Year 2021-2022 | Gas Year 2022-2023 |
|---|---|---|
| 025 Shipperless Sites | 32 GWh | **26 GWh** |

## 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 could 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 of AQ changes subsequent to registration of shipperless sites, scale the shipperless AQs to reflect the likely post-registration AQs more accurately[26];
- 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;

[26] This additional step has been added to the methodology this year.

- 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[27] and SSrP sites as per Modification 0425V[28];
- 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.

## CALCULATION

**Inputs**

- Shipperless Sites PTS report from the CDSP;
- 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;
- Our Consumption Forecast (as described in Section 4 of this Statement); and
- Shipperless AQ History report from the CDSP.

**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

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

b. The number of Supply Meter Points removed[29] 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.

*Determine the likely actual AQs subsequent to registration[30]*

3. Using the Shipperless AQ history report, determine the post-shipperless scaling factor by dividing registered AQ by shipperless AQ. Do this for three bands:
   a. Sites with AQ of 1;
   b. Sites with an AQ greater than 1 and less than 73,200; and
   c. Sites with an AQ greater than 73,200 (median for unregistered); and
4. Apply the post-shipperless scaling factor to the Supply Meter Points determined in step 2.

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

5. 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;

6. 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

7. 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 5).

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

8. Apply the proportion of PTS Shipperless Sites determined in step 7 to the forecast of total AQ of PTS Shipperless Sites for each month in the target Gas Year (from step 4), for each main EUC band; and

9. 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, and divide by 12 to determine the UIG due to PTS Shipperless Sites for each of these EUC bands over the target Gas Year.

*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*

10. 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;

[29] These are likely either to have been registered by a Shipper or by Xoserve on behalf of a Shipper.
[30] This is a new methodology step introduced this year.

   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

11. From step 10, 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*

12. 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;
13. 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
14. Determine the number that were not back billed and not confirmed to be non-issues (from step 13) 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*

15. Apply the proportion of SSrP Shipperless Sites determined in step 14 to the forecast of total AQ of SSrP Shipperless Sites for each month in the target Gas Year (from step 11), for each main EUC band; and
16. 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, and divide by 12 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*

17. Sum the forecast PTS UIG in the target Gas Year (from step 9) and the forecast SSrP UIG in the target Gas Year (from step 1) to get the total UIG by main EUC band;
18. 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
19. 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.

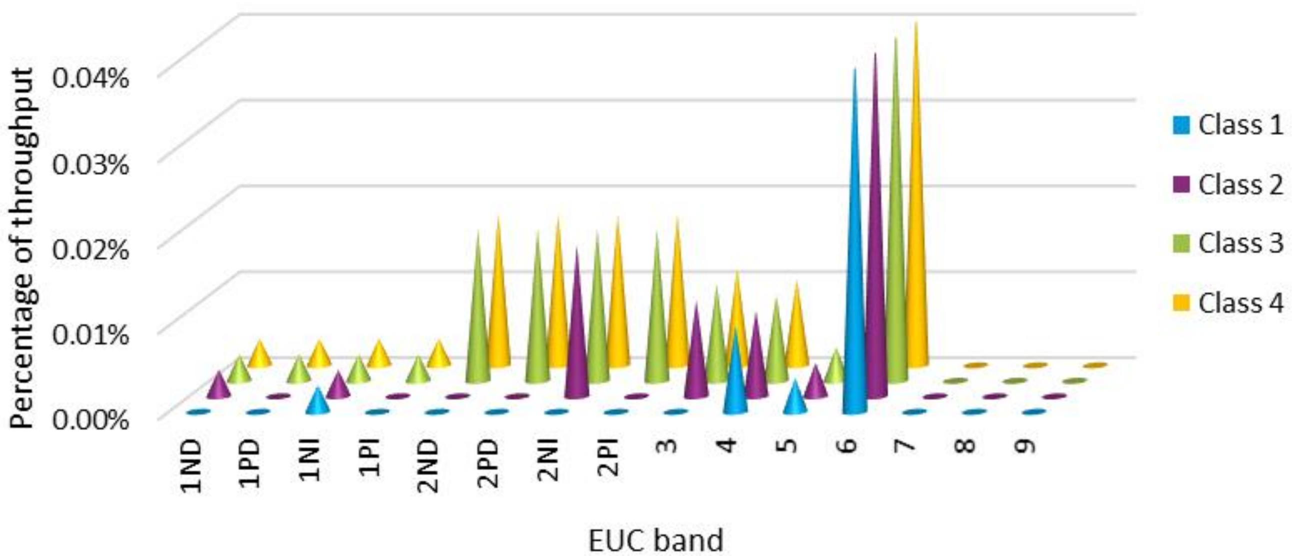
## RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **26 GWh.** 4 GWh of this is due to PTS Shipperless Sites and 22 GWh due to SSrP Shipperless Sites.

It is broken down across the sub-EUC bands as follows:

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

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




## NOTABLE OBSERVATIONS

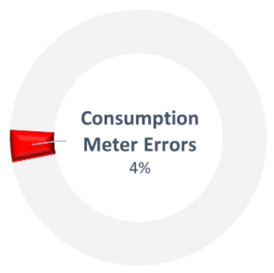
### Comparison to Statement for Gas Year 2021-2022

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor to be 32 GWh (compared to this year's quantification of 26 GWh). The period of the dataset has moved on by a year, and the data suggests fewer of these sites are generating UIG - either because they are now connected or errors in recording these sites as Shipperless have been corrected.

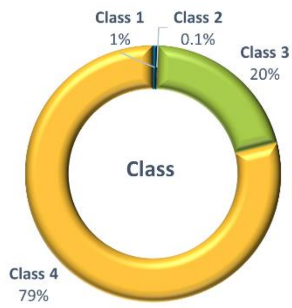
# 040 – CONSUMPTION METER ERRORS – INHERENT BIAS

## DASHBOARD

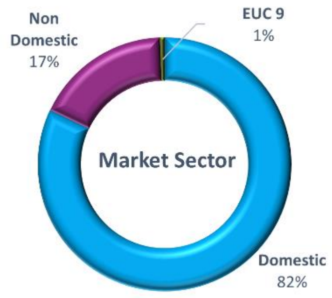
*% Share of total UIG*




*UIG split by Class*




*UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES | | |
|---|---|---|
| Data inputs updated to reflect an additional year of industry data. | | |
| **UIG** | **Gas Year 2021-2022** | **Gas Year 2022-2023** |
| 040 Consumption Meter Errors | 789 GWh | **432 GWh** |

## 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.

We have previously assessed the potential for calculating UIG across the three sources noted above. Of these, only the first (inherent bias) has sufficiently robust data to enable a quantification methodology.

**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.

## METHODOLOGY

**UIG Forecast**

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

- 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; and
- 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.

**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 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

**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.

**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 four 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.

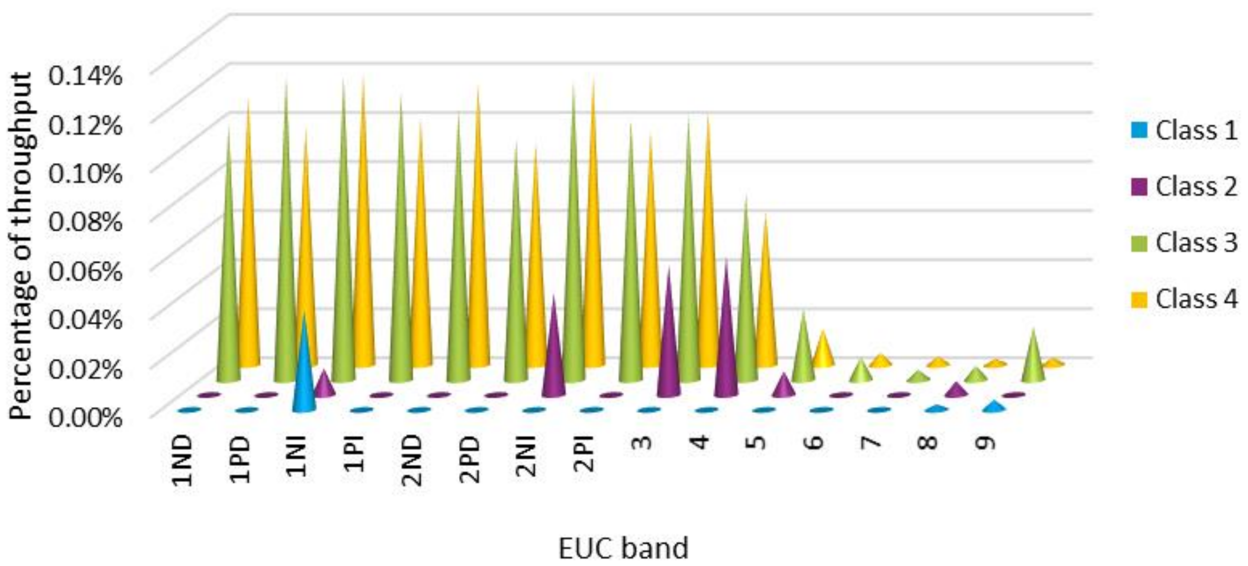
## RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **432 GWh**.

This is allocated across Matrix Positions as follows[31]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 59 | 271 |
| | 1PD | - | - | 2 | 15 |
| | 1NI | 0 | 0 | 3 | 10 |
| | 1PI | - | - | 0 | 0 |
| | 2ND | - | - | 0 | 8 |
| | 2PD | - | - | 0 | 0 |
| | 2NI | - | 0 | 8 | 14 |
| | 2PI | - | - | 0 | 0 |
| | 3 | - | 0 | 8 | 12 |
| | 4 | - | 0 | 6 | 9 |
| | 5 | - | 0 | 1 | 1 |
| | 6 | - | - | 0 | 0 |
| | 7 | - | - | 0 | 0 |
| | 8 | 0 | 0 | 0 | 0 |
| | 9 | 2 | - | 0 | 0 |

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




[31] 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.

# NOTABLE OBSERVATIONS

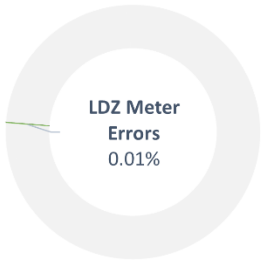
**Comparison to Statement for Gas Year 2021-2022**

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor as 789 GWh (compared to this year's quantification of 432 GWh). This is due to the continued replacement of synthetic diaphragm meters with ultrasonic and a reduction in the error rate in the latest in-service testing results.

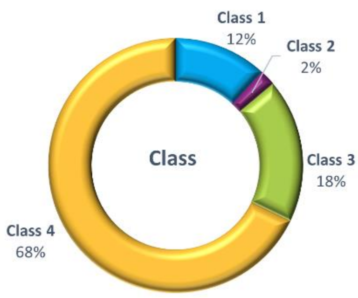
# 050 – LDZ METER ERRORS

## DASHBOARD

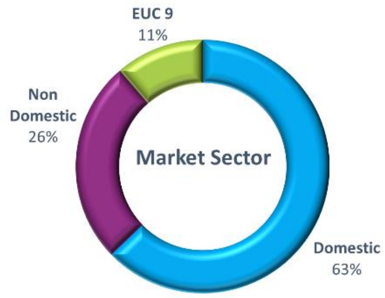
*% Share of total UIG*




*UIG split by Class*




*UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES | | |
|---|---|---|
| ‣ Data inputs updated to reflect an additional year of industry data. | | |
| **UIG** | **Gas Year 2021-2022** | **Gas Year 2022-2023** |
| 050 LDZ Meter Errors | 0 GWh | **1 GWh** |

## DESCRIPTION

**Settlement Context**

In summary, UIG is the gas entering LDZs from the NTS[32], 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 also gives rise to UIG.

The injection points of gas from the NTS 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.

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

Specifically, it includes:

- LDZ meters manufactured with an inherent bias to slightly over or under-record;
- 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.

## METHODOLOGY

**UIG Forecast**

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

- Calculating the average number and annual energy error across all identified LDZ meter errors over the last five years;
- Estimating the probability of an LDZ meter error going undetected from the PAW risk assessment model[33]; and
- From the identified annual energy error and the probability of an error being undetected, calculating the annual error across all undetected LDZ meters errors.

**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**

- 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

**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).

[33] Risk assessment model provided to the Performance Assurance Workgroup (PAW) under UNC governance, and available in the public domain.

**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; and
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

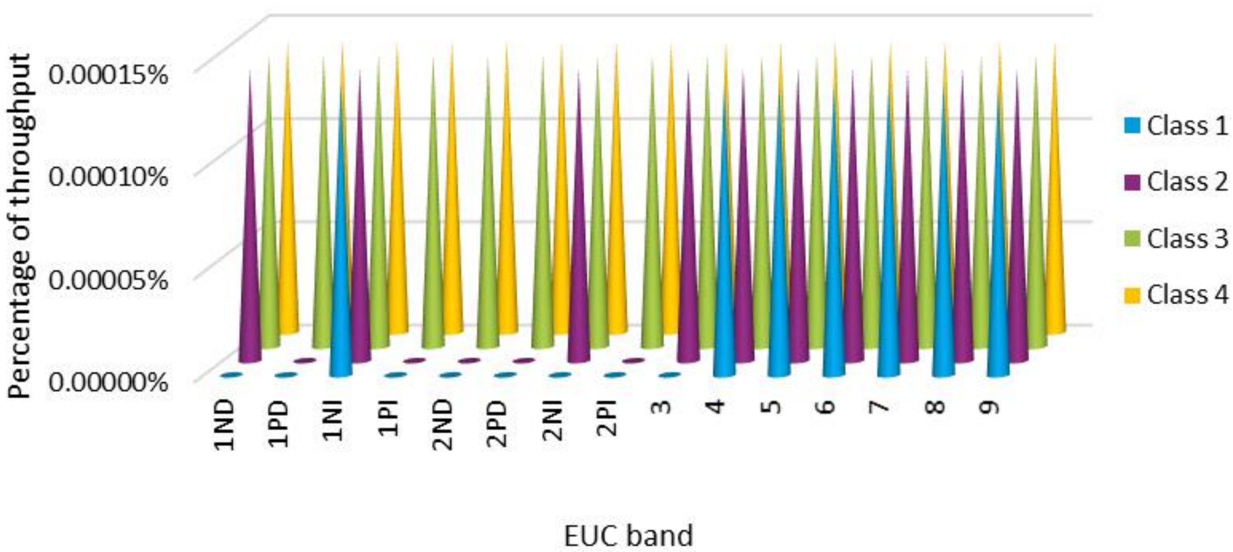
The forecast UIG associated with this contributor at the Line in the Sand for the target Gas year is: **738 MWh.**

This is allocated across Matrix Positions as follows:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | 0 | 80 | 350 |
| | 1PD | - | - | 2 | 21 |
| | 1NI | 0 | 0 | 4 | 11 |
| | 1PI | - | - | 0 | 0 |
| | 2ND | - | - | 0 | 10 |
| | 2PD | - | - | 0 | 0 |
| | 2NI | - | 0 | 10 | 17 |
| | 2PI | - | - | 0 | 0 |
| | 3 | - | 0 | 10 | 17 |
| | 4 | 0 | 0 | 11 | 19 |
| | 5 | 0 | 0 | 6 | 13 |
| | 6 | 1 | 1 | 4 | 13 |
| | 7 | 2 | 4 | 4 | 12 |
| | 8 | 6 | 8 | 3 | 13 |
| | 9 | 79 | 1 | 0 | 3 |

For this contributor only, we show the results in MWh, otherwise GWh values would show as zero.

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




## NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

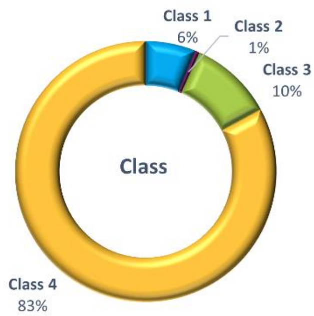
The Statement for Gas Year 2021-2022 quantified this contributor as 134 MWh. For the target Gas Year, our determination is 738 MWh. This increase is the result of recent measurement errors reported in 2021 which impact the shape of the rolling five-year dataset.

