GL Noble Denton

Report Number: 13846	1st May 2013

2013 Allocation of Unidentified Gas Statement for 2014/15

Not Restricted	GL Noble Denton

Prepared for:

Uniform Network Code Committee

Prepared by:

Andy Gordon, Clive Whitehand, Tony Perchard, Mark Lingham

GL Industrial Services UK Ltd trading as GL Noble Denton

Holywell Park
Ashby Road
Loughborough Leicestershire
LE11 3GR
United Kingdom

Tel: +44 (0)1509 28 2000
Fax: +44 (0)1509 28 2141

E-mail: AUGE@gl-group.com

Website: www.gl-nobledenton.com

Version 1

Customer Reference: 1-6AS9AC

Version	Changed against	Date	Status (for consultation For approval Approved)
1.0	Created	1st May 2013	For consultation

Executive Summary

This document contains details of the methods developed by the Allocation of Unidentified Gas Expert (AUGE) for estimating the overall level of Unidentified Gas (UG) and splitting it between market sectors, the data requested to support this analysis, and the data received following such requests. Full estimates of the total energy value of UG split by LDZ and source will be provided once the methods described in this document have been approved by the Uniform Network Code Committee (UNCC).

In addition to the above, this document describes how the AUGE has followed the published guidelines.

This document is the 1st Draft 2013 AUGS for 2014/15. The document describes analyses undertaken in 2013 to improve the estimate of UG and investigates a number of issues arising from the consultation of the 2nd Draft 2012 AUGS for 2013/14. The following key topics have been covered:

- Investigation of handling of Multiple Meter Supply Points
- Potential use of LSP meter reads to calculate consumption when LSP metered consumptions are invalid
- Assessment of an alternative theft split method proposed by ICoSS
- Derivation of a Balancing Factor split formula that can be used year on year
- Revision of the consumption calculations to improve handling of Read Units for certain scenarios
- Assessment of the impact of Modifications 0424 and 0398
- Assessment of the impact of vacant sites on consumption calculation
- Update to the unregistered site methodology to handle bias in the initial AQ estimates

Section 3 of this document provides a high level overview of the methodology in general terms.

Section 4 describes the analyses carried out this year and conclusions reached. It does not describe the resulting methodology as that is covered separately.

Section 5 describes the data used. With the exception of information pertaining to Multiple Meter Supply Points (MMSPs) the analysis has used the data from last year with updates requested from Xoserve in order to produce the AUG table later this year.

Section 6 describes the resulting methodology proposed for April 2014 – March 2015.

From the analyses undertaken in the preparation of this AUGS we have concluded the following:

- Having obtained information for Multiple Meter Supply Points we confirmed that meters failing the consumption calculation have been scaled correctly where they were part of a MMSP and that there were no exceptions that required different treatment.
- We considered the use of LSP meter reads to calculate consumption when LSP metered consumptions are invalid. However, as each of the data sources used (consumption calculated from meter reads, metered volumes and AQs) rely on fundamental asset meter parameters Read Units and T&P factors, there is no single data source that provides a defacto correct consumption for comparison. We recommend the industry makes every effort to correct these key data items as they impact many gas industry processes. We concluded that the most appropriate data to use for LSPs is the metered consumptions and if this fails, consumptions will be estimated using the EUC average.

- An assessment of the theft split method proposed by ICoSS identified a number of flaws in the proposed solution. Furthermore, the method relies on data sources which we have previously highlighted as not robust enough for deriving a theft split method and uses a small sample of detected thefts. In particular, we conclude that theft periods, estimated volumes and AQs used to determine sector classification are unreliable and any conclusions drawn from these data sets should be treated with caution. We have concluded that the fairest method of splitting theft is by throughput.
- We have identified a number of improvements to the throughput method proposed last year. This includes using our consumption estimates rather than the ODR report data, applying a seasonal adjustment to the consumptions and using a rolling average instead of a forward extrapolation. This results in a much more transparent, simple and consistent method going forward.
- The consumption method has been updated to improve the handling of certain subsets of calculations where read unit information was not being used fully. This will address two of the issues identified by ICoSS during consultation. This statement includes details of the improved consumption methodology.
- We have assessed the impacts of Modifications 0424 and 0398 and these are described in this AUGS. Mod 0424 changes the content of the UG associated with Shipperless Passed to Shipper (PTS) sites and information will be provided by Xoserve in order to identify the meters affected going forward.
- With the information currently available Mod 0398 is not expected to impact the methodology.
- An assessment of vacant sites has been carried out, but there is insufficient information to determine whether a site is really vacant or not. Mod 0282 would have improved the situation but it was rejected. Until additional information becomes available such sites will be treated in the same way as we treat the general population.

Following the issues encountered at the end of last year's process the AUGE will not provide initial or ballpark estimates of UG either verbally or written until the methodology has been approved and the interim AUG table is published by the Gas Transporters (GTs) on 1st November 2013.

For each area of Unidentified Gas under consideration, the AUGE has provided details of the proposed method of estimating the level of Unidentified Gas from this source, and where necessary, the method of splitting this estimate between Larger Supply Point (LSP) and Smaller Supply Point (SSP) markets.

The methodology estimates the total level of Unidentified Gas, directly calculating its individual component parts where possible, and calculating the aggregate effect of the remaining causes (i.e. those that it is not possible to estimate directly in a robust manner) by subtraction as the Balancing Factor.

The methodology is an improvement on both the method produced in 2011 and the method developed during 2012. It is still dependent on source data accuracy and any initiatives to improve data quality within the industry will improve the estimate of UG.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Background

The Great Britain gas industry can be segmented into two market sectors; Larger Supply Points (LSP) and Smaller Supply Points (SSP). These sectors are defined by the Annual Quantity (AQ) of gas offtaken from the system in a year. Larger Supply Points have an AQ of 73,201 kWh and above, Smaller Supply Points have an AQ of up to 73,200 kWh. Many processes within the gas industry differ between these two sectors.

The majority of gas consumed in Great Britain is metered and registered. However, some gas is lost from the system, or not registered, due to theft, leakage from gas pipes, consumption by unregistered supply points and other reasons. Some elements of the gas that is not directly consumed/measured are currently modelled, and hence the gas consumed by these can be estimated. The gas that is lost and not recorded or modelled is referred to as Unidentified Gas (UG).

Prior to April 2012 there was no methodology in place to determine the allocation of UG between the LSP and SSP market sectors; UG was allocated entirely to the SSP market sector (an interim amount was allocated for 2011/12). Through the approval of Modification 229 (implemented in UNC section E 10 – Mechanism for Correct Apportionment of Unidentified Gas [5]) and the appointment of an Allocation of Unidentified Gas Expert (AUGE) a methodology has been defined to ensure that UG can be estimated and charged equitably to the relevant gas sectors.

Under the current Uniform Network Code (UNC) charges are made to Shippers for the volume of gas transported, which include commodity and energy charges. For LSPs the actual value charged is determined by the volume of gas transported as measured by the metering equipment. For SSPs, the commodity charge is derived by calculating the difference between the volumes of gas measured coming in to the network and the volume of gas measured by the LSPs. Each Shipper with an SSP portfolio is charged a proportion of the total SSP market in proportion to their Annual Quantity (AQ) value against the total SSP market AQ. This calculation of SSP load by subtraction leads to all lost gas being assigned to this market sector.

There had been several UNC modification proposals intended to resolve this issue (Mod 194 [2], 194a [3], 228 [4], 228a [4]), none of which have been accepted by the industry. A further modification, Mod 229 [5] provided for the appointment of the AUGE with responsibility for determining the value of UG so that relevant quantities could be allocated to the correct market sectors.

GL Noble Denton was appointed to the role of AUGE in 2011 and has developed a methodology to apportion UG fairly across both the LSP and SSP market sectors.

The initial methodology used RbD and AQ Bias to estimate UG. Items of UG that could be estimated and apportioned directly were deducted to leave a balancing factor which was split into market sectors based on a theft split. The AUG table was composed of directly estimated UG (e.g. Shipperless, Unregistered sites etc) plus a portion of the balancing factor for that market sector.

In 2012 consumption data was obtained for all customers and used to estimate total UG by subtracting the total consumption from the gas input. A methodology was produced based on this data. However, it was not possible to complete the AUGE process in time for implementation.

The methodology for 2014/15 is based very much on the 2012 method with improvements to key areas following the consultation on the previous 2nd Draft 2012 AUGS for 2013/14. This document describes the analysis undertaken and the resulting methodology for 2014/15.

1.2 High Level Objectives

The AUGE's high level objectives are:

- To determine what data is required from industry bodies to evaluate UG
- To develop and update the methodology of calculating UG
- To publish the methodology in the AUGS (this document)
- To consult with the industry bodies and respond to questions / issues raised
- To prepare an AUG table containing UG totals and rates

1.3 Scope

This document contains the following:

- A detailed description of the proposed methodology
- Description of areas of the methodology that are being developed further and the proposed approach to these as appropriate
- Summary of data requested, received and used, and associated assumptions
- Questions raised by the industry bodies during consultations and responses as appropriate (this is provided as a separate document)
- Details of the databases used to hold information associated with UG and used to develop the methodology
- Details of the analyses carried out in 2013 in preparation of the methodology

The final AUGS Table and financial estimates will be included in a future version of this document once the methodology has been approved.

1.4 Out of Scope

The AUGE is not concerned with issues regarding the deeming algorithm or the RbD mechanism.

The AUGE is not concerned with resolution of fundamental gas industry business process issues.

The AUGE process is not an opportunity to deal with/investigate issues within the gas industry that should be addressed by other workgroups (e.g. Shrinkage Forum.)

1.5 Document Status

This section provides a status summary of the Unidentified Gas methodology as contained in this version of the AUGS. Final estimates of the energy value and financial value of UG have not been made at this stage, and will only be provided when the methods detailed in this AUGS have been approved by the UNCC. Table 1 below shows the status of each element of UG:

Table 1: Unidentified Gas Estimate Status

Unidentified Gas Subject	**Data Status**	**Methodology Status**	**AUGS Status**
Unregistered sites	Updated data provided every two months	Updated method proposed for consultation	Methodology updated and described in full in this document
Shipperless sites	Updated data provided every two months	Updated method proposed for consultation in light of Mod 0424 implementation	Methodology updated and described in full in this document
IGT CSEPs	Updated data provided every two months	Complete	Methodology described in 2011 AUGS [10] and included in this draft for completeness
Shrinkage error	N/A	Complete	Status described in 2011 AUGS [10]
Shipper responsible theft	Theft data covering detections to 2012 received EUC Groups, meter read frequencies and meter reads and metered volumes received. Updated data to end March 2013 pending	Updated method proposed for consultation	Proposed method described in this document based on improvement to methodology described in 2012
Metering errors (SSP supply point, NDM LSP Supply point, DM supply point, LDZ offtake metering)	Updated data pending	Complete	Methodology described in 2011 AUGS [10] and Section 6.2 of this document for completeness
Overall UG estimate: using meter reads / metered volumes	Data covering time period to 2012 received, data to end March 2013 pending	Updated method for consultation	Methodology described in this document

2 Compliance to Generic Terms of Reference

This section describes how GL Noble Denton has adhered to the Generic Terms of Reference described in Section 5 of the AUGE Guidelines [1].

The AUGE will create the AUGS by developing appropriate, detailed methodologies and collecting necessary data.

The AUGE has developed a detailed methodology for estimating total UG using meter read and consumption data for both LSP and SSP sectors and requested the necessary data to apply this method from Xoserve. Further enhancements to the UG calculation are also described in this document.

The decision as to the most appropriate methodologies and data will rest solely with the AUGE taking account of any issues raised during the development and compilation of the AUGS.

The proposed methodology and assessment of what constitutes UG has been decided solely by the AUGE based on information supplied by all parties. Comments raised by shippers relating to the AUGS documents from previous years have been considered and responses issued, as detailed in Section 8 below. All views expressed have been considered, although all final decisions are the AUGE's own.

The AUGE will determine what data is required from Code Parties in order to ensure appropriate data supports the evaluation of Unidentified Gas.

The AUGE has assessed what data is required to support the proposed methodology and has requested information from relevant parties. For the 2014/15 analysis, updated data sets have been requested from Xoserve for all items, and a number of these have currently been received.

The AUGE will determine what data is available from parties in order to ensure appropriate data supports the evaluation of Unidentified Gas.

The AUGE has determined data available following discussions with Xoserve, as all of the data required for this analysis is held by them.

The AUGE 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 gas.

Questions regarding various elements of UG have been sent to Shippers during the production of the AUGS for previous years. Further communication will take place as and when necessary.

The AUGE will use the latest data available where appropriate.

Data for the 2013 method has been requested. This includes updates to LSP consumptions (including corrections from 2008 onwards) and new meter reads for SSPs up to end March 2013. Updates for theft data, CSEPS, Shipperless/Unregistered sites etc have also been requested and will be used to generate the interim AUG table later in the year. Xoserve have set up several processes for producing reports containing new data on a regular basis (for example the two monthly Shipperless/Unregistered site snapshots). These will continue to be supplied to the AUGE to ensure that the latest data is used for each analysis as appropriate.

Where multiple data sources exist, the AUGE will evaluate the data to obtain the most statistically sound solution, will document the alternative options and provide an explanation for its decision.

For the consumption method of estimating total UG, both meter reads and metered volumes are provided. Over time LSP metered volumes may be corrected, but the meter reads are not. Xoserve advised the AUGE to use metered volumes but analysis has shown that these can be erroneous, particularly for non-corrected SSP data. Therefore the decision was taken to use meter reads for SSP and metered volumes for LSP. Details of how these are determined are described in previous versions of the AUGS [10], [19].

Where data is open to interpretation, the AUGE will evaluate the most appropriate methodology and provide an explanation for the use of this methodology.

Throughout the statement the AUGE has described how data will be used and why.

Where the AUGE considers using data collected or derived through the use of sampling techniques, then the AUGE will consider the most appropriate sampling technique and/or the viability of the sampling technique used.

The consumption method for estimating the UG total is the only part of the analysis where a sample rather than the full dataset is used. This calculation will be at its most accurate when the largest possible representative subset of the meter point population is used. In order to achieve this, a validation process was developed that was designed to maximise the sample size whilst removing any meter points with invalid data. This is described fully in the 2012 AUGS for 2013/14 [19].

The AUGE will present the AUGS in draft form (the "Draft AUGS"), to Code Parties seeking views and will review all the issues identified submitted in response.

The AUGE has documented and reviewed all feedback resulting from AUGS from previous years. Section 8 of this document refers to these publications with details of the issues raised, with the full text of the comments from the Code Parties and the AUGE responses contained in separate documents published on the Joint Office of Transporters website.

The AUGE will consider any query raised by a Code Party with regard to the AUGS or the data derived, and will respond promptly with an explanation of the methodology used.

Responses were issued to all parties who submitted comments on AUGS from previous years and previous drafts of this AUGS, and these are noted in Section 8. Separate documents provide the detail of all responses [8], [9], [11], [12], [13], [20].

The AUGE will consider any relevant query that was raised during the creation of the previous AUGS and was identified as requiring a change to the AUGS, but was not incorporated into the immediately previous AUGS.

All queries have been carefully considered by the AUGE and where appropriate improvements to the UG calculation have been made. The evolution of the UG calculation can be seen in successive versions of the AUGS.

The AUGE will provide the Draft and Final AUGS to the Gas Transporters for publication.

This 1st draft 2013 AUGS for 2014/15 is provided to the GTs for publication on 1st May 2013.

The AUGE's final determination shall be binding on Shippers except in the event of fraud, material breach, or where The Committee unanimously considers it is so clearly erroneous for it to be inapplicable.

This guideline has not needed to be applied at this stage.

The AUGE will undertake to ensure that all data that is provided to it by all parties will not be passed on to any other organisation or used for any purpose other than the creation of the methodology and the AUGS.

On receipt of data, the AUGE stores the data on our secure project storage area with limited access by the consultants working on the project. The AUGE can confirm data used in the analysis has not and will not be passed on to any other organisation. The data used will be made available to all industry participants in order to review the methodology, and in this dataset all MPR information has been replaced by 'dummy' MPR references by Xoserve so that the anonymity of the consumer is protected.

The AUGE 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.

Data is stored on our secure project storage area with access limited to those working on the project. Any data that contains market share or code party specific information has been and will be made anonymous to ensure the source of the information cannot be ascertained.

3 High Level Overview of Methodology

This section provides a high level overview of the methodology. For each of the areas of UG presented here a more detailed discussion is given in Section 6 and/or in previous versions of the AUGS [10], [19].

3.1 LDZ Load Components

Daily load (as measured or calculated at the Supply Meter Point) falls into three relevant categories as far as the reconciliation process is concerned. These are:

Daily Metered (DM) Load

This is by definition metered and known on an ongoing daily basis. However, it is subject to error and data for known errors is used to correct it.

Larger Supply Point Non Daily Metered (LSP NDM) Load

The deemed load is first calculated using the allocation algorithm on a daily basis. It is then corrected when genuine meter reads become available, with reciprocal corrections being made to the Smaller Supply Point load via Reconciliation by Difference (RbD).

Smaller Supply Point (SSP) Load

This is calculated using the same allocation process used for LSP NDM load on a daily basis. When actual LSP NDM readings become available, this is subject to RbD, the effect of which is usually to increase the SSP load as described above.

The sum of these three load components does not equal the gas intake into the LDZ due to the presence of two further factors, as follows:

Shrinkage

LDZ Shrinkage occurs between the LDZ offtake and the end consumer (but not at the Supply Meter Point - the LDZ shrinkage zone stops immediately before this point). It covers:

- Leakage (from pipelines, services, AGIs and interference damage)
- Own Use Gas
- Transporter-responsible theft

The majority of shrinkage is due to leakage, and the overall LDZ shrinkage quantity is calculated using the standard method defined in the Uniform Network Code (UNC) [6].

Unidentified Gas

UG occurs downstream of Shrinkage, i.e. at the Supply Meter Point. It potentially covers:

- Unregistered and Shipperless sites
- Independent Gas Transporter CSEP setup and registration delays

- Errors in the Shrinkage estimate
- Shipper-responsible theft
- Meter errors – this includes LDZ offtakes, LSP consumer meters and SSP consumer meters

UG is currently unknown and hence must be estimated.

In addition to the above factors, there may also be a small element of Stock Change, which represents the difference between opening and closing stock on any given gas day. Given that aggregate UG is based on annual rather than daily consumptions, any adjustment due to stock change (which in this case would be the difference in stock between the start of the UG year and the end of the UG year) will be negligible. It has therefore been discounted from calculations.

3.2 Unidentified Gas Methodology

The original method created by the AUGE for calculating UG was described in detail in the 2011 AUGS for 2012/13 [10]. This original method was based on RbD values and will be referred to as the RbD based methodology in the remainder of this document. Since this time, major changes have occurred in two areas. These are summarised below but were described in detail in the 2nd draft 2012 AUGS for 2013/14 [19].

1. The estimation of the UG total across all market sectors:
   In the 2011 AUGS for 2012/13 this was estimated based on RbD quantities adjusted for allocation bias (resulting from underlying AQ bias), as this was the most accurate method given the data available at the time. As described in the 2012 AUGS for 2013/14 [19], meter read and consumption data is now available for all supply points (both LSP and SSP) and so an improved method based on these has been developed. The new method is theoretically more accurate than the RbD based methodology. More input data validation is required for the consumption method, but this has the advantage of being able to delve into more detail to find and resolve issues hidden by the RbD method.
2. The market sector split of undetected theft:
   In the 2011 AUGS for 2012/13 this calculation was based on detected theft levels. However, this method is highly dependent on Shipper-supplied estimates of theft (duration and value) and can be influenced by Shipper theft detection strategy. It is also highly dependent on AQ's particularly with regards to sector classification. In 2012 detailed analysis of theft data and meter consumptions/reads associated with theft-affected meters indicated that this data was not fit for purpose. An alternative method based on throughput was proposed. In this document a review of a further method proposed by ICoSS has also been carried out.

3.2.1 Estimation of Total UG using Meter Reads/Metered Volumes

The overall concept of calculating total UG using metered consumption data is simple. Total UG is estimated by taking the difference between the calculated total NDM demand (i.e. LDZ intake minus shrinkage and DM load) and the sum of metered consumption for all NDM meter points. There are, however, a number of complexities which have been identified that must also be accounted for in the calculation. The total UG is estimated for each LDZ and formula year separately, and an overview of the process is provided in the flowchart shown in Figure 1.

