

Unaccounted for Gas Report

National Grid

Gas Transmission

October 2016

Target audience

Ofgem and other interested industry parties

About this document

This document sets out the work undertaken by National Grid Gas, in its role as System Operator, to investigate potential causes of Unaccounted for Gas (UAG).

It is published to meet National Grid Gas Plc (NTS) Gas Transporter Licence Special Condition 8E: Requirement to undertake UAG Projects to investigate the causes of Unaccounted for Gas (UAG).

Executive Summary

This report provides a review of National Grid's Unaccounted for Gas (UAG) management over the last five years with particular emphasis on 1st March 2016 to 31st August 2016 inclusive, the period since the publication of the April 2016 UAG report.

For four of the past six months total monthly assessed UAG has been higher than for the equivalent months in 2015. With the exception of August, which had the highest monthly assessed UAG during this period, total monthly UAG has been less than the long term average. UAG for August is expected to reduce as data errors associated with the implementation of the new Gas Control Suite (GCS) system are reconciled.

It is expected that for Formula Year 2016/17 annual assessed UAG will be less than for Formula Year 2015/16 and will support the decline in annual quantities observed since 2009/10. It is also expected that annual meter error/data reconciliations, in absolute terms, for 2016/17 will be greater than for 2015/16. This again supports the year on year increase in the amount of energy reconciled by National Grid over the past five years despite annual assessed UAG declining over the same period.

Good progress has been made with the development of the NGage applications over the past six months with the meter validation application being made available to a number of meter asset owners for field trials.

The formation of the National Grid Energy Balancing team and, despite some initial challenges, the implementation of the GCS system is expected to improve the quality of energy balancing information for the National Transmission System by Exit Closeout and enhance National Grid's analytical capability to support its ongoing work into the investigation of the causes of UAG.

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1. Introduction

This report provides a review of National Grid's Unaccounted for Gas (UAG) management. The report provides information on assessed Unaccounted for Gas quantities over the last five years with particular emphasis on 1st March 2016 to 31st August 2016 inclusive, the period since the publication of the April 2016 UAG report. (The April report covered UAG management during the period up to and including 29th February 2016). It also describes the various activities and initiatives that National Grid has been undertaking or is planning to undertake to investigate the causes of UAG.

UAG is one of the three components of NTS Shrinkage together with Own Use Gas (OUG) and CV Shrinkage (CVS). Further information on the components of NTS Shrinkage can be found on the National Grid website via the following link: <http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/unaccounted-for-gas/>.

To compliment this report, National Grid also provides a range of UAG related data including:

- all previous UAG reports
- daily data on the components of NTS Shrinkage including UAG

which are available on the National Grid website via the above link.

This report discharges National Grid Gas's responsibilities under the Gas Transporter Licence Special Condition 8E: Requirement to undertake UAG Projects to investigate the causes of Unaccounted for Gas (UAG).

If you have any feedback or questions on this document please get in contact with the National Grid Energy Balancing team via the following email address:

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2. National Transmission Unaccounted for Gas Trends

This section of the Unaccounted for Gas Report provides information on assessed Unaccounted for Gas quantities over the last five years with particular emphasis on the period March to August 2016.

