

Unaccounted for Gas Report

National Grid

Gas Transmission

October 2017

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 to 31st August 2017 inclusive, the period since the publication of the April 2017 UAG report.

The total monthly assessed UAG quantity for each month during the March to August 2017 period has been less than for the equivalent month in 2016. In addition, total monthly assessed UAG has all been less than the five year long term average monthly assessed UAG.

It is expected that for Formula Year 2017/18 annual assessed UAG will be less than for Formula Year 2016/17 and will support the decline in annual quantities observed since 2009/10. Despite the decline in annual assessed UAG National Grid is expecting to process as much meter or data error reconciliation, in absolute energy terms, for 2017/18 as was reconciled for 2016/17.

Testing of the NGage meter validation application has now been completed. The release of version 2.0 of the application to meter owners is expected to take place during the second half of 2017/18.

Progress has been made on enhancing National Grid's analytical capability through the development of improved data visualisation to support its ongoing work into the investigation of the causes of UAG.

Good progress has also been made on obtaining and reviewing meter validation information for NTS entry and exit facilities for 2016/17 and 2017/18. This data is being used to assist with the identification of causes of UAG and to inform the preparation of future meter witnessing campaigns.

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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 to 31st August 2017 inclusive, the period since the publication of the April 2017 UAG report. (The April report covered UAG management during the period up to and including 28th February 2017). 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 and the UAG related data published on the National Grid website discharge 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). Special Condition 8E is reproduced in Appendix I of the report. The relevant data used to produce the tables and graphs included in the report is provided or referenced in Appendix II.

If you have any feedback or questions on this document please contact the National Grid Meter Assurance team via the meterassurance@nationalgrid.com email address. Meter Assurance, who are part of the Energy Balancing team within National Grid's UK System Operator directorate, are responsible for investigating the causes of and reporting upon UAG.

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 2017. It also provides a review of the assessed quantities of UAG observed for Formula Year 2016/17.

2.1 Formula Years 2013/14 to 2017/18

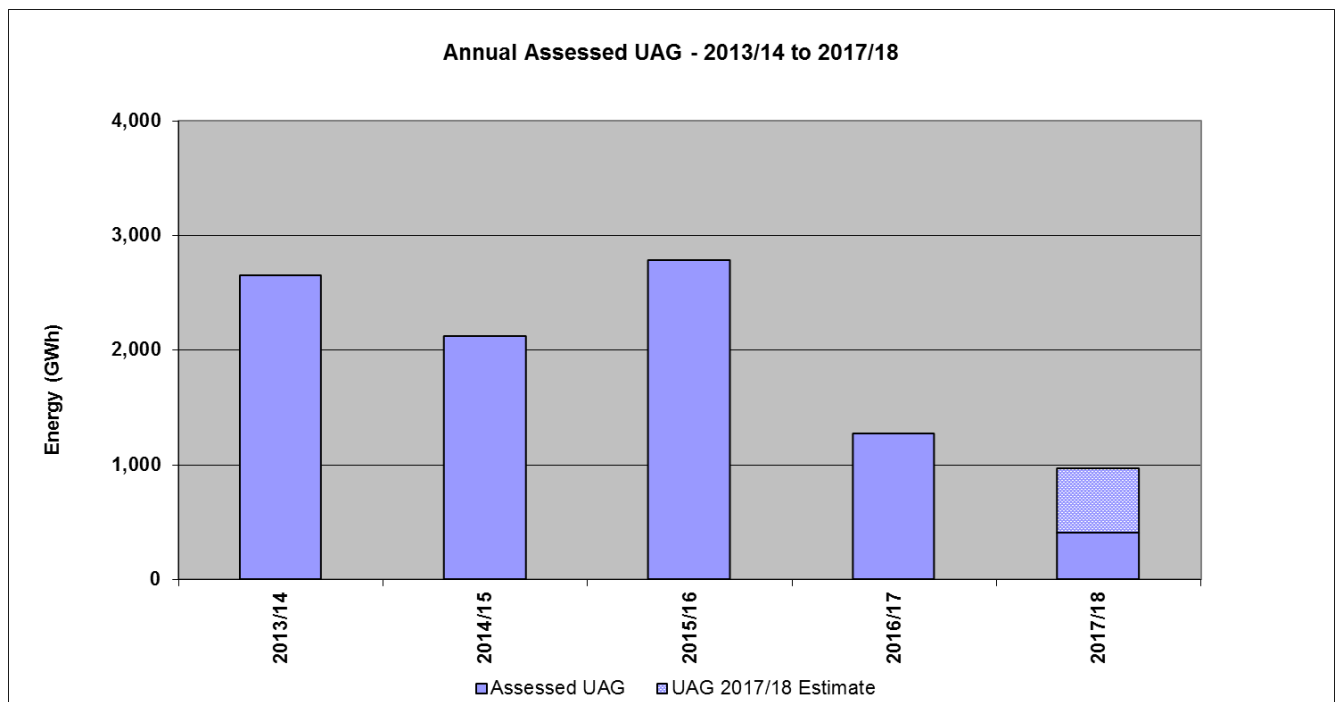


Figure 1: Annual assessed UAG – 2013/14 to 2017/18

Figure 1 provides the annual assessed quantities of UAG for Formula Years 2013/14 to 2017/18. 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 during the remainder of the current Formula Year.