# 060 – IGT SHRINKAGE

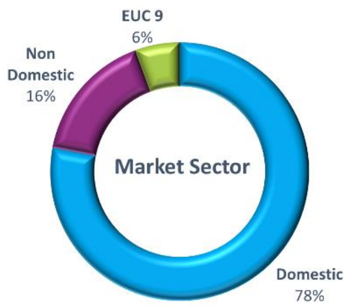
## DASHBOARD

*% Share of total UIG*


*UIG split by Class*




*UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES |
|---|

- Our calculation is now based on actual average IGT main length - this data was unavailable for the 2021-2022 Statement.
- The allocation of the UIG estimate is now based on the IGT Consumption Forecast for the Matrix Positions for IGT Supply Meter Points rather than the Consumption Forecast for the total system (LDZ).
- Data inputs updated to reflect an additional year of industry data.

| UIG | Gas Year 2021-2022 | Gas Year 2022-2023 |
|---|---|---|
| 060 IGT Shrinkage | 18 GWh | **18 GWh** |

## 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 LDZ 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 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;
- 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; and
- The main leaks at the same rate whether it is located at the start or end of a network.

## CALCULATION

**Inputs**

- Average Main Length from the Independent Networks Association (INA);
- 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 2019 to 30th September 2021; and

- IGT Supply Meter Points Consumption Forecast.

**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; and
3. Project this growth trend to the target Gas Year to forecast the total IGT Supply Meter Points for each LDZ for 1st April 2023 (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; and
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 the IGT Supply Meter Points Consumption Forecast of the target Gas Year; and
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.

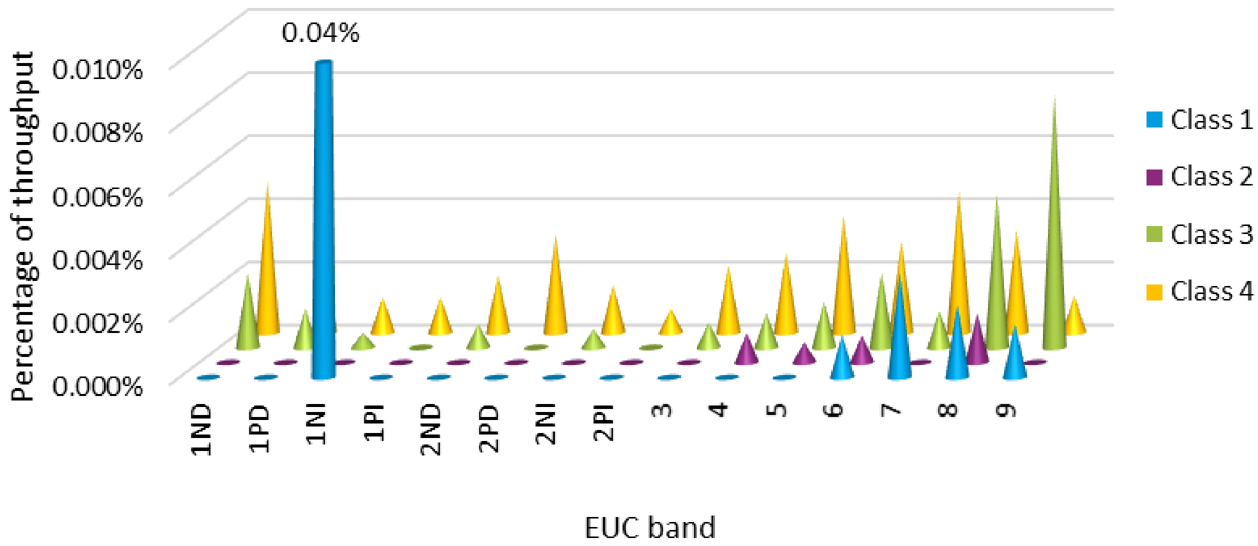
## RESULTS

The UIG calculated for the target Gas Year is **18 GWh**.

This is broken down by Matrix Position as follows[34]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 1 | 12 |
| | 1PD | - | - | 0 | 0 |
| | 1NI | 0 | - | 0 | 0 |
| | 1PI | - | - | - | 0 |
| | 2ND | - | - | 0 | 0 |
| | 2PD | - | - | - | 0 |
| | 2NI | - | - | 0 | 0 |
| | 2PI | - | - | - | 0 |
| | 3 | - | - | 0 | 0 |
| | 4 | - | 0 | 0 | 0 |
| | 5 | - | 0 | 0 | 0 |
| | 6 | 0 | 0 | 0 | 0 |
| | 7 | 0 | - | 0 | 0 |
| | 8 | 0 | 0 | 0 | 0 |
| | 9 | 1 | - | 0 | 0 |

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




## NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor as 18 GWh (compared to this year's quantification of 18 GWh).

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[34] Note that a number of Matrix Positions were >0.5 GWh and therefore display as 0 in the table as positions have been rounded up or down to whole numbers, as appropriate.

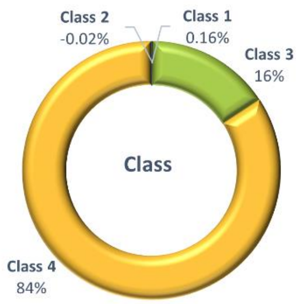
The small increase – not visible here due to rounding - is down to the growth in the number of IGT Supply Meter Points and a slight increase in mains length based on new data from the INA.

# 070 – AVERAGE PRESSURE ASSUMPTION

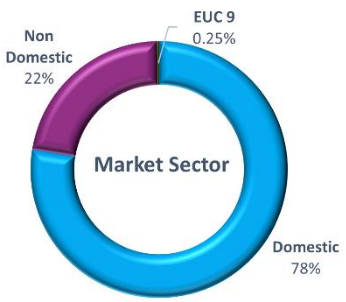
## DASHBOARD

*% Share of total UIG*


*UIG split by Class*




*UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES | | |
|---|---|---|
| Data inputs updated to reflect an additional year of industry data. | | |
| **UIG** | **Gas Year 2021-2022** | **Gas Year 2022-2023** |
| 070 Average Pressure Assumption | 371 GWh | **359 GWh** |

## 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[35] 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

[35] Also known as Conversion Factor.

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 67.5m. 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 67.5m.

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[36]. 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.

**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.

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

# 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;
- 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:
    a. Have meters with correction equipment fitted; and
    b. 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.

# 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[37];
- 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 67.5m 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 (67.5m 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 energy change for every 1 millibar change in pressure. This is 0.00098692 per millibar. Call this the Pressure Gas Volume Error Rate.

*Calculate the Volume Error Factors*

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

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.

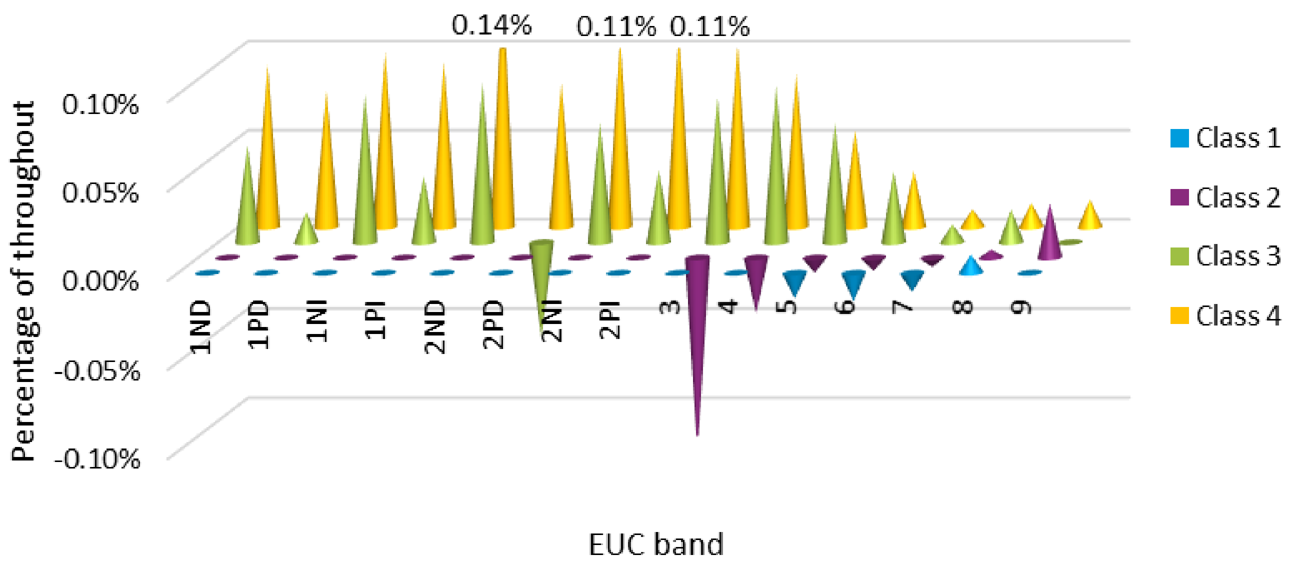
## RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **359 GWh**.

This is broken down by Matrix Position as follows[38]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 31 | 226 |
| | 1PD | - | - | 0 | 12 |
| | 1NI | - | - | 2 | 8 |
| | 1PI | - | - | 0 | 0 |
| | 2ND | - | - | 0 | 9 |
| | 2PD | - | - | -0 | 0 |
| | 2NI | - | - | 5 | 13 |
| | 2PI | - | - | 0 | 0 |
| | 3 | - | -0 | 6 | 12 |
| | 4 | - | -0 | 7 | 12 |
| | 5 | -0 | -0 | 3 | 5 |
| | 6 | -0 | -0 | 1 | 3 |
| | 7 | -0 | -0 | 0 | 1 |
| | 8 | 0 | 0 | 0 | 1 |
| | 9 | 0 | 0 | - | 0 |

The graph below shows UIG as a percentage of throughput for each Matrix Position[39].




[38] 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.
[39] 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.

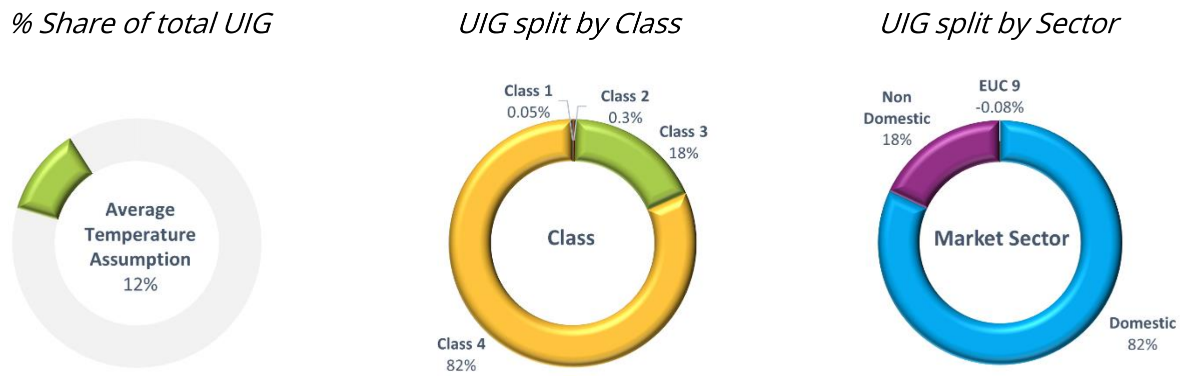
# NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor to be 371 GWh (compared to this year's sum of 359 GWh). This slight decrease is due to a minor change in the proportion of volume conversion and the consumption forecast.

# 080 – AVERAGE TEMPERATURE ASSUMPTION

## DASHBOARD




| GAS YEAR 2022-2023 UPDATES | | |
|---|---|---|
| Data inputs updated to reflect an additional year of industry data. | | |
| **UIG** | **Gas Year 2021-2022** | **Gas Year 2022-2023** |
| 080 Average Temperature Assumption | 1,249 GWh | **1,220 GWh** |

## 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[40] 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

[40] Also known as Conversion Factor.

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.

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[41]. 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.

**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:

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

- Identifying a flow-weighted[42] 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);
- 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:
  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;
- 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.

[42] 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.

**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.

# 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;
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

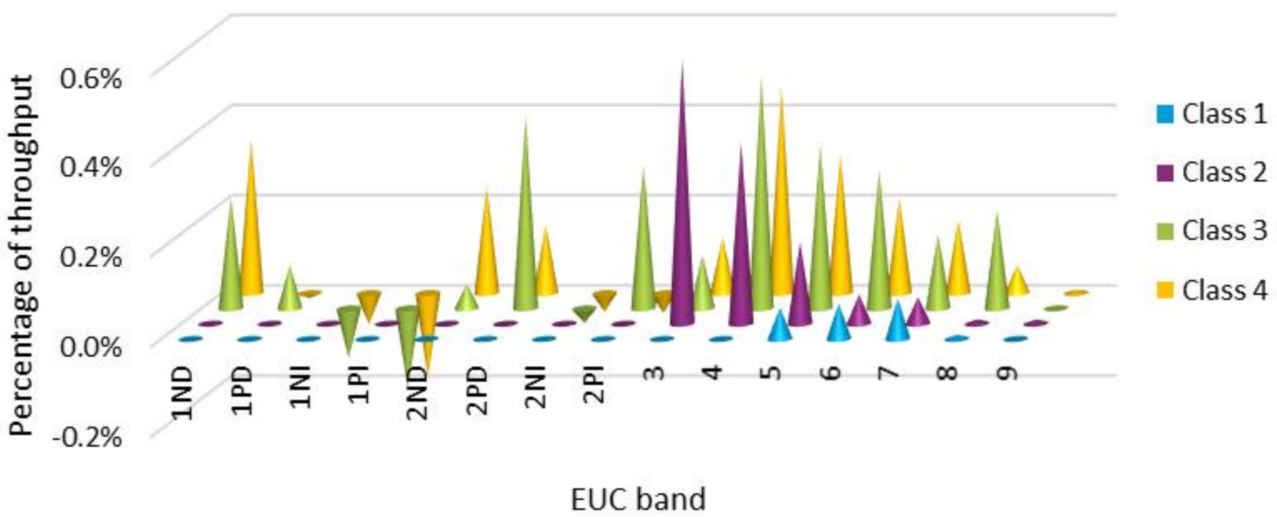
We have calculated the total estimated UIG associated with the average temperature assumption for the target Gas Year to be **1,220 GWh**.

This is broken down by Matrix Position as follows[43]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 139 | 846 |
| | 1PD | - | - | 1 | -2 |
| | 1NI | - | - | -3 | -6 |
| | 1PI | - | - | -0 | -0 |
| | 2ND | - | - | 0 | 16 |
| | 2PD | - | - | 0 | 0 |
| | 2NI | - | - | -2 | -5 |
| | 2PI | - | - | 0 | -0 |
| | 3 | - | 0 | 9 | 15 |
| | 4 | - | 1 | 42 | 62 |
| | 5 | 0 | 0 | 16 | 29 |
| | 6 | 0 | 1 | 9 | 20 |
| | 7 | 1 | 2 | 4 | 14 |
| | 8 | 0 | 1 | 5 | 6 |
| | 9 | -1 | 0 | - | 0 |

There are some Matrix Positions that create negative UIG. 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:




[43] 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.

# NOTABLE OBSERVATIONS

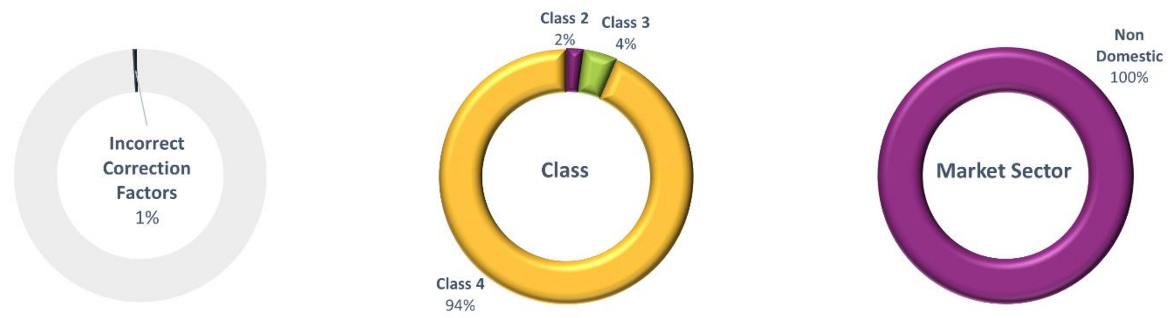
**Comparison to Statement for Gas Year 2021-2022**

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor to be 1,249 GWh (compared to this year's quantification of 1,220 GWh). The difference is due to the increase in internal meters on CDSP records relative to other types.