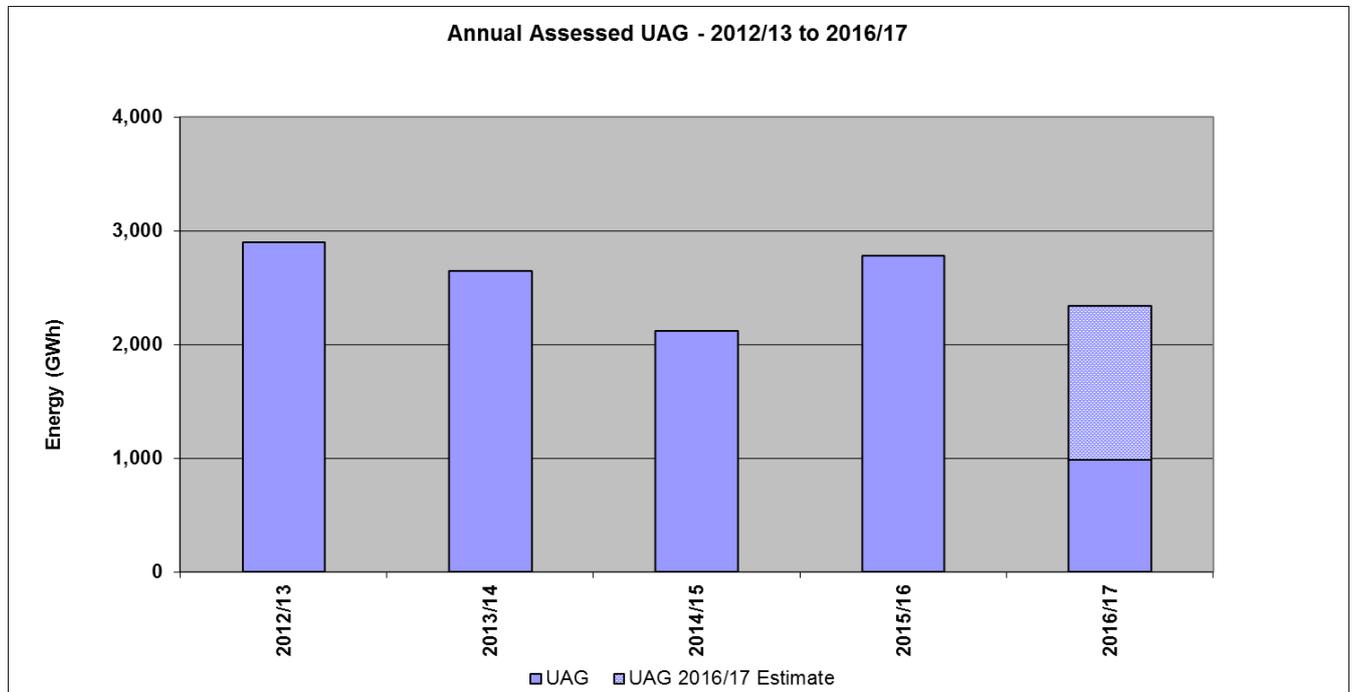


Figure 1: Annual Assessed UAG – 2012/13 to 2016/17

Figure 1 provides the annual assessed quantities of UAG for Formula Years 2012/13 to 2016/17. A Formula Year refers to the period from 1st April to 31st March of the following year. Figure 1 also provides an estimate of the additional quantity of UAG that is expected to be generated during the remainder of the current Formula Year.

From the above figure it can be seen that the total assessed UAG quantities for 2016/17 are not expected to change significantly from previous years and are currently estimated to be lower than the equivalent quantities for the previous year. It appears that the year on year reduction in the annual assessed UAG quantities observed since 2009/10 may have plateaued.

Table 1 provides the actual assessed and estimated levels for UAG, OUG and CVS for 2016/17. The table indicates that UAG remains the predominant element of NTS Shrinkage.

2016/17	UAG	OUG	CVS	Total
Actual Assessed Levels - April to August (GWh)	981	662	22	1,665
Estimated Levels – September to March (GWh)	1,359	917	30	2,306
Estimated Annual Levels (GWh)	2,340	1,579	52	3,971

Table 1: Actual and estimated assessed levels for UAG, OUG and CVS for 2016/17

Table 2 provides the annual and daily average assessed UAG quantities for Formula Years 2012/13 to 2016/17. The table also provides the annual assessed UAG quantities as a percentage of annual NTS Throughput.

UAG Statistics	2012/13	2013/14	2014/15	2015/16	2016/17*
Assessed Annual Level (GWh)	2,894	2,648	2,121	2,782	981
Assessed Daily Average (GWh/d)	7.93	7.25	5.81	7.60	6.41
Percentage of NTS Throughput	0.29	0.29	0.23	0.29	0.30

*2016/17 covers period 1st April to 31st August 2016 inclusive

Table 2: Statistical performance of UAG - 2012/13 to 2016/17

The values provided in the table for 2016/17 cover the 5 month period from 1st April to 31st August and indicate that the daily average assessed UAG quantity for the year is currently lower than that for the previous year. UAG as a percentage of annual NTS Throughput for 2016/17 is currently 0.1% higher than for 2015/16.