From the above figure it can be seen that the total assessed UAG quantity for 2017/18 is expected to be lower than for the previous years and is currently estimated to be over 23% less than the equivalent quantity for 2016/17. It appears that the year on year reduction in the annual assessed UAG quantities observed since 2009/10, with the exception of 2015/16, may have continued.

Table 1 provides the actual assessed and estimated levels for UAG, OUG and CVS for 2017/18. The table indicates that OUG is expected to be the predominant element of NTS Shrinkage for 2017/18. UAG is expected to account for approximately 34% of the total estimated 2017/18 NTS Shrinkage.

2017/18	UAG	OUG	CVS	Total
Actual Assessed Levels - April to August (GWh)	407	730	50	1,186
Estimated Levels – September to March (GWh)	563	1,011	70	1,644
Estimated Annual Levels (GWh)	970	1,740	120	2,830
Percentage of Total Estimated Annual Level	34.3	61.5	4.2	100.0

Table 1: Actual assessed and estimated levels for UAG, OUG and CVS for 2017/18

Table 2 provides the annual and daily average assessed UAG quantities for Formula Years 2013/14 to 2017/18. The table also provides the annual assessed UAG quantities as a percentage of annual NTS Throughput.

UAG Statistics	2013/14	2014/15	2015/16	2016/17	2017/18
Assessed Annual Level (GWh)	2,648	2,121	2,782	1,272	407
Assessed Daily Average (GWh/d)	7.25	5.81	7.60	3.48	2.66
Percentage of NTS Throughput	0.29	0.23	0.29	0.13	0.12

Table 2: Statistical performance of UAG - 2013/14 to 2017/18

The values provided in the above table for 2017/18 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 2017/18 is also expected to be lower than that for 2016/17.

Figure 2 provides the total monthly assessed UAG from April 2013 to August 2017. It also provides the average monthly assessed UAG for this period (174.15 GWh). For the last 11 months total monthly assessed UAG has been less than the long term average monthly assessed UAG.