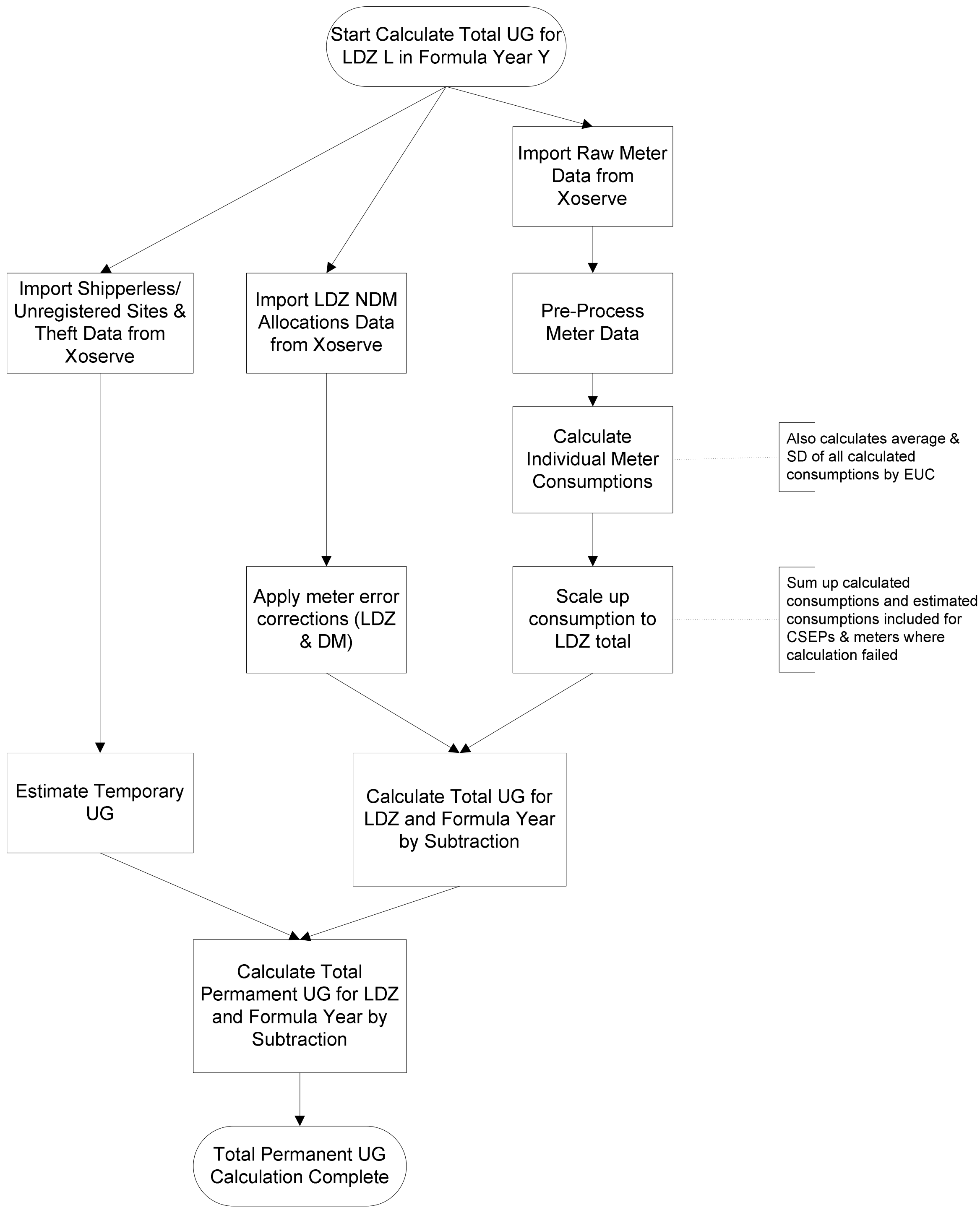

Figure 1: Overview of UG Calculation Methodology

Having obtained the total figure using the consumption methodology, the value of individual components that make up the UG total are calculated where this is possible. The difference between the calculated UG total and the sum of the directly estimated components is referred to as the Balancing Factor, and contains the remainder of UG, which cannot be calculated directly. The Balancing Factor is comprised of UG elements for which data is either unavailable or unreliable.

A key drawback of the old RbD-based method for estimating the UG total was that it was only capable of estimating the volume of UG assigned to the LSP sector. Whilst, as discussed in [10], the AUGE believed that the volume of UG assigned to the SSP sector was small, this was only true given the high bias in LSP AQ values relative to SSP AQ values at the time. The most recent data obtained in 2012 showed that this difference in AQ bias is not present and therefore invalidates the assumption that SSP-assigned UG is small. The RbD based approach to estimating UG cannot therefore be reliably used to estimate total UG without estimating the SSP-assigned UG separately. The use of consumption data in the UG estimation process allows the actual total, including both LSP-assigned and SSP-assigned UG, to be calculated. This is a key advantage of the new method.

It is known that data for each of the five potential components of UG (Unregistered and Shipperless sites, IGT errors, Shrinkage error, Shipper-responsible theft and metering errors) is available, along with meter read and consumption data for all supply points, and other general background data on RbD values, AQs, allocation algorithm coefficients, etc. The availability and quality of this data varies from component to component, and the AUGE has therefore attempted to identify the best method of calculating the total level of UG and the split between its causes based on the quality of information available for each component.

The proposed approach as derived in 2012 is therefore to first estimate the UG total for each LDZ, which can be defined as follows:

$$\text{Total UG} = (\text{Alloc SSP} + \text{Alloc LSP}) - (\text{Metered SSP} + \text{Metered LSP}) \tag{3.1}$$

This can be expressed as follows:

$$\text{Total UG} = \text{Aggregate LDZ Load} - \text{DM Load} - \text{Shrinkage} - (\text{Metered SSP} + \text{Metered LSP}) \tag{3.2}$$

Figure 2 below shows the 'Gas into LDZ' component. This is made up of NDM demand, DM demand, Shrinkage and UG along with their respective measurement errors. There is also an overall error in the measurement of gas entering the LDZ. Subtracting LDZ metering errors, the sum of DM metered volumes (including their errors) and Shrinkage, the total NDM demand plus UG plus any error in estimating Shrinkage can be obtained.

The 'Metered Gas Out' component is calculated using meter read information for every meter point. Where possible, the consumption for the formula year in question is calculated from meter reads or metered volumes. Where this calculation is not possible, an EUC-appropriate average value is used for this meter point. More details of this process are given in Section 6.1.

Having obtained an estimate of gas going into the network and gas being metered across all meter points, the difference between the two is our best estimate of UG plus Shrinkage estimate error. There will also be as yet undetected LDZ offtake meter errors and DM meter errors. This is shown in Figure 3. Note that the calculated total consumption across all meter points will have an error associated with it, which in turn will affect the estimate of UG. This overall consumption error consists of the error in estimating consumption at individual meter points which is based on either meter reads or average EUC consumption.

The total UG figure calculated thus far contains both permanent and temporary UG. Some elements of UG are subsequently corrected for and billed. These temporary sources of UG need to be removed from the total UG to obtain the total permanent UG. More details of temporary and permanent sources of UG are given in Section 3.3.

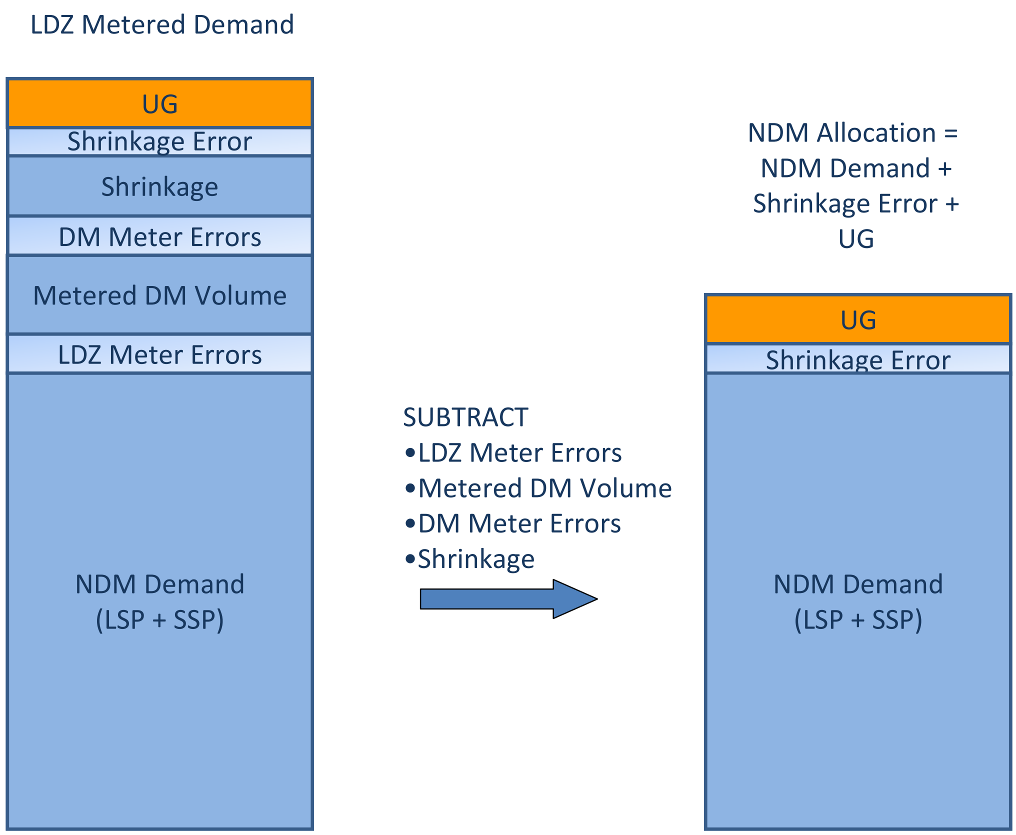

Figure 2: Derivation of Unidentified Gas

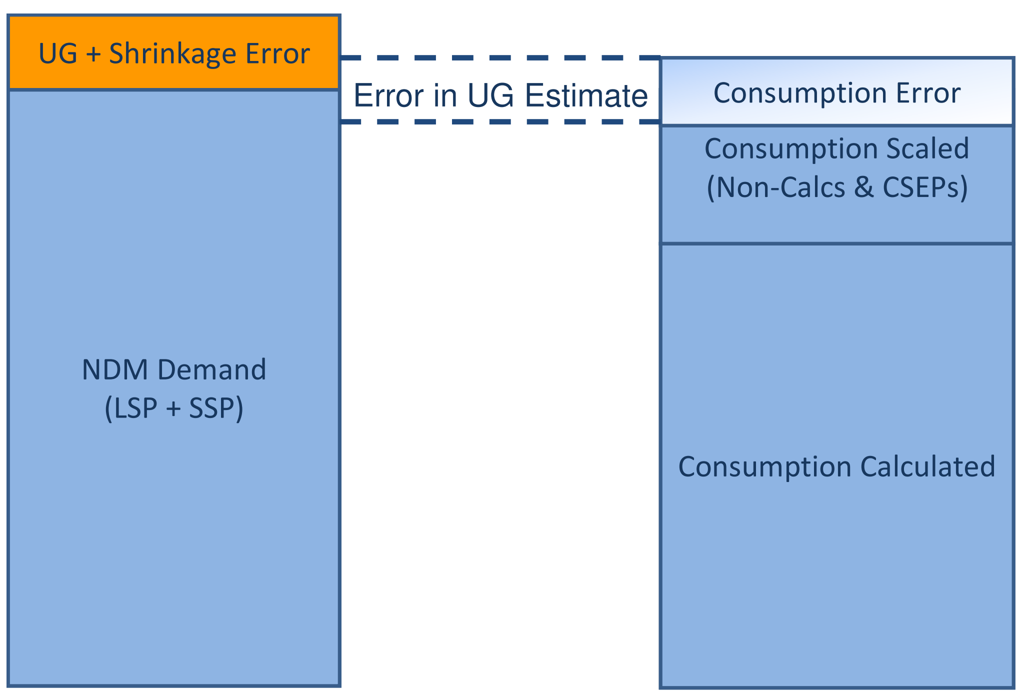

Figure 3: Calculation of Unidentified Gas from Consumptions and Allocations

3.2.2 Calculating Total UG Components

Elements of the UG total that have good quality data can be estimated directly, with the remaining elements for which insufficient data exists to produce a robust estimate grouped together and calculated by subtraction as the Balancing Factor.

Full details of this approach to the analysis, including full descriptions of the calculation methods for Total UG and for each individual element, are provided in previous versions of the AUGS [10], [19]. Brief descriptions of each UG element are given below.

a) Unregistered and Shipperless Sites

The AUGE believes these sites should be included in the UG calculations. The data required for this element consists of the historic number and AQ of sites either late registered or unregistered, split by cause and market sector. UG from this source is then calculated by assigning calculated consumption profiles to the validated AQ values from these sites. Unregistered and Shipperless sites that contribute to UG are split into the following sub-categories:

- Shipper Activity
- Orphaned Sites
- Unregistered <12 Months
- Shipperless PTS (Passed to Shipper)
- Shipperless SSrP (Shipper Specific Report)
- Without Shipper <12 Months

b) IGT Connected System Exit Point (CSEP) Setup and Registration Delays

IGT CSEP setup and registration delays should also be included in the UG calculation. UG from this source is due to gas networks owned by iGTs but not present in Xoserve's records, and also comes from unregistered sites on known CSEPs. The data required for this analysis consists of the number and composition of these unknown projects (number of sites and AQ split by market sector), and the number and AQ of unregistered sites associated with known projects.

c) Shrinkage Error

Shrinkage errors affect the Total UG calculation in that estimated Shrinkage is deducted from the LDZ input total (along with DM load) in order to give the total from which metered load is then removed. The remainder is UG. The Shrinkage estimate comes from the Shrinkage Model, and if this is biased it will affect the UG estimate.

In addition to this, in the UG estimation process the figures for *Total LDZ Input minus Shrinkage minus DM Load* are calculated using allocations. Initial estimates of Shrinkage are used during the allocation process, and the final Shrinkage estimates may differ from these.

Shrinkage Model errors are very hard to quantify, given that actual Shrinkage is unknown and that the models are built on the most accurate data available. At the time they were trained they were, by definition, unbiased, and this may remain the case. If this is true, each individual instance of Shrinkage model error may affect the UG total that relies upon it, but these errors will even out over time, leaving a net effect of zero. If changing conditions over time have led to the Shrinkage model becoming biased, these effects will be picked up by the Balancing Factor, and this is therefore where this element will be captured.

d) Shipper-Responsible Theft

The AUGE believes that this element should be included in the UG calculation. Very little reliable data on theft exists, however, and whilst information for detected and alleged theft is available, theft by its nature is often undetected. Undetected theft levels are very difficult to quantify accurately, and estimates from different sources vary widely, from 0.006% of throughput (based on detected theft only) to around 10%. It is therefore very difficult to accurately estimate theft levels directly, and for this reason theft will be calculated by subtraction. It is part of the Balancing Factor, and considered over time, it forms the vast majority of that figure (based on an assumption that the Shrinkage models are unbiased, so their individual contribution can be positive or negative and will sum to a value close to zero over time).

e) Meter Errors

Meter errors can affect UG depending on their source. Errors in LDZ offtake metering and DM supply metering affect the estimate of total NDM demand including UG, whilst LSP NDM and SSP metering errors contribute to UG by affecting the NDM metered total. The AUGE has assessed this area and corrections are applied to LDZ offtakes, DM and unique site meters. SSP meter errors have been assumed to cancel out, further industry led studies would be required to evaluate this further.

The calculation processes detailed above will allow a reliable estimate of UG to be calculated based on the latest available data, which will in turn be used to populate the UG table, the format of which is given in Section 7. It also gives a sound basis for the year-on-year update of these figures, given appropriate provision of up-to-date information as requested.

3.3 Permanent and Temporary Unidentified Gas

Regardless of the calculation method used, certain elements of UG are permanent and others are temporary. The definitions of these terms are as follows:

Permanent UG is consumed in an unrecorded fashion and costs are never recovered.

Temporary UG is initially consumed in an unrecorded fashion, but volumes are later calculated directly or estimated and the cost is recovered via backbilling.

For all directly calculated elements of UG, the data supplied to the AUGE relates to all UG sources, both permanent and temporary. It is therefore necessary to split these into the correct category and only include permanent UG sources in the final calculations.

Table 2 below shows the permanent/temporary status of each element of UG.

Table 2: Permanent and Temporary UG

Unidentified Gas Source	Type
iGT CSEPs	*Temporary* for LSP sites on CSEPs. *Permanent* for SSP sites on CSEPs.
Shipperless/Unregistered	
- Shipper Activity	*Temporary* if shipper carries out site works. *Temporary* if a third party carries out site works but asset meter read is the same as the shipper's opening meter read. *Permanent* otherwise.
- Orphaned	As for "Shipper Activity".
- Unregistered <12 Months	As for "Shipper Activity".
- Shipperless PTS	*Permanent* for sites that became Shipperless prior to 25th January 2013 *Temporary* afterwards
- Shipperless SSrP	*Permanent*
- Without Shipper <12 Months	*Permanent* if the site would be classified as SSrP once it has been Shipperless for 12 months, or if it became Shipperless prior to 25th January 2013 *Temporary* otherwise.
Meter Errors	*Temporary* for detected errors that are corrected within the reconciliation period. *Permanent* otherwise.
Theft	*Temporary* for detected theft. *Permanent* for other theft.

4 Summary of Analyses

This section contains a summary of the analysis work carried out during preparation of the 2013 AUGS for 2014/15.

4.1 AQ – EUC Mismatch

During the development of the consumption method in 2012 it was noticed that some of the AQ records provided by Xoserve contained AQs and EUCs which did not correspond. Specific examples were raised with Xoserve and were identified as Multi-Metered Supply Points (MMSPs) where the EUC is determined and assigned at the supply point level rather than at the individual meter point level. In order to correctly deal with meter points in an MMSP where the consumption algorithm fails, the AUGE chose to calculate its own EUC at the meter point level.

During the consultation period for the 2nd draft 2012 AUGS for 2013/14 a concern was raised by ICoSS that the difference between the EUCs from Xoserve and those calculated by the AUGE may be a source of significant error if the AUGE is incorrectly assigning EUCs and those meters are not part of an MMSP. Therefore the AUGE requested and received a complete list of meter points associated with MMSPs from Xoserve and has undertaken an analysis of all AQ record mismatches.

Of the approximately 80 million AQ records provided with an effective date on or after 01-Apr-2008, there were 277,614 records with an AQ-EUC mismatch. Of these, 229,955 records were associated with a meter point which is (or was) part of an MMSP. All of the remaining 47,659 records were found to be caused by an issue with the data provided by Xoserve; where a meter point has changed AQ value mid gas year there were some errors appending the appropriate EUC value.

This analysis is complete and the AUGE believes that the correct EUCs are being used in the consumption calculations.

4.2 Use of LSP Meter Reads

This concerns LSP meter points with reads, but which fail the consumption calculation because of negative metered volumes or a consumption estimate which is greater than five times the AQ. It has been suggested by ICoSS during consultation that in these cases, raw meter reads should be used to calculate consumption if possible.

The methodology proposed in the 2nd draft 2012 AUGS for 2013/14 used only metered volumes for LSP meters. This approach was taken because the metered volumes can be corrected if errors are discovered, but meter reads are not. It would therefore be expected that the metered volumes would always be the best data to use given they have been through further stages of validation and correction. This may not be the case if the meter units and/or T&P correction factors used to calculate the metered volumes are incorrect. However, in these cases it would be expected that the error would be identified and the metered volume subsequently corrected.

For example, in NO LDZ in 2009 there were 1,405 LSP meters which failed the metered consumption calculation. Of these, if meter reads where used as a fall back 1,101 could be successfully calculated. In principle these successfully calculated consumptions should be more accurate than using the EUC average. Using the meter reads, however, introduces possible errors from incorrect Read Units, T&P correction factors and Imperial/Metric indicators. It is also possible that the AQ is incorrect and that the metered volume is correct (i.e. we incorrectly rejected the metered volume). In this case, using the meter reads may lead to a successful calculation of the consumption which may in fact be less accurate than the metered volume.

In this particular case the aggregate consumption calculated from meter reads for the 1,101 meter points is 442.1 GWh, compared to 476.1 GWh when using EUC averages. There is no evidence that the value based on meter reads is any more accurate than that based on EUC averages given the issues with Read Units and T&P factors and whilst there are examples that show using the meter reads would be better there are plenty of examples when this is not the case.

Unless the industry can improve the quality of Read Unit and T&P factors going forward we will continue to use the metered consumptions provided by the Shippers to Xoserve. We will also flag up all sites where we suspect there is a Read Unit or T&P factor issue to Xoserve to pass on to the relevant Shippers for amendment.

4.3 Improved Handling of Read Units

During the consultation period for the 2nd draft 2012 AUGS for 2013/14, ICoSS identified two examples of meter points where read units had been incorrectly excluded from the consumption calculation process. The AUGE responses [20] explained the specific situation in which this occurred (which relates to meter points that change market sector). As a result the AUGE has updated the consumption algorithm to correctly handle this situation and the overall calculation method is described in Section 6.1.2.

4.4 Vacant Sites

During the consultation on the 2nd draft 2012 AUGS for 2013/14 a concern was raised by British Gas that although the AUGE has taken steps to account for non-consuming sites in the general population there may be an issue with vacant sites. In order for a meter to be excluded from the allocation process, the shipper must remove the meter and isolate the supply. A shipper may not wish to do this where a site may remain vacant for only a short period. Modifications 0282/0282A [24] were raised by British Gas and ScottishPower to create a process for handling vacant sites including collecting data to flag such sites, but these modifications were rejected. A vacant site will therefore continue to be included in the allocation process with its latest AQ value until such time as two identical meter reads are received, at which point its consumption will be calculated as zero and its AQ will be set to one (assuming that the meter reads meet the criteria for consumption calculation). This may not happen if there is no access to the meter. It was argued that sites with no meter read data for an extended period have a higher propensity to be vacant and as such be non-consuming.

This raises the obvious questions of how long a site should be without reads before it can be assumed to be vacant and how long vacant sites are unoccupied for on average. Neither of these can be satisfactorily answered with the available data.

Table 3 below shows the number of live meters with no meter reads after the start of the formula year within the entire NDM meter population. For example, 6,357 meters did not have any meter reads from 1st April 2009 onwards. As would be expected this number is significantly higher at the end of the dataset as infrequently metered sites are awaiting a new read.

Table 3: Number of Meter Points Without Reads

Year	Number of Meters
2009	6,357
2010	56,036
2011	297,545

Of the 6,357 sites with no reads for 3 years, 760 have a rolled over AQ of 1. We have no information about whether the remaining 5,597 meter points are consuming or not, but we can quantify the possible effect by comparing the UG estimates under two scenarios: all such meters consuming vs. all such meters non-consuming.

We have calculated consumptions under both scenarios for all meters with no meter reads for three years using our method of scaling based on average consumptions per EUC band. The difference is approximately 90 GWh per year. Given that some of these meters will be consuming and some will only be vacant for part of a year the true difference is likely to be much less. Unfortunately Xoserve do not hold any information which can be used to determine explicitly if a site is vacant. Mod 0282/0282A proposed that a shipper confirm a site is vacant to Xoserve, who store this information. For the AUGE to be able to further quantify the effects of vacant sites, this information would be required.

Going forward our method assumes that these meters will behave in the same way as the wider population (i.e. same ratio of consuming to non-consuming meters) and will be scaled up accordingly.

4.5 Seasonal Normal UG

The methodology in the 2nd Draft 2012 AUGS for 2013/14 involved calculating the total UG by taking the difference between the total LDZ NDM demand (LDZ demand – shrinkage – metered DM demand) and the sum of all metered demands. However, the demand in any given year is subject to non-seasonal weather effects. As the UG estimate is forward looking, it makes sense that it be based on seasonal normal weather.