# 100 – INCORRECT CORRECTION FACTORS

## DASHBOARD

*% Share of total UIG* *UIG split by Class* *UIG split by Sector*




| GAS YEAR 2022-2023 UPDATES | | |
|---|---|---|
| Data inputs updated to reflect an additional year of industry data. | | |
| **UIG** | **Gas Year 2021-2022** | **Gas Year 2022-2023** |
| 100 Incorrect Correction Factors | 48 GWh | **53 GWh** |

## 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[44] 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.

[44] Also known as Conversion Factor.

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.

**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[45].

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;

[45] 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).

- Determining a Correction Error Factor$^{LM}$[46] 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;
- 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$^{SP}$[47] as the difference between the lowest feasible Correction Factor (0.995088) and the actual Specific Correction Factor, for each Supply Meter Point:
    a. With an AQ greater than 732,000 kWh;
    b. That does not have a meter with correction equipment fitted; and
    c. 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.

**Matrix Allocation**

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

**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.

[46] This represents the difference between the average Correction Factor for the Matrix Position and the Standard Correction Factor actually applied.
[47] This represents the difference between the Specific Correction Factor for the Supply Meter Point and the lowest feasible Correction Factor.

# CALCULATION

### 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

The detailed calculation is described below.

*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; and
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.

*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[48] 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.

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

*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.

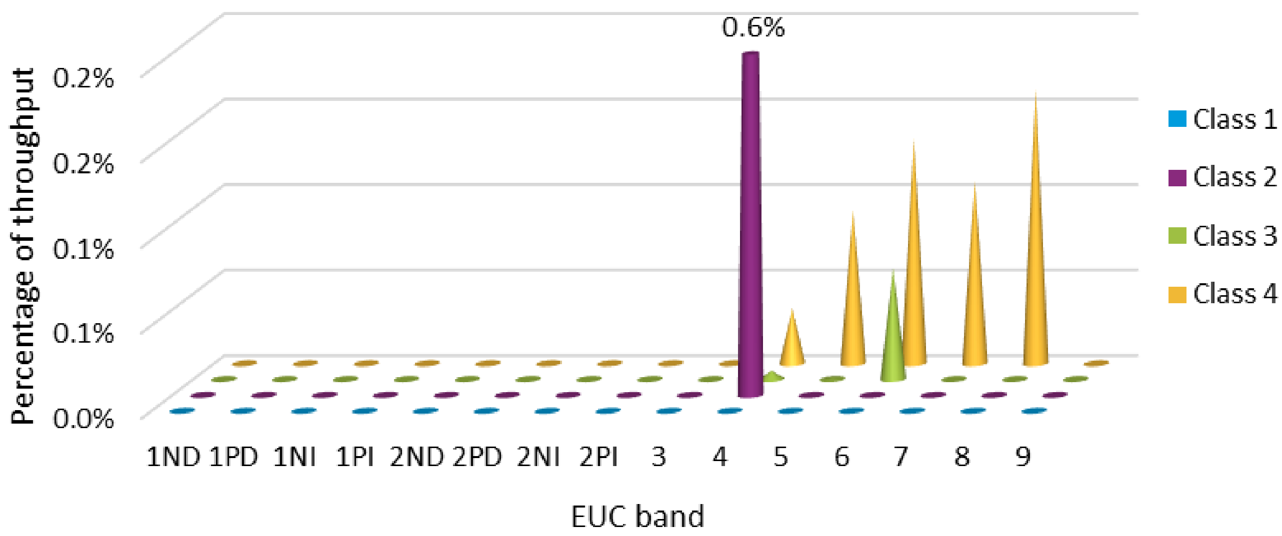
## RESULTS

The forecast UIG for this contributor, at the Line in the Sand, for the target Gas year is: **53 GWh,** comprising 49.2 GWh due to incorrect (but feasible) Correction Factors and 3.5 GWh due to unfeasibly low Correction Factors.

This is allocated across Matrix Positions as follows[49]:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | - | - |
| | 1PD | - | - | - | - |
| | 1NI | - | - | - | - |
| | 1PI | - | - | - | - |
| | 2ND | - | - | - | - |
| | 2PD | - | - | - | - |
| | 2NI | - | - | - | - |
| | 2PI | - | - | - | - |
| | 3 | - | - | - | - |
| | 4 | - | 1 | 0 | 4 |
| | 5 | - | - | 0 | 8 |
| | 6 | - | - | 2 | 13 |
| | 7 | - | - | - | 9 |
| | 8 | - | - | - | 15 |
| | 9 | - | - | - | - |

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




# NOTABLE OBSERVATIONS

**Comparison to Statement for Gas Year 2021-2022**

The Statement for Gas Year 2021-2022 quantified the UIG for this contributor to be 48 GWh (compared to this year's quantification of 53 GWh). This is due to the increase in average correction factors for some

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

LDZ Matrix Positions, the change in Consumption Forecast and the low correction factors for a few Supply Meter Points.

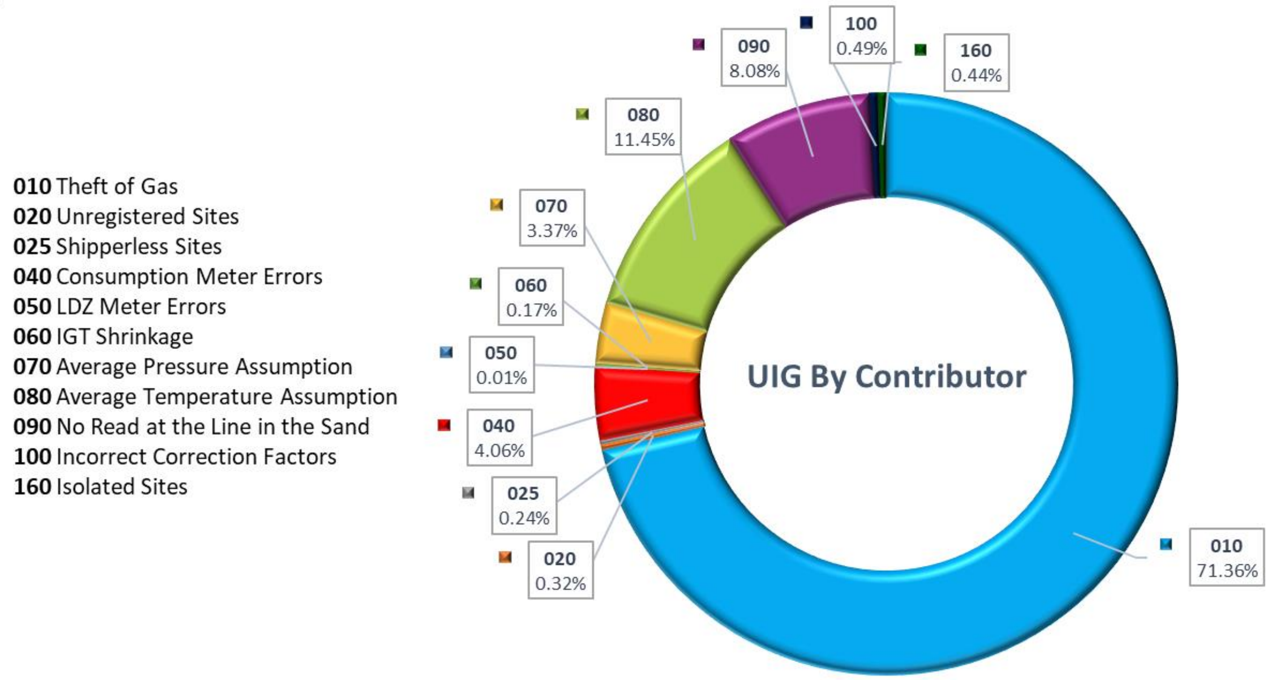
# 7 Results

## UIG

We quantified total UIG to be **10,652 GWh**, across eleven contributors, at the Line in the Sand for the target Gas Year. This compares to 10,982 GWh in the Statement for Gas Year 2021-2022.

## UIG BY CONTRIBUTOR

This is broken down across contributors as shown in the following diagram and table[50].




[50] Movement in UIG noted in the table (Gas Year 2021-2022 vs the target Gas Year) is based on a tolerance threshold of more than 1% and 1 GWh change.

| Contributor | 2021-2022 Gas Year UIG Volume | Related UIG Volume | Change |
| --- | --- | --- | --- |
| **Theft of Gas** | 7,730 GWh | 7,602 GWh | ↓ |
| **Average Temperature Assumption** | 1,249 GWh | 1,220 GWh | ↓ |
| **No Read at the Line in the Sand** | 643 GWh | 861 GWh | ↑ |
| **Consumption Meter Errors** | 789 GWh | 432 GWh | ↓ |
| **Average Pressure Assumption** | 371 GWh | 359 GWh | ↓ |
| **Incorrect Correction Factors** | 48 GWh | 53 GWh | ↑ |
| **Isolated Sites** | - | 47 GWh | ↑ |
| **Unregistered Sites** | 101 GWh | 35 GWh | ↓ |
| **Shipperless Sites** | 32 GWh | 26 GWh | ↓ |
| **IGT Shrinkage** | 18 GWh | 18 GWh | → |
| **LDZ Meter Errors** | 0 GWh | 1 GWh | → |
| **Total** | **10,982 GWh** | **10,652 GWh** | ↓ |

## UIG BY MATRIX POSITION

The 10,652 GWh of UIG we quantified across the eleven contributors is allocated across Matrix Positions as shown in the table[51] below.

| | | CLASS | | | |
| --- | --- | --- | --- | --- | --- |
| | | 1 | 2 | 3 | 4 |
| EUC BAND | **1ND** | 0 | 0 | 775 | 4,774 |
| | **1PD** | - | - | 18 | 1,311 |
| | **1NI** | 0 | 0 | 105 | 1,398 |
| | **1PI** | - | - | 0 | 8 |
| | **2ND** | - | - | 5 | 195 |
| | **2PD** | - | - | 0 | 6 |
| | **2NI** | - | 0 | 99 | 544 |
| | **2PI** | - | 0 | 0 | 1 |
| | **3** | 0 | 0 | 60 | 139 |
| | **4** | 0 | 3 | 101 | 217 |
| | **5** | 0 | 2 | 42 | 106 |
| | **6** | 1 | 16 | 31 | 205 |
| | **7** | 2 | 38 | 30 | 114 |
| | **8** | 8 | 77 | 44 | 110 |
| | **9** | 61 | 1 | 0 | 3 |

[51] 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.

# 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:

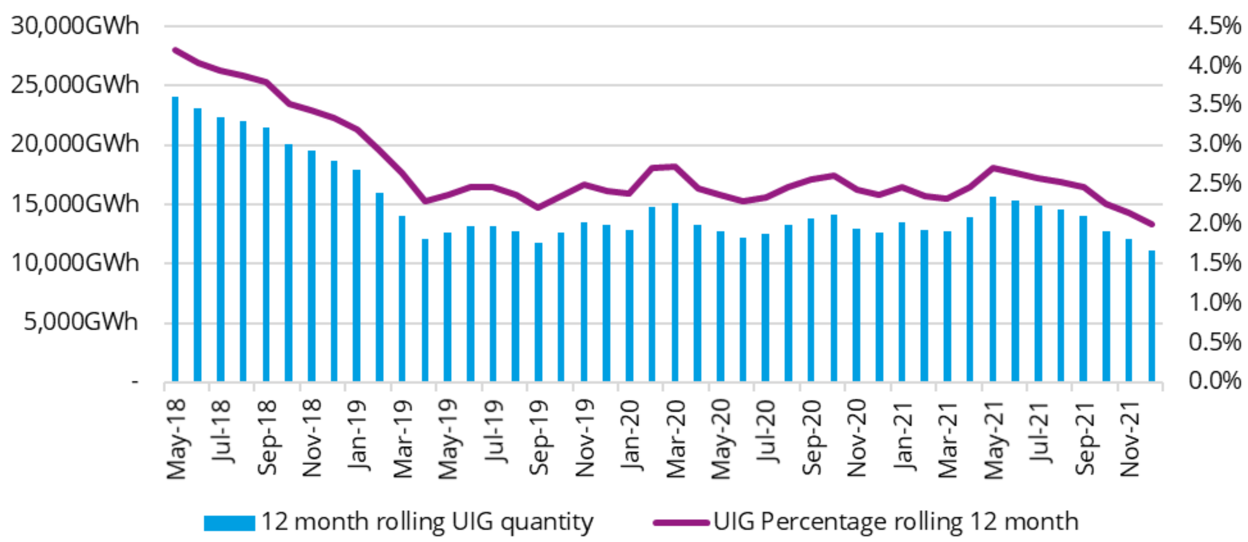
- UIG values at allocation from the Throughput report from the CDSP;
- UGR values from the Monthly Reconciliation and Offline Adjustment reports from the CDSP;
- Total throughput values from the Throughput report from the CDSP; and
- Our Consumption Forecast (as described in Section 4 of this Statement).

**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 2.43%.

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 2.43% was an appropriate value to use for benchmarking purposes.

Using this 2.43% and our Consumption Forecast, we calculated a benchmark UIG for the target Gas Year as 12,664 GWh.

**Comparison of Results to Benchmark**

Our quantification of UIG, based on the current eleven contributors, is circa 84.1% of the benchmark UIG we forecast for the target Gas Year. This suggests that there is a proportion of UIG that is yet to have its cause identified or, despite identification, can't be quantified due to the reliability of available data - for example Meters with a By-Pass Fitted (140).

The AUGE process of identifying new data sources and the ongoing refinement of existing methodologies will lead to an increasing proportion of UIG being quantified over time.

# 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; and
- 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:

- We combined Class 1 and EUC 9;
- We combined Class 3 1NI with 1PI, 2ND with 2PD, and 2PI with 2NI; and
- We combined Class 4 1NI with 1PI, 2ND with 2PD, and 2PI with 2NI.

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

Note that due to observed differences between Class 3 and 4 in other Matrix Positions, we did not combine Classes 3 and 4 for 2PI and 2NI, as was the case for the 2021-2022 Gas Year. This reflects our approach to allocate UIG equitably (in this case more granularly) where there is justification or evidence to support doing this.

## 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.

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

# 9 AUG Table

The AUG Table for the 2022-2023 Gas Year is shown below:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | 60.12 | 60.12 | 60.12 | 84.50 |
| | 1PD | 64.11 | 64.11 | 64.11 | 382.64 |
| | 1NI | 5.10 | 830.68 | 173.52 | 756.21 |
| | 1PI | 173.52 | 295.06 | 173.52 | 756.21 |
| | 2ND | 69.94 | 69.94 | 70.04 | 126.46 |
| | 2PD | 70.04 | 91.22 | 70.04 | 126.46 |
| | 2NI | 5.10 | 100.34 | 63.15 | 199.46 |
| | 2PI | 26.18 | 26.18 | 63.15 | 199.46 |
| | 3 | 5.10 | 53.23 | 48.36 | 52.53 |
| | 4 | 5.10 | 60.64 | 54.07 | 58.44 |
| | 5 | 5.10 | 55.38 | 52.51 | 55.56 |
| | 6 | 5.10 | 58.76 | 53.69 | 71.81 |
| | 7 | 5.10 | 63.30 | 57.14 | 62.54 |
| | 8 | 5.10 | 50.85 | 60.52 | 46.14 |
| | 9 | 5.10 | 28.00 | 23.64 | 26.34 |

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 Statements for previous Gas Years, the absolute numbers are not.