Figure 2 provides the total monthly assessed UAG from April 2012 to August 2016. It also provides the average monthly assessed UAG for this period (215,600,631 kWh). For 7 of the last 8 months total monthly assessed UAG has been less than the long term average monthly assessed UAG.

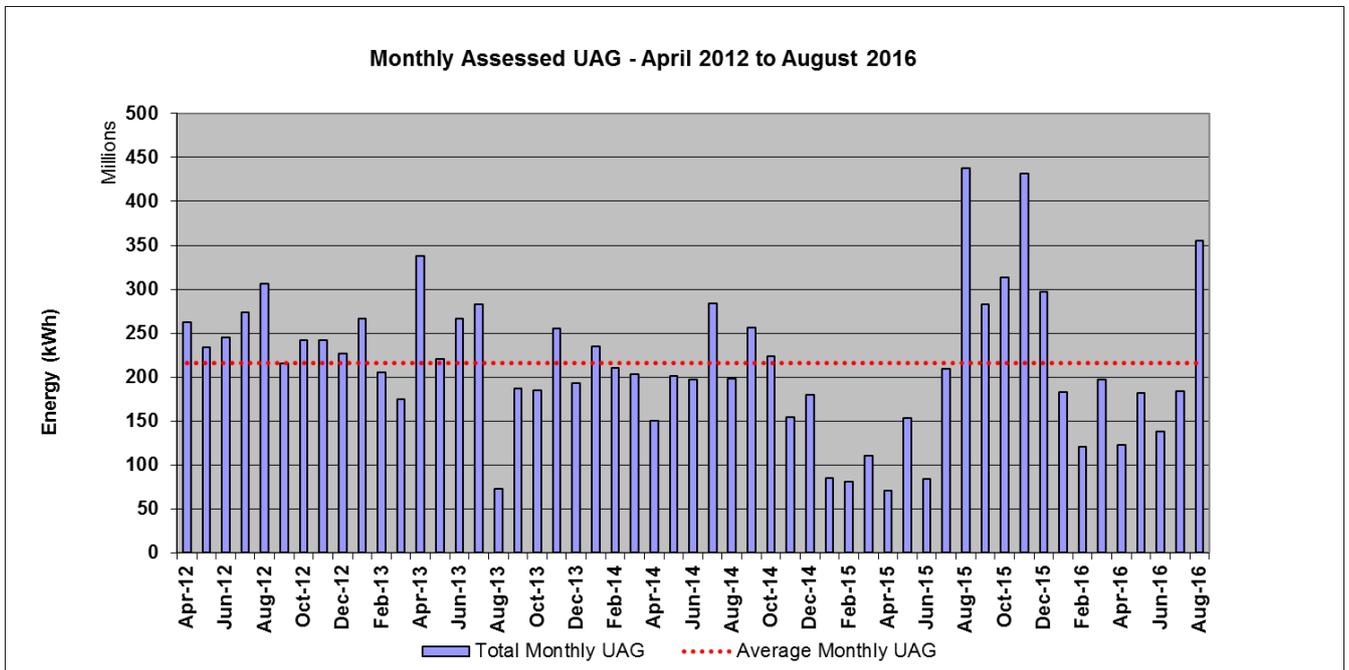


Figure 2: Monthly Assessed UAG - April 2012 to August 2016

From the above figure there appears to be the possible emergence of a seasonal profile over the past 2 years with lower monthly values being observed during the February to June period and higher monthly values observed during the August to December.

Figure 3 provides the total monthly assessed UAG for March to August 2016 compared to the equivalent months of 2015. Figure 3 indicates that total monthly assessed UAG for 2016 has exceeded the previous year’s monthly value for 4 out of the last 6 months. The July and August monthly UAG quantities were, however, lower than in 2015. The monthly UAG values for both 2015 and 2016 follow the same trend.