The AUGE therefore proposes that the allocations and the consumptions are scaled to seasonal normal conditions prior to subtracting to obtain total UG. The resulting UG estimate will therefore be based on seasonal normal weather.

4.6 Temperature and Pressure (T&P) Conversion Factors

A concern was raised by Energy UK on behalf of British Gas that large LSPs (AQ > 732,000 kWh), which should have site specific T&P factors, may have been incorrectly assigned the default T&P factor of 1.02264. These factors are not currently used by the AUGE as metered volumes are used for LSPs, but if meter reads were used as a fall-back option they would impact consumption estimates. It should be noted however that incorrect T&P factors may have been used in the calculation of metered volumes provided to Xoserve by the Shippers.

Looking at the factors provided by Xoserve, around 25% of these large sites appear to have the default conversion factor. It is difficult to assess the impact if these values are incorrect (as they may or may not have been used when the metered consumption was calculated and may or may not feed into the AQ calculation process) but most of the non-default factors are in fact close to this value. Therefore the AUGE believes that this is unlikely to be a significant issue, especially compared to the issues with Read Units.

There are, however, clear cases of the number of dials being entered as a T&P factor, T&P factors of zero and T&P factors that look like the default factor with the decimal point in the wrong place.

As noted previously, where we have identified potential T&P factor issues we will flag these to Xoserve to follow up with the relevant Shipper. Table 4 shows the number of meters in the general population which appear to have incorrect T&P factors. Where T&P factor issues are present for larger LSP meters the impact is potentially significant.

Table 4: Suspicious T&P Correction Factors

Correction Factor	Number of Meters
0	722
1	9,950
3	1
4	5,886
5	3,494
6	286
7	14
8	22
10.2264	14
102.264	1

It is important, therefore, that all code parties make every effort to ensure that the T&P conversion factors are correct as these underpin calculations of consumption used in many other downstream processes including estimating UG.

4.7 Theft Analysis

In the 2nd Draft 2012 AUGS for 2013/14, it was proposed that throughput should be used as the basis for estimating the Balancing Factor, which we believe mainly consists of undetected theft split between the SSP and LSP market sectors. There were a number of reasons for this, as follows:

- Using detected theft to estimate the theft split for undetected thefts inherently assumes that the detected thefts are a representative sample of all thefts. This is unlikely to be the case as
    1. The detected thefts are a very small proportion of total thefts – the detected thefts are about 0.5-0.6% of the Balancing Factor (comparison of average annual theft occurring per year with the Balancing Factor from the 2011 AUG Table).
    2. Theft detection is likely to target larger thefts where the financial benefits from detection are greatest.
    3. Larger thefts are potentially easier to detect. In particular, SSP thefts other than cases where a high proportion of the AQ is stolen will be difficult to detect and prove.

4. There are arguments that thefts are easier to detect in some market sectors rather than others and/or that the effort expended in theft detection varies between market sectors.
5. It can be argued that undetected thefts will continue for longer, as detected thefts are generally cut short by being detected, i.e. the average length of a detected theft doesn't necessarily give an indication of the average length of an undetected theft.

- The detected theft data consists of estimates of both the time period and quantity of theft, which are both subject to error. This has a knock-on effect in terms of uncertainty in market sector classification.
- Theft split methods that rely on theft detection rates can be potentially influenced by Shippers.
- There is a disincentive to detect theft for theft split methods that rely on the amount of detected theft in a given sector.
- Other non-theft related components of the Balancing Factor should be split by throughput
- AQs for theft-affected sites are volatile because the data they are based on is generally sparse and potentially theft-affected, compared to AQs calculated for the wider population.

4.7.1 ICoSS Alternative Method

ICoSS suggested an alternative approach to estimating the theft split based on their analysis of the theft dataset. The detected theft data was used to estimate the average theft quantity (per instance of theft) for each market sector. ICoSS then assumed, based on qualitative arguments, that the fraction of sites stealing was the same between market sectors. Their calculations gave an average SSP theft of 23MWh and an average LSP theft of 74MWh. A theft split was then proposed using the following equation:

Total Theft of Gas (MWh) = % theft sites x (Total # SSP sites x 23MWh + Total # LSP sites x 74MWh)

Assuming approximately 22,070,000 SSP meters and 310,000 LSP meters, this would give a theft split of ~4.3% LSP.

In the responses to the consultation, the AUGE noted that there were a number of issues with the data used in the ICoSS analysis but agreed to review their calculations using the most appropriate data and to consider the merits of the proposed approach further.

4.7.2 Assessment of ICoSS Method

Following the assessment of the proposed method, the conclusion was drawn that there are a number of fundamental flaws in the methodology proposed and the data used by ICoSS:

1) The data set used was from a spreadsheet dating from the AUGE's first year of analysis, which included a calculation to estimate the annual theft rate for a detected theft site (i.e. the amount of gas that would have been taken over a full year if the theft had not been detected). In 2012 it was concluded that scaling up theft to an annualised rate was incorrect, primarily as there are many examples where a modest amount of theft has been estimated to have occurred over a very short time scale (e.g. a few days), resulting in unrealistically high rates of theft per day. Such cases are likely to be due to inaccuracies in the estimated theft duration, and scaling up of the theft to obtain an annual rate therefore potentially over-estimates the amount of theft that actually occurred. Table 6 shows examples where the period of theft is less than 30 days and the 'current' AQ is less than

73,200 kWh, but the resulting 'adjusted' AQ is greater than 73,200kWh. This demonstrates how relatively small amounts of theft can result in massive annual quantities when the period of theft is estimated to be so small. Many of these are unlikely to be realistic, although data on the capacity of the meters installed would be required to validate this fully. A typical domestic meter (e.g. U6) has a maximum flow rate of 6m^3/hr and can only pass 565,896 kWh per annum, and this would require a continuous maximum flow rate. Of course larger meters may be in place and the sites in question may in fact be LSP sites, but we do not have customer details with which to investigate further. In situations where the meter is bypassed before the governor, then the pressure of gas would be higher resulting in higher flows – however, this could potentially result in appliance problems depending on their input pressure rating. The overall effect of the annual theft rate calculation phenomenon is to increase the average AQ for SSP sites and potentially incorrectly reclassify some sites as LSP.

Table 5: Theft Records with Short Periods of Theft Resulting in Large Annual Theft Rates

MPR	Sector	AQ/kWh	Theft (kWh)	Period of theft (days)	Theft per year (kWh)
3001	SSP	21,027	18,580	1	6,781,700
2977	SSP	14,177	7,742	1	2,825,830
709	SSP	1	3,500	1	1,277,500
3661	SSP	11,752	20,148	6	1,225,670
2288	SSP	4,848	53,333	22	884,843
4378	SSP	10,963	34,667	19	665,971
682	SSP	1	7,149	5	521,877
6738	SSP	17,303	5,425	4	495,031
4000	SSP	57,274	6,133	6	373,091
3736	SSP	6,335	14,083	14	367,164
4190	SSP	25,960	18,401	21	319,827
4189	SSP	4,401	18,401	21	319,827
7265	SSP	7,654	6,704	9	271,884
2557	SSP	5,563	10,436	16	238,071
3692	SSP	3	667	1	243,455
6297	SSP	12,667	10,639	19	204,381
7459	SSP	12,247	8,400	16	191,625
2917	SSP	16,213	8,000	18	162,222
3287	SSP	28,719	9,545	25	139,357
2333	SSP	8,587	9,600	25	140,160
3453	SSP	26,646	3,001	9	121,707
7304	SSP	16,792	5,813	17	124,809
4336	SSP	1	5,845	16	133,339
1074	SSP	11,106	9,158	28	119,381
1360	SSP	43,596	4,000	17	85,882
2097	SSP	736	10,000	29	125,862
3467	SSP	10,410	7,573	25	110,566
6180	SSP	9,536	5,480	18	111,122
6567	SSP	61,633	2,386	16	54,431
3899	SSP	104	7,796	29	98,122
4125	SSP	58,000	2,216	23	35,167
2338	SSP	31,751	3,773	24	57,381
6865	SSP	7,279	2,000	9	81,111
1737	SSP	32,987	3,430	24	52,165
130	SSP	40,559	1,805	17	38,754
3892	SSP	36,523	733	7	38,221

2) ICoSS calculated an adjusted AQ based on the AQ in this original data set added to the annualised theft rate. The AQs in the data set are **current** AQs (i.e. those in place in 2011) and therefore they are not necessarily representative of the AQs that were in place at the time of the theft. Therefore, by adding the theft to the current AQ, the level of consumption is being over-estimated resulting in meters moving incorrectly to the LSP sector and the average SSP AQ being over estimated.

3) In the original spreadsheet ICoSS referenced for the derivation of this method, there is a table showing the number of sites and detected theft volumes by sector after adjusting the AQ for theft. This resulted in a theft split of 25.1% (see Table 6). This is included in this report to illustrate the variety of theft splits that can be achieved depending on what data you choose to use. As noted previously, the adjusted recent AQs should NOT be used for this calculation (since they are not representative of the AQ at the time of the theft, and theft should only be added where the AQ is affected by unmetered consumption). Therefore this split is not appropriate to use. We highlight it here to demonstrate that very different theft splits can be obtained from the same data set depending on what assumptions are made.

Table 6: Theft Split by Volume using Adjusted AQ from ICoSS Spreadsheet

Adjusted	Number	% of Total	TOG Volume	% of Total
SSP	4,244	91.17%	84,855,197	74.87%
LSP	411	8.83%	28,487,639	25.13%

4) ICoSS have assumed that the number of sites likely to steal in each sector as a proportion of the population is the same. Table 7 below shows the number of theft records (from the original data that was used for their analysis), the overall population of sites for each sector (this is an average over 2009 and 2010 from the consumption data we have), and the rate of theft detections per 100,000 of the population of each sector. This indicates that the rates of detected theft by sector are not the same and there are approximately three times as many LSP thefts per 100,000 of the population compared to SSP.

Table 7: Theft Rate (sites) per 100,000 Sector Population

Sector	No theft records	Population 100,000s	Rate per 100,000 sites in population
SSP	4,474	220.7	20.3
LSP	181	3.1	58.4

5) The data for thefts that occurred prior to 2006/7 are generally of poor quality and should be treated with caution.

Notwithstanding the above, we have looked at the method ourselves and taken account of the following:

1) In our previous analyses we have generally looked at the level of theft that has occurred in a given year (rather than detected by year), and calculated an annual theft rate occurrence from that. However, when looking at theft rates per unit AQ we cannot scale thefts that occur over multiple years to a yearly rate and not scale up part year theft periods, as we would not be comparing like for like. Therefore to be consistent we have calculated the theft rate per annum although we note that the results will be skewed by those records where theft occurs over a short period of time (as shown in Table 5).

2) As we have consumption data, we can calculate metered plus unmetered consumption to give an AQ that is a fairer reflection of what the AQ was during the period of theft. As many meters fail the consumption calculation, an alternative estimation of AQ is derived from the pre-theft AQ or post-theft AQ plus the amount of theft occurring in a given year.
3) The site theft rate per market sector population has been calculated for both sectors using our AQs for sector classification to estimate what the difference in rate is across sectors.
4) Sites that are unregistered have been excluded from the dataset.
5) There are a number of issues that occur when trying to recalculate the ICoSS table using the more recent theft data and AQs:
    a. The ICoSS analysis uses one AQ to cover the whole period of theft (in this case the 'current' AQ). To do this correctly we need to use an AQ that is representative of the period of theft to ensure the correct EUC band is used.
    b. In our data sets we have AQs by year based on metered plus unmetered consumption, or pre-theft AQs as appropriate when the consumption cannot be calculated. The question then is which AQ to use? Should an average AQ be used over the period of theft? Should the theft rates be considered on a year by year basis (i.e. matching the theft per annum with the AQ for the year of the theft being examined)? The latter is not possible for all theft records as some go back to the 1990s and the AQ data does not go back that far. For the purposes of comparison we have used average AQ over the period of theft for a given theft record.
    c. The average AQ by EUC band associated with the theft records cannot be compared directly to the ICoSS version. As noted in a) this is because multiple AQs occur over the duration of the theft. Using adjusted AQs as already noted is incorrect because it skews the AQs to LSP (as illustrated in Table 6). It is not really possible to calculate a satisfactory average AQ that can be used to compare theft rates per AQ between EUC groups as noted in b), in addition AQs may or may not be theft affected.

The results produced by ICoSS are shown in Table 8 below. Using the datasets from 2012 we have produced an equivalent set of results as shown in Table 9.

Table 8: ICoSS Results

EUC	01B	02B	03B	04B	05B	06B
Average Theft Duration (years)	1.5	1.3	1.1	1.4	1.1	0.5
Average Theft Volume (MWh)	22.7	73.9	83.9	51.3	87.1	11.8
Average Adjusted AQ (MWh)	23.7	127.8	463.6	1134.2	7273.3	18498.0
Theft Volume / AQ	0.96	0.58	0.18	0.05	0.01	0.00

Table 9: Equivalent ICoSS Results using Average Calculated AQ

	01B	02B	03B	04B	05B	06B	07B	LSP Average
Average Duration / yrs	1.69	1.92	0.92	1.23	2.30	1.36	0.75	1.86
Average Theft Volume (MWh)	19.47	71.02	161.94	158.01	6.95	8.94	13.02	74.88
Average AQ (MWh)	15.58	121.06	450.89	1,197.20	5,700.47	12,564.50	22,691.74	416.33
Theft Volume/AQ	1.250	0.587	0.359	0.132	0.001	0.001	0.001	0.180
Number Records	5048	143	5	3	1	1	1	154

The ICoSS method then chose an amount of 23MWh as the average theft for an SSP site and 74MWh as the average theft for an LSP site.

Using the results of our overall analysis we would use a figure of 19.47Mwh for SSP and 74.47MWh for an LSP site.

Before we calculate the overall theft split, we calculate the difference in theft rates per 100,000 of the overall population as shown in Table 10. This is different from the figures shown in Table 7 as there are more theft records in our data set and the adjusted AQ is replaced by a better AQ approximation, which results in fewer sites being misclassified as LSP. This is then used to correct the initial theft split since the rate of thefts between populations is not the same. Table 11 shows the resulting theft split. The key difference between this and the results from the ICoSS method is the assumption that the number of thefts per unit of the population are the same across sectors, which the data shows is not the case.

Table 10: Corrected Theft Rate (sites) per 100,000 of Population

	No. Sites	Population 100,000s	Number thefts / 100,000 of population
SSP	5,048	220.7	22.87
LSP	154	3.1	49.68

Table 11: Adjusted Theft Split using Population Correction

	LSP Split using average theft per site/%	LSP detected rate multiplier	Theft Split/%
Theft Split	5.12	2.17	11.13

We now consider this method in terms of the potential sources of error in the previously derived methods that relied on detected theft data. In the Interim Report [13] and the 2nd draft 2012 AUGS for 2013/14 [19] we highlighted that methods using detected theft suffered from the following issues:

- The calculations are still heavily dependent on the accuracy of the estimate and duration of theft.
- Use of AQs - particularly as we can only calculate metered consumption for 50% of the data set.
- Use of AQs – using a singular AQ for the entire period of theft is not necessarily appropriate because demand varies over time and the AQ used may not represent the site's true behaviour (and classification). It is also unclear whether the AQs are theft-affected or not.
- Accuracy of the metered consumption calculation (Unit Reads, T&P factor issues).
- Potential effect of customer changes on pre/post theft AQs.
- Site classification issues – e.g. Unregistered sites.

- Assumption that the market sector split of unknown theft is the same as that of detected theft.
- The potential still exists to a certain degree for external influence on the theft split if mixed shippers focus on detecting theft in one sector over another, because this could affect the average theft amount per sector (rather than the amount of detected theft overall).

As part of this review we also took a closer look at the periods of theft. Figure 4 shows a histogram of theft periods in 30 day intervals. Note the very large spike corresponding to the bucket that contains the theft period of one year (in fact ~500 theft records have a theft period of exactly 365 days). This raises a serious question about the periods estimated for detected theft because this spike constitutes a clear outlier. Are the periods for these thefts really exactly one year? We suspect that a year has been used as a default option in many cases, and this will skew the calculated average period of theft. In addition, if when the theft is recorded the period of theft is then used to estimate the amount of theft (based on typical consumer consumption rates) then these too will be erroneous. This in turn will impact on the results of the ICoSS theft split method, and any other method that uses this information.

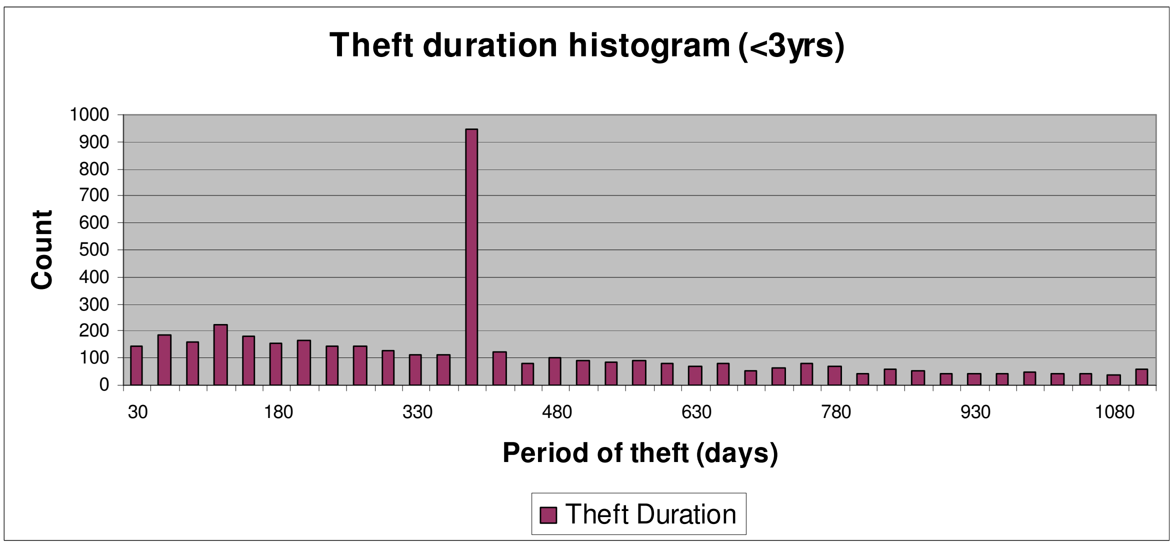

Figure 4: Theft Duration Histogram, 30-Day Intervals

4.7.3 Comparison of Methods

This table summarises the key data issues associated with detected theft.

Table 12: Theft-Related Data Issues

Source Data	Issue	Comments
Theft period	Very short periods of theft coupled with modest theft amounts are unlikely to be correct and result in physically impossible annualised gas flows. Periods of theft are agreed with the consumer (SPAA Appendix 4 [26]) but may be different in practice, especially for estimates prior to the SPAA.	We conclude that this data is unreliable and should not be used for theft analysis.

Source Data	Issue	Comments
	A large portion of the data set has the theft period set either exactly or very close to a one year, which is likely to be erroneous and skews the results.	
Theft amounts	The SPAA guidelines provide recommendations for estimating theft but they may vary from Shipper to Shipper in practice, especially for estimates prior to the SPAA. Some theft volumes, if scaled to annual level, could be physically impossible.	This data is potentially unreliable, especially if the theft period is used to estimate the theft amount.
AQs	Current AQs do not represent past behaviour (certainly not for thefts that occurred several years ago). Calculation of robust AQs are difficult given the scarcity of meter read data, and it is difficult to obtain a reliable average AQ for theft affected sites. This issue has the potential to shift large proportions of detected thefts between market sectors.	We conclude that this data is unreliable (in the theft-affected population) and should not be relied on for theft analysis.

The following table compares the AUGE's theft occurrence rate method from 2011/12, the ICoSS proposed method, and the AUGE's proposed throughput method in terms of how they use theft data and their associated assumptions.

Table 13: Comparison of AUGE Theft Methods and ICoSS Method

	Theft Occurrence Rate Method	ICoSS Method	Throughput Method
Period of theft	Used to estimate the amount of theft that occurred in each year (unscaled).	Used to calculate an annual rate of theft.	Does not use period of theft.
Amount of detected theft	Apportioned to each AUG year covered by period of theft.	Used to calculate an annual rate of theft.	Does not use amount of detected theft.
AQ estimate	Uses unmetered plus metered consumption, and if this fails defaults to AQs prevailing prior to the theft period. Failing that uses post theft AQs corrected for theft.	Used current (2011) AQs. This could use AQs from theft occurrence rate method but these are different year on year.	Uses AQs to determine market sector for the whole population of meters. The population of theft-affected meters is much smaller and hence the "whole population" results are less susceptible to volatile AQs.
Assumption that the proportion of theft sites per unit population is the same across market sectors	Does not use this assumption.	Uses this assumption (although evidence indicates the rates are different).	Does not use this assumption.

	Theft Occurrence Rate Method	ICoSS Method	Throughput Method
Assumption that total theft rate per unit throughput is the same across market sectors	Does not use this assumption.	Does not use this assumption.	This assumption follows from using the throughput method but it is not the reason for choosing it.
Handling of unregistered sites for detected thefts	Unregistered sites excluded.	Unregistered sites included (but could be removed).	Method is not affected by unregistered sites.
Impact of "current AQ plus theft per annum" method of estimating AQ	No impact, not used.	Significant impact, AQs over-inflated.	No impact, not used.

Having concluded that the detected theft data is not sufficiently robust to be used to split theft in 2012, the alternative method proposed by ICoSS and underpinned by the same data has the same inherent issues and cannot be considered sufficiently robust either.

Significant improvements would need to take place in the recording and estimating of detected theft, and a much bigger sample obtained, in order to allow a sufficiently robust and stable method of theft split to be produced going forward.

In 2012 we concluded that detected theft data was not sufficiently robust to provide a suitable theft split methodology, leading to throughput being selected as the most appropriate method. It follows from using throughput as the method of splitting theft that the theft per unit AQ is assumed to be the same across each market sector, and this assumption may or may not be true. The only data available to assess the merits of this assumption is the detected theft data, however, and this suffers from serious issues as described above.