## YEAR ON YEAR COMPARISON OF FACTORS

Whilst the absolute factors cannot be usefully compared, the relative values can be. We used the Weighting Factors, our calculated UIG and our Consumption Forecast to determine UIG as a percentage of throughput. The value for each Matrix Position for Gas Years 2021-2022 and 2022-2023 are provided below.

*2021-2022 UIG as % of throughput*

| | | CLASS | | | |
|---|---|---|---|---|---|
| | 2021-2022 | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | 0.0% | 0.0% | 1.5% | 1.9% |
| | 1PD | 0.0% | 0.0% | 2.3% | 5.4% |
| | 1NI | 0.3% | 13.7% | 13.4% | 14.8% |
| | 1PI | 0.0% | 0.0% | 13.4% | 14.8% |
| | 2ND | 0.0% | 0.0% | 4.4% | 5.3% |
| | 2PD | 0.0% | 0.0% | 4.4% | 5.3% |
| | 2NI | 0.3% | 3.6% | 3.8% | 3.8% |
| | 2PI | 0.0% | 0.0% | 3.8% | 3.8% |
| | 3 | 0.3% | 1.4% | 1.6% | 1.9% |
| | 4 | 0.3% | 1.5% | 1.6% | 2.1% |
| | 5 | 0.3% | 1.2% | 1.5% | 1.5% |
| | 6 | 0.3% | 1.1% | 1.3% | 1.4% |
| | 7 | 0.3% | 1.0% | 1.1% | 1.3% |
| | 8 | 0.3% | 0.9% | 1.0% | 1.2% |
| | 9 | 0.3% | 0.6% | 0.7% | 0.8% |

*2022-2023 UIG as % of throughput*

| | | CLASS | | | |
|---|---|---|---|---|---|
| | 2022-2023 | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | 0.0% | 1.4% | 1.4% | 1.9% |
| | 1PD | 0.0% | 0.0% | 1.5% | 8.8% |
| | 1NI | 0.1% | 19.1% | 4.0% | 17.3% |
| | 1PI | 0.0% | 0.0% | 4.0% | 17.3% |
| | 2ND | 0.0% | 0.0% | 1.6% | 2.9% |
| | 2PD | 0.0% | 0.0% | 1.6% | 2.9% |
| | 2NI | 0.0% | 2.3% | 1.4% | 4.6% |
| | 2PI | 0.0% | 0.0% | 1.4% | 4.6% |
| | 3 | 0.0% | 1.2% | 1.1% | 1.2% |
| | 4 | 0.1% | 1.4% | 1.2% | 1.3% |
| | 5 | 0.1% | 1.3% | 1.2% | 1.3% |
| | 6 | 0.1% | 1.3% | 1.2% | 1.6% |
| | 7 | 0.1% | 1.5% | 1.3% | 1.4% |
| | 8 | 0.1% | 1.2% | 1.4% | 1.1% |
| | 9 | 0.1% | 0.6% | 0.5% | 0.6% |

The differences in the 2022-2023 percentage values and the 2021-2022 percentage values[52] are:

| | | CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | 0.0% | 1.4% | -0.1% | 0.0% |
| | 1PD | 0.0% | 0.0% | -0.9% | 3.4% |
| | 1NI | -0.1% | 5.3% | -9.4% | 2.6% |
| | 1PI | 0.0% | 0.0% | -9.4% | 2.6% |
| | 2ND | 0.0% | 0.0% | -2.8% | -2.4% |
| | 2PD | 0.0% | 0.0% | -2.8% | -2.4% |
| | 2NI | -0.3% | -1.3% | -2.3% | 0.8% |
| | 2PI | 0.0% | 0.0% | -2.3% | 0.8% |
| | 3 | -0.3% | -0.2% | -0.5% | -0.7% |
| | 4 | -0.1% | -0.1% | -0.4% | -0.7% |
| | 5 | -0.1% | 0.1% | -0.3% | -0.3% |
| | 6 | -0.1% | 0.3% | -0.1% | 0.3% |
| | 7 | -0.1% | 0.4% | 0.2% | 0.2% |
| | 8 | -0.1% | 0.3% | 0.4% | -0.1% |
| | 9 | -0.1% | 0.1% | -0.1% | -0.1% |

The reasons for the changes year on year shown above are as follows:

- 1ND: due to the change in traditional theft proportions due to the TOG/TRAS data refresh, and an increase in UIG relating to no read at the Line in the Sand;

[52] Note that due to rounding, the individual Matrix Position values may not equal the total percentage value differences.

- 1PD: change in traditional theft proportion due to the TOG/TRAS data refresh and the proportion of Smart meters in Class 3;
- 1NI: Class 3 decrease due to AMR change to theft methodology;
- 1NI: Class 4 increase due to the delta of the AMR methodology, the traditional theft percentages due to the TOG/TRAS data refresh, and UIG related to no read at the Line in the Sand;
- 2ND and 2PD: due to the traditional theft percentage due to the TOG/TRAS data refresh;
- 2NI and 2PI: due to the AMR theft methodology refinement;
- EUC band 3-8 class 2: due to the AMR theft refinement; and
- Class 1: decrease due to the reduction in the Unregistered Sites UIG forecast.

# 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.

**AMR –** A meter able to provide at least half-hourly reads and can provide remote access to such data, which is not a Smart Meter. Used predominantly at non-domestic premises.

**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.

**By-pass** – Mechanical device or arrangement used to provide an alternative route for gas to a Supply Meter Point when the meter requires maintenance or replacement.

**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 2022-2023 Gas Year.

**Consumption Adjustment** – Process used to manually adjust recorded consumption volumes in the CDSP System where a Supply Meter Point’s reads are not reflective of actual consumption (e.g. meter error; by-pass operation)

**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.

**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.

**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** – 1$^{st}$ October to 30$^{th}$ 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.

**INA** – Independent Networks Association. The trade body for Independent Gas Transporters and Independent Distribution Network Operators.

**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 the 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.

**Lower Outer Tolerance** - An AQ threshold used to prevent anomalous reads entering Settlement. In this case, a meter read is materially above “expected” consumption, but a re-submitted identical read would be accepted if accompanied by a flag to indicate that the Shipper is satisfied that the read reflects actual consumption.

**Main EUC Band** – EUC bands 01 to 09.

**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 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 DSC Change Proposal XRN4665 (*"Creation of New End User Categories"*).

**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.

**Upper Outer Tolerance** – An AQ threshold used to prevent anomalous reads entering Settlement. In this case, a meter read is so far above "expected" consumption that the site's AQ would need to be altered for a re-submitted identical read to be accepted

**Weighting Factors** – The factors contained within the AUG Table and used to share UIG between Classes and EUC bands.

# 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 proposed final 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.<br>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, at 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. (There is also some additional historical methodology rationale for reference in Appendix 5.)<br>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. |

| AUGE Framework Document Requirement | Evidence of Fulfilment |
| --- | --- |
| The AUG Expert will determine what data is necessary from parties in order to ensure it has appropriate data to support the evaluation of Unidentified Gas. | Please see above. |
| 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. | We have asked a number of questions of Code Parties, for example, in relation to validating AMR populations, and actual mains length from INA.<br>This process includes regular progress updates to industry via the monthly report and discussions with Code Parties during AUG Sub-Committee meetings. |
| 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 available. Updated datasets have been requested and validated 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 outcomes and have provided an explanation of this process within this proposed final 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 proposed final 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. |

| AUGE Framework Document Requirement | Evidence of Fulfilment |
|---|---|
| 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 presented the draft AUG Statement to industry at the AUG Sub-Committee meeting on 14 January 2022 and our response to the AUG Statement consultation at the AUG Sub-Committee meeting on 18th February 2022. We will present this proposed Final AUG Statement at the AUG Sub-Committee meeting on 11th March 2022. We have sought, at all stages, to take full consideration of stakeholder feedback provided and will continue to do so. |
| The AUG Expert will provide the AUG Statement, including the AUG Table, to the Gas Transporters for publication who will then provide the AUG Statement and Table to the CDSP. | The Final AUG Statement for 2022-2023 will be provided to the Gas Transporters for publication by 1st April 2022. |
| 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 AUG data is kept secure. 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.<br>To ensure an impartial approach, we have also maintained a record of all our contacts with external parties in relation to the AUGE service. |

| AUGE Framework Document Requirement | Evidence of Fulfilment |
| --- | --- |
| 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.<br>Our AUGE team includes a Quality Lead independent of our Service Delivery Lead and SME.<br>We maintain director level oversight of delivery and quality. |

# Appendix 2 – List of Data Sources

| Report Name | Report Description | Source | Frequency | Use |
|---|---|---|---|---|
| **Accepted Reads for Isolated Sites** | Details of the accepted meter reads for Supply Meter Points with a live isolation status | CDSP | Annual | Isolated Sites (160) |
| **Accepted Reads for Sites with a Meter By-pass** | Details of the accepted meter reads for Supply Meter Points with a meter by-pass | CDSP | Annual | Meters with a By-Pass Fitted (140) |
| **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) |
| **AMR History** | A report of all the Supply Meter Points with AMRs previously installed | CDSP | n/a | Theft of Gas (010) |
| **AMR Snapshot** | Details of all the Supply Meter Points with an AMR device | CDSP | Quarterly Snapshots | Theft of Gas (010) |
| **Annual Load Profile** | Annual Load Profiles for Gas Year 2021-2022 | CDSP | Annual | Shipperless Sites (025)<br>Unregistered Sites (020)<br>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 | CDSP | Monthly | Consumption Forecast |

| | | | | |
|---|---|---|---|---|
| | Matrix Position for each LDZ | | | |
| **Average Main Length** | The average length of main for IGT Supply Meter Points | INA | 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 since been registered to a Shipper | CDSP | Annual | Shipperless Sites (025) |
| **Consumption Adjustments** | A report of the accepted consumption Adjustments submitted since January 2018 | CDSP | One-off | Meters with a By-Pass Fitted (140) |
| **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)<br>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)<br>Incorrect Correction Factors (100) |
| **Embedded AMR** | Details of all the Supply Meter Points with an embedded AMR device | CDSP | Quarterly Snapshots | Theft of Gas (010) |
| **Flow Weighted Gas Temperatures** | Gas Temperature Data from DMTS & ICTS | DNV (BG Technologies) | n/a | Average Temperature Assumption (080) |
| **Historical Isolated Sites** | A historical report of the Supply Meter Points that have had a live isolation status | CDSP | n/a | Isolated Sites (160) |
| **Historical Meter By-pass** | A historical report of the Supply Meter Points with a meter by-pass installed | CDSP | n/a | Meters with a By-Pass Fitted (140) |
| **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) |
| **Isolated Sites** | A report of the Supply Meter Points that have been identified as Isolated | CDSP | Quarterly Snapshots | Isolated Sites (160) |
| **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 | CDSP | Monthly | Unregistered Sites (020) |

| | | | | |
|---|---|---|---|---|
| | legitimately never been registered to a Shipper | | | |
| **Measurement Error Register** | The register of the LDZ Meter Errors | Public Domain (Joint Office) | n/a | LDZ Meter Errors (050) |
| **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)<br>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) |
| **Post Code and Elevation Data** | The altitude of each postcode in Great Britain | Open Data[53] | n/a | Average Pressure Assumption (070) |
| **Pressure Data** | Historical Pressure information by Weather Station | CDSP | n/a | Average Pressure Assumption (070) |
| **Rejected Reads for Isolated Sites** | Details of the rejected meter reads for Supply Meter Points with a live isolation status | CDSP | Annual | Isolated Sites (160) |
| **Rejected Reads for Sites with a Meter By-pass** | Details of the rejected meter reads for Supply Meter Points with a meter by-pass | CDSP | Annual | Meters with a By-Pass Fitted (140) |
| **Read Rejections for Sites with No Read** | Details of the read rejections carried out on the Supply Meter Points with no Reads after April 2019 report | CDSP | Annual | No Read at the Line in the Sand (090) |
| **Seasonal Normal Factors** | Seasonal normal factors that are applied in the AQ calculation forecast to | CDSP | Every five years | Consumption Forecast |

53 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.

| | | | | |
|---|---|---|---|---|
| | take account of seasonal normal changes | | | |
| **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) |
| **Sites with a Meter By-pass** | A report of the Supply Meter Points with a meter by-pass installed | CDSP | Quarterly Snapshots | Meters with a By-Pass Fitted (140) |
| **Smart Meter Data** | Smart Meter Installation data by quarter from BEIS | Public Domain (BEIS) | n/a | Consumption Forecast<br>Consumption Meter Errors (040) |
| **Supply Meter Points with no Reads after April 2019** | Details of the Supply Meter Point ID, their AQ and the last read for Supply Meter Points with no actual read after April 2019 | CDSP | Quarterly Snapshots | No Read at the Line in the Sand (090) |
| **Telemetered Sites** | Details of all the Telemetered Supply Meter Points | CDSP | n/a | Theft of Gas (010) |
| **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, verified and enhanced by the CDSP with meter type data | ElectraLink/ CDSP (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 2020 and September 2021). These have been included as reference points against which our Consumption Forecast can be compared.

Aggregate AQ (GWh) – September 2020:

| | 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 | - | - | 3 | 171 |
| | 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 |
| | | | | | 554,607 |

Aggregate AQ (GWh) – September 2021:

| | CLASS | | | | |
|---|---|---|---|---|---|
| | Sep-21 | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 44,593 | 256,294 |
| | 1PD | - | - | 1,519 | 18,979 |
| | 1NI | 0 | 0 | 1,797 | 9,338 |
| | 1PI | - | - | 1 | 39 |
| | 2ND | - | - | 251 | 5,868 |
| | 2PD | - | - | 1 | 174 |
| | 2NI | 0 | 2 | 6,218 | 14,216 |
| | 2PI | - | - | 1 | 10 |
| | 3 | - | 12 | 5,130 | 14,015 |
| | 4 | - | 113 | 4,838 | 16,958 |
| | 5 | 20 | 184 | 2,271 | 12,362 |
| | 6 | 338 | 1,313 | 1,584 | 11,343 |
| | 7 | 667 | 2,348 | 1,618 | 9,492 |
| | 8 | 3,562 | 5,548 | 1,815 | 9,451 |
| | 9 | 55,614 | 494 | 390 | 2,882 |
| | | | | | 523,663 |

Total Supply Meter Points – September 2020:

| | CLASS | | | | |
|---|---|---|---|---|---|
| | Sep-20 | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 3,662,163 | 17,945,562 |
| | 1PD | - | - | 37,236 | 2,098,800 |
| | 1NI | 3 | 9 | 61,823 | 494,103 |
| | 1PI | - | - | 21 | 3,640 |
| | 2ND | - | - | 2,317 | 42,023 |
| | 2PD | - | - | 25 | 1,652 |
| | 2NI | 1 | 12 | 42,515 | 111,399 |
| | 2PI | - | - | 9 | 56 |
| | 3 | 1 | 15 | 12,080 | 31,880 |
| | 4 | 2 | 43 | 3,869 | 14,546 |
| | 5 | 7 | 60 | 688 | 3,696 |
| | 6 | 30 | 130 | 177 | 1,277 |
| | 7 | 33 | 120 | 72 | 471 |
| | 8 | 76 | 126 | 25 | 236 |
| | 9 | 338 | 11 | 4 | 24 |
| | | | | | 24,573,406 |

Total Supply Meter Points – September 2021:

| | CLASS | | | | |
|---|---|---|---|---|---|
| | Sep-21 | 1 | 2 | 3 | 4 |
| EUC BAND | 1ND | - | - | 3,409,385 | 18,461,028 |
| | 1PD | - | - | 140,679 | 1,945,138 |
| | 1NI | 2 | 13 | 65,374 | 457,488 |
| | 1PI | - | - | 29 | 3,397 |
| | 2ND | - | - | 2,270 | 52,137 |
| | 2PD | - | - | 14 | 1,608 |
| | 2NI | 1 | 12 | 41,717 | 101,698 |
| | 2PI | - | - | 7 | 97 |
| | 3 | - | 24 | 11,563 | 30,868 |
| | 4 | - | 80 | 4,088 | 14,241 |
| | 5 | 4 | 51 | 684 | 3,651 |
| | 6 | 31 | 132 | 178 | 1,251 |
| | 7 | 32 | 114 | 80 | 461 |
| | 8 | 78 | 131 | 46 | 233 |
| | 9 | 361 | 8 | 6 | 33 |
| | | | | | 24,750,523 |

# Appendix 4 – Pressure And Temperature Impact on Energy Content

A number of the contributors 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

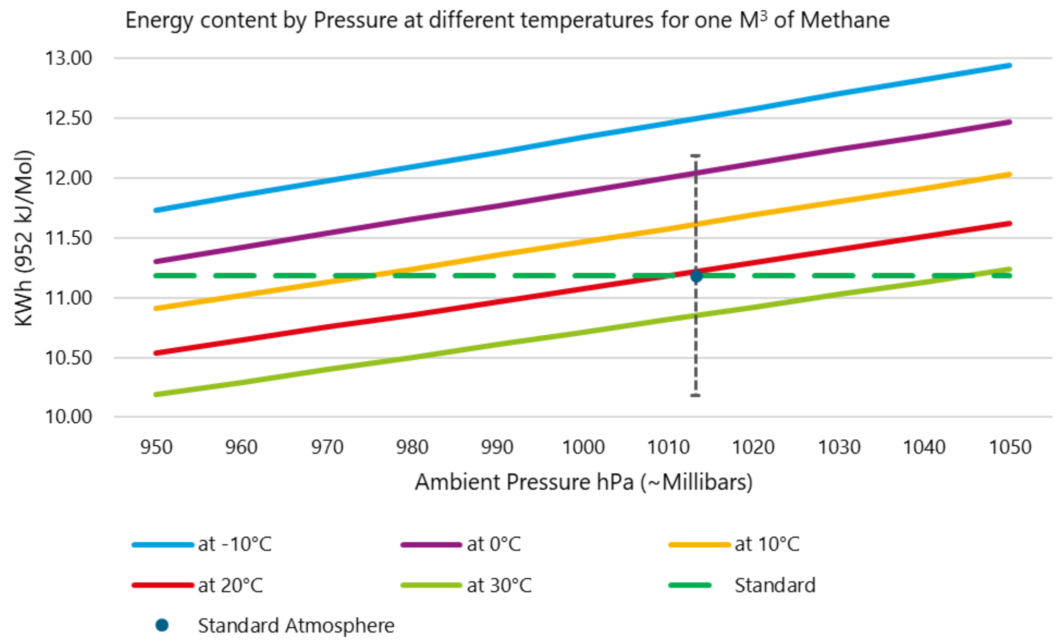
T is the temperature.