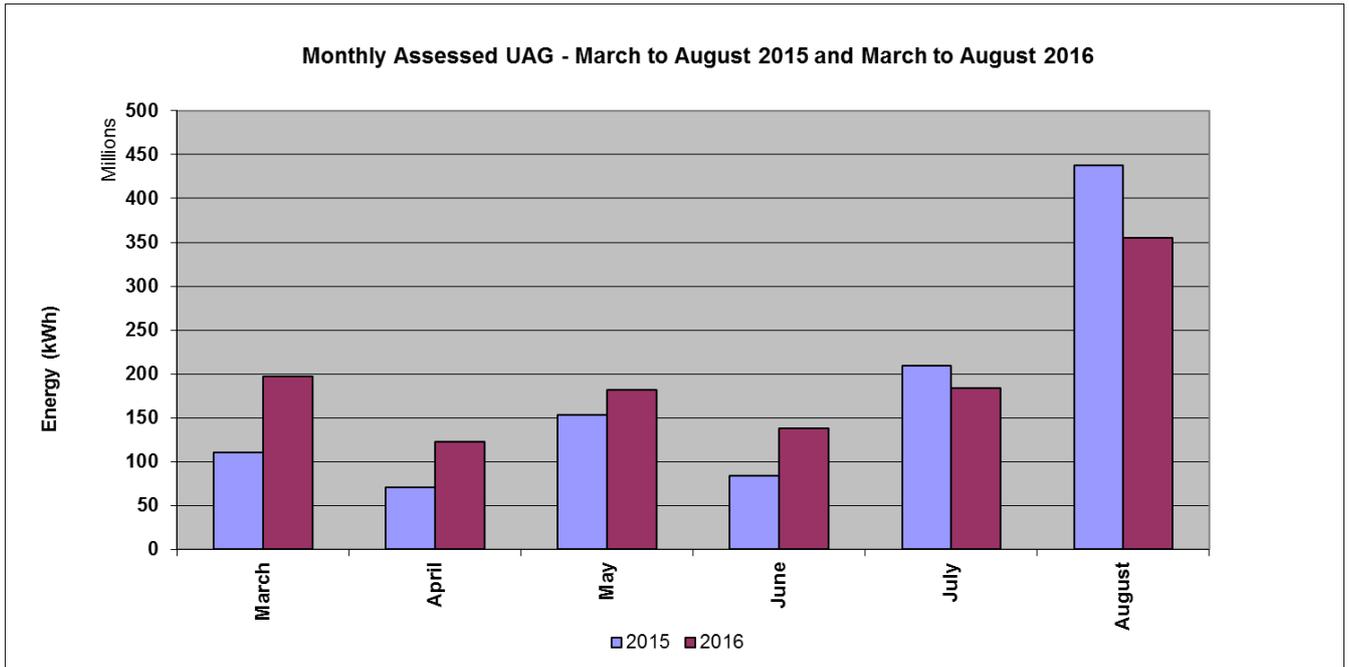


Figure 3: Monthly Assessed UAG – March to August 2015 and March to August 2016

Figure 4 provides the daily assessed UAG values for 1st March to 31st August 2016. Figure 4 indicates that there continues to be large day to day variability in the daily assessed UAG values. During this period daily UAG varied from -26,637,718 kWh to +82,699,653 kWh.