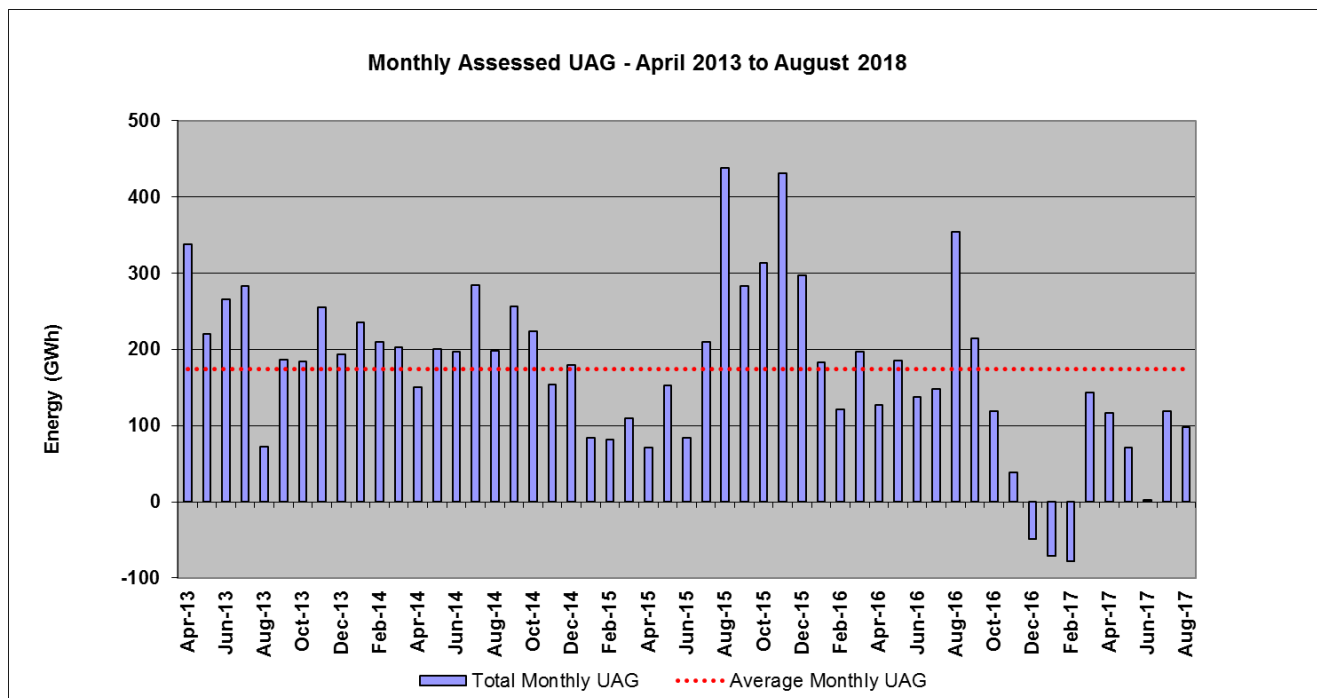


Figure 2: Monthly assessed UAG - April 2013 to August 2017

Total monthly assessed UAG has been positive for each of the last six months following the three months of negative UAG observed for December 2016, January 2017 and February 2017. During the March to August 2017 period the total monthly assessed UAG varied from +2.0 GWh to +143.3 GWh with a monthly average of 91.6 GWh.

Figure 3 provides the total monthly assessed UAG for March to August 2017 compared to the equivalent months of 2016. Figure 3 indicates that total monthly assessed UAG for 2017 has been less than the previous year's monthly value for each of the last 6 months. The total monthly assessed UAG levels have remained relatively consistent during the March to August period with the exception of June 2017 when very low levels of positive UAG were observed. The very low levels of positive UAG observed during this month are currently being investigated.

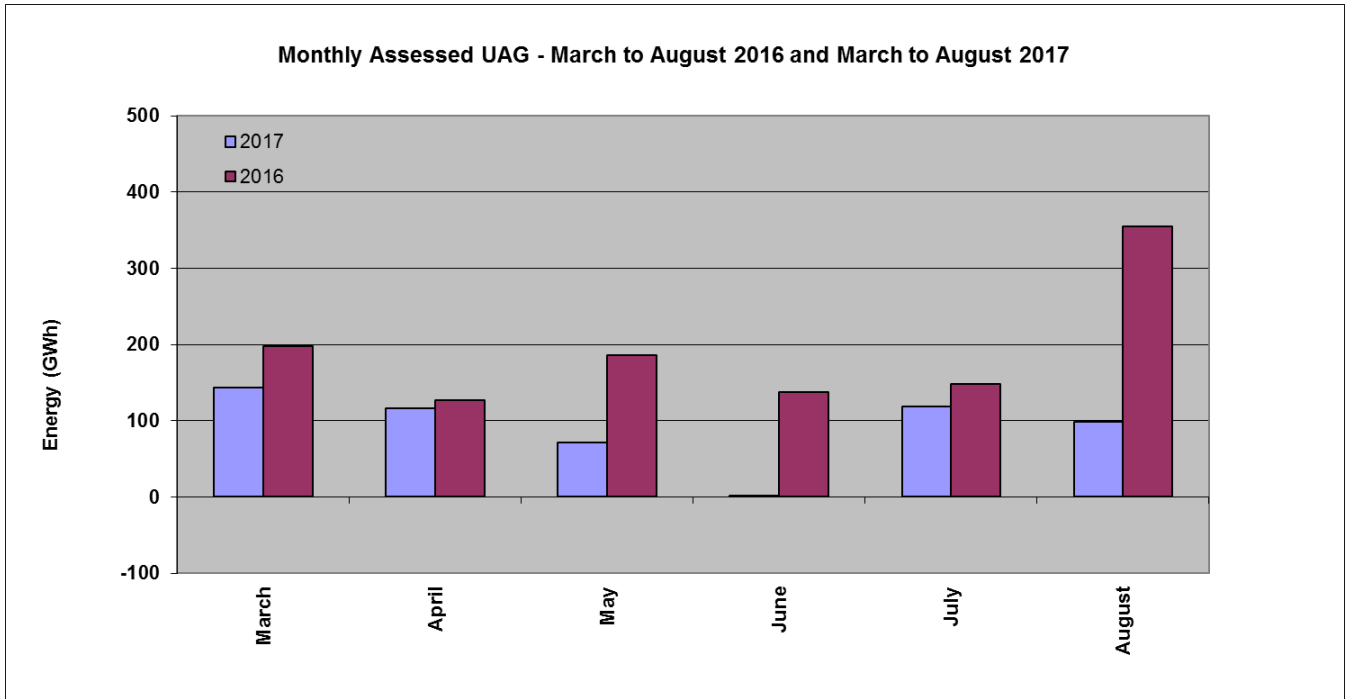


Figure 3: Monthly assessed UAG – March to August 2016 and March to August 2017

Figure 4 provides the daily assessed UAG values for 1st March to 31st August 2017. 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 -35.5 GWh to +65.3 GWh.