The detected theft data as it stands does indeed show some differences between market sectors in theft per unit AQ, but until this analysis can be carried out using reliable data it cannot be used to invalidate the throughput method.

Taking all of these issues into account, and having reviewed the proposed ICoSS method in detail, we believe the only fair and most robust method for splitting theft by market sector is the throughput method.

4.8 Improvements to the Theft Split Throughput Method

In the 2nd Draft 2012 AUGS for 2013/14, it was proposed that throughput should be used as the basis for estimating the theft split between SSP and LSP market sectors. At this time, throughput values were taken from the ODR1209 report and extrapolated forward. However, there are some issues with using this data in its raw form. The AUGE notes that if this data were to be used, a number of corrections would need to be applied as follows

- RbD – the ODR1209 values are raw allocations and as such do not include reconciliation corrections. RbD values should therefore be used to correct these allocations. One major downside of applying the RbD corrections to the allocations is that the SSP throughout value used to calculate the split will include all UG resulting in a slightly larger SSP proportion. RbD corrections also represent corrections applied in a given year rather than corrections which should apply for a given year. It must therefore be assumed that these corrections are stationary.

- Meter Errors – the raw allocations are subject to metering errors and should be corrected for LDZ and DM meter errors in the same way as when calculating UG

An alternative approach to using the allocation values with corrections applied is to use the consumption values as calculated to estimate UG. Using the AUGE's calculated consumptions has the advantage that the effects of UG can be correctly allocated by market sector, and no assumptions are made about the statistical properties of RbD. Where UG has been calculated directly (e.g. Shipperless sites), this should be included.

It should be noted that both the allocations and the calculated consumptions are subject to non-seasonal weather related effects. It is therefore proposed that SSP and LSP consumptions are adjusted to seasonal normal conditions (using CWAALP, in the same way that AQ values are calculated). This will ensure that when projecting forward, the estimated market sector split will be on a seasonal normal basis.

The throughput method proposed in 2012 was based on a trend line extrapolated for future years based on a consistent trend of the ratio of LSP throughput vs SSP throughput. More recent data shows that this trend does not continue and the percentage of LSP throughput increased compared to SSP in 2011 and 2012. In order to produce a method that has longevity, the AUGE proposes that a rolling average based on the most recent 3 years data is used to be consistent with the period used for total UG estimation. This will be calculated by summing the seasonal normal SSP and LSP consumptions over the 3 year period and using these values to calculate the SSP/LSP split.

The recommended method is described in full in Section 6.8.

4.9 Metered Volume Corrections

Metered volumes are calculated from raw meter reads and asset information (meter units, T&P factors). For LSP meters, corrections can be made to metered volumes through the reconciliation process when an error has been identified. The majority of these corrections occur within the first year (see modification 0398 workgroup report [7]), but there are corrections which can go back several years. These corrections can only be applied if they fall after the reconciliation backstop. This was set at 4 years (increasing to 4 years 364 days by the end of the formula year), but the implementation of Mod 0398 has reduced this to 3 years (increasing to 3 years 364 days by the end of the formula year). The implications of Mod 0398 are discussed in more detail in Section 4.12.

The metered volume data used by the AUGE to estimate UG is a snapshot of data at a given point in time. As such, this data will be subject to corrections at some future point in time. This section discusses the issues of corrections to LSP metered volumes that have yet to be applied.

When calculating the UG for 2014/15, metered volume data for LSPs will be available for formula years 2009-2012. The AUGE does not intend to use data for 2012 as there will still be a significant number of outstanding corrections yet to be applied for this year. According to the Mod 0398 workgroup report [7], there will still be about 20% of the energy consumed still to be reconciled. This drops to about 5.5% for the preceding year (2011) and the unreconciled energy reduces further for each year prior to that.

As part of the calculation of UG for 2014/15, the AUGE will look at the change in consumption based on metered volumes provided by Xoserve for the 2013/14 year and the newly calculated consumptions using the most up to date data. By assessing the change from year to year, the AUGE will assess whether a correction is necessary to account for the as yet unreconciled energy, and if so, how this correction should be estimated.

4.10 AQ Correction for Unregistered Sites

In the calculations of UG from Unregistered Sites (Orphaned, Shipper Activity and Unregistered <12 Months), AQ values as supplied in the snapshot files provided by Xoserve were used directly for production of the figures in the AUGSs for previous years. It has become apparent, however, that this approach will lead to errors in the resulting UG estimates.

The AQs reported in the snapshots for all categories of Unregistered sites are the Shippers' Requested AQs, which have undergone no validation whatsoever and are not necessarily representative of the real consumption of each site.

There are in fact three stages in the assignment of an AQ to a new site, and therefore this requires us to make 2 separate corrections in the UG calculation process (i.e. AQ1→AQ2 and then AQ2→AQ3).

AQ1 is the Requested AQ:
This is the initial AQ requested by the Shipper. It has undergone no validation of any sort and is whatever the Shipper asked for. It is this value that appears in the Shipperless and Unregistered snapshots.

AQ2 is the Confirmed AQ:
The Requested AQ undergoes some rudimentary validation (i.e. whether it is appropriate for the type of site). If it passes then it becomes the Confirmed AQ, if it fails then a new, more appropriate, AQ is set. In either case the value is still just an approximation.

AQ3 is the AQ Following AQ Review:
This is the first AQ for the site that is actually based on any meter read data and hence the first that can be regarded as accurate.

Analysis has been undertaken to calculate these effects by comparing AQs from each stage to the equivalents from the next stage.

- Factors have been calculated using requested and confirmed AQ data that convert from AQ1 to AQ2, with separate factors for each type of Unregistered site. This is new analysis carried out during 2013 for the 2014/15 AUGS. Based on the data supplied by Xoserve to date, the following factors have been calculated for each type of Unregistered Site.

Table 14: Requested AQ to Confirmed AQ Conversion Factors

Type	Total Confirmed Sites	Average Requested AQ	Average Confirmed AQ	Conversion Factor
Orphaned Sites	447	123,059 kWh	117,614 kWh	0.96
Shipper Activity	19	198,261 kWh	198,261 kWh	1.00
Unregistered <12 Months	10904	64,965 kWh	49,573 kWh	0.76

- Factors have previously been calculated using confirmed and post-review AQ data that convert from AQ2 to AQ3. In this case a single universal factor was found to be most appropriate. This work was carried out in 2012 and is described in Section 4.2 of the 2nd draft 2012 AUGS for 2013/14 [19].

Therefore, in order to convert to the final, reliable, AQ the calculation process for Unregistered Sites becomes:

AQ1 → Factor 1 → (Estimate of) AQ2 → Factor 2 → (Estimate of) AQ3

This process will therefore be applied to the calculations for production of the UG figures for 2014/15 and for subsequent years.

4.11 CSEP Shrinkage

During consultation of the 2nd draft 2012 AUGS for 2013/14, ICoSS raised the issue of CSEP Shrinkage as this is not calculated as part of the GT estimation of Shrinkage for their networks. We concluded that this issue should be raised at the Shrinkage forum. The issue was raised by ICoSS at a recent Shrinkage forum meeting and National Grid Transmission have since provided an initial assessment of CSEP shrinkage [25], suggesting an overall leakage of approximately 13GWh. We will continue to monitor the progress of this and consider the conclusions that are subsequently reached by the Shrinkage forum.

4.12 Industry Initiatives under Review

In the 2011 and 2012 AUGSs the AUGE identified a number of industry initiatives that may have an impact on UG going forward. New modifications have also been raised that, if implemented, may also have an impact on the AUGE processes. Modifications that could potentially impact on the UG calculations are summarised briefly below.

Mod 0398 Limitation on Retrospective Invoicing and Invoice Correction

Mod 0398 [7] proposes reducing the reconciliation window to 3-4 years. This has been accepted by Ofgem and effective from 1 April 2014 [22]. Mod 0395 was a similar modification with a different reconciliation window of 2-3 years. Mod 0398 was implemented in preference to Mod 0395.

In line with this modification, a backstop date of 3 years will be set at 1 April each year. This backstop remains for the whole year giving an increasing reconciliation window as the year progresses, up to a maximum of 3 years 364 days before the backstop is then reset to 3 years for the following year.

The final modification report for Mod 0398 [7] includes data from Xoserve which shows that only a very small proportion of reconciliations occur in the 4-5 year window and concludes "Reducing the reconciliation window would therefore have a minimal impact on energy allocation". The AUGE would therefore expect the impact on UG to be correspondingly minimal. This will also align the reconciliation window and the period of data used in total UG calculation.

One exception to this may be Significant Meter Errors (SMEs). Ofgem noted in their decision letter regarding Mod 0398 that "Several respondents raised concerns about the impact UNC 0395 or UNC 0398 may have on the accurate reconciliation of Significant Meter Errors ('SMEs'), particularly in relation to an NTS-LDZ offtake meter given the length of time that an error may go undiscovered and subsequently take to resolve". If Mod 0429 is accepted then the additional corrections allowed could also be accounted for by the AUGE, assuming that the necessary information can be provided.

Mod 0410/0410A Responsibility for Gas Off-taken at Unregistered Sites following New Network Connections

Modification 0410/0410A [15], [21] seeks to reduce the amount of Unidentified Gas caused by Unregistered sites by introducing mechanisms to reduce this in terms of the responsible party. If approved, it intends to change the AUGE guidelines to specifically require the AUGE to take account of information from Xoserve when dealing with Unregistered sites.

Mods 0410/0410A are live modifications and have not yet been implemented so has no impact on the proposed AUG methodology at this time.

If implemented, these modifications would mean that UG arising from unregistered sites would be temporary going forward and so should be removed from the total UG estimate. However, as the proposal is not retrospectively applied, there will still be some unregistered sites which continue to contribute to the permanent UG initially, but this amount will reduce over time as the registration issues for these sites are resolved.

Mod 0424 Re-establishment of Supply Meter Points – Prospective Measures to address Shipperless Sites

Modification 0424 [16] seeks to reduce the impact of Shipperless sites on Unidentified Gas. This modification was implemented as of 25 Jan 2013 [23] and so will have an impact on the level of Unidentified Gas attributable to Shipperless sites for 2014/15. The AUGE will account for the effects of this modification through the information currently provided by Xoserve.

This modification means that UG arising from Shipperless sites where the original meter is still present (Shipperless PTS report) would be temporary going forward and so should be removed from the total UG estimate. However, as the proposal is not retrospectively applied, there will still be some Shipperless sites which continue to contribute to the permanent UG initially, but this amount will reduce over time as the registration issues for these sites are resolved. Xoserve have agreed to provide the date the site became Shipperless in their snapshot files so that the AUGE can determine those sites that the modification applies to.

Mod 0425 Re-establishment of Supply Meter Points – Shipperless Sites

Modification 0425 [17] aims to reduce the impact of Shipperless sites on Unidentified Gas if implemented. It will place an obligation on the last registered Shipper to take responsibility for investigation and resolution of the registration of the site (either to re-register it from the date of registration or to register it with another Shipper). If implemented, the AUGE would pick up the effects of this through the information currently provided by Xoserve.

Mod 0425 is a live modification and has no impact on the proposed AUG methodology at this time. If implemented it will be treated in a similar manner to Mod 0424.

Mod 0429 Customer Settlement Error Claims Process

Modification 0429 [14] seeks to address the mismatch between the reconciliation window (currently 4-5yrs but reducing to 3-4yrs following implementation of Mod 0398) and the Limitation Act (6yrs). This results in energy invoices between Shippers and Customers that are adjusted in the Limitation Act period not being reflected in the energy allocation settlement in the current UNC process.

The proposed solution requires the AUGE to assess the amount of energy that would have been corrected (and class this as temporary Unidentified Gas) over the full period. The Modification Workgroup report also indicates costs for the AUGE should be minor.

The methodology based on meter reads and metered volumes may benefit from any historical corrections to those read/volumes in the same way as RbD does (assuming that such change succeeds in passing the validation processes for the methodology). However, there is no mechanism within UNC to reconcile Unidentified Gas for years prior to the reconciliation period, which this modification effectively requires.

In order to achieve the required back-correction, the AUGE would require meter point level details of exactly what corrections were applied and when. For the meter read/consumption method this would be the corrected meter reads/volumes as appropriate, i.e. anything that had changed since the point at which Xoserve provided the data to the AUGE. From our experience of obtaining and processing such data this is likely to be a significant undertaking, even on the assumption that the data is available with the tracking of dates as required. Furthermore, the AUGE would rely on corrections being captured for the full Limitation Act period regardless of the current reconciliation window. The AUGE believes this information may not be available and thus estimating this mismatch may not be feasible.

The AUGE has not been involved in the preparation of the Mod 0429 report, and this lack of involvement is necessary to ensure neutrality. It would be worth discussing the implications of Mod 0429 before the final report is produced, however, to ensure the proposed changes are actually feasible.

This is a live modification and has not yet been implemented so has no impact on the proposed AUG methodology at this time.

5 Data Used

This section describes the data requested, received and used to derive the methodology to calculate UG. The AUGE has taken care to ensure that all datasets include all components of NDM consumption, i.e. CSEPs and Scottish Independents are included throughout.

There have been a variety of issues with obtaining data in previous years. This was partly to do with the way the industry manages various processes. For example, the AUGE could not obtain a history of data relating to Shipperless/Unregistered sites over time as only current snapshots can be produced. However, Xoserve now provides regular snapshots so that trends can be identified over time.

In 2012 there were issues obtaining meter reads and metered volume data, and this is described in previous versions of the AUGS. Data requests for 2013 have been submitted to Xoserve and data preparation is underway to ensure that all required data will be available in time to generate the interim and final AUG tables later in the year. One key difference this year is that in the event of data issues (particularly with consumption data) we do have the fall back position of the data provided from 2012 which we did not have the benefit of last year.

Section 5.1 below gives a summary of the data items requested and their current status. The subsequent sections give more details about the data items for each individual element of the analysis.

5.1 Summary

Table 15: Data Status Summary

Analysis Area	Dataset Requested	Status
Direct Total UG Calculation	Allocated SSP and LSP loads	Requested
	Metered SSP and LSP loads	Requested – expected week ending 7th June 2013
	LDZ, DM and Unique Sites Metering Errors	Requested
	Meter Asset Information	Requested
	Algorithm data (ALPs, DAFs, EWCFs, WCFs, SFs)	Requested
	CV data	Requested
	CSEP AQ data	Requested
	Non-CSEP AQ data	Requested
Unregistered and Shipperless Sites	Asset and Shipper meter reads for new LSP sites	Requested
	Asset meter reads for orphaned sites	Requested
	Gas Safety Visit data	Requested
	Snapshot files	Supplied on an ongoing basis
iGT CSEPs	Known CSEP data	Requested
	Snapshot files	Supplied on an ongoing basis
Meter Error	Meter capacity report	Requested
New Analysis	Multiple Meter Supply Point data	Received
Additional Supporting information		
	Mod81 data	Requested

Analysis Area	Dataset Requested	Status
	Proportions of SSP and LSP sites successfully recalculated in AQ review	Requested
Theft	Detected and alleged theft updated to end March 2013	Requested
	AQs before, during and after theft	Requested
	Metered volumes and meter reads, Read Units and T&P factors for theft detected sites	Requested
	EUC groups and meter read frequencies for theft affected sites	Requested

5.2 Total UG Calculation (Consumption Method)

Data has been requested from Xoserve in the following formats. In all cases, data has currently been provided for the time period 01/04/2008 to 31/03/2012. The supply of data for the 2013/14 formula year is ongoing.

- Allocation data on a day-by-day basis, split by End User Category (EUC). This data includes CSEP allocations.
- Meter read data on an MPRN-by-MPRN basis, with one record for each meter read. Therefore, the volume of data supplied for each MPRN is dependent on the meter read frequency for that meter. In addition to meter reads, the EUC and the AQ have been provided for each MPRN so that calculated consumptions can be reconciled against allocations on an EUC-by-EUC basis.
- A list of MPRNs for which no meter reads were recorded in the analysis time period. This list also includes both EUC and AQ. Therefore, the total number of MPRNs in each EUC can be obtained by adding the count of meter points in the consumption data file to the count of meter points in the "no meter reads" file.
- Lists of all new sites and lost sites during the analysis period, including start/end dates. These are used to accurately track the population over time and to ensure that each new or lost site is only included in calculations for the time period for which it was active.
- Aggregate MPRN count and AQ data by EUC for CSEPs. Meter read data is not available for these sites, but knowledge of the number and AQ of MPRNs allows them to be included in the total UG calculations when the sample consumption is scaled up to cover the full population.
- Meter asset information on an MPRN-by-MPRN basis. This includes meter installation dates, numbers of meter dials, meter index units and T&P correction factors. This information is used in a number of different parts of the consumption algorithm.

The provision of this data allows the consumption for each individual meter point, for each formula year of interest, to be calculated using the method described in the 2012 AUGS for 2013/14 [19]. The exact format of the data provided is also given in this document.

5.3 IGT CSEP Setup and Registration Delays

Data for iGT CSEP setup and registration delays consists of two elements, as follows:

- Unrecognised projects summary, including
  - number of unknown projects by LDZ
  - count of supply points and aggregate AQ of unknown projects by LDZ

  This data is supplied by Xoserve in two-monthly snapshot files on an ongoing basis.

- Known CSEP Data
  This file contains data for both registered sites on known CSEPs and unregistered sites on known CSEPs. It is supplied on an annual basis.

5.4 Unregistered/Shipperless Sites

The following information is supplied by Xoserve concerning Unregistered/Shipperless sites. For all aggregate-level data both the number of sites and their aggregate AQ is included. All data is split by LDZ, and also between "Small AQ" and "Large AQ" categories.

Xoserve have created a regular report to ensure that new data is collated and sent to the AUGE every two months. This report covers the following categories of Unregistered and Shipperless sites:

- Shipper Activity
  These are new sites created more than 12 months previously, that a Shipper has declared an interest in (such as by creating the MPRN), but are nevertheless not registered to any Shipper. This data is split into sites believed to have a meter and those believed to have no meter.

- Orphaned
  These are new sites created more than 12 months previously, that no Shipper is currently declaring an interest in. This data is split into sites believed to have a meter and those believed to have no meter.

- Shipperless sites PTS (Passed to Shipper)
  These are sites where a meter is listed as having been removed and 12 months later the gas transporter visits the site to remove or make the service secure, but find a meter connected to the service and flowing gas. If it is the same meter as allegedly removed 12 months ago it is passed to the Shipper concerned to resolve.

- Shipperless sites SSrP (Shipper Specific rePort)
  Similar to Shipperless (Passed to Shipper) sites, these are sites where a site visit finds a new meter fitted, in which case it is reported to all Shippers.

- No Activity
  These are sites currently being processed. They will end up in one of the other categories.

- Legitimately Unregistered
  These are sites believed to have no meter and hence are not capable of flowing gas.

- Created <12 months
  These are new sites that have been in existence less than 12 months and are not registered with a Shipper. Action is not taken on such sites until they have been in existence for 12 months.

This data is supplied by Xoserve in two-monthly snapshot files on an ongoing basis.

In addition, the following information is supplied on an annual basis:

- A summary of the remaining Shipperless sites, i.e. those that have been without a Shipper for less than 12 months and hence do not yet appear in the "Shipperless PTS" or "Shipperless SSP" lists. This data comes from the records of Gas Safety Visits.

- Asset meter reads for orphaned sites to determine the proportion which have been flowing gas prior to becoming registered.

- Asset and shipper details for a sample of confirmed sites. This is used to calculate the proportion of UG from Unregistered sites that cannot be backbilled.

Updated data for all of these items covering the time period up to February 2013 has been received.

5.5 Meter Errors

Data for meter error calculations consists of meter capacity, AQ and NDM/DM classification records for all LSP sites. This report is supplied on an annual basis, with the last one having been received by the AUGE in April 2012. An update to this file for the new formula year is therefore required.

6 Methodology

This section describes in detail the methodology for each aspect of UG where the calculation method has changed since the last published analysis in 2012. Where methods have remained the same, details can be found in Section 6 of the 2012 AUGS for 2013/14 [19].or in the previous 2011 AUGS for 2013/14 [10]. Details of the Consumption Method have been included here for completeness because whilst they were given in the last AUGS they have yet to be used in a UG estimate. In addition, elements of the method have been developed since the last AUGS and so a full description of the latest version of the method is given here.

The Consumption Method can be stated in its simplest form as:

Total UG = (Alloc SSP + Alloc LSP) – (Metered SSP + Metered LSP)

This can be alternatively stated as:

Total UG = Aggregate LDZ Load – DM Load – Shrinkage – (Metered SSP + Metered LSP)

Unlike the RbD method first presented in the 2011 AUGS for 2012/13 [10], this method estimates the actual UG total, including both LSP-assigned and SSP-assigned UG. This is a key benefit compared to the RbD-based method, which estimates LSP-assigned UG only and uses this as the best estimate of total UG.

The Consumption Method in its raw form includes both permanent and temporary Unidentified Gas in its output. Therefore temporary UG (calculated from the individual component parts of UG) has to be subtracted from the initial UG total, and it is this amended figure that then goes forward into the remainder of the calculations.

6.1 Total UG Calculation (Consumption Method)

The consumption algorithm relies on a large quantity of data, summarised in Section 5.2. A full description of the raw data used to calculate consumption figures for each individual meter point is described in Appendix A. This raw data is then pre-processed to derive additional information and helps speed up the consumption calculation process. Appendix B describes the resulting dataset. After the pre-processing the main algorithm is run to calculate consumption on a meter by meter basis. This calculation will not be successful in all cases so a final step is required to scale up the consumption estimate to account for these ‘failed’ sites.

6.1.1 Data Pre-Processing

In order to calculate the total UG figure it is useful to pre-process the raw data and derive some additional data fields. All data fields used by the consumption method are described in Appendix B. In this section we explain the methods used to derive those fields from the raw data.

1. ANNUAL_QUANTITY_XX(LATEST)
This field is a simple (Y/N) flag to indicate the latest AQ record in each gas year for each MPR.