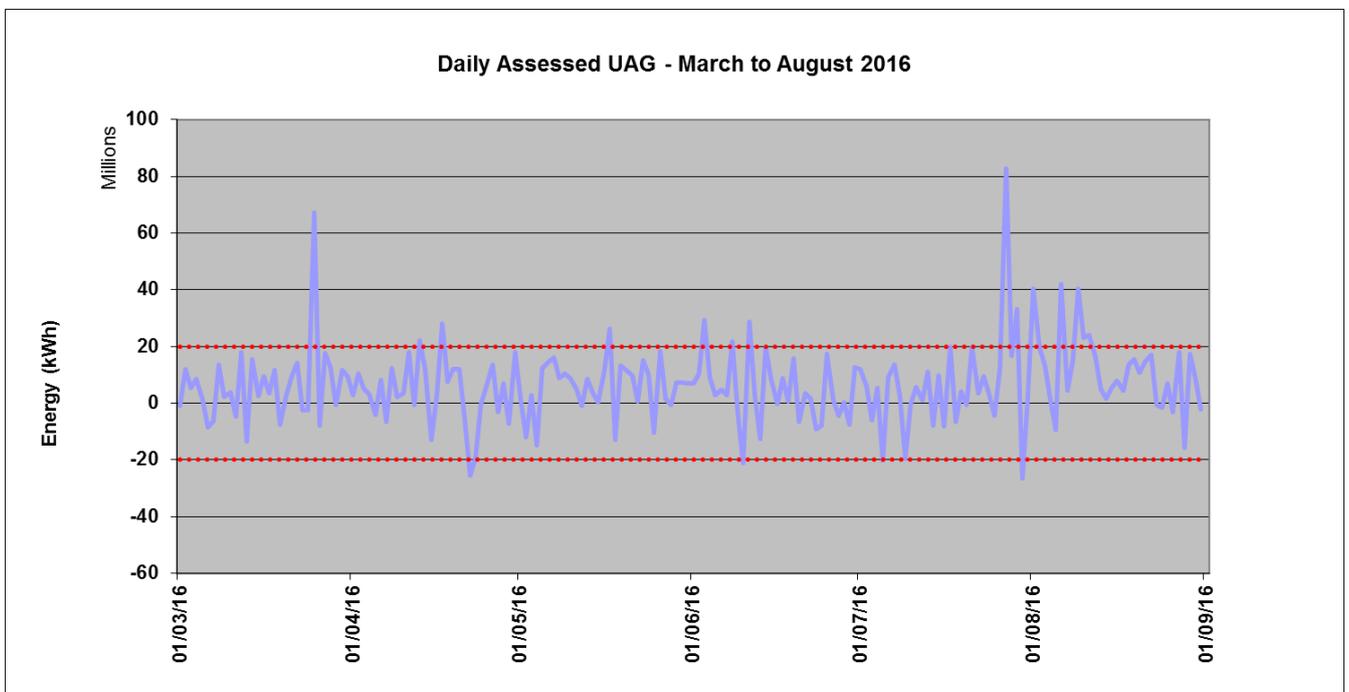


Figure 4: Daily Assessed UAG – March to August 2016

National Grid reviews and investigates the assessed UAG values on a daily basis paying particular attention to any values that exceed $\pm 20,000,000$ kWh. These baseline UAG quantities are provided as red dotted lines in the above figure. During the period of March to August 2016 there were 19 days when daily assessed UAG exceeded $\pm 20,000,000$ kWh (10.3% of occasions).

Investigation into the very high positive UAG observed at the end of March was discovered to be due to a data error at an NTS storage facility that had not been notified to National Grid during the Exit Closeout period.

The instances of high positive and negative UAG observed during the period at the end of July and start of August were investigated and discovered to be due to data errors associated with the implementation of National Grid's new Gas Control Suite system.

Reconciliations of these errors have been or are currently being processed. Further information on Reconciliation is provided in section 3.2 of this report.

National Grid is continuing to investigate other days with high levels of positive or negative UAG during the March to August 2016 period. National Grid is also continuing to monitor for the presence of the trends discussed above.

3. UAG Management Activities

This section of the Unaccounted for Gas Report describes the various activities and initiatives that National Grid has been undertaking or is planning to undertake to investigate the causes of UAG.

3.1 Meter Witnessing

National Grid plans and undertakes an annual meter witnessing campaign. For 2016/17 the annual meter witnessing programme comprises 24 visits to a range of different metering installations including terminal, NTS storage, power station and gas distribution network facilities.

National Grid was unable to undertake any witnessing visits during the period of March to August 2016. This was primarily due to staff changes within National Grid's Meter Assurance team but also due to meter asset owners being unable to accommodate our visits to site during their metering validations. The team plan to complete a number of visits before the end of the Formula Year.

National Grid has continued to review the meter validation (ME2) reports provided for validations undertaken during 2016 and where necessary raise queries with meter asset owners.

3.2 Reconciliation

National Grid has an obligation to reconcile NTS related meter and data errors on behalf of the shipping community.

Figure 5 provides the annual reconciliation quantities, in absolute terms, for Formula Years 2012/13 to 2016/17. Figure 5 also provides an estimate of the planned reconciliations expected to take place during the second half of 2016/17. The vast majority of these planned reconciliations relate to data errors associated with the implementation of the new Gas Control Suite system.