Therefore, the amount of gas (moles) is affected by the pressure, the temperature and the volume as follows:

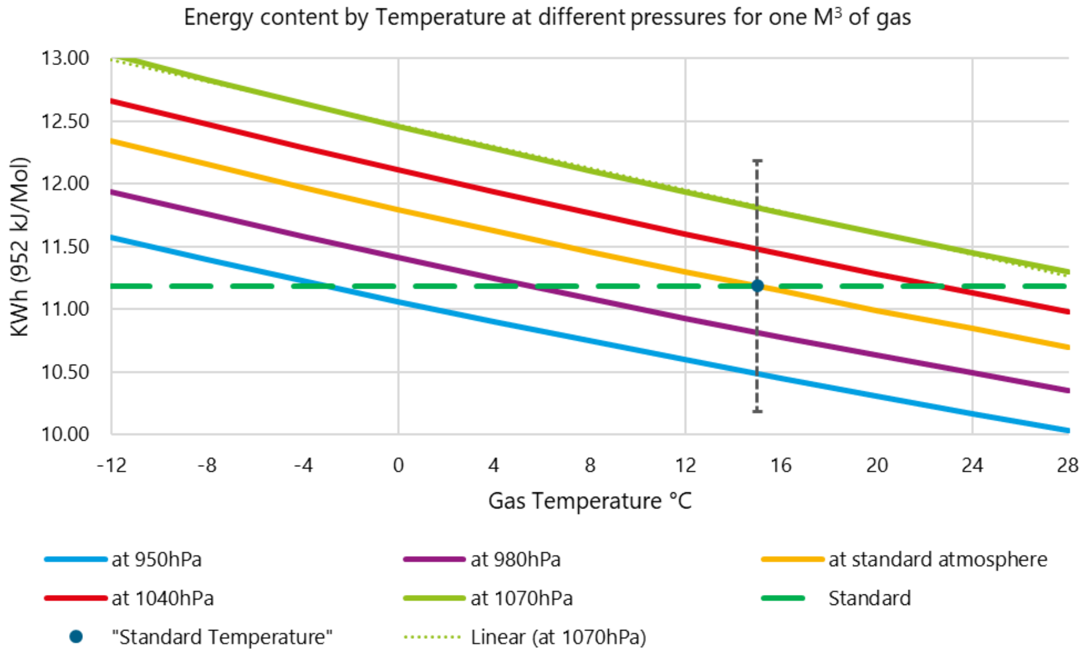
- If the volume and the temperature stay the same and the pressure increases, the number of gas moles will increase.
- If the volume and the pressure stay the same and the temperature decreases, the number of gas moles will increase.
- If the temperature and the pressure stay the same and the volume 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 – Previous Analysis and Rationale

The main body of the proposed final AUG Statement describes the detailed analysis we undertook this year for two new potential contributors, and the refinement of two existing contributors. It then describes the methodology and calculation for the contributors to UIG in our model which have not been subject to a material methodology update for the 2022-2023 Gas Year.

For the two contributors subject to refinement and for those contributors with unchanged methodologies, some of the more detailed analysis and rationale in the main body of the Statement has been moved to this Appendix. This is because it has been covered in previous AUG Statements. For readers wanting to understand the thinking behind contributors whose methodologies were developed previously, we will maintain this Appendix.

This Appendix therefore reproduces sections of previous AUG Statements as a point-in-time reference. There are no updates to numbers used at the time of initial writing. We have however noted for which Gas Year the analysis was undertaken.

## 010 – THEFT OF GAS

**Analysis Previously Undertaken for AUG Statement 2021-2022**

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

It is a fact that only a very small proportion of gas theft is detected. This makes it particularly difficult to quantify and even more difficult to attribute.

The previous methodology sought to overcome this by estimating the theft contributing to UIG as the difference between the forecast close-out UIG for the target Gas Year and the sum of the forecasts for all non-theft UIG contributors for the target Gas Year. For this reason, the previous methodology is sometimes referred to as a "top-down" or "differencing" methodology.

The resulting estimate of theft UIG varied in size from 3.77 TWh for Gas Year 2018-2019 to 7.16 TWh for Gas Year 2020-2021. This quantified theft was then split across Matrix Positions based on TRAS data with Supplier identified theft removed.

This "top-down" differencing methodology is reliant upon:

- an accurate quantification of close-out UIG; and
- a complete and accurate quantification of all non-theft contributors to UIG.

We consider that there is a high risk of these methodology requirements not holding true and this leading to material errors in the quantification of theft. It is inevitable that there will be a non-zero error tolerance on the most diligent quantification of close-out UIG as well as the non-theft contributors to UIG that have been identified to date. We are also of the view that there are likely to be additional contributors to UIG that have not yet been identified. We judge it as a major weakness that the methodology attributes the aggregate of all such sources of imprecision to theft.

As part of our review, we assessed the "top-down" differencing methodology calculations that were used to derive the final Weighting Factors published in Statements for previous Gas Years. We identified that the forecast of close-out UIG used was underestimated significantly. This is shown in the table below[54], where the forecast is a factor of <u>three</u> out in one year and a factor of <u>two</u> out in the other.

| Gas Year | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|
| Forecast of Close-out UIG (GWh) | - | 3,826 | 5,958 | 7,846 |
| Observed Latest UIG (GWh) | 20,827 | 11,589 | 11,713 | - |
| Observed Volume as a percentage of Forecast Volume | - | 303% | 197% | - |

The previous methodology determines theft contributing to UIG as:

$$Theft = Close\ Out\ UIG - Non\ Theft\ UIG$$

As a consequence, this significant underestimate in close-out UIG had a critical impact on the quantification of theft contributing to UIG (both absolute and percentage). It resulted in a figure

[54] "-" indicates that the figure is not available or is not derivable.

substantially lower than the quantification that would have resulted had the inputs to the methodology been correct. This is shown in the table below[55].

| Gas Year | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|
| Top-down Methodology as applied - using the significant underestimate of Close-out UIG | | | | |
| Theft (GWh) | 3,000 | 3,769 | 5,393 | 7,159 |
| Theft Percentage | - | 0.70% | 1.09% | 1.43% |
| Top-down Methodology - using the correct observed latest UIG | | | | |
| Theft (GWh) | - | 11,401 | 11,230 | - |
| Theft Percentage | - | 2.2% | 2.1% | - |

This demonstrates quite categorically that the theft figures used previously in the derivation of Weighting Factors were not an analytically rigorous consequence of the “top-down” differencing methodology, but were instead an inadvertent consequence of a significantly underestimated forecast of close-out UIG. This had a material impact on the resulting factors.

It also shows that correct application of the “top-down” differencing methodology would have resulted in theft levels that exceeded 2% of throughput (less shrinkage).

**Our Approach**

We consider that the previous “top-down” differencing methodology:

- is too dependent on the accurate quantification of total close-out UIG;
- is too dependent on the accurate quantification of all other contributors to UIG; and
- incorrectly assumes that all unquantified UIG is attributable to theft.

It is for these reasons that we chose not to follow the “top-down” 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**

There is no single authoritative source of the amount of theft in retail sectors, including the gas sector. A common characteristic across all theft is that thieves operate covertly and only a small percentage of their theft is detected. It is therefore impossible to quantify the amount or source of gas theft precisely. However, the data that is available can be used to make a reasoned estimate of the amount and sources of gas theft and this is what we sought to do.

We chose to examine the electricity and water sectors in developed countries as these have strong analogies with the gas sector. We also chose to consider other retail sectors. We accept that each of these sectors has differences, but we are also of the view that they have many commonalities.

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

[55] “-“ indicates that the figure is not available or is not derivable.

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. We identified and used five authoritative sources of electricity theft estimates. These are referenced below[56]. The theft estimates in these ranged from 1.0% to 2.5% with an average of 1.65%.

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. Most of the sources of information were opaque and less authoritative than the electricity information. The most relevant is referenced below[57]. This estimates water theft and public supplies (such as water used in firefighting) as 3.0% but does not provide a ratio between these.

Finally, we identified two authoritative sources of more general retail theft. Again, these are referenced below[58]. They estimate retail theft as 1.06% and 1.21% respectively (after taking into consideration staff errors), although we acknowledge that general retail has less in common with the gas sector than the electricity and water sectors do. Importantly though, these two sources provided an informative insight into the types of theft in operation across retail sectors, notably increasing levels of organised crime which the former estimates at 13.34% of all theft.

In establishing an estimate of gas theft, we placed significantly more weight on the electricity data than the water data. This is because the data sources are more authoritative, there are not the same safety issues associated with water theft. We acknowledge that electricity theft is likely to be higher than gas theft because of the former's use in the cultivation of marijuana plants.

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%. As a comparator, we replicated the previous AUGE's "top-down" differencing methodology for quantifying theft, using a robust forecast of close-out UIG[59] and this resulted in a figure of 2.00% of throughput, which is significantly higher than the upper point in our range.

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[56] Theft of Electricity (Illegal Abstraction) - Terry Keenan BSc., MSc., C.Eng., FIEE – 2004 Theft of Electricity (Illegal Abstraction); Theft Detection and Smart Metering Practices and Expectations in the Netherlands - P. Kadurek ; J. Blom ; J.F.G. Cobben ; W.L. King – 2010 Theft Detection and Smart Metering Practices and Expectations in the Netherlands; Electricity Theft Detection Using Smart Meter Data - S. Sahoo ; D. Nikovski ; T. Muso ; K. Tsuru – 2015 Electricity Theft Detection Using Smart Meter Data; Electricity Theft: A Comparative Analysis - T.B. Smith - 2004 Electricity Theft: A Comparative Analysis; Theft of Electricity and Gas – Discussion Document - Ofgem - 2004 Theft of Electricity and Gas - Discussion Document

[57] Water: Theft - Question for the Department for Environment, Food and Rural Affairs - Lord Kennedy of Southwark; Lord Gardiner of Kimble - 2018 Water: Theft - Question for the Department for Environment, Food and Rural Affairs

[58] What is the Cost of Retail Crime in the UK? – Centre for Retail Research – 2019 What is the Cost of Retail Crime in the UK?; National Retail Security Survey 2020 – National Retail Federation – 2020 National Retail Security Survey 2020

[59] Based on observed values of close-out UIG.

We have therefore decided to use 1.50%, this being the mid-point in our range. 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 is: **1.48%.** This compares directly to 1.45% theft which is implied in the Statement for Gas Year 2020-2021 (both figures including the very small proportion of theft that is detected).

**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:

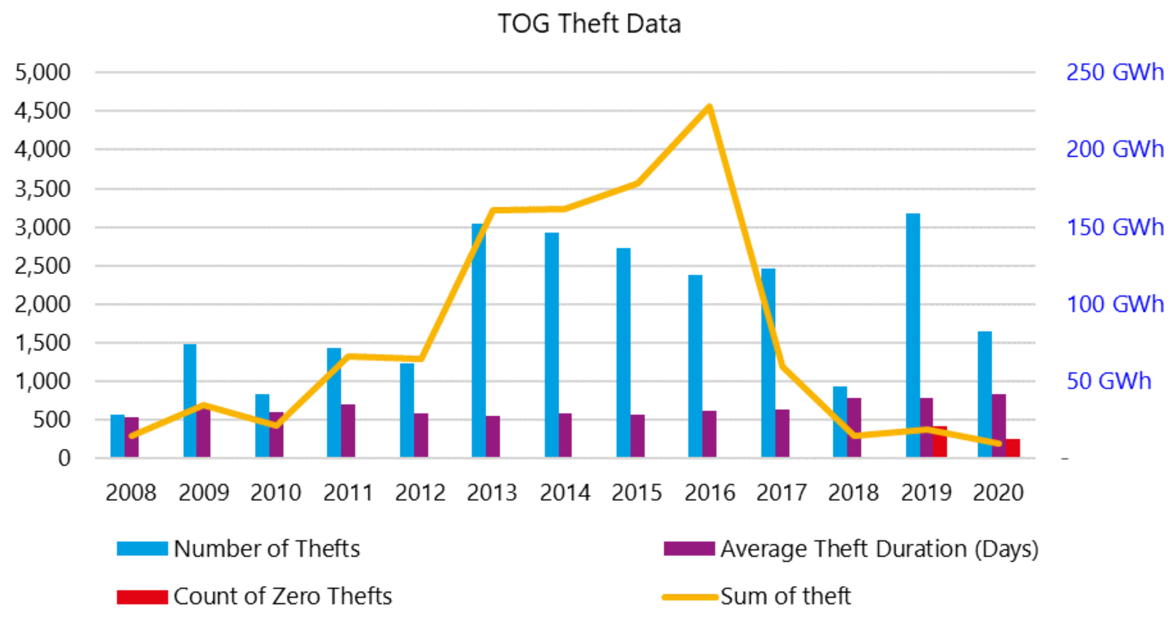
- Combined TOG and TRAS data to obtain a comprehensive dataset of detected theft by reported (detected) year;
- Established the relationship between theft year and reported (detected) year;
- Applied this relationship to the TOG and TRAS data to obtain detected theft by theft year;
- Used trend analysis 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.

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

<u>TOG Data</u>

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[60]; 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.