2. ANNUAL_QUANTITY_XX(EUC_CALC)
This field is calculated using a function defined in the database called Calc_EUC_Band which returns an EUC band given an AQ using the following logic:

if AQ <= 73,200 then '01B'
else if AQ <= 293,000 then '02B'
else if AQ <= 732,000 then '03B'
else if AQ <= 2,196,000 then '04B'
else if AQ <= 5,860,000 then '05B'
else if AQ <= 14,650,000 then '06B'
else if AQ <= 29,300,000 then '07B'
else if AQ <= 58,600,000 then '08B'
else '09B'

3. FACTORS_DAILY(WC)
This is calculated as max(0.01, 1 + DAF * EWCF).

4. FACTORS_DAILY (WAALP)
This is simply ALP * WC.

5. FACTORS_YEARLY(CWAALP)
The sum of WAALP over formula year.

6. FACTORS_DAILY (VOL_WAALP)
This is WAALP / CV.

7. FACTORS_YEARLY(VOL_CWAALP)
This is CWAALP / CV.

8. METER_INFO_XX(UNITS_CALC)
This field is derived using the following method:

For each MPR, for each pair of meter reads (mr_1, mr_2) check

- The meter was not replaced in between
- $mr_2 - mr_1 > 0$
- metered volume (mv_2) associated with $mr_2 > 0$
- round the clock indicator associated with $mr_2 = 0$

If yes to all, calculate

$$Ratio = mv_2 / ((mr_2 - mr_1) * CF)$$

$$A = log_{10}(Ratio)$$

$$B = abs([A] - A)$$

where $[A]$ denotes the integer part of A.

If

- $0 \leq [A] \leq 4$
- $B < 0.002$

Then set $units\_calc = 10^{[A]}$. We then look up the latest meter_info entry prior to the meter reads and update the units_calc field. If no such entry exists a new dummy record is inserted with an installation date = mr_1_date -1 and default values for the other fields.

9. METER_INFO_XX(IMP_IND_CALC)

This field is the IMP_IND flag taken from the meter read records for the meter. It is stored here for comparison with the value from the meter asset data.

10. METER_READS_XX(BAD_READ)

The algorithm for flagging bad reads is as follows:

Given subsequent meter reads mr_1, mr_2, mr_3 and mr_4 calculate:

$$con_1 = mr_2 - mr_1$$
$$con_2 = mr_3 - mr_2$$
$$con_3 = mr_4 - mr_3$$

If any of these are negative we check for meter index rollover (see Section 6.1.2.1)
If the meter was replaced we leave the consumption null
Then if the meter was not replaced during the period we check

- If ($con_3 > 0$) and ($con_2 < 0$) and ($con_1 > 0$) then we have a bad reading
    - If $con_1 > \text{abs}(con_2)$ then mr_2 is bad
    - Else if $con_3 > \text{abs}(con_2)$ then mr_3 is bad

11. NDM_DM_CHANGE(NDM_START_DATE, NDM_END_DATE)

The entries in this table are calculated manually. The first step is to list the MPRs from the AQ records which are recorded as both DM and NDM (there were 375 such meters during 2012 analysis). Then by inspecting the AQ records for each MPR determine the start and end date of its NDM status.

6.1.2 Algorithm

In addition to the step-by-step description below, worked examples of both a standard consumption calculation and a meter index roll-over affected calculation are given in Appendix C.

1. Given a formula year Y, define the start and end dates as 01 Apr YY and 31 Mar YY+1

2. Find all meter points that were active and NDM in a least part of year Y.

3. Look up the first AQ estimate effective after the end of the formula year. If none exists after the end of the formula year use the latest value. Only look at the latest AQ value from each year. (This may fail if a site was only NDM for part of a year, so we relax the condition on using the latest AQ from each year in this case). From this record store
    i. The AQ value
    ii. The EUC provided by Xoserve
    iii. The pre-calculated consumption band derived by the AUGE from the AQ value.
    iv. Market sector (SSP/LSP) based on the EUC from Xoserve

4. For each meter point find the meter reading date and value for:

- LB1 (Lower Bound 1) – the latest metering reading prior to the start of the formula year
- LB2 (Lower Bound 2) – the earliest meter reading within the formula year
- UB1 (Upper Bound 1) – the latest metering reading within the formula year
- UB2 (Upper Bound 2) – the earliest meter reading after the end of the formula year

The above excludes those readings which have been flagged as bad by the pre-processing.
Note that for any given meter point, only a subset of this full set of reads may be available. We need at least one lower bound and one different upper bound meter read. Possible scenarios are shown in Figure 5 below:

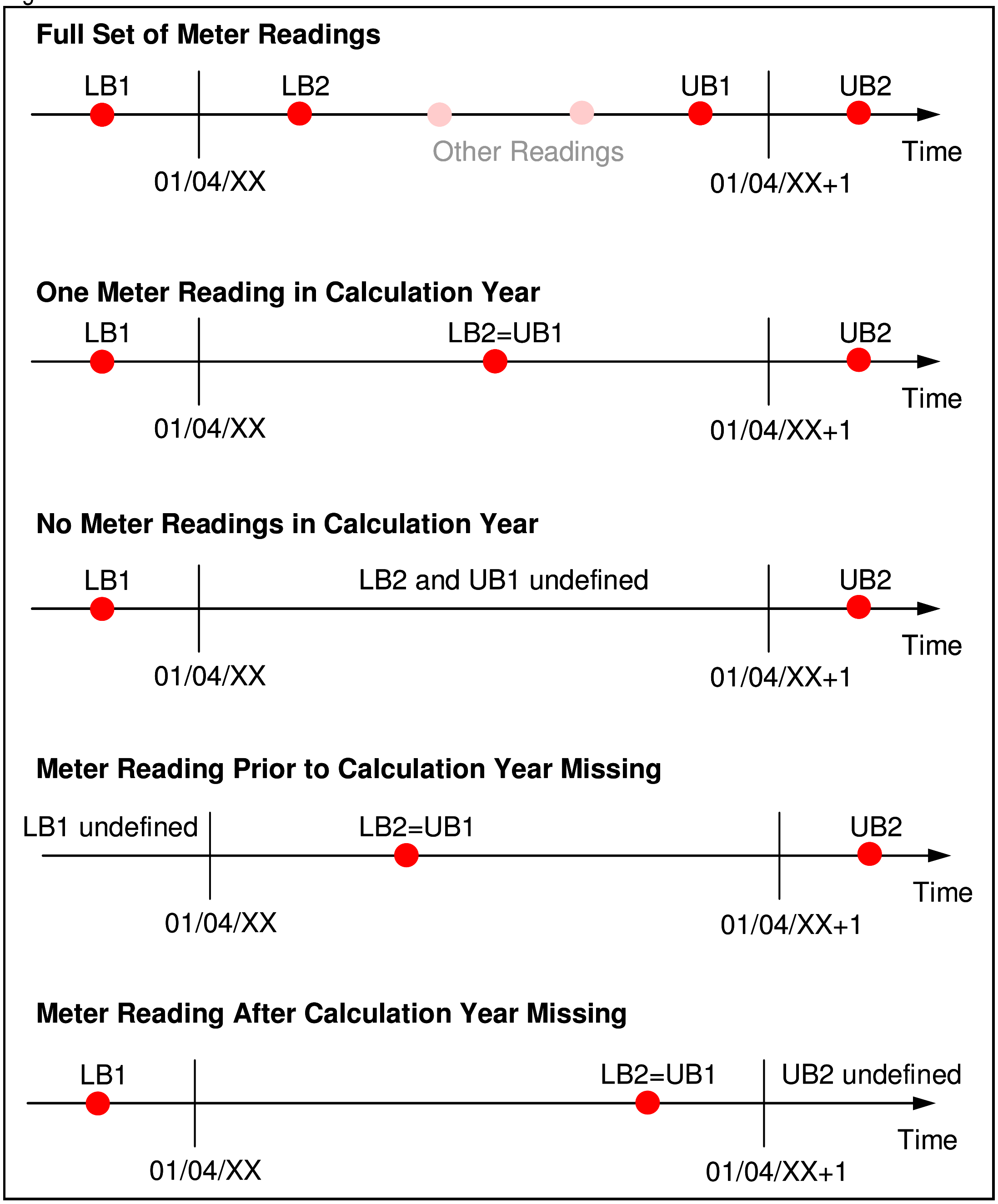

Figure 5: Meter Read Availability Scenarios

5. Set the start meter read date to LB1 unless
   - The date of LB1 is more than 540 days from the start of the formula year, or
   - LB1 is recorded as the final read of a meter

   In which case set it equal to LB2.

6. Set the end meter read date to UB2 unless
   - The date of UB2 is more than 540 days from the end of the formula year, or
   - UB1 is recorded as the last reading of the meter

   In which case set it equal to UB1.

7. If the meter was replaced on or after LB2 and before UB1 then reject the meter point.

8. Check that:
   - The distance between the two chosen meter readings is at least 120 days
   - The overlap between the metering period and the formula year is at least 60 days

   If this is true then proceed to calculating the metered volume, otherwise reject the meter point.

9. Apply either Rule A or Rule B according to the market sector of the site:
   A. If the site is SSP then calculate the volume consumed between the two chosen meter readings (mr_1, mr_2). If this gives a negative volume then check if the meter index has rolled over (see subsection 6.1.2.1 below)
   B. Otherwise sum the metered volumes (mv_i) between the two chosen meter readings. If there are any negative volumes in the range, set the sum to -1.

   If this step produces a positive volume then proceed to the next step, otherwise reject the meter point.

10. Calculate the fraction of the year that the meter point was active and NDM weighted by the ALPs.

11. Calculate the volume taken over the formula year (or fraction calculated in the previous step) by multiplying the volume from step 9 by

$$\frac{\sum\limits_{\substack{\text{Formula Year}\\ \text{or Part Thereof}}} WAALP^{v}}{\sum\limits_{\substack{\text{Metered}\\ \text{Period}}} WAALP^{v}}$$

   where $WAALP^v$ is the WAALP divided by the relevant CV value (i.e. a 'volume' WAALP rather than the usual energy WAALP).

12. Look up, in the meter asset information, whether the meter is/was metric or imperial and then apply either Rule A or Rule B to match the rule chosen in step 9.
   A. If the site is SSP look up the read units (*U*).
      - First choice is the units inferred from the meter read records.
      - If this could not be calculated then use the units provided by Xoserve.

- In the case where the read units from Xoserve are obviously wrong (i.e. are 0 or not a power of 10) use 1 for metric and 100 for imperial meters.

  Combine this value with the default correction factor (*CF*) 1.022640 and relevant metric/imperial conversion factor to get a combined conversion factor.

B. Otherwise just look up the appropriate metric/imperial factor.

If no meter asset information can be found, reject the meter point.

13. Calculate the weighted average CV for the formula year, calculated as

$$\frac{\sum\limits_{\substack{Formula\,Year \\ or\,Part\,Thereof}} WAALP}{\sum\limits_{\substack{Formula\,Year \\ or\,Part\,Thereof}} WAALP^{v}}$$

14. Convert the formula year volume to energy in kWh by multiplying the output of steps 11, 12 and 13 together. In summary, depending on the market sector of the meter point, this will be

$$E = (mr_2 - mr_1) * U * CF * CV / 3.6 (* 0.0283 \text{ if imperial}) \text{ for SSP} \quad (6.1)$$

$$E = \sum mv_i * CV / 3.6 (* 0.0283 \text{ if imperial}) \text{ for LSP} \quad (6.2)$$

15. Calculate an AQ from this consumption

$$AQ = Con * 365 / CWAALP$$

16. If we have calculated a new AQ value from the meter readings that is more than 5 times larger than the old AQ and the new AQ puts the site in the LSP market then reject the meter point. Such sites may be manually reviewed as appropriate.

17. If the consumption calculation was successful, calculate an EUC band based on the new AQ.

6.1.2.1 Meter Index Rollover Check

Given two reads mr_1 and mr_2 where $(mr_2 - mr_1) < 0$ we use the following process:

1. Estimate the number of dials from mr1

$$num\_dials = max(ceil(log_{10}(mr_1)), 4)$$

2. Determine the maximum possible meter read

$$max\_read = 10^{num\_dials}$$

3. Calculate the period between the two meter reads in years

$$num\_years = \sum_{mr_1(date)}^{mr_2(date)} ALP / 365$$

4. Assume meter index roll-over and re-calculate the volume

$$tmp_1 = max\_read - mr_1 + mr_2$$

5. Calculate the new volume as a fraction of the max read per year

$$tmp_2 = (tmp_1 / max\_read) / num\_years$$

6. If $tmp_2 < 0.25$ then we assume meter index rolled over and use tmp_1. Otherwise we leave the calculated volume as negative and reject the meter point.

6.1.3 Aggregation and Scaling-Up

When applied to each meter point in any given LDZ, the algorithm outputs a set of consumptions which can be aggregated to EUC level. The aggregated data for each EUC is also naturally split into the following categories by the algorithm:

- Meters for which a consumption could be calculated
- Meters for which the algorithm failed (failed to calculate consumption or calculated consumption failed validation)
- Meters in CSEPs (for which meter reads are not available)

The sum of these three categories across all EUCs gives the total NDM population of the LDZ.

Where a consumption value was successfully calculated the EUC is based on this consumption, otherwise it is calculated by the AUGE based on the AQ.

So for each EUC band we can calculate

1. The number of meter points with a successfully calculated consumption.
2. The number of meter points for which we do not have a calculated consumption (i.e. failed calculation plus CSEPs)
3. The average consumption for those meter points with a calculated consumption greater than zero.

The values for 3) are then used to estimate the consumption for meter points in 2). This involves a number of subtleties:

- In 3) we restrict attention to consuming meters only, in order to account for potential differences in the proportion of non-consuming meters within and outside the sample.
- Meters where the consumption calculation fails are classified as consuming/non-consuming based on AQ, as this is the only reliable data available for such meters. It is recognised that due to changing circumstances for each meter, those with an AQ of 1 for Year X are not necessarily non-consuming during Year X. Likewise, those with an AQ greater than 1 for Year X are not necessarily

consuming in Year X. Therefore, two figures have been calculated using available information (i.e. meters within the sample):
- the proportion of meters with AQ = 1 for Year X that are consuming in Year X = A
- the proportion of meters with AQ > 1 for Year X that are consuming in Year X = B

- The consumption for the non-calculated meter points is then calculated as

Consumption = A x (meters with AQ = 1) x average consumption
+ B x (meters with AQ > 1) x EUC average consumption

where the average consumptions are based on the sample of successful meters and exclude those calculated to have zero consumption.

- CSEPs are treated similarly to failed meters. The only difference is that in the absence of AQs at the meter point level for CSEPs, we assume that CSEPs contain the same proportion of meter points with AQ=1 as the wider population.
- Where the sample size for a particular EUC for a given LDZ and formula year is less than 30 the national average is used in place of the LDZ average.
- Failed meters which were only active for part of the year are assigned an average demand scaled based on the WAALPs for that part of the year.

Figure 6 below summarises the process for obtaining a consumption value for each meter point.

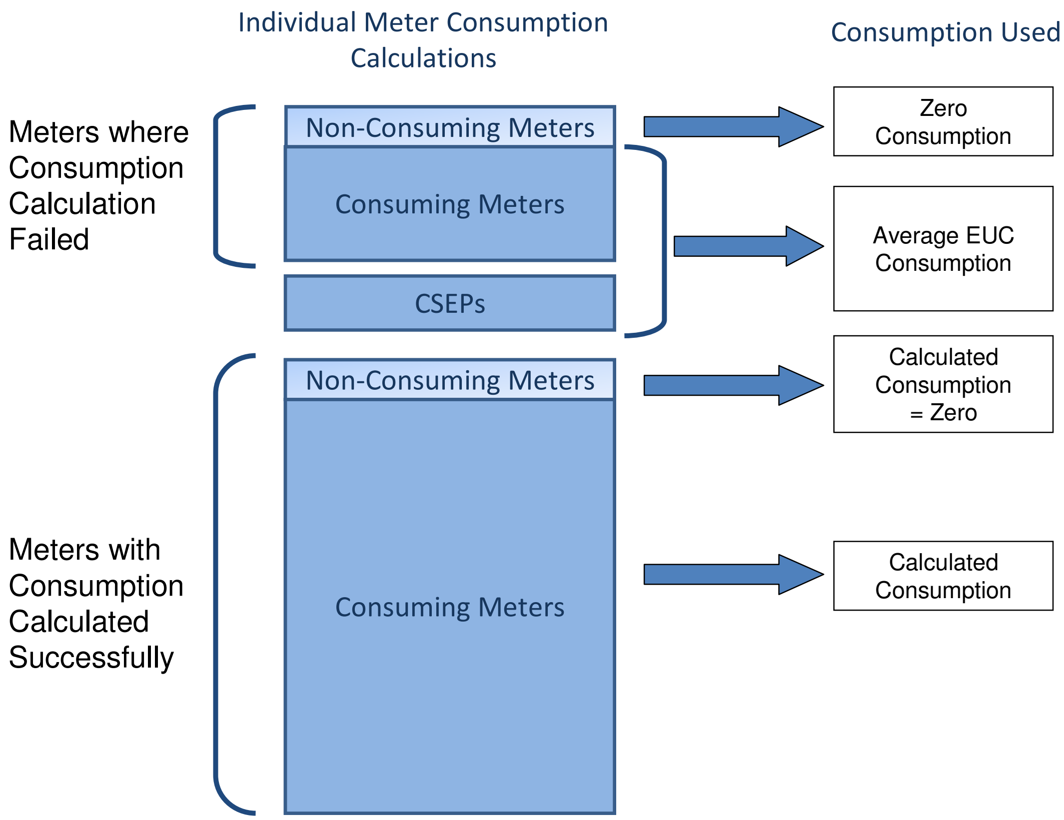

Figure 6: Consumption Method for Each Meter Point

UG for the LDZ for the formula year in question is then calculated by summing the metered NDM consumptions across all EUCs and subtracting these from the total combined allocations for the same period.

It is important to note that at this stage these figures include both permanent and temporary UG, and are not corrected for either meter errors or detected theft. Therefore, whilst giving an indication of the order of magnitude of the UG total for that year, this is simply a step in the calculation process and not an estimate of the final value.

6.2 Known DM and LDZ Metering Errors

Meter error adjustment data is received on an LDZ by LDZ basis split by billing month. The total value of the error is given, and this is split into 6-month periods so that the correct proportion of each meter error can be assigned to each formula year in which the error is active. An example of the data is given in Table 16 below.

Table 16: Sample Meter Error Data

Billing Month	LDZ	Aggregate Energy (kWh)	Reason	01/10/04 - 31/03/05 (kWh)	01/04/05 - 30/09/05 (kWh)	01/10/05 - 31/03/06 (kWh)	01/04/06 - 30/09/06 (kWh)
May-06	EM	41,990,049	1 Large consumption adjustment.	1,104	41,987,825	1,120	0
May-06	NE	-17,666,209	1 Large credit & 1 debit consumption adjustment.	-21,318,352	0	3,652,143	0
May-06	SC	-57,390,483	2 Large credits & 1 debit consumption adjustment.	-47,880,657	-11,514,298	2,004,472	0
May-06	SE	10,298,400	1 Large consumption adjustment.	0	1,593,800	8,704,600	0

These adjustments are therefore applied to the Unidentified Gas calculation after the consumptions have been calculated and aggregated to EUC level. Given that for LSP load consumption corrections are already included in the calculations and for SSP load the AUGE's own validation procedure mimics this process, this leaves the following meter errors as relevant to the UG calculation:

- LDZ metering errors
- DM site errors
- Unique site errors

When considering the high-level consumption method UG equation

Total UG = Aggregate LDZ Load – DM Load – Shrinkage – (Metered SSP + Metered LSP)

these errors affect the Aggregate LDZ Load and the DM Load, i.e. the total figure from which metered consumption is subtracted to leave UG. Using the other form of the UG equation

Total UG = (Alloc SSP + Alloc LSP) – (Metered SSP + Metered LSP) it can be seen that this total is calculated using allocations. Therefore, the three types of meter error adjustment listed above are applied to the allocation total, which is calculated at the formula year level of granularity. Corrections for

- LDZ meter under-reads *increase* the total NDM allocation
- LDZ meter over-reads *decrease* the total NDM allocation
- DM/Unique site meter under-reads *decrease* the total NDM allocation
- DM/Unique site meter over-reads *increase* the total NDM allocation

6.3 Permanent and Temporary Unidentified Gas

The correction for temporary UG is applied on a formula year by formula year basis after the initial total UG figure has been calculated (including the meter read corrections described above). As described in Section 3.3, Temporary UG can exist in the following categories:

- iGT CSEPs (for LSP sites only)
- Shipperless Sites: See Mod 0424
- Unregistered Sites: Shipper Activity, Orphaned and Unregistered <12 Months (if the Shipper carries out site works, or if asset and shipper meter reads match)
- Theft (detected theft only)

Unidentified Gas as calculated using the Consumption Method includes both permanent and temporary UG, and so the temporary element is removed as the final step of the “Total UG” calculation. The method for calculating the temporary element of the categories of UG listed above is defined in detail in the 2011 AUGS for 2012/13 [10] and the only change since this time is an additional adjustment to the Unregistered sites calculation to account for the consistent initial AQ overstatement. This is described in detail in Section 6.5 below.

The figures calculated for Temporary UG using this method are therefore deducted from the (meter error adjusted) total UG figure to give the final permanent UG total. This figure then feeds into the remainder of the UG calculations, where the total is split into its component parts and also split by market sector.

6.4 Shrinkage Error

Shrinkage Error is not strictly a component of UG, and hence no attempt is made to estimate it directly. Any residual effects of Shrinkage on the UG estimate (such as long-term bias in the Shrinkage models), should they exist, are automatically included in the UG calculation via the Balancing Factor.

Full details of the AUGE’s assessment of Shrinkage can be found in Section 6.4 of the 2011 AUGS for 2012/13 [10].

6.5 Unregistered and Shipperless Sites

The analysis for this element of UG has been updated for the current year. For completeness, a full description of the calculation method, including the new elements, is given.

Raw data for all categories of Shipperless/Unregistered UG except “Without a Shipper <12 Months” is contained in snapshot files supplied by Xoserve every two months. In addition to the summarised data in these files, details of each individual MPRN that contributes to the summary data are also supplied.

The following files contain data that is also used in the calculation process and are supplied on an annual basis.

- Orphaned Sites with Opening Meter Reading
  This is used to calculate the proportion of Unregistered sites with meters that flow gas before they are registered (i.e. those that have a non-zero opening meter read).
- Connection Details for Unregistered Sites
  This is used to calculate the proportion of Unregistered sites that can be backbilled for gas consumed before registration. This can only be done if the confirming Shipper is the same as the Shipper that carried out site works.
- Gas Safety Visit Details
  The gas safety visit data is used to estimate the number and AQ of sites that have been Shipperless for less than 12 months and hence do not yet appear in the snapshots as "Shipperless PTS" or "Shipperless SSrP", but are nevertheless still consuming Shipperless gas.

Further details of these data files are given in Section 5.4 above.

A flowchart of the calculation process for Shipperless and Unregistered UG is shown in Figure 7. A step-by-step procedure for the calculation of the UG estimates from this source is given below this.

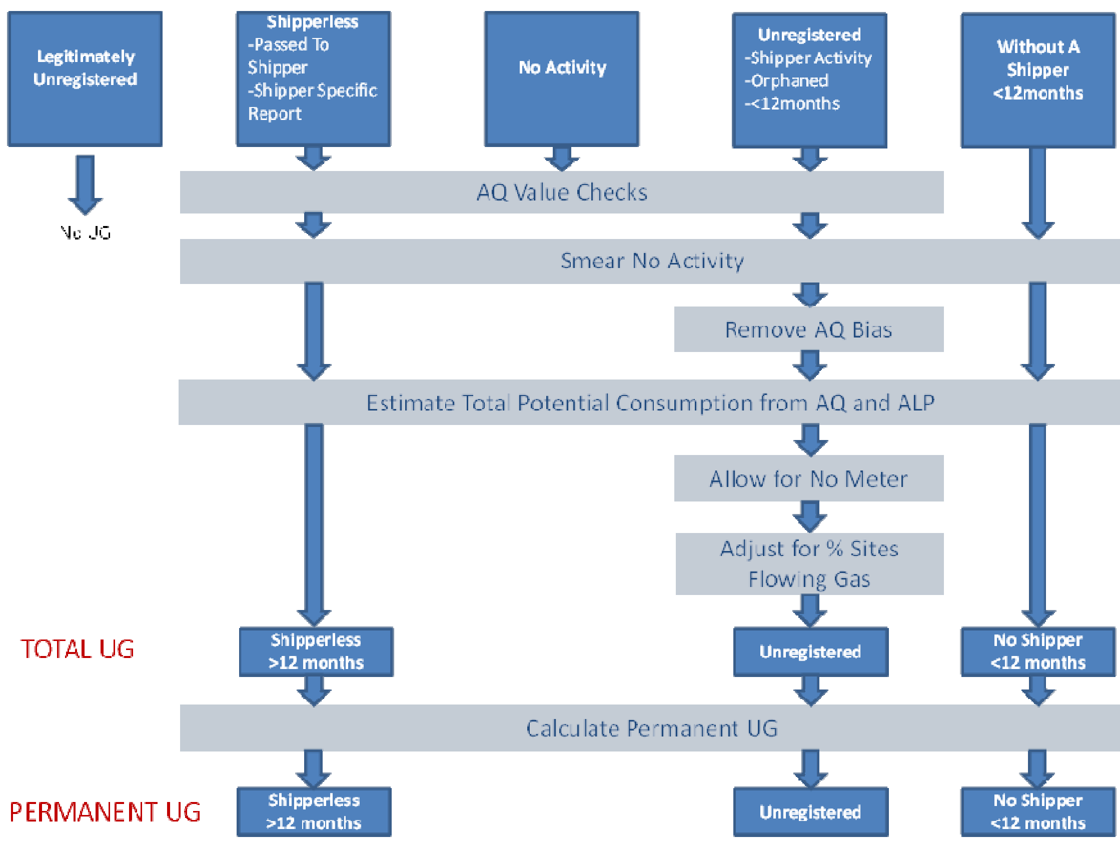

Figure 7: Shipperless and Unregistered UG Calculation Process

The step by step calculation process for Shipperless and Unregistered UG is as follows:

1. In the backup files containing data for each individual MPRN, each is assessed and flagged for further investigation by Xoserve if any of the conditions specified below are satisfied.
   - If a graph of AQs sorted by descending magnitude contains a "shoulder" point (i.e. a distinct change in gradient), any points to the left of the shoulder are flagged.
   - Any site with an AQ more than 100 times the average LSP AQ is flagged.
   - Any DM site (i.e. with an AQ greater than 58.6 GWh) is flagged.

   The resultant list of flagged sites is sent to Xoserve.

2. Xoserve will respond with details where any of the flagged sites have been confirmed on their system, and the confirmed AQ of each such site is provided. Any differences between the queried AQs and the confirmed AQs are aggregated to LDZ level for each category of Shipperless or Unregistered site for each snapshot. The data in the relevant snapshot file is then amended to account for these differences. Seven consecutive two-monthly snapshot files are required to calculate the Shipperless and Unregistered UG for a year. Sites where Xoserve have no further information are left as is.

3. Before the analysis is run, the following coefficients are also updated if new data is available.
   - Fraction of opening meter reads with gas flow
   - Fraction of UG not backbilled

4. "Fraction of opening meter reads with gas flow" is calculated using the "Orphaned Sites with Opening Meter Read" spreadsheet. This file contains a list of Orphaned meters and includes their opening meter reading. A meter is defined as having no gas flow whilst Unregistered if its opening reading is either zero or a close to the meter index zero (e.g. 99999). If the meter read does not satisfy either of these conditions it is defined as having gas flow whilst Unregistered. The number of meters with gas flow is expressed as a proportion of the total number of meters in the sample. This proportion is applied to the total number of sites with meters to give an estimate of the sites that are actually flowing gas in the Unregistered UG calculations.

5. "Fraction of UG not backbilled" is calculated using the "Connection Details for Unregistered" spreadsheet. This contains sets of meter readings for new confirmed LSP sites. For this analysis only the opening meter reading is required for each site, and so the remainder are discarded. For each meter, two variables are now defined:
   - Gas Flow: if gas flow has occurred at the site before confirmation (i.e. the asset meter read is different from the confirmation meter read) this is set to 1, otherwise 0.
   - Gas Flow with Different Shipper: if gas flow has occurred and the confirming Shipper is not the same as the asset Shipper, this is set to 1, otherwise 0.

   The number of sites that have gas flow with a different Shipper is expressed as a proportion of the total number of sites with gas flow, and this proportion is used to split each type of Unregistered UG calculations into permanent and temporary elements.

6. Once the data has been validated and updated where necessary, the first step in the calculation process is to smear the "No Activity" data. The AQ for this category is divided between all other categories in proportion to their relative AQs (except Legitimately Unregistered sites, which do not contribute to UG). The No Activity category plays no further part in calculations because the UG from these sites will be calculated as part of the remaining categories.

7. The raw Shipperless/Unregistered UG calculations are now carried out. The calculations are done using VBA code contained in spreadsheets previously supplied to Shippers for their perusal. Note that for Orphaned Sites, Shipper Activity and Unregistered <12 Months, both the total UG (including that which will subsequently be backbilled) and the permanent UG are calculated. The difference between these figures is the temporary UG from this source and this is used to adjust the UG total as described in Section 6.3 above. Before this adjustment is carried out, both total and permanent UG figures are modified as described in Step 9 below.

   The total consumption for Shipperless and Unregistered sites is first estimated using AQ data from the snapshot files (amended as described above). To do this, the most recent seven bi-monthly snapshots are used. Seven snapshots are required to cover a full year because each two month period of consumption is calculated from the average aggregate AQ across two snapshots for any given Shipperless/Unregistered UG category. Each of these averages is then multiplied by a factor based on the sum of the ALP over that two month period, with this factor normalised such that the sum of the factors over the six periods equals one. The estimate of total annual consumption is therefore given by

$$Consumption = \sum \left(AQ_m - AQ_{m-2} \right) \times \frac{P_m}{2}$$

   where

   AQ_m = Aggregate AQ from snapshot for month m
   AQ_{m-2} = Aggregate AQ from snapshot for month m-2, i.e. the previous snapshot
   P_m = Normalised Profile Factor for month m calculated as

$$P_m = \frac{\sum ALP_d \left(2\,month\ period \right)}{\sum ALP_d \left(full\ year \right)}$$

   where

   ALP_d = Value of Annual Load Profile for Day d

8. Unregistered sites may or may not have a meter fitted. Where no meter is present, it is assumed that consumption will be zero. For meters in the Shipper Activity and Orphaned categories, the snapshot files contain data split into meter points with and without a meter present. Consumption for these categories is therefore calculated as described above only for meter points where a meter is actually known to be present. For the Unregistered <12 Months category, it is not recorded whether a meter is present or not. For these sites it is therefore assumed that the fraction of meter points where a meter is present is the same as that found across the other two Unregistered categories.

9. The UG estimate for each type of Unregistered site is adjusted to account for the proportion of such sites with meters that actually flow gas whilst Unregistered, as described in Step 4 above.

10. The UG estimate for each type of Unregistered site is split into permanent and temporary elements based on whether the site will be backbilled or not, as described in Step 5 above.

11. For past iterations of this calculation, the resultant UG values were used without further modification in the AUGS. This process has been updated for 2014/15, however, as described in Section 4.10 above. Factors are now used to convert from Requested AQ to Confirmed AQ and then from Confirmed AQ to AQ Following Review, as follows:

    AQ1 → Factor 1 → (Estimate of) AQ2 → Factor 2 → (Estimate of) AQ3

12. The UG estimates produced in Step 6 above are therefore multiplied by the appropriate combination of these factors. This is done as follows:
    - Shipperless sites (PTS, SSrP): no adjustment
    - Unregistered (Orphaned, Shipper Activity and Unregistered <12 Months): adjust using composite *Factor1(n) x Factor2*.

13. Following the implementation of Mod 0424, Shipperless PTS Unidentified Gas is no longer all permanent. UG from sites that became Shipperless before the implementation of the mod on 25th January 2013 will remain permanent, but sites becoming Shipperless after that date will be backbilled and hence UG arising from them is temporary. The AUGE has requested that Xoserve start to provide a flag in the MPRN details that shows whether each site became Shipperless before or after the threshold date, and this will be used to divide the UG from this component into permanent and temporary elements. The temporary element will then be used to adjust the UG total as described in Section 6.3 above.

    At the time of writing, all sites that appear in the snapshot files will by definition have become Shipperless before the threshold date because they only appear in the file when they have been Shipperless for 12 months or more. The AUGE is required to forecast UG for 2014/15, however, when sites that became Shipperless after 25/01/2013 *will* qualify for inclusion. In addition, the "Without a Shipper <12 Months" category will also be affected because it is composed of sites that will end up in both the PTS and SSrP categories. UG from the SSrP sites will remain permanent in 2014/15, but that from the PTS sites will be temporary because in this year, any site that has been without a Shipper for less than 12 months will have become Shipperless after 25/01/2013.

    Therefore, it will be necessary to estimate the impact of the 25/01/2013 changeover on future UG. This can be done by comparing the individual MPRN files from one snapshot to the next for a number of snapshot files. The number of sites that appear in Snapshot N+1 but not Snapshot N represent the number of sites that have become Shipperless in the relevant time period (i.e. in the 2 months beginning 12 months before the date of Snapshot N). Carrying out this comparison for a number of time periods will allow an average proportion of newly Shipperless sites per snapshot to be produced, and this can be applied to data from the current snapshot files to estimate the effect of Mod 0424 on Shipperless PTS UG in 2014/15. For "Without a Shipper <12 Months" sites, the average split of Shipperless UG between the PTS and SSrP categories can also be calculated using the snapshot files. This can be used to estimate the effect of the temporary nature of UG from PTS sites in the 2014/15 formula year.

These adjustments will therefore be applied to data for these UG categories in the figures that feed through into the AUGS. The full calculation for “Without a Shipper <12 Months” is described in Step 15 below.

14. The final figures produced in this way are now used to populate the AUGS for all categories except “Without a Shipper <12 Months”.

15. “Without a Shipper <12 Months” UG is calculated using gas safety visit data contained in the “GSR Passed To Shipper” spreadsheet. This file contains the details of each Shipperless site that has crossed the 12-month threshold during a period of a year and has subsequently been visited and found to be flowing gas. The actual sites listed in this file by definition appear in the summarised data in the snapshot files because they have been Shipperless for more than 12 months. If it is assumed that sites become Shipperless at a steady rate, however, it can be assumed that the number and AQ of sites crossing the 12-month threshold in Year Y is a good approximation of the number and AQ that will cross in Year Y+1. At the end of Year Y these sites will have been Shipperless for less than 12 months and hence make up the “Without a Shipper <12 Months” UG category for this year.

    Therefore, in order to estimate the UG from this category, the AQs from the gas safety visit data are aggregated by LDZ and SSP/LSP split. Given that the sites in question will have been becoming Shipperless at a steady rate throughout the year, they will on average have been Shipperless for 6 months each. Therefore each aggregate AQ total is divided by 2 to give the final total UG estimate for this category. This figure then needs to be split into PTS and SSrP components.

    All sites that fall into the “Without a Shipper <12 Months” category will end up either as Shipperless PTS or Shipperless SSrP if they remain Shipperless for more than a year. Under the terms of Mod 0424, any UG from Shipperless PTS sites that became Shipperless after 25/01/13 is temporary and hence should be removed from the “Without a Shipper <12 Months” permanent UG total. The Gas Safety Visit data does not group sites into those with an existing meter and those with a new meter, and so the split of “Without a Shipper <12 Months” UG into PTS and SSrP categories is done using ratios obtained from the Xoserve snapshot data. PTS UG estimated in this way is classified as temporary, whilst SSrP UG is classified as permanent.

    The current AUGS provides UG estimates for the 2014/15 formula year. During this year, any site that has been Shipperless for less than 12 months must, by definition, have become Shipperless after 25/01/13, and so no further modification is required with respect to the dates at which the sites became Shipperless.

6.6 IGT CSEPs

The methodology for IGT CSEPS has not changed and is the same as that described in the 2011 AUGS for 2012/13 [10]. However, for completeness it is included in this AUGS.

Connected System Exit Points (CSEPs) are typically small networks owned by Independent Gas Transporters (iGTs) that connect to the GTs’ systems. They are often new housing estates, where the gas network for the estate has been built and is owned by an iGT. CSEPs can potentially contribute to Unidentified Gas where either loads within them or entire iGT networks are not recognised by the Xoserve system and are thus taking gas in an unrecorded manner.

Regular meetings are held between then iGTs and Xoserve with regard to Unknown Projects (ie CSEPs that are not registered on the Xoserve system), and a regular report is produced. Xoserve have put systems in place in order to report not only the number of Unknown Projects but also their composition in terms of number of sites and aggregate AQ. This report is produced every two months and supplied to the AUGE. The composition of Unknown Projects is not split by EUC or SSP/LSP market sector, and therefore this split has to be estimated from other data.

Xoserve have also provided a breakdown of known CSEPs, with a split between known sites on known CSEPs and unregistered sites on known CSEPs. Both of these data sets are split by EUC, and can hence be aggregated up to SSP/LSP level. For each EUC, both the number of sites and the AQ is reported.

The contribution of unregistered sites to Unidentified Gas is simple to calculate using this information, and in addition the average composition of known CSEPs (in terms of percentage SSP/LSP split) can be used as a basis for splitting Unknown Projects into their market sector components. This also allows both LSP and SSP UG to be calculated for Unknown Projects.

The final step in the calculations for CSEPs is to define the Unidentified Gas estimates as either temporary or permanent. For this element of the UG estimate, LSP sites are backbilled and hence UG from these is temporary and excluded from further calculations. SSP UG is permanent and so feeds into the final estimates.

6.7 LSP and SSP Metering Errors

The analysis for this element of the UG calculation remains the same as described in the 2011 AUGS for 2012/13 [10] and is included here with reference to the Consumption Method for completeness. The figures will be updated based on the latest data when the final UG estimates for 2014/15 are produced.

The effects of LDZ metering errors and known DM/Unique Site supply point errors are discussed in Section 6.2 above. In addition, errors in SSP and NDM LSP supply point meters can cause gas to be burnt in an unrecorded or inaccurately recorded manner and hence have the potential to contribute to Unidentified Gas. An assessment of this area of metering error has therefore been carried out.

The GL Noble Denton Metering Team were asked to provide input for the analyses identified above, and the conclusions drawn in this section come from them. The following conclusions were drawn from the investigation:

- Very little work has been done in the field of accurately assessing meter drift over time. Information is available about calibration curves taken at a particular point in time for certain meters, but there has never been any dedicated work looking at how these change over time. Therefore, conclusions drawn in this area are largely based on anecdotal evidence and/or extrapolation.
- Smaller sites (i.e. SSP loads and smaller LSP loads) typically have diaphragm meters. The rubber diaphragm is known to warp over time, which causes drift in meter readings. Available evidence suggests that drift is equally likely to be up or down, which would result in a net bias of zero across each population. In the absence of any evidence to the contrary, this is therefore the assumption made throughout the UG calculations.
- In order for a more detailed analysis of meter drift to be carried out, a large amount of data would have to be collected via a national meter survey similar to that conducted many years ago, as noted in the AUGE's responses to comments on the second draft of the 2012 AUGS for 2013/14 [20]. To carry out such a survey would be a significant undertaking as it would require a random sample of a sufficient size to cover many classes of meter (e.g. age of meter, type, model, level of consumption, capacity etc),

as well as co-operation of the customers and the physical testing of the meter itself with properly calibrated equipment. If such a survey was commissioned and carried out, the results could be used in future analyses of meter error. In the meantime, however, the evidence available leads to the assumption of a net zero drift over the population being used.

- Larger sites and offtakes generally have rotary/turbine meters that are constructed of metal and are unlikely to warp over time. These drift less than diaphragm meters, and again are equally likely to drift up or down, resulting in a net bias of zero across the population.
- Where large errors requiring an ad-hoc adjustment are found, these affect the UG calculations directly as described in Section 6.2. Data regarding such adjustments is supplied to the AUGE by Xoserve on a regular basis and is used to adjust the initial UG estimates.
- Calibration curves for both diaphragm and rotary/turbine meters follow a similar pattern. Such a curve for an NDM LSP RPD meter is shown in Figure 8 below.

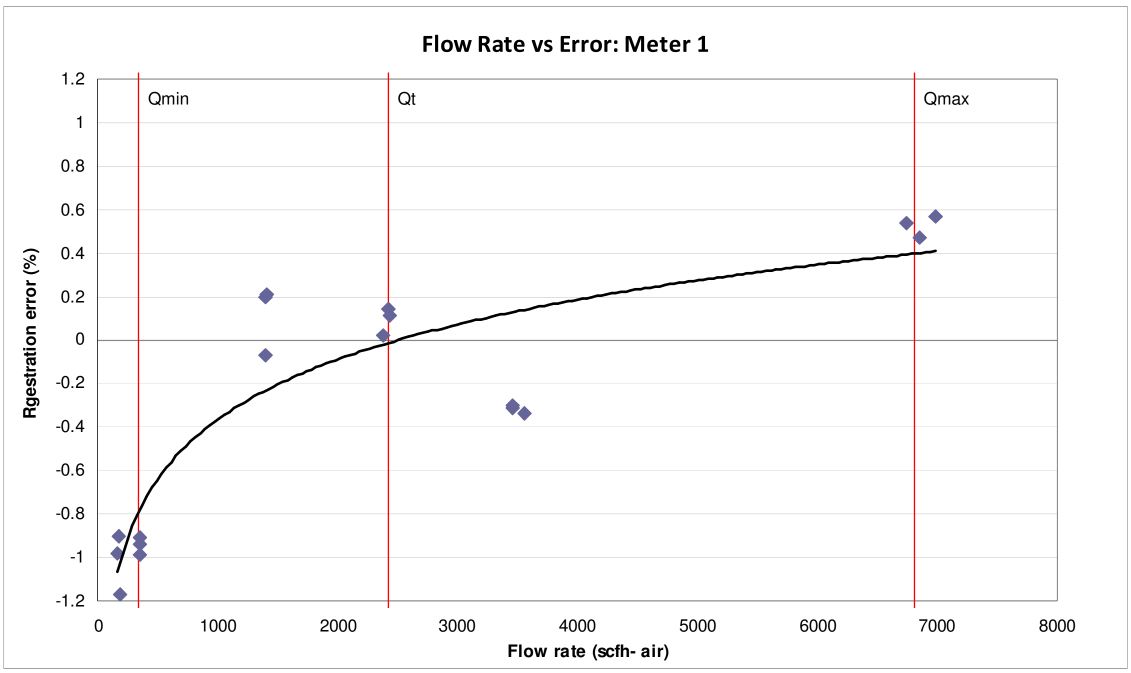

Figure 8: Typical Calibration Curve for an RPD Meter

Data for this graph was provided by the GL Noble Denton metering team and comes from laboratory testing of a typical RPD meter. All identifying information has been removed for confidentiality purposes.

- The prominent features of this calibration curve are a consistent under-read of 1%-1.5% when operating at or below Q_{min}, unbiased readings around Q_t, and a consistent over-read at or close to Q_{max}.
- Meters are designed to operate at or around Q_t, ensuring that unbiased readings are obtained. This is not always the case, however, and circumstances may arise that cause some meters to operate close to Q_{min} or Q_{max}.
  - Loads at a particular site can drop over time, either due to changes in gas usage or because of economic conditions. This can lead meters to operate consistently close to Q_{min}.
  - Where businesses expand their operations without informing their gas supplier, the meter may no longer be appropriate for the load, causing it to run at or above Q_{max}.

Based on the above conclusions, an assessment of likely meter operating zones was carried out. Available data was limited to the meter capacity and AQ of each LSP site, and this required the AQ to be used to estimate average hourly load, which could then be compared to meter capacity. This translation from annual load to hourly load necessarily introduces uncertainty into the analysis, but the comparison of average hourly load and meter capacity allows those meters that are likely to be operating at their extremes to be identified.