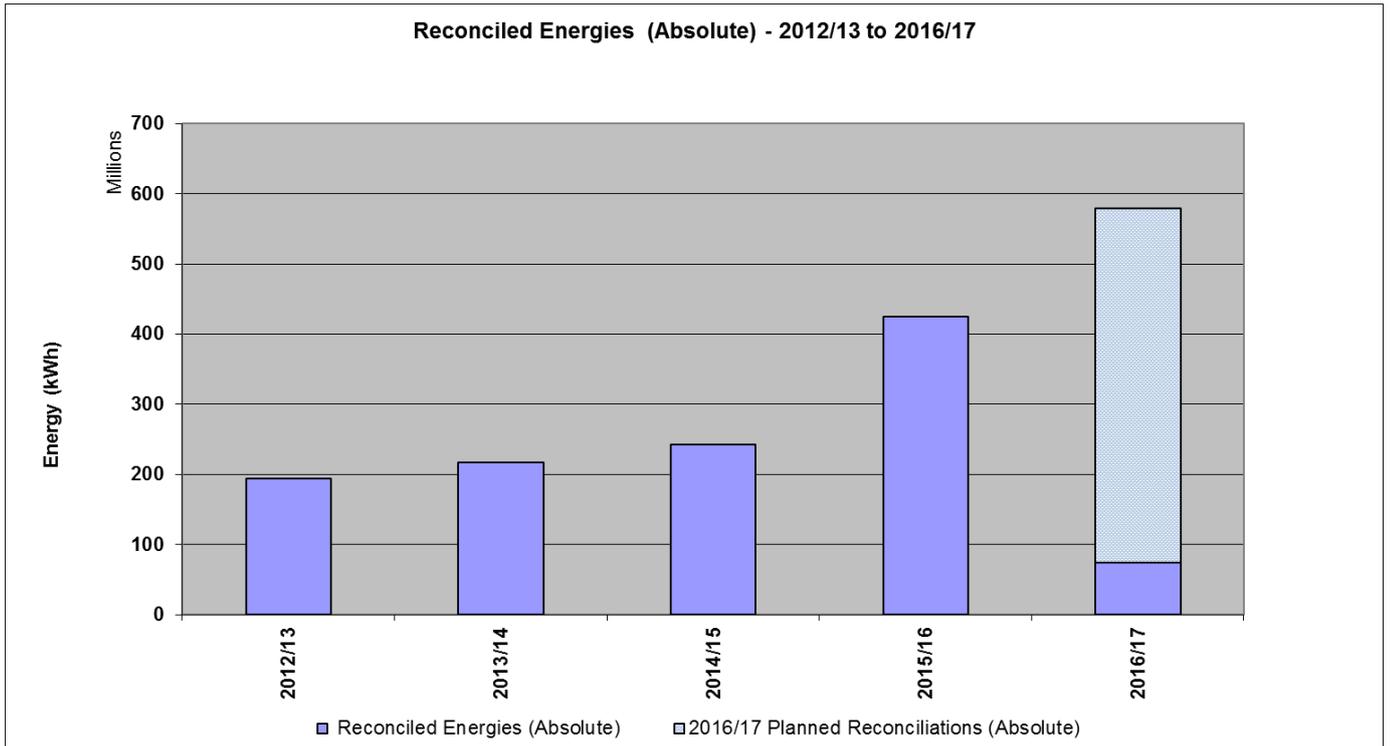


Figure 5: Reconciled Energies (Absolute) – 2012/13 to 2016/17

From the above figure it can be seen that the annual reconciliation quantity for 2016/17 is currently estimated to be greater than the equivalent quantity for the previous year. The expected 2016/17 annual absolute reconciliation quantity supports the year on year increase in annual reconciliation quantities observed over the last five years.

Figure 6 provides the annual assessed UAG levels for Formula Years 2012/13 to 2016/17 compared with the annual reconciliation quantities, in absolute terms, for this period. The assessed UAG quantity provided for 2016/17 includes the actual assessed quantity for the April to August 2016 period and an estimate of UAG expected to be generated during the remainder of the year. The reconciliation quantity provided for 2016/17 includes the actual reconciliations completed to date and an estimate of those to be undertaken during the second half of the year.