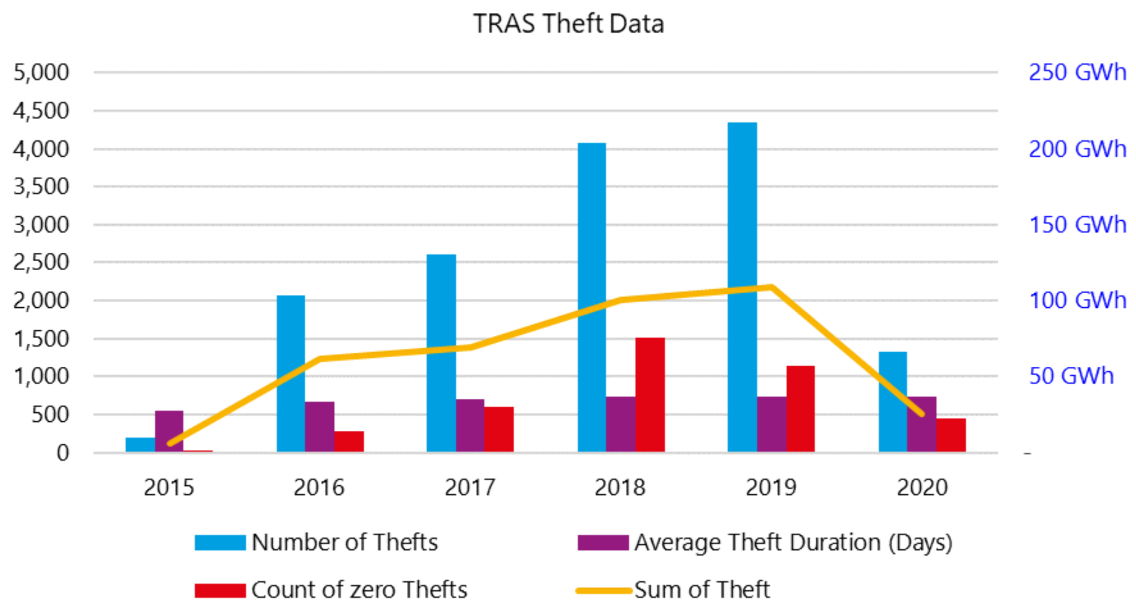
In addition, the graph suggests a rather inconsistent use of the TOG regime. Whilst it contains useful information it does not, in isolation, provide a sufficiently robust basis for our forecast of detected theft in the target Gas Year.

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.

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




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 2020; and
- A reduction in the number of cases and amount of theft reported in 2021, 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.

Consideration of TOG and TRAS Datasets

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 service being launched in April 2016, the GTDIS incentive scheme being introduced in June 2017 and the introduction of individual reconciliation for all Supply Meter Points from June 2017.

Prior to 2017, it is likely that some theft on Small Supply Points was not reported via TOG as it should have been, on the basis that these were settled by difference at that point in time. Equally, post 2015, it is likely that the GTDIS scheme resulted in a predominance of Small Supply Point thefts being reported in TRAS, as this is where the "easy pickings" incentive payments were to be obtained.

The previous AUGE's methodology did not use TOG data. In addition, only 38% of TRAS data was used as the remaining 62% was considered to have an inherent bias, although that does pre-suppose a known target unbiased position. This means that, of the industry theft data available, only 9.5% of it was used as the basis of allocating all theft[61]. This is against the unavoidable backdrop of industry theft data representing less than 1.5% of all theft.

[61] This resulted in anomalies such as all Class 3 theft being extrapolated from just three traditional meters.

Furthermore, our analysis of the TOG and TRAS datasets (detailed below) shows that less than 90% of detected gas theft is identified within five years of it first taking place. The remaining 10% is identified in the following five years. Theft is detected so infrequently in some parts of the market that a prolonged assessment period is required to establish a meaningful probability of it existing. For example, consider a hypothetical scenario where a theft is discovered for a particular part of the market once in every five years. If a ten-year period was used to assess this probability, two thefts would be found and the analysis would correctly conclude detection was a one in five year occurrence. If a one-year period was used, zero thefts would be found in four of the years and the analysis would incorrectly conclude detection was non-existent; and one theft would be found in one of the years and the analysis would incorrectly conclude detection was once every year.

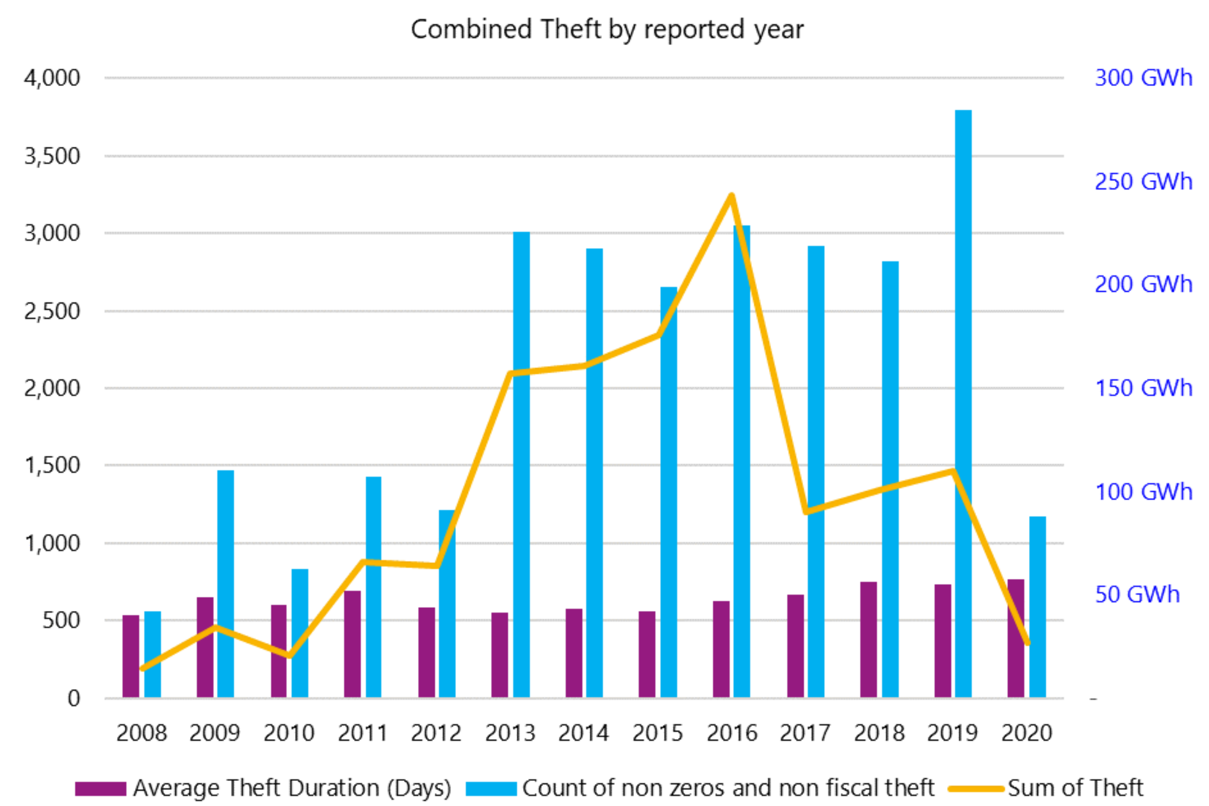
Our conclusion was that the assessment period needs to be more than five years and up to 10 years for it to be a reasonable basis for allocating theft. TRAS theft data starts from late 2015, which means there is only four full years' worth of data available, one of which has been affected by COVID-19. Our view is that this is insufficient for it to be representative of all sectors of the market.

Combined TOG and TRAS Data

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.



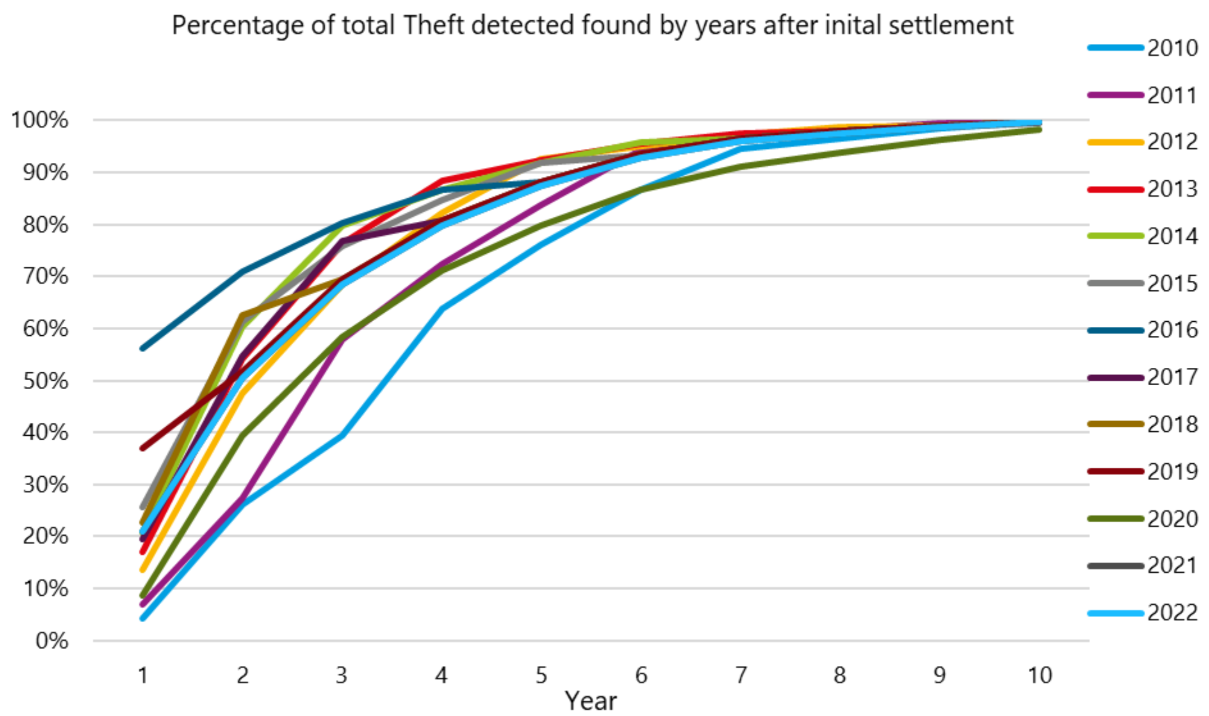
This dataset confirms that there is:

- 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.

Relationship between Theft Year and Detected Year

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.



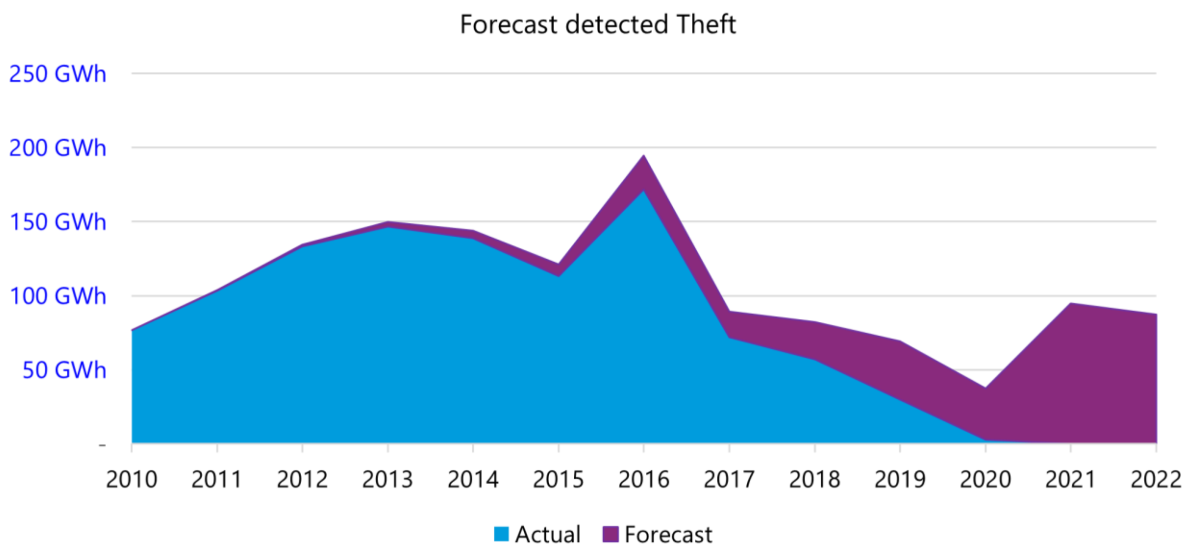

Forecasting Detected Theft for the Target Gas Year

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.

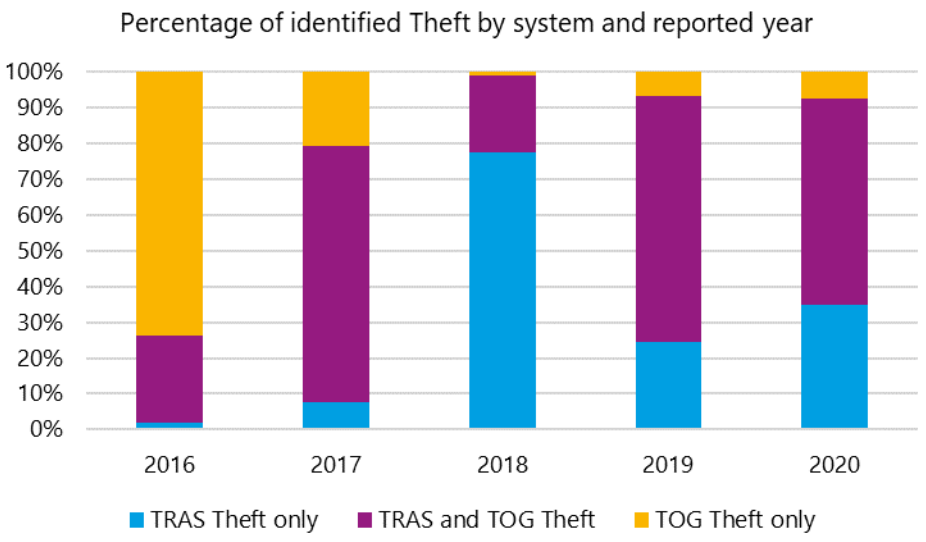
We therefore increased our forecast of detected theft for the target Gas Year by (100/80-1) = 25% to **111 GWh.**

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[62] 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.

<u>Detected Theft Forecast Summary</u>

Our forecast for the target Gas Year is that:

- Theft will comprise 1.48% of throughput which, based on our Consumption Forecast, is 7,788 GWh;
- 111 GWh or 1.43% of this 7,788 GWh will be detected before the Line in the Sand; and
- 58 GWh or 0.75% of this 7,788 GWh will be adjusted for in Settlement before the Line in the Sand.

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

**Undetected Theft**

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

7,788 GWh – 111 GWh = 7,677 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 sophisticated, operating across the market, which is very difficult to detect.

The two authoritative sources of more general theft[63] we considered, both cite "organised crime" as being a significant and rising percentage of overall theft, employing a range of sophisticated methods to avoid detection. The Retail Crime Costs in the UK – Centre for Retail Research estimate that organised crime accounts for 13.34% of overall theft.

We assert that the gas sector is highly unlikely to be different from other retail sectors in this respect and that it too has some level of organised crime across the 98.5+% of undetected theft, where the perpetrators are professional criminals, as opposed to just being opportunist/dishonest individuals with access to the necessary "DIY skills" to steal gas. It is impossible to quantify how much and so, in recognition of the differences associated with the gas sector, in particular the additional complexity in monetising gas theft, we have taken a conservative estimate of half of the figure for organised crime in the broader retail sector, this being 6.67% of overall theft.

We have therefore categorised and quantified undetected theft as:

- Theft that is akin to detected theft = 7,157 GWh or 91.90% of 7,788 GWh; and
- Theft that is more sophisticated and very hard to detect = 519 GWh or 6.67% of 7,788 GWh.