- Sites with an average hourly flow of less than 1% of meter capacity were considered to be likely to be operating at or around Q_{min} when gas was flowing. These were assumed to be operating with an average under-read of 1.5%.
- Sites with an average hourly flow of more than 95% of meter capacity were considered to be likely to be operating at or around Q_{max} when gas was flowing. These were assumed to be operating with an average over-read of 0.5%.

The effects of under-reads and over-reads work in different directions, and the difference between then represents the net over- or under-read in the population.

- A net under-read for any given LDZ results in permanent Unidentified Gas equal to the value of the under-read.
- A net over-read for any given LDZ results in the raw estimate of Unidentified Gas being over-stated, and it is therefore adjusted down by the value of the over-read.

6.8 Shipper Responsible Theft

As described in Section 4.7, undetected theft (which forms the vast majority of the Balancing Factor) will be calculated using the Throughput Method. This is a very simple method that splits this element of UG in the same proportion as SSP/NDM LSP throughput. This has a number of advantages over other methods of splitting theft between market sectors, as follows:

- This method acts as an incentive to reduce theft as it removes the situation where detecting a theft would increase the theft split percentage for that market sector. Instead, prevention and detection of theft will reduce the total UG figure, which in turn will result in a lower residual figure for the Balancing Factor. This will result in a lower figure of UG in each sector.
- It is simple and transparent to calculate.
- It cannot be manipulated or affected by different detection rates.
- It does not rely on estimates of theft and estimates of periods of theft.
- It does not rely on estimation of AQs and correct sector assignment of detected thefts which is fundamental to any theft split method.
- Other elements of the Balancing Factor (i.e. those elements bundled in with theft) are also apportioned by throughput.
- Issues concerning treatment of unregistered theft-affected sites and use of pre/post theft AQ are removed.
- The risk of large changes in theft split percentages year on year is reduced.

Going forward, the market sector split for theft will not be calculated using allocations from the ODR report. Instead, the split will be calculated using the seasonal normal adjusted consumption values calculated to estimate UG. This has the advantage that the effects of UG can be correctly allocated by market sector and makes no assumption about the statistical properties of RbD.

T^{LSP} = the ratio of LSP seasonal normal throughput to the total seasonal normal throughput defined below.

$$T^{LSP} = \frac{Tput_{SN}^{LSP}}{\left(Tput_{SN}^{LSP} + Tput_{SN}^{SSP}\right)}$$

where $Tput_{SN}^{LSP}$ and $Tput_{SN}^{SSP}$ are the total LSP and SSP throughputs calculated over the same 3 formula years as the total UG, corrected to seasonal normal conditions. These values also include any directly calculated UG associated with the relevant market sector. $Tput_{SN}^{LSP}$ is calculated as follows (and $Tput_{SN}^{SSP}$ is calculated in a similar way):

$$Tput_{SN}^{LSP} = \sum_{LDZ=1}^{13} \sum_{yr=1}^{3} \left(SNCons_{LDZ,yr}^{LSP} + UGPerm_{LDZ,yr}^{LSP}\right)$$

where

$SNCons_{LDZ,yr}^{LSP}$ = Calculated seasonal normal annual consumption for all LSP meters

$UGPerm_{LDZ,yr}^{LSP}$ = Total permanent directly calculated component of UG for all LSP meters (includes shipperless sites, unregistered sites and iGT CSEPs) occurring over the relevant year.

The resulting factor (T^{LSP}) is used when calculating the LSP permanent UG as described in Section 6.10.

6.9 DM LSP Market Sector

In the 2011 AUGS for 2012/13, the UG attributed to DM LSP sites was concluded to be negligible. This is based on the following assumptions:

- There is no theft from DM sites.
- Any Unregistered DM sites are backbilled.
- DM sites do not become Shipperless.
- There are no unknown DM sites.

In addition, it is known that DM sites on unknown CSEPs will be backbilled because this applies to all LSP sites on CSEPs.

This leaves only unknown meter error for DM sites, and as described in the Worked Example in Section 6.11 below, current data indicates that there is little or no over-read on DM sites due to meters working at the very low end of their range.

Updated data received during the course of the current formula year will be reviewed to confirm whether these assumptions still hold or not. At the time of this draft DM LSP UG is concluded to be negligible.

6.10 Aggregation of Final National UG Figure

Although the analysis of UG has been carried out on an LDZ by LDZ basis, the final national figure will be based on the combined total.

For 2014/15 this will be based on the total LDZ consumptions for formula years 2009-2011 subtracted from their corresponding total NDM allocations with corrections for meter error and temporary UG which includes detected theft.

The resulting figure will be averaged over the years used, and split into the LSP and SSP sectors.

The total permanent UG for the LSP sector (FUG_{LSP}) is calculated by adding the directly calculated permanent UG for the LSP sector to the LSP portion of the Balancing Factor.

$$FUG_{LSP} = \frac{1}{3}\sum_{LDZ=1}^{13}\sum_{yr=1}^{3}\left(BF_{LDZ,yr}^{LSP} + DCPUG_{LDZ,yr}^{LSP}\right)$$

where,

$DCPUG_{LDZ,yr}^{LSP}$ = Directly Calculated Permanent UG for LSP by LDZ, year

$BF_{LDZ,yr}^{LSP}$ = Balancing Factor for the LSP sector by LDZ, year as defined below

$$BF_{LDZ,yr}^{LSP} = BF_{LDZ,yr}^{All} \times T^{LSP}$$

where,

T^{LSP} = the ratio of LSP seasonal normal throughput to the total seasonal normal throughput as defined in Section 6.8.

$BF_{LDZ,yr}^{All}$ = Total Balancing Factor quantity for a given LDZ, year as defined below,

$$BF_{LDZ,yr}^{All} = Alloc_{LDZ,yr}^{SSP} + Alloc_{LDZ,yr}^{LSP} + LDZcorr_{LDZ,yr} + DMcorr_{LDZ,yr} - Cons_{LDZ,yr}^{LSP} - Cons_{LDZ,yr}^{SSP} - UG_{LDZ,yr}^{Temp}$$

where,

$Alloc_{LDZ,yr}^{SSP}$ = SSP Allocations for each LDZ for each year used

$Alloc_{LDZ,yr}^{SSP}$ = LSP Allocations for each LDZ for each year used

$LDZcorr_{LDZ,yr}$ = Total LDZ level meter corrections per LDZ per year

$DMcorr_{LDZ,yr}$ = Total DM and Unique site meter corrections per LDZ per year

$Cons_{LDZ,yr}^{SSP}$ = Calculated total SSP consumptions per LDZ per year

$Cons_{LDZ,yr}^{LSP}$ = Calculated total LSP consumptions per LDZ per year

$UG_{LDZ,yr}^{Temp}$ = Total temporary UG by LDZ by year from the direct calculated UG process including total detected theft

6.11 Worked Example

In order to illustrate how the above techniques are applied in practice, the following worked example is provided for an unspecified LDZ (referred to as XX LDZ) and year. This shows how each element of UG is calculated and how it contributes to the final total. The values used throughout this example are for illustrative purposes only and do not relate to real figures from any LDZ.

The UG calculation takes places in stages, as follows:

1. Calculation of total UG using the consumption method. At this stage this includes both permanent and temporary UG and in the 2012 AUGS was calculated over the formula years 2009 to 2010 and seasonally adjusted. The calculation is carried out as described in Section 6.1 above,and for XX LDZ the total calculated UG is 550.0 GWh.

2. The temporary UG total is now calculated for the categories of UG listed in the table in Section 3.3 and calculated as described in the 2011 AUGS for 2012/13 [10]. This is deducted from the total UG figure calculated in Step 1 above to give the total permanent UG. In this example, temporary UG totals 50.0 GWh and hence:

   Permanent UG = Total UG – Temporary UG = 550 GWh – 50 GWh = 500 GWh

3. The next stage of the process is to calculate the directly estimated components of UG. This is done separately for SSP and LSP, thereby giving a breakdown by market sector as well as the total for each component.

4. The iGT CSEPs calculation is based on data provided by Xoserve in the Unknown Projects Summary, along with information about live and Unregistered sites on known CSEPs. Figures are as follows for XX LDZ:

   Unknown Projects = 100
   Supply Point Count = 1305
   AQ Total = 18.0 GWh

   From known CSEPs in XX LDZ:

   SSP Supply Point proportion = 99.5%
   LSP Supply Point proportion = 0.5%
   SSP AQ proportion = 84.0%
   LSP AQ proportion = 16.0%

   These figures are used to split the unknown project supply point count and aggregate AQ by market sector:

   For unknown projects:

   SSP Supply Points = 1299
   LSP Supply Points = 6
   SSP AQ = 15.0 GWh
   LSP AQ = 3.0 GWh

Data regarding Unregistered sites on known CSEPs is supplied by Xoserve and is as follows:

SSP Supply Points = 3000
LSP Supply Points = 10
SSP AQ = 45.0 GWh
LSP AQ = 0.1 GWh

Total UG from this source is the combination of these two, plus a proportion of 10 unknown projects with unknown LDZ smeared across all LDZs:

SSP Supply Points = 4400
LSP Supply Points = 16
SSP UG = 62.0 GWh
LSP UG = 3.5 GWh

Note that the LSP UG calculated here is temporary in nature and forms part of the 50 GWh subtracted from the initial total UG in Step 2. It is therefore not taken further into the final UG categorisation. The SSP UG is permanent and is taken forwards.

5. Shipperless and Unregistered sites are split into six categories. Calculations for each category are very similar, so a single typical example - LSP Shipper Activity Sites - is given here.

   Site count and AQ data is supplied in the two-monthly snapshot files. Figures for XX LDZ are:

   Snapshot 1 AQ: 2.6 GWh
   Snapshot 2 AQ: 3.2 GWh
   Snapshot 3 AQ: 3.0 GWh
   Snapshot 4 AQ: 3.2 GWh
   Snapshot 5 AQ: 2.8 GWh
   Snapshot 6 AQ: 3.0 GWh
   Snapshot 7 AQ: 2.9 GWh

   The gas consumed between snapshot x and snapshot y is calculated as the average AQ across these two snapshots, multiplied by the appropriate factor from Table 7 in the 2011 AUGS for 2012/13 [10] to reflect the time of year:

   Snapshots 1-2: Average AQ = 2.9 GWh
   Time of year factor = 0.065
   Percentage of orphaned/shipper activity sites with non-zero opening reads = 36.8%
   Percentage of occurrences that are not backbilled = 31.25%
   Permanent UG = 2.9 GWh * 0.065 * 36.8% * 31.25% = 21,678 kWh

   Similar calculations for the remaining snapshots give the following consumptions:

   Snapshot 1-2: 21,678 kWh
   Snapshot 2-3: 24,955 kWh
   Snapshot 3-4: 65,205 kWh

Snapshot 4-5: 96,600 kWh
Snapshot 5-6: 86,250 kWh
Snapshot 6-7: 50,370 kWh
Total: 0.35 GWh

Calculations for each other category of Shipperless or Unregistered site are similar. The final totals of permanent UG across all categories of Shipperless/Unregistered sites for LDZ XX are:

SSP UG = 10.6 GWh
LSP UG = 75.5 GWh

6. For meter errors, sites with an average hourly consumption (calculated from the AQ) of 1% or less of their Q_{max} value are considered to be consistently operating in the "under-read" area. Sites with an average hourly consumption of 95% or more of their Q_{max} value are considered to be consistently operating in the "over-read" area. The average levels of under-read and over-read are taken from calibration curves, as described in detail in the 2011 AUGS for 2012/13 [10].

   Average under-read: 1.5%
   Average over-read: 0.5%

   Total sites in under-read zone for XX LDZ: 5000
   Aggregate under-read: 2.0 GWh

   Total sites in over-read zone for XX LDZ: 5
   Aggregate over-read: 0.1 GWh

   Net contribution to UG: 2.0 GWh – 0.1 GWh = 1.9 GWh

   This is the error arising from the NDM LSP market and hence this is where the full 1.9 GWh is applied..

7. The sum of the directly measured UG components calculated in Steps 4-6 above gives the figure for total directly measured permanent UG. The SSP and LSP elements are summed and deducted from the total UG figure (calculated in Step 2 above) to give the total for the Balancing Factor. At this stage the Balancing Factor is a single figure, the sum of SSP and LSP elements.

   Balancing Factor = 500.0 GWh – Total Directly Measured = 350.0 GWh

8. All elements of the Balancing Factor other than Theft are either small or will sum to zero over time. Therefore it is reasonable to split the Balancing Factor volume between the SSP and LSP market sectors using the percentage split for Theft, as defined in Section 6.8 above.

   SSP proportion = 76.7%
   LSP proportion = 23.3%

   For XX LDZ for a single year:

   Total UG = 550.0 GWh

Temporary UG = 50.0 GWh
Total Permanent UG = 500.0 GWh
Directly Measured UG = 150.0 GWh
Aggregate Balancing Factor = 350.0 GWh

SSP Balancing Factor = 350.0 * 0.767 = 268.5 GWh
LSP Balancing Factor = 350.0 * 0.233 = 81.5 GWh

9. Finally, total UG from each sector is calculated by summing the components, values for all of which have now been populated:

   SSP UG = 62.0 GWh + 10.6 GWh + 268.5GWh = 341.1 GWh
   LSP UG = 75.5 GWh + 1.9 GWh + 81.5 GWh = 158.9 GWh
   Total UG = 341.1 GWh + 158.9 GWh = 500 GWh

These calculations are then repeated for each LDZ and year to give an estimate over 3 years.

7 Unidentified Gas Estimates

This section is reserved for a set of tables containing the best estimates of UG calculated using the methods described in Section 6 and in previous versions of the AUGS. These values will be calculated using the methodology once this has been approved by the UNCC and the most recent data that is available applied. Estimates will be presented on an LDZ by LDZ basis, with each LDZ's figures split into SSP and LSP market sectors, and also by each category of UG. The Scottish Independents will also be included within the figures for SC LDZ, although their contribution to the overall UG figure has been negligible up to this point. These tables will therefore give a full breakdown of UG by source in each LDZ.

An example (unpopulated) table is shown below. The top section shows the breakdown of UG by category, with different columns for the SSP and LSP market sectors. The individual components of the Shipperless/Unregistered category are shown in grey, with the total for the category in black. The total of the directly measured components is shown, to which the Balancing Factor (i.e. Theft plus Other) is added to give the overall LDZ UG totals for the SSP and LSP sectors, which are shown in bold. All units are GWh.

Table 17: Unidentified Gas Summary (GWh) – Example Table

	XX LDZ		
	SSP	NDM LSP	DM LSP
iGT CSEPs	0.00	0.00	0.00
Shipperless/Unregistered	0.00	0.00	0.00
- Shipper Activity	0.00	0.00	0.00
- Orphaned	0.00	0.00	0.00
- Unregistered <12 Months	0.00	0.00	0.00
- Shipperless PTS	0.00	0.00	0.00
- Shipperless SSrP	0.00	0.00	0.00
- Without Shipper <12 Months	0.00	0.00	0.00
Meter Errors	0.00	0.00	0.00
Total Directly Measured	0.00	0.00	0.00
Theft + Other	0.00	0.00	0.00
Total	**0.00**	**0.00**	**0.00**

7.1 Estimation of SAP price

The estimation of SAP price will be based on the methods used for the AUGS year 2012/13. The SAP price for 2014/15 will be estimated using the latest SAP price data obtained at the time the interim and later when the final figures and rates are calculated.

This 2014/15 SAP price is only used to provide a common basis for estimating the overall cost of UG in the coming gas year. In practice the SAP price actually used will be the daily average SAP price over the reconciliation billing period in question and the shipper's relevant aggregate AQ share. This is described in the TPD [6] section E 10.5.

7.2 Final AUGS Table

To be populated following UNCC approval of AUGS methodology.

8 Consultation Questions and Answers

This section captures a history of the questions raised by industry bodies during the consultation periods and the AUGE's responses. These relate to all drafts of the 2011 AUGS for 2012/13 and the 1st and 2nd draft 2012 AUGS for 2013/14. The questions have been assessed against the AUGE Guidelines [1] and responses provided as appropriate. All questions and answers have also been published on the Joint Office website.

Due to the in-depth nature of the questions raised and the detailed responses required, it is not appropriate to publish full transcripts in this document. Instead, this section contains a summary of the organisations that provided questions. The questions themselves and their associated responses can be found in external documents "AUGS Query Responses 30_09_2011" [18], "AUGS Draft2 Query Responses 14_11_2011" [9], "AUGS Query Responses 19_03_2012" [11], "AUGE Responses to 1st Draft 2012 AUGS" [12], "AUGE Responses to Interim Report Consultation" [13] and "AUGE Responses to 2nd Draft AUGS Consultation 12032013" [20].

Note that all responses contained in these documents relate to the UG calculations at the time they were written, rather than reflecting the process as it currently stands. Therefore, wherever information differs between the responses and the latest AUGS, this is because the UG analysis has evolved and information in the response documents has been superseded. The information supplied in the latest version of the AUGS is always the most up-to-date.

Table 18 below contains a list of organisations that responded to the first draft of the 2011 AUGS for 2012/13.

Table 18: Responses to the First Draft of the 2011 AUGS

Organisation Name	Date of Communication
National Grid Transmission	06/05/2011
Corona Energy	23/05/2011
E.On	23/05/2011
British Gas	15/06/2011
EDF Energy	16/06/2011
GDF Suez	16/06/2011
Gazprom	17/06/2011
ScottishPower	17/06/2011

Table 19 below contains a list of organisations that responded to the second draft of the 2011 AUGS for 2012/13.

Table 19: Responses to the Second Draft of the 2011 AUGS

Organisation Name	Date of Communication
Npower	31/10/2011
ICoSS	31/10/2011
Total Gas and Power	31/10/2011
ScottishPower	31/10/2011
British Gas	31/10/2011

Table 20 below contains a list of organisations that responded to the final version of the 2011 AUGS for 2012/13.

Table 20: Responses to the Final Draft of the 2011 AUGS

Organisation Name	Date of Communication
British Gas	20/02/2012
Inexus	08/03/2012
Shell Gas Direct	08/03/2012

Table 21 below contains a list of organisations that responded to the first draft of the 2012 AUGS for 2013/14.

Table 21: Responses to the First Draft of the 2012 AUGS

Organisation Name	Date of Communication
Energy UK	15/06/2012
ScottishPower	15/06/2012
ICoSS	29/06/2012

Table 22 below contains a list of organisations that responded to the September 2012 Interim Report

Table 22: Responses to the September 2012 Interim Report

Organisation Name	Date of Communication
Energy UK	28/09/2012
Gazprom	28/09/2012
Corona Energy	28/09/2012
Npower	28/09/2012
Total Gas and Power	28/09/2012

Table 23 below contains a list of organisations that responded to the 2nd Draft of the 2012 AUGS for 2013/14.

Table 23: Responses to the Final Draft of the 2012 AUGS

Organisation Name	Date of Communication
ICoSS	01/03/2013
DONG Energy	01/03/2013
Energy UK	01/03/2013
RWEnpower	01/03/2013
ScottishPower	01/03/2013
SSE Energy Supply	01/03/2013
British Gas	01/03/2013

9 Contact Details

Questions can be raised with the AUGE at AUGE@gl-group.com

10 References

[1] Guidelines for the Appointment of an Allocation of Unidentified Gas Expert and the provision of the Allocation of Unidentified Gas Statement V3.0, 24th February 2011

[2] Mod 0194 Framework for correct apportionment of NDM error

[3] Mod 0194a Framework for correct apportionment of LSP unidentified gas

[4] Mod 0228/0228A Correct apportionment of NDM Error – Energy

[5] Mod 0229 Mechanism for Correct Apportionment of Unidentified Gas implemented in UNC Section E 10 v3.54 26th April 2011,

[6] Uniform Network Code (UNC) Transportation Principal Document

[7] Mod 0398: Limitation on Retrospective Invoicing and Invoice Correction Version 6.0, 28 August 2012

[8] AUGS Draft 1 Query Responses, September 2011

[9] AUGS Draft 2 Query Responses, November 2011

[10] AUGS Final (Version 4), December 2011, GL Noble Denton

[11] 2011 AUGS for 2012/13 Query Responses 19_03_2012, March 2012

[12] AUGE Responses to 1st Draft 2012 AUGS for 2013_14 Consultation, July 2012

[13] AUGE Responses to Interim Report Consultation 17102012, October 2012

[14] Modification 0429 Version 4.0, 27 January 2013

[15] Modification 0410 Version 7.0, 09 January 2013

[16] Final Modification Report 0424 Version 4.0, 20 December 2012

[17] Draft Modification Report 0425 Version 1.0, 21 March 2013

[18] AUGS Query Responses 30_09_2011, GL Noble Denton

[19] 2012 AUGS for 2013/14 Final Version, December 2012, GL Noble Denton

[20] AUGE Responses to 2nd Draft AUGS Consultation 12032013, March 2013

[21] Modification 0410A Version 7.0, 12 November 2012

[22] Mod 0398 OFGEM decision letter 1 March 2013

[23] Mod 0424 OFGEM decision letter 24 January 2013

[24] Mod 0282 Introduction of a process to manage Vacant sites 2010/11

[25] Estimation of CSEP Leakage, Roy Malin, National Grid Distribution, 22nd February 2013

[26] SPAA Schedule 33 “Theft of Gas Code of Practice” from version 9.4 of SPAA ,1st April 2013

Glossary

AGI	Above Ground Installation
ALP	Annual Load Profile (deeming algorithm parameter)
AQ	Annual Quantity. An estimate of annual consumption under seasonal normal conditions
AUGE	Allocation of Unidentified Gas Expert
AUGS	Allocation of Unidentified Gas Statement
Balancing Factor	An aggregate of the combined unidentified gas of various items calculated by subtraction. This includes theft, errors in the Shrinkage estimate, open bypass valves, meters “Passing Unregistered Gas”, unknown sites, and additional Common Cause variation.
Consumption Method	Unidentified Gas methodology using meter reads and metered volumes
CSEP	Connected System Exit Point
CV	Calorific Value
CWAALP	Cumulative Weather Adjusted Annual Load Factor
CWV	Composite Weather Variable
DAF	Daily Adjustment Factor (deeming algorithm parameter)
DM	Daily Metered
ECV	Emergency Control Valve
EUC	End User Category
EWCF	Estimated Weather Correction Factor (deeming algorithm parameter. Alternative to WCF based on CWV rather than demand)
IGT	Independent Gas Transporter
LSP	Larger Supply Point
MAM	Meter Asset Manager
Model Error	The statistical error associated with any modelling or estimation process. It an inherent part of any statistical model and does not imply that the model itself is inadequate or incorrect.
MPRN	Meter Point Reference Number
NDM	Non Daily Metered
OUG	Own Use Gas
PSND	Pseudo Seasonal Normal Demand calculated using AQ values rather than being based on historic metered demands
RbD	Reconciliation by Difference
RbD-based Method	The methodology developed and approved in 2011 AUGS for 2012/13
SF	Scaling Factor (deeming algorithm parameter)

SNCWV	Seasonal Normal Composite Weather Variable
SND	Seasonal Normal Demand
SSP	Smaller Supply Point
TPD	Transportation Principle Document
UIP	Utility Infrastructure Provider
UNC	Uniform Network Code
UG	Unidentified Gas
WAALP	Weather Adjusted Annual Load Factor
WCF	Weather Correction Factor (deeming algorithm parameter)
WSENS	Weather Sensitivity (deeming algorithm parameter used in EWCF definition. Sensitivity of an EUC to difference in CWV from seasonal normal)

Appendix A Raw Data Description

This appendix describes the raw data provided by Xoserve for the consumption method.