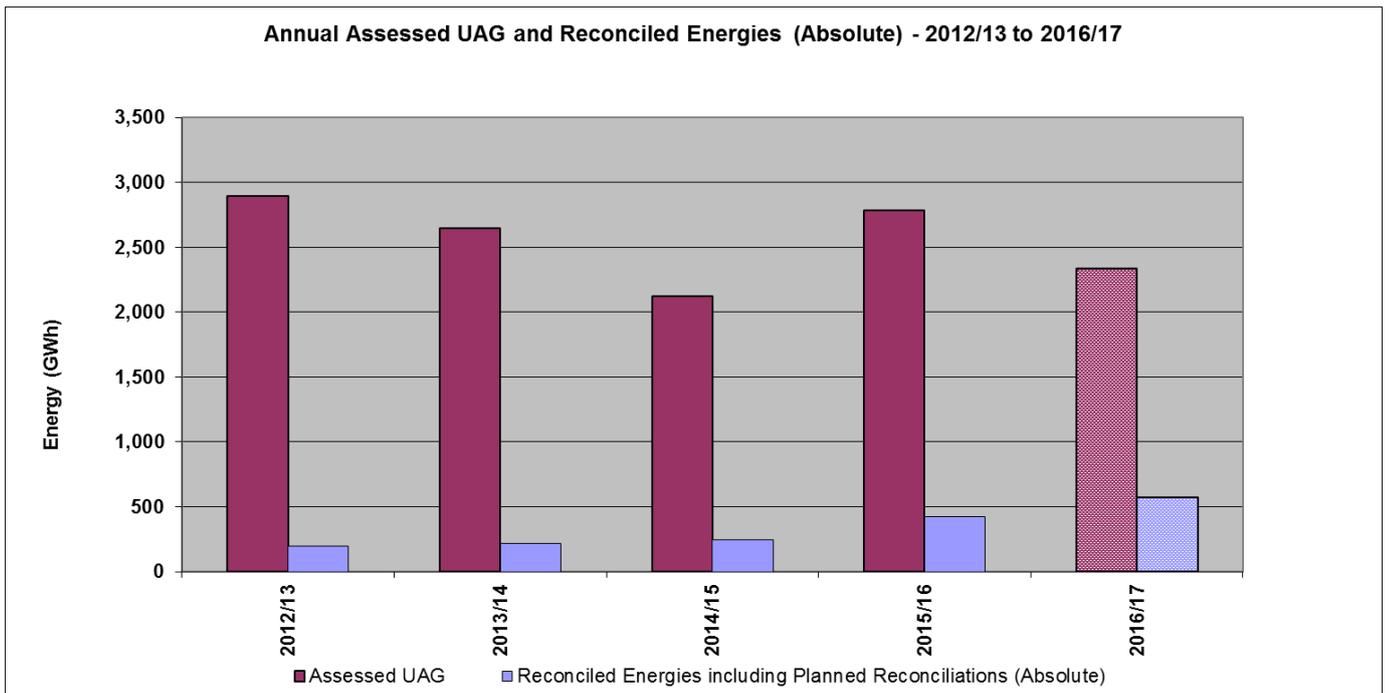


Figure 6: Annual Assessed UAG and Reconciled Energies (Absolute) – 2012/13 to 2016/17

The figure demonstrates a year on year increase in the amount of energy reconciled by National Grid over the past five years whilst the annual assessed UAG has declined over the same period.

Over the next six months National Grid is planning to undertake further analysis on the reconciliations processed to be able to provide further detail in future reports on the types of reconciliations undertaken. National Grid will also process as much reconciliation as possible.

3.3 NGage Meter Validation Application

NGage is the meter validation and analysis application for use on iOS or Android devices. This is being developed by National Grid and will be made available free of charge to meter asset owners and the third party organisations they contract to carry out metering validation activities on their behalf. NGage is designed to facilitate the collection of meter validation data, in accordance with the current meter validation standard (T/PR/ME/2), and provision of this information to National Grid. The application will automatically upload the results of meter validations to a secure data portal which will enable improved analysis of these results which will be available to both National Grid and the asset owner.