**Summary of Theft Type**

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

<table>
<tr><th>Type of Theft</th><th>Sub Type</th><th>Settlement Allocation</th><th colspan="2">Proportion of Total Theft</th></tr>
<tr><td rowspan="2">Adjusted for Theft</td><td>Theft in TOG<br>(and optionally TRAS also)</td><td>Correct</td><td rowspan="2">0.75%</td><td rowspan="4">1.43%</td></tr>
<tr><td>Theft has not yet but will be detected and put into TOG</td><td>Correct</td></tr>
<tr><td rowspan="2">Unadjusted for Theft</td><td>Theft in TRAS but not in TOG</td><td>UIG</td><td rowspan="2">0.68%</td></tr>
<tr><td>Theft detected but not put in TRAS or TOG</td><td>UIG</td></tr>
</table>

[63] What is the Cost of Retail Crime in the UK? – Centre for Retail Research – 2019 What is the Cost of Retail Crime in the UK?; National Retail Security Survey 2020 – National Retail Federation – 2020 National Retail Security Survey 2020

| Type of Theft | Sub Type | Settlement Allocation | Proportion of Total Theft | |
|---|---|---|---|---|
| | Theft has not yet but will be detected, but will not be put into TOG | UIG | | |
| **Undetected Theft** | Akin to detected theft | UIG | 91.90% | 98.57% |
| | Sophisticated, harder to detect theft | UIG | 6.67% | |

**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.<br><br>Allocated across Matrix Positions in proportion to the TRAS only reported Theft from 2019. |

| Type of Theft | Sub type | Basis of Matrix Allocation |
|---|---|---|
| **Undetected Theft** | Typical Theft akin to detected theft | Traditional Meters<br>The forecast quantity of Undetected Typical Theft, less the amount of this attributable to smart meters (see below).<br><br>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.<br><br>Then sub-allocated across Classes as in proportion to our Consumption Forecast for traditional meters (see below).<br><br>Smart Meters<br>The forecast quantity of Undetected Typical Theft attributable to smart meters (see below).<br><br>Allocated in proportion to our Consumption Forecast for smart meters. |
| **Undetected Theft** | Sophisticated, harder to detect theft | The forecast quantity of Undetected Sophisticated Theft.<br><br>Allocated in proportion to throughput for all Matrix Positions. |

Unadjusted for Theft

The allocation of Unadjusted for Theft was in the following percentages[64] (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% |

64 Note that due to rounding the total is greater than 100.

Undetected Theft

Smart meters have the potential to have materially different theft percentages due to their additional detection mechanisms compared to traditional meters. In addition, they comprise a highly changing proportion of multiple Matrix Positions. This means that data based on past matrix compositions might not be indicative of forecast compositions, unless smart and traditional meters are considered separately. It is for these reasons that we decided to investigate whether it was appropriate to model smart and traditional meters independently.

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:

| 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 splits | EUC | Traditional Theft percentage splits |
|---|---|---|---|
| **1BND** | 35.12% | **3** | 2.32% |
| **1BNI** | 25.33% | **4** | 2.49% |
| **1BPD** | 13.71% | **5** | 1.70% |
| **1BPI** | 0.09% | **6** | 1.68% |
| **2BND** | 4.12% | **7** | 1.68% |
| **2BNI** | 9.65% | **8** | 2.06% |
| **2BPD** | 0.05% | **9** | 0.00% |
| **2BPI** | 0.00% | | |

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.

## 040 – CONSUMPTION METER ERRORS

**Analysis Previously Undertaken for AUG Statement 2021-2022**

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)[65]. 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**

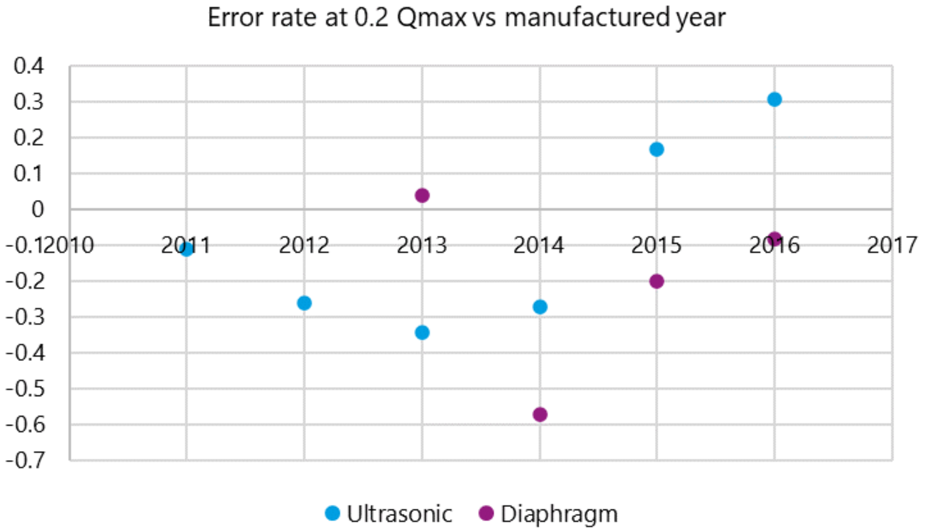
We obtained the three most recent years' IST results from OPSS and used these to investigate inherent bias. The results are summarised below.

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

| YEAR TESTED | Manufacture Year | Meter Type | Meter Type and Manufacture Year | Sample Tested | Outliers removed | EXTREME VALUE (%) 0.2Qmax Greatest Error (+) | EXTREME VALUE (%) 0.2Qmax Greatest Error (-) | EXTREME VALUE (%) Qmax Greatest Error (+) | EXTREME VALUE (%) Qmax Greatest Error (-) | MEAN ERROR (%) 0.2Qmax | MEAN ERROR (%) Qmax | STANDARD DEVIATION 0.2Qmax | STANDARD DEVIATION Qmax |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2017** | 2011 | Ultrasonic | 2011 Ultrasonic | 334 | 1 | 0.84 | -2.16 | 1.64 | -2.64 | -0.11 | 0.07 | 0.43 | 0.43 |
| | 2014 | Ultrasonic | 2014 Ultrasonic | 219 | 0 | 1.8 | -1.95 | 1.6 | -1.77 | -0.27 | -0.17 | 0.39 | 0.42 |
| | 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 |
| | 2015 | Ultrasonic | 2015 Ultrasonic | 209 | 0 | 1.33 | -0.63 | 1.81 | -1.08 | 0.17 | 0.07 | 0.31 | 0.39 |
| | 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 |
| | 2013 | Diaphragm | 2013 Diaphragm | 52 | 0 | 2.05 | -1.41 | 1.16 | -1.94 | 0.04 | -0.36 | 0.71 | 0.73 |
| | 2016 | Ultrasonic | 2016 Ultrasonic | 338 | 0 | 1.37 | -0.65 | 1.7 | -1.28 | 0.31 | 0.04 | 0.33 | 0.37 |
| | 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.

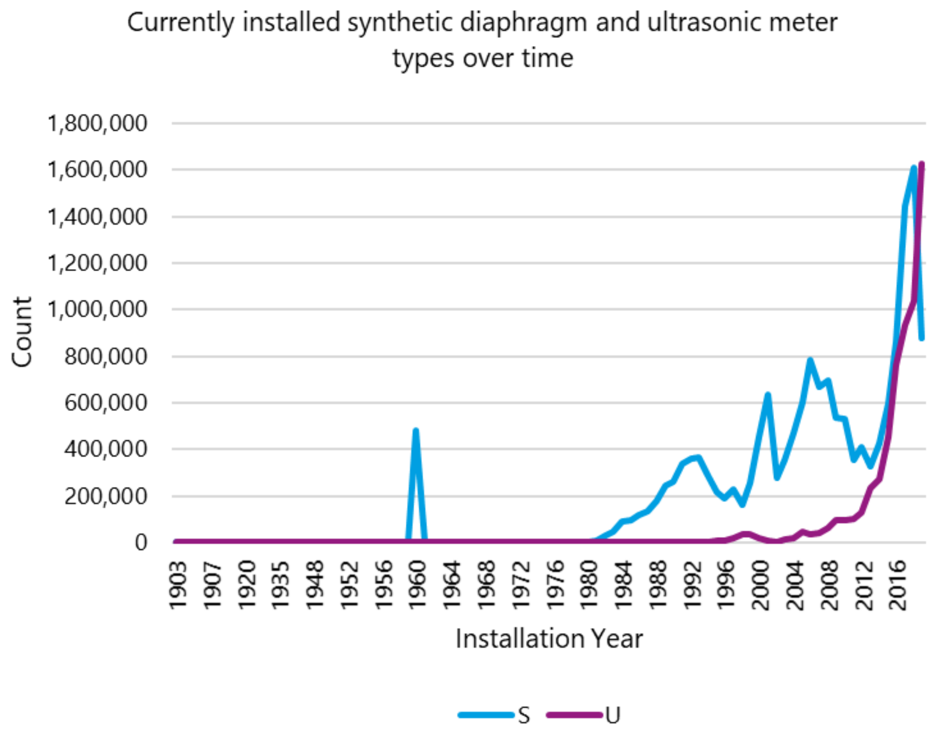



As there did not appear to be any trend across year of manufacture, we decided to use the average under-recording error of 0.05% for all ultrasonic meters in our analysis and 0.23% for all diaphragm meters. This assumes that meters manufactured prior to 2017, including those manufactured under GB legislation (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=∑ 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.

Meter Faults

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 AUG Statements for previous Gas Years, 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 Statements for previous Gas Years.

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.

# 050 – LDZ METER ERRORS

**Analysis Previously Undertaken for AUG Statement 2021-2022**

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.

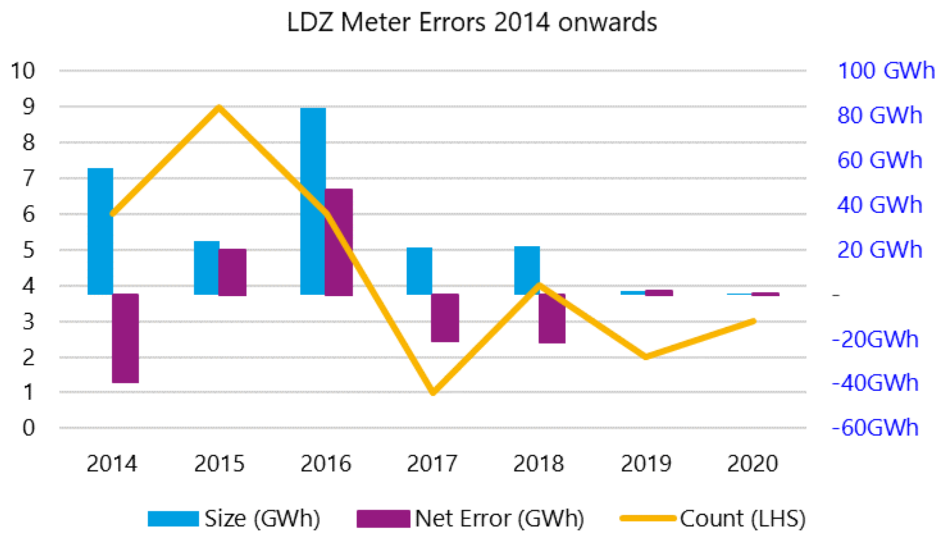
However, we were unable to find any data or studies that informed this further. We have therefore assumed, for the purposes of this Statement, that UIG is not caused by an inherent bias in LDZ meters.

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.

**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.

# 090 – NO READ AT THE LINE IN THE SAND

**Analysis Previously Undertaken for AUG Statement 2021-2022**

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

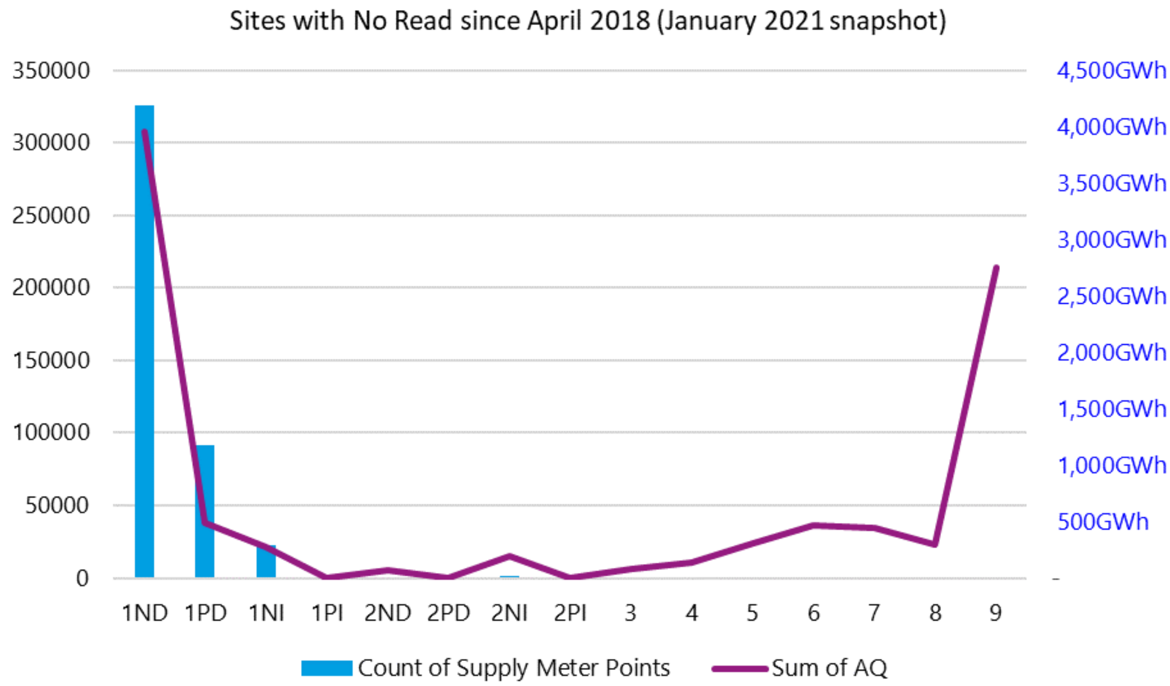
- To investigate how much consumption is likely to remain unreconciled to valid meter reads at the Line in the Sand; and
- To investigate how closely the consumption derived from AQs and used in allocation is reflective of the actual consumption.

These investigation stages are described in the following sections.

**Determining Unreconciled Consumption Forecast**

Supply Meter Points without a Read

We obtained a snapshot of all Supply Meter Points that had not had a meter read since April 2018, as at January 2021. 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 33 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 June 2020 and September 2020.

Rates of Reconciliation

We used the June 2020 and January 2021 snapshots to identify the rate at which reads are submitted and accepted against Supply Meter Points with limited recent read history. These snapshots contained Supply Meter Points with no read accepted since April 2018 – broader than the dataset that is ultimately impacted at the Line in The Sand - to give a large enough sample to derive a trend in reconciliation rates.

Then, considering only the Supply Meter Points that had not had a read accepted since April 2017, we 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 average rates determined above will be a fair representation of the remaining period until the Line in the Sand occurs for the year April 2017 to March 2018 (on 1st April 2021) given the plateauing of read submission activity for a consumption period so far in the past.

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[66] as at the end of September 2020. 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 January 2021 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.

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

We investigated four areas:

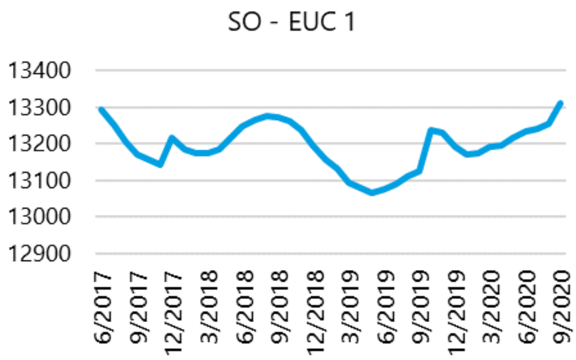
- AQ change trend – to determine if increases in average consumption over time lead to AQs used in allocation (and not subsequently reconciled to a valid meter read) being out of date and so not reflective of the actual consumption;
- Read rejection reasons – to determine if the reasons for rejected 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.