A.1 ALLOCATIONS

This data contains all allocations including CSEPs from 01/04/2008 onwards.

Name	Description
GAS_DAY	Date - Gas day for which allocation applies
LDZ	Char[2] - LDZ identifier e.g. EA
EUC	Char[11] - Full EUC Code e.g. WM:E0708W02
ALLOCATED_ENERGY	Number - Final allocated energy value (kWh). Includes CSEPs

A.2 ANNUAL_QUANTITY

This data includes all meter points active at any point from 01/04/2008 onwards, not just those currently live. It includes all within gas year updates, appeals etc.

Name	Description
MPR_ID	Number – Unique dummy ID for meter point which is used consistently throughout the data
AQ_EFFECTIVE_DATE	Date - Date on which AQ becomes effective
EUC	Char[11] - Full EUC Code e.g. WM:E0708W02
AQ	Number - Annual Quantity to apply from effective date (kWh)
SITE_TYPE_FLAG	Char[1] - Indicator ="N" for NDM meter point, "D" for DM meter point or "U" for Unique site

A.3 CSEPS

This data contains information for formula year 2008 onwards.

Name	Description
FORMULA_YEAR	Date - Formula year for which CSEP AQ/Numbers apply
EUC	Char[11] - Full EUC Code e.g. WM:E0708W02
TOTAL_AQ	Number - Aggregate CSEP AQ at start of formula year
COUNT_OF_SUPPLY_POINTS	Number - Count of supply points at start of formula year

A.4 FACTORS

This data is provided from 1st April 2008

Name	Description
LDZ	Char[2] - LDZ identifier e.g. EA
EUC	Char[11] - Full EUC Code e.g. WM:E0708W02
GAS_DAY	Date - Gas day for which factors applies
ALP	Number - Annual Load Profile
DAF	Number - Daily Adjustment Factor
EWCF	Number - Estimated Weather Correction Factor
CV	Number - Calorific Value

A.5 METER_READS

This data includes all meter reads from 01/04/2008 onwards. Multiple records for a meter point with the same date are filtered by Xoserve using the following methodology.

Where there is an A (Actual) Read Type and an E (Estimate) Read Type Xoserve remove the E and retain the A Read. Where there are Read Types of R (Replacement) Xoserve retain this read and remove the original read type that it replaced. Where there are multiple R Reads they are ranked by number e.g. R01 and R02 and the highest number is the latest replacement read that is retained.

Name	Description
MPR_ID	Number - Unique dummy ID for meter point which is used consistently throughout the data
METER_READ_DATE	Date - Date of meter read
IMP_IND	Char[1] - Indicator ="Y" for imperial meter read, else "N"
METER_READ_VAL	Number - Value of meter read
METERED_VOL	Number - volume of gas since previous meter read in units appropriate for meter (imperial or metric)
ROUND_THE_CLOCK_IND	Number – Number of times the meter index has passed zero since the last read.
AQ	Number – Prevailing Annual Quantity at time of meter read (kWh)
METER_READ_FREQ	Char[1] - Indicator for frequency of meter reads (A-Annual, 6-6 monthly, M-monthly)
SSP_LSP	Char[3] - "SSP" or "LSP"
EUC	Char[11] - Full EUC Code e.g. WM:E0708W02
READ_TYPE_CODE	Char[4] - Code for type of meter read

The read type codes are as follows:

Code	Description
A	Agreed between Shippers
AR01	Actual Read (Replacement)
B	Xoserve estimated unbundled or opening read
C	End user read (bundled)
D	Xoserve estimated unbundled final read
E	Estimated / Automatic
F	Final read for metering transaction
G	Gas card Read (Opening)
I	Information read
J	Further read agreed between Shippers, used for final unbundled meter reads
K	End user read provided by the Shipper
L	Further read not agreed between Shippers, used for final unbundled read
M	Estimated (manual)
N	A Normal / Firm read
O	Opening read for metering transaction
P	Opening read for corrector transaction
Q	Shipper Provided Estimated Read
R	Replacement read
S	Shipper provided read
T	Transfer of ownership
U	Meter reading organisation read, provided by the Shipper
V	Cyclic read from MRA and is used for Shipper transfer
W	Cyclic read from Shipper used for transfer
X	Remote Reading Equipment Read (Normal)
XROx	Remote Reading Equipment Read (Replacement)
Y	Remote reading Equipment Read (Opening)

A.6 METER_INFO

Name	Description
MPR_ID	Number - Unique ID for meter used across ALL data
LDZ	Char[2] - LDZ identifier e.g. EA
NUM_DIALS	Number - Number of meter dials
IMP_IND	Char[1] - Indicator ="Y" for imperial meter read, else "N"
METER_FITTED_DATE	Date - Date meter was fitted
UNITS	Number - Multiplier for meter read units (1, 10, 100 etc)
CORRECTION_FACTOR	Number - Correction factor (P & T)

A.7 NEW_LOST_SITES

This data contains all meter points with a first confirmation date or an end date from 01/04/2008 onwards.

Name	Description
MPR_ID	Number - Unique dummy ID for meter point which is used consistently throughout the data
START_DATE	Date - First confirmation date for meter point
END_DATE	Date - Date meter point was excluded from allocations process

A.8 METER_ERRORS

Name	Description
METER_TYPE	Data for all of the following meter point categories is required: DM, Unique, CSEP, LDZ Offtake
LDZ	Char[2] - LDZ identifier e.g. EA
START_DATE	Date - Start date of error
END_DATE	Date - End date of error
ADJUSTMENT	Number - Value of adjustment in kWh

Appendix B Consumption Algorithm Database Description

This appendix describes the data structure used by the AUGE to store the data required for the consumption analysis.

The majority of data is stored in separate tables for each LDZ. The two letter abbreviation for each LDZ is appended to the name of the relevant tables. This is denoted below by _XX. Where a database field is described as raw data it contains unprocessed data from Xoserve. All other fields are derived from this information.

There is a database package which encodes the consumption algorithm. It is run by calling consumption.calculate_all(p_year=>XXXX);

There are also two packages POPULATE_SITE_LIST and PROCESS_METER_READS which help with the necessary pre-processing of the data.

B.1 ANNUAL_QUANTITY_XX

Name	Description
MPR_ID	Raw data
AQ_EFFECTIVE_DATE	Raw data
EUC	Char[5] – Strip LDZ and year from full EUC Code to give e.g. 08W02
AQ	Raw data
SITE_TYPE_FLAG	Raw data
LDZ	Char[2] - taken from first 2 digits of EUC
LATEST	Char[1] - Indicator ="Y" latest AQ record within gas year
EUC_CALC	Char[3] - EUC consumption band calculated from AQ e.g. 01B – Needed to handle supply points containing multiple meter points.

B.2 FACTORS

There is a daily version containing the following information for 01-Apr-2008 onwards

Name	Description
LDZ	Char[2] - LDZ identifier e.g. EA
EUC_BAND	Char[5] – EUC band e.g. 08W02
GAS_DAY	Date
ALP	Raw data
DAF	Raw data
EWCF	Raw data
WC	Number - Max(0.01, 1 + DAF * EWCF)

Name	Description
CV	Raw data
WAALP	Number - ALP * WC
VOL_WAALP	Number - WAALP / CV

Then to help speed up the consumption algorithm there is a yearly version which aggregates the WAALP and VOL_WAALP by formula year.

Name	Description
LDZ	Char[2] - LDZ identifier e.g. EA
EUC_BAND	Char[5] – EUC band e.g. 08W02
F_YEAR	Number
CWAALP	Number - Sum WAALP
VOL_CWAALP	Number - Sum VOL_WAALP

B.3 METER_INFO_XX

Name	Description
MPR_ID	Raw data
LDZ	Raw data
NUM_DIALS	Raw data
IMP_IND	Raw data
METER_FITTED_DATE	Raw data
UNITS	Raw data
CORRECTION_FACTOR	Raw data
UNITS_CALC	Number - Units estimated from meter reads
IMP_IND_CALC	Char[1] – Indicator flag taken from meter read records.

The UNITS_CALC field is calculated by looking at the ratio of the difference between meter reads and the recorded volume (since read unit data is unreliable).

B.4 METER_READS_XX

Name	Description
MPR_ID	Raw data
METER_READ_DATE	Raw data
IMP_IND	Raw data
METER_READ_VAL	Raw data
METERED_VOL	Raw data
ROUND_THE_CLOCK_IND	Raw data
AQ	Raw data

Name	Description
METER_READ_FREQ	Raw data
SSP_LSP	Raw data
EUC	Char[5] – Strip LDZ and year from full EUC Code e.g. 08W02
READ_TYPE_CODE	Raw data
LDZ	Char[2] - taken from first 2 digits of EUC
BAD_READ	Char[1] - Indicator ="Y" don't use meter read

B.5 NDM_DM_CHANGE

This table is pre-calculated from the AQ records

Name	Description
MPR_ID	Number - Unique ID for meter point used across ALL data
NDM_START_DATE	Date – date when site becomes NDM
NDM_END_DATE	Date – date when site becomes DM
LDZ	Char[2] - LDZ identifier e.g. EA

B.6 RESULTS_XX

Name	Description
MPR_ID	Number
LDZ	Char[2]
EUC	Char[5] – taken from AQ record
F_YEAR	Number
CONSUMPTION	Number – Consumption (in kWh) for formula year calculated using meter reads / metered volumes
OLD_AQ	Number - AQ (in kWh) chosen during consumption algorithm.
NEW_AQ	Number – Updated AQ estimate (in kWh) based on consumption value.
METER_READS	Char[1] - Indicator ="Y" found two meter reads which satisfy the criteria listed in the algorithm
POSITIVE_VOLUME	Char[1] - Indicator ="Y" positive volume calculated after possibly correcting for meter index rollover
AQ_CHECK	Char[1] - Indicator ="N" if FY_MR_CON puts the site into the LSP market and is >5 times the consumption calculated using the AQ
YEAR_FRACTION	Number – (0<= <=1) fraction of the year for which the site was active (calculated using the ALPs)
EUC_CALC	Char[3] – Consumption band calculated based on consumption from meter read data if calculated successful, else on the AQ
OLD_AQ_DATE	Date – Effective date for the old AQ
METER_ASSET_DATE	Date – Installation date for the meter is place during the metered period

Name	Description
START_READ_DATE	Date – Date of the start meter read used in the calculation
END_READ_DATE	Date – Date of the end meter read used in the calculation

B.7 SITE_LIST_XX

This table is populated with a unique list of MPR ids from the AQ table. Start and end dates taken from NEW_LOST_SITES and NDM_DM_CHANGE tables.

Name	Description
MPR_ID	Number
START_DATE	Date – Date from which the site is active and NDM
END_DATE	Date – Date from which the site ceases to be active or NDM

Appendix C Worked Example of Consumption Algorithm

This appendix shows the consumption algorithm, described in Section 6.1.2, applied to example data.

C.1 Full Example

To calculate the consumption for MPR_ID 913600 (which is in EA LDZ) for formula year 2009 the following steps are taken:

1. Check the site is active and NDM in 2009: Yes

2. Select a representative AQ. In this case the AQ from 1/10/2010 is used as the meter reads it is based on are most representative of the demand for 2009/10.

MPR_ID	AQ EFFECTIVE DATE	EUC	AQ	SITE TYPE FLAG	LDZ	LATEST	EUC_CALC
913600	01/10/2007	01B	7544	N	EA	Y	01B
913600	01/10/2008	01B	5523	N	EA	Y	01B
913600	01/10/2009	01B	9457	N	EA	Y	01B
913600	**01/10/2010**	**01B**	**10477**	**N**	**EA**	**Y**	**01B**
913600	01/10/2011	01B	11505	N	EA	Y	01B

3. Find candidate meter read dates (see meter read table overleaf)

LB1	LB2	UB1	UB2
19/03/2009	28/04/2009	18/01/2010	12/04/2010

4. Choose the best two

   LB1-'01-apr-2009' < 540 and no meter replacement since 20/11/2008 so use LB1

   UB2-'31-mar-2010'< 540 and no meter replacement since 20/11/2008 so use UB2

5. Validate the choice of meter reads

UB2-LB1 > 120

(LB1,UB2) intersection (’01-apr-2009’, ’31-mar-2010’) > 60

So we have found two valid reads

MPR ID	METER READ DATE	IMP IND	METER READ VAL	METERED VOL	ROUND THE CLOCK IND	AQ	METER READ FREQ	SSP_LSP	EUC	LDZ	READ TYPE CODE	BAD READ	
913600	20/11/2008	N	5707	211	0	5523	6	SSP	01B	EA	U	N	
913600	02/03/2009	N	6229	534	0	5523	6	SSP	01B	EA	U	N	
913600	**19/03/2009**	**N**	**6275**	**47**	**0**	**5523**	**A**	**SSP**	**01B**	**EA**	**L**	**N**	**LB1**
913600	28/04/2009	N	6400	128	0	5523	A	SSP	01B	EA	U	N	LB2
913600	28/08/2009	N	6455	56	0	5523	A	SSP	01B	EA	U	N	
913600	18/01/2010	N	6964	521	0	9457	A	SSP	01B	EA	U	N	UB1
913600	**12/04/2010**	**N**	**7438**	**485**	**0**	**9457**	**A**	**SSP**	**01B**	**EA**	**U**	**N**	**UB2**
913600	01/06/2010	N	7518	82	0	9457	A	SSP	01B	EA	U	N	
913600	14/12/2010	N	7928	419	0	10477	A	SSP	01B	EA	U	N	
913600	22/08/2011	N	8665	58	0	10477	A	SSP	01B	EA	U	N	
913600	15/11/2011	N	8844	183	0	11505	A	SSP	01B	EA	U	N	
913600	04/02/2012	N	9340	507	0	11505	A	SSP	01B	EA	U	N	
913600	27/07/2012	N	9968	642	0	11505	A	SSP	01B	EA	U	N	

6. Calculate the volume consumed between the two meter reads:

Site is an 01B so calculate volume as difference of meter reads

Difference = 7,438 – 6,275 = 1,163

This is positive. The meter is metric and has been predetermined to have read units=1

Therefore the final volume is 1,163 * 1.022640 = 1,189.33 m^3 (Compared to 1,190 m^3 if we had used the metered volumes in this case)

7. Calculate consumption for formula year 2009 based on meter reads

The meter was active for the whole year, so

Volume taken over the year is = 1,189.33 * sum volume profile over 2009 / sum volume profile over metered period

=1,189.33 * 9.40 / 10.19

=1,097.12 m^3

Weighted average CV for 2009 is = 370.46 / 9.40 = 39.40

Therefore consumption = 1097.12 * 39.40 / 3.6 = 12,007.51 kWh

8. Calculate a new AQ based on this consumption and compare it to the AQ chosen earlier

New AQ = consumption * 365 / CWAALP = 12,007.51 * 365 / 370.46 = 11,830 kWh

This makes the site still 01B and is consistent with the old AQ estimate

C.2 Example of Meter Index Roll Over Detection Algorithm

Given the following meter reads:

MPR ID	METER READ DATE	IMP IND	METER READ VAL	METERED VOL	ROUND THE CLOCK IND	AQ	METER READ FREQ	SSP_LSP	EUC	LDZ	READ TYPE CODE	BAD READ
16608022	17/11/2008	Y	8601	21782	0	22310	6	SSP	01B	WN	U	N
16608022	28/05/2009	Y	9086	49598	0	22310	6	SSP	01B	WN	U	N
16608022	**19/11/2009**	**Y**	**9257**	**17487**	**0**	**22826**	**6**	**SSP**	**01B**	**WN**	**U**	**N**
16608022	**15/02/2011**	**Y**	**299**	**-916081**	**0**	**19974**	**6**	**SSP**	**01B**	**WN**	**U**	**N**
16608022	16/08/2011	Y	572	1050558	1	19974	6	SSP	01B	WN	K	N
16608022	29/02/2012	Y	967	1063034	1	19974	6	SSP	01B	WN	U	N

We initially calculate the difference between the reads to be = 299 – 9257 = -8958

As this is negative we test for meter index roll-over

num_dials = round_up(log(10, start_mr)) = round_up(log(10, 9257)) = round_up(3.97) = 4

max_read = $10^{num\_dials} = 10^4$ = 10,000

num_years = (15/02/2011 – 19/11/2009) / 365 =1.24

new_diff = (max_read - start_mr + end_mr) = 10,000 – 9,257 + 299 = 1,042

The check is: new_diff / max_read / num_years < 0.25

We have 1,042 / 10,000 / 1.24 = 0.08 > 0.25 so we set the difference to be 1,042 and continue.

Appendix D Theft Analysis Database Description

The database structure used by the AUGE for the theft an analysis is very similar to the structure used for the consumption analysis.

The theft analysis results were generated using the THEFT package.

NOTE: The MPR_IDs used for the theft data are not consistent with those provided with the data for the consumption analysis (Xoserve currently hold the conversion mapping).

D.1 ANNUAL_QUANTITY

Name	Description
MPR_ID	Raw data– dummy MPR ID
START_DATE	Raw data
END_DATE	Raw data
EUC	Char[5] – Strip LDZ and year from full EUC Code to give e.g. 08W02
AQ	Raw data
SITE_TYPE_FLAG	Raw data
LATEST	Char[1] - Indicator ="Y" latest AQ record within gas year
EUC_CALC	Char[3] - EUC consumption band calculated from AQ e.g. 01B – Needed to handle supply points containing multiple meter points.

EUC_CALC is as for the consumption algorithm to determine EUC group from an AQ.

D.2 FACTORS

There is a daily version containing the following information for 01-Apr-2006 onwards

Name	Description
LDZ	Char[2] - LDZ identifier e.g. EA
EUC_BAND	Char[5] – EUC band e.g. 08W02
GAS_DAY	Date
ALP	Raw data
DAF	Raw data
EWCF	Raw data
CV	Raw data
ENERGY_PROFILE	Number - ALP * (1 + DAF * EWCF)
VOL_PROFILE	Number - ENERGY_PROFILE / CV

Then to help speed up the consumption algorithm there is a yearly version which aggregates the ENERGY_PROFILE and VOL_PROFILE by formula year.

Name	Description
LDZ	Char[2] - LDZ identifier e.g. EA
EUC_BAND	Char[5] – EUC band e.g. 08W02
F_YEAR	Number
ENERGY_PROFILE	Number - ALP * (1 + DAF * EWCF)
VOL_PROFILE	Number - ENERGY_PROFILE / CV

D.3 METER_DIALS

Name	Description
MPR_ID	Raw data– dummy MPR ID
LDZ	Raw data
DATE_FITTED	Raw data
NUM_DIALS	Raw data

D.4 METER_READS

Name	Description
MPR_ID	Raw data – Dummy MPR ID
METER_READ_DATE	Raw data
IMP_IND	Raw data – Imperial/Metric indicator
METER_READ_VAL	Raw data – Meter Read
METERED_VOL	Raw data – Calculated consumption as provided by Xoserve
SSP_LSP	Raw data – Market sector
EUC	Char[5] – Strip LDZ and year from full EUC Code e.g. 08W02
LDZ	Char[2] - taken from first 2 digits of EUC
CORRECTION_FACTOR	Raw data – T&P correction factor
UNITS	Raw data – Read Units
BAD_READ	Char[1] - Indicator ="Y" don’t use meter read

The algorithm for flagging bad reads is as for the consumption algorithm.

D.5 T_RESULTS(_V2)

There are two versions of this table. The consumptions in T_RESULTS are calculated using default meter index units and the consumptions in T_RESULTS_V2 are calculated using the meter index units from the meter asset data provided by Xoserve.

Name	Description
MPR_ID	Number – dummy MPR ID
SSP_LSP	Char[3] – Sector classification calculated from consumption+theft process
F_YEAR	Number – Formula year
THEFT	Number – theft amount that occurred within the formula year
CONSUMPTION	Number – consumption estimate using meter reads
NEW_AQ	Number – Updated AQ estimate based on theft algorithm
OLD_AQ	Number – AQ to be used if consumption estimate fails
AQ_DATE	Date – effective date of OLD_AQ
CALC_METHOD	Number – (1,2 or 3) indicates whether OLD_AQ is pre, post or during theft and only used if consumption calculation fails
LDZ	Char[2] – LDZ that the theft occurred in

D.6 TOG

This table contains the raw theft record data

Name	Description
MPR_ID	Raw data – dummy MPR ID
FROM_DATE	Raw data – Estimated start date of theft
TO_DATE	Raw data – Estimated end date of theft
LDZ	Raw data – LDZ the theft occurred in
SSP_LSP	Raw data – Current SSP/LSP market sector classification at the time of data extract
AQ	Raw data – Current AQ at the time of data extract
THEFT	Raw data – The estimated amount of theft that occurred during the period of theft in kWh
EUC	Char[3] – Consumption band portion of full EUC, e.g. 03B
METER_READ_FREQ	Raw data – Frequency of meter reads (A, 6 or M)

END OF DOCUMENT