Version 1.0 of the NGage application successfully completed user acceptance testing. The application has been released to a number of meter asset owners for field trials and to obtain user feedback to inform future development of the tool. Development of version 2.0 of NGage is proceeding with an expected release date for user testing of October 2016.

Development of version 2.0 of National Grid's gas property and flow calculator application, NGageCalc, is also proceeding with an expected release date for user testing of October 2016. Version 1.0 of NGageCalc is currently available via the iTunes App Store or Google Play Store.

The NGage and NGageCalc applications are being developed using Network Innovation Allowance funding.

Over the coming months National Grid are planning to complete user testing of versions 2.0 of the NGage and NGageCalc applications and make these applications available to meter asset owners. National Grid will support meter asset owners in using these applications during their meter validations.

3.4 Baseline UAG Analysis

An independent assessment of the baseline level of UAG, which could be expected from the network operating under normal measurement uncertainties, is being undertaken by Manchester University's mathematics department. As discussed in section 2 of the report National Grid currently uses legacy UAG baseline values of $\pm 20,000,000$ kWh as triggers to investigate potentially high levels of positive or negative UAG. This study is expected to provide a more robust UAG baseline quantity which will assist in the future management of UAG.

A PhD student has begun work on the baseline analysis which is anticipated to include the development of novel mathematical techniques outside the statistical approaches already employed. Progress on identifying novel techniques to improve the analysis of UAG data is expected over the next 6 to 12 months.

3.5 Formation of Energy Balancing Team

In April 2016 National Grid brought together existing teams within its UK System Operator directorate to form the Energy Balancing team. This team combines the Gas Energy Management team, responsible for validating and publishing after the gas day energy balancing information for the NTS, and the Meter Assurance team who are responsible for investigating the causes of and reporting upon UAG. Bringing the Gas Energy Management and Meter Assurance teams together has allowed the new team to initiate an end to end process review which is expected, over time, to improve the quality of energy balancing information at Exit Closeout and lead to a reduction in assessed UAG.

Over the coming months the team are planning to develop and introduce a number of new key performance indicators to assist with the day to day management of UAG.

3.6 Implementation of Gas Control Suite

At the end of July 2016 National Grid implemented its new Gas Control Suite (GCS) system. This replaced the existing Integrated Gas Management System and is the system used to control the physical and commercial operation of the NTS. One of the roles of the GCS is to facilitate the validation of end of day measurements for system inputs to the NTS and system outputs from the NTS. This information is passed to Gemini which is the system used for customer billing purposes. GCS also calculates the energy balance for the NTS which is used to manage assessed NTS shrinkage and UAG quantities.

As discussed in section 2 of the report there were a number of unexpected data errors associated with the implementation of the GCS. These have impacted the UAG values that have been provided in this report for July and August 2016. Work is currently underway to identify these data errors and to process the required reconciliations.

Notwithstanding GCS provides a number of new tools which make available additional analytical functionality. These should improve National Grid's analytical capability and support its ongoing work into the investigation of the causes of UAG.

The team are working closely with the GCS project team to support the resolution of any remaining system defects which caused data errors that require reconciliation. The team are planning to investigate and exploit the new analytical tools GCS provides over the coming months.

4. Conclusion

For four of the past six months total monthly assessed UAG has been higher than for the equivalent months in 2015. With the exception of August, which had the highest monthly assessed UAG during this period, total monthly UAG has been less than the long term average. UAG for August is expected to reduce as data errors associated with the implementation of the new GCS system are reconciled.

It is expected that for Formula Year 2016/17 annual assessed UAG will be less than for Formula Year 2015/16 and will support the decline in annual quantities observed since 2009/10. It is also expected that annual meter error/data reconciliations, in absolute terms, for 2016/17 will be greater than for 2015/16. This again supports the year on year increase in the amount of energy reconciled by National Grid over the past five years despite annual assessed UAG declining over the same period.

Good progress has been made with the development of the NGage applications over the past six months with the meter validation application being made available to a number of meter asset owners for field trials.

The formation of the Energy Balancing team and the implementation of GCS, despite some initial challenges, is expected to improve the quality of NTS energy balancing information by Exit Closeout and enhance National Grid's analytical capability to support its ongoing work into the investigation of the causes of UAG.