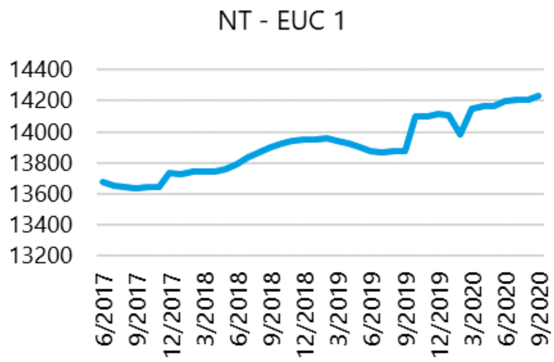
AQ Change Trends

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:

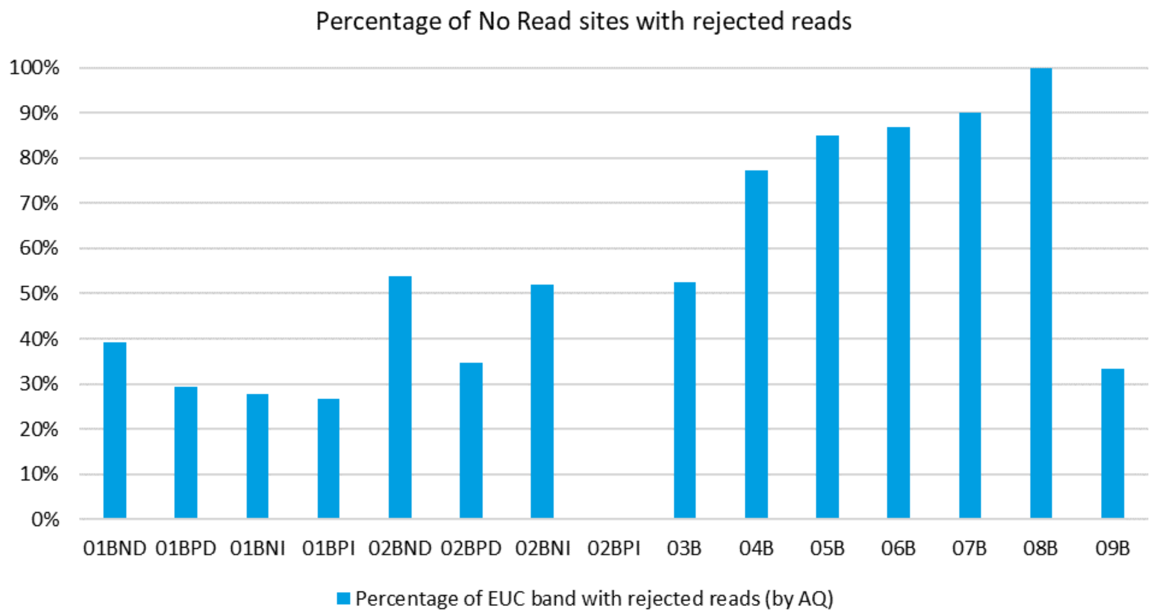
$$100 * \frac{\text{recent average AQ} - \text{original average AQ}}{\text{original average AQ}}$$

Read Rejections

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)
- Over 10% of rejected reads were due to the resulting AQ being outside the Upper Outer Tolerance (“upper tolerance”); and
- Over 20% of rejected reads were due to the resulting AQ being outside the Lower Outer Tolerance (“lower tolerance”).




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

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).
- 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 lower tolerance (using reads rejected for this reason as close to a year apart as possible).
- Determined the percentage error on the original AQs for each tolerance band 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);
- Determined the proportion of Supply Meter Points that had multiple reads that were rejected due to the resulting AQ being outside the Lower Outer Tolerance, from the set that had one or more rejections (of any type);
- Applied the resulting upper and lower proportions 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 for each tolerance band 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 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 for each tolerance band 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 2020 to January 2021 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.

# 020 – UNREGISTERED SITES

### Analysis Previously Undertaken for AUG Statement 2021-2022

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 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.

## 025 – SHIPPERLESS SITES

### Analysis Previously Undertaken for AUG Statement 2021-2022

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.

# 060 – IGT SHRINKAGE

**Analysis Previously Undertaken for AUG Statement 2021-2022**

The Statement for Gas Year 2020-2021 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 the Statement for Gas Year 2020-2021. 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.

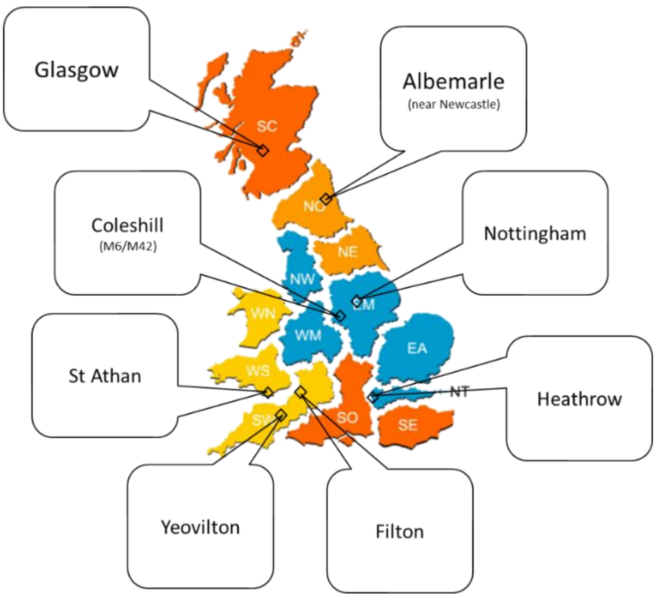
# 070 – AVERAGE TEMPERATURE ASSUMPTION

### Analysis Previously Undertaken for AUG Statement 2021-2022

We assessed the method used in the Statement for Gas Year 2020-2021 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 Statement for Gas Year 2020-2021. 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 Statement for Gas Year 2020-2021 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 67.5m 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[67] was under the Open Government Licence[68].

**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 67.5m above Mean Sea Level).

**Pressure Volume Error Rate**

The Statement for Gas Year 2020-2021 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[69], 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 number of gas moles in a cubic metre, we determined that this Pressure Gas Volume Error Rate is 0.00098692 per millibar.

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

[68] 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.

[69] See Appendix 4 for calculation details.

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.

**COVID Impact**

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

## 080 – AVERAGE PRESSURE ASSUMPTION

**Analysis Previously Undertaken for AUG Statement 2021-2022**

We assessed the method used in the Statement for Gas Year 2020-2021 and have replicated it with minor updates and enhancements.

**Temperature Studies**

Two studies were carried out in the early 2000s by BG Technology[70]. 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 Statement for Gas Year 2020-2021.

We decided to undertake our calculations broken down by EUC sub-bands to reflect the implementation of Modification 0711[71]. 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 Statements for previous Gas Years.

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 Statement for Gas Year 2020-2021.

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

[70] Now part of DNV GL Group.

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

| | 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[1] | 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) |
| | 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 | ICTS | Domestic (derived) | Small I&C | Large I&C | DM |
|---|---|---|---|---|---|---|---|
| **EA** | 15.12 | 9.37 | **EA** | 9.4 | 9.6 | 10.1 | 11.1 |
| **EM** | 13.70 | 9.11 | **EM** | 10.1 | 10.1 | 10.9 | 12.1 |
| **NE** | 13.47 | 8.79 | **NE** | 9.4 | 9.3 | 9.9 | 11.2 |
| **NO** | 13.19 | 8.50 | **NO** | 9.0 | 8.8 | 9.4 | 10.5 |
| **NT** | 16.43 | 10.13 | **NT** | 12.8 | 13.3 | 13.4 | 14.8 |
| **NW** | 13.07 | 9.01 | **NW** | 9.7 | 9.7 | 10.4 | 11.4 |
| **SC** | 16.92 | 7.95 | **SC** | 8.3 | 8.4 | 8.8 | 9.9 |
| **SE** | 16.10 | 10.16 | **SE** | 10.7 | 11.2 | 11.5 | 13.0 |
| **SO** | 15.42 | 9.74 | **SO** | 9.7 | 9.7 | 10.6 | 11.8 |
| **SW** | 13.56 | 9.53 | **SW** | 10.1 | 10.1 | 11.0 | 12.1 |
| **WM** | 12.86 | 9.26 | **WM** | 8.9 | 8.9 | 10.0 | 10.7 |
| **WN** | 12.60 | 9.33 | **WN** | 9.0 | 9.0 | 9.9 | 10.7 |
| **WS** | 14.66 | 9.86 | **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 Statement for Gas Year 2020-2021 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.

# 100 – INCORRECT CORRECTION FACTORS

**Analysis Previously Undertaken for AUG Statement 2021-2022**

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:

- 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[72] 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.

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

# Appendix 6 – Future Considerations

In this Appendix we have collated for reference a list of suggestions and potential considerations for potential UIG contributors, or refinements to methodologies for existing contributors. Some considerations arise during our own investigation and analysis. Others are proposed by industry stakeholders during consultation or stakeholder meetings.

At the start of each AUGE year, entries on this list will be reassessed, regardless of the outcome of previous assessments. Previous considerations that have been incorporated into our ongoing methodologies are removed from the list.

This list has been updated following the consultation on the draft AUG Statement for the gas year 2022-2023.

| 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.<br><br>To progress this we would need the Shipper identifier to be provided within the theft datasets. |
| **010 Theft of Gas** | The continued rollout of smart and AMR may impact not only the amount of theft detected, but also the total amount of theft, especially as site visits occur for customers who have to date resisted a meter exchange.<br><br>We will consider whether and how the assumptions we use to determine the total amount of theft may need to change over time. To progress this we would need to investigate aspects such as the link between detected theft and recent meter exchanges. |

| Contributor | Future Considerations |
|---|---|
| **010 Theft of Gas** | It has been suggested that the implementation of Modification 0664 ('Transfer of Sites with Low Valid Meter Reading Submission Performance from Classes 2 and 3 into Class 4') will impact the default read frequency of a cohort of Supply Meter Points.<br><br>We will acquire the relevant data to investigate the impacts of Modification 0664 and whether there is a relationship between read frequency and theft. |
| **040 Consumption Meter Errors** | We will consider the potential impact of flow rates on Consumption Meter errors.<br><br>To progress this we would require Shippers to provide us with within day consumption information for high consuming Supply Meter Points. This may not be available. |
| **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.<br>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.<br><br>To progress this would require in-field testing of LDZ meters and the results provided to us. |
| **060 IGT Shrinkage** | We have 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.<br><br>To progress this we would require IGTs to provide us with records of theft from their networks. This may not currently exist. |
| **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.<br><br>If these sites are tracked for an extended period, the accuracy of our estimation of AQ at risk will increase. This will occur as we continue to request this data as part of the annual data request process. |

| Contributor | Future Considerations |
|---|---|
| **090 No Read at the Line in the Sand** | Understanding in more detail the causes of missing meter reads would require close investigation and probably access to Shipper systems but could lead to a more accurate estimation of UIG, or a new source of data to be used in future methodologies.<br><br>To progress this we would need to have access to data from Shipper systems or be provided with information about why Supply Meter points do not have a read for an extended period of time. |
| **090 No Read at the Line in the Sand** | Most Supply Meter Points that were subject to a Consumption 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.<br><br>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.<br><br>To progress this we will monitor the output of Review Group 0783 and continue to track AQ Corrections on sites with no read. |
| **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. To progress we would require information on failed must reads. |
| **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.<br><br>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.<br><br>To progress this would currently require work under the innovation service as it is outside of the scope of the core AUGE activity. |

| Contributor | Future Considerations |
|---|---|
| **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.<br><br>To progress this would require further research and analysis into feasibility and options for approach. |
| **UIG Calculation** | Further validation of our outputs may give stakeholders additional confidence in their accuracy. We will consider the appropriateness and practicality of further 'top down' validation of the UIG we calculate. |
| **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.<br><br>To progress this the additional pressure data would need to be purchased and provided to us. |
| **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.<br><br>To progress this would require a temperature study which has been proposed under our innovation service. |
| **025 Shipperless Sites** | We progressed the potential inclusion of Shipperless sites awaiting their GSR visit in our data and analysis for the 2022-2023 Gas Year.<br><br>To progress this we will need up to date GSR visit outcome data that has to date been unavailable. |

| Contributor | Future Considerations |
|---|---|
| **140 Meters with a By-pass Fitted** | We considered UIG caused by Meter Bypass Arrangements, in the AUG Statement for the Gas Year 2022-2023, with no UIG incorporated into our model due to poor data quality.<br><br>In accordance with our overarching annual AUGE process, this contributor will be re-assessed alongside all others identified in early 2022.<br><br>It is likely to score highly in our assessment – as it did this year – based on the potential scale of UIG, but also based on a clear view of the limited Consumption Adjustment records among this year's baseline dataset, and the other findings of the detailed investigation above.<br><br>However, the methodology followed in this proposed final Statement has been proven unviable on the basis of the data available. We do not consider that the usefulness of this data will improve with a further year of industry operation. Therefore an alternative approach will be necessary using data that we did not request this year, but that we believe is realistic to acquire with the support of industry.<br><br>To that end we will be collaborating with industry – through the ongoing Review Group 0763 and the AUG Sub-Committee – to discuss the development of this alternative methodology for investigation for the 2023-2024 Gas Year. These discussions will inform our assessment process in the Spring. |
| **130 Consumption Adjustments** | We will consider UIG attracted by Consumption Adjustment Errors, in line with our initial assessment procedure, for subsequent years. Assessment for the 2022-2023 Gas Year did not score this contributor highly enough to warrant investigation. This potential contributor will remain on our list for assessment for Gas Year 2023-2024. |
| **160 Isolated Sites** | Some sites in our Isolated Sites dataset may usefully be exclude with further validation.<br><br>We will consider investigating additional ways to validate the Isolated Sites data to improve the accuracy of the output from this contributor.<br><br>To do this we will require further site-specific data, for example vacancy status, electricity reads etc. |

| Contributor | Future Considerations |
|---|---|
| **160 Isolated Sites** | We use available AQ data to forecast the future state of the Isolated Sites dataset. There may be ways to improve the accuracy of this forecast by looking for alternative data to validate the AQ values used.<br><br>We will assess whether additional data is available to improve the accuracy of AQ assumptions for Isolated Sites. This is likely to require historical read data for sites in the relevant dataset. |
| **180 Unfound UIG Contributors** | The UIG calculated using our bottom up approach comprises only UIG from identified sources. We acknowledge that there will be additional sources that we are yet to identify and/or calculate.<br><br>We will consider an approach to 'scaling up' our calculated UIG to a 'likely' actual level under an existing (but so far unused) contributor 180 (Unfound UIG Contributors). |

# Appendix 7 – Changes Made After Consultation on the Draft Statement

The table below details the updates that have been made between our draft Statement published on 23rd December 2021 and this proposed final Statement.

| Area | Update |
|---|---|
| **010 Theft of Gas** | The data inputs used in the AMR refinement have been refreshed to reflect the identification of a cohort of sites with missing AMR flags, and a subsequent industry activity to bring data up to date.<br><br>This has resulted in a more accurate reflection of meter populations in a number of Matrix Positions and a reduction in allocation of traditional theft UIG to this cohort. |
| **010 Theft of Gas** | We have removed unreported theft from our estimate for the target Gas Year owing to the confirmed imminent implementation of Modification 0734S ('Reporting Valid Confirmed Theft of Gas into Central Systems and Reporting Suspected Theft to Suppliers'). |
| **060 IGT Shrinkage** | We have adjusted the way that we allocate UIG from this contributor. We now use an IGT-specific consumption forecast rather than the previous LDZ profile.<br><br>This has resulted in a more equitable allocation of UIG between domestic and non-domestic Matrix Positions because our analysis showed a relatively higher proportion of domestic Supply Meter Points attached to IGT networks. |
| **160 Isolated Sites** | We acknowledge the impact of a single large site on the UIG calculated for this contributor in the draft AUG Statement.<br><br>In the latest Isolated Sites snapshot there are no Class 1 Isolated Sites and we judge that it is unlikely that another such site will exist in the target Gas Year. We have therefore updated our calculated UIG at the Line in the Sand. |

<table>
<tr><th>Area</th><th>Update</th></tr>
<tr><td>General data refresh</td><td>We have taken a refreshed dataset to recalculate our overall Consumption Forecast for the target Gas Year. This has led to minor changes to the output from all contributors.<br><br>We have sourced, validated and analysed refreshed datasets for the following contributors:<br>▸ 010 Theft<br>▸ 020 Shipperless Sites<br>▸ 025 Unregistered Sites<br>▸ 090 No Read at Line in the Sand<br>▸ 160 Isolated Sites<br><br>In each case, this has resulted in further changes to the UIG calculated.</td></tr>
</table>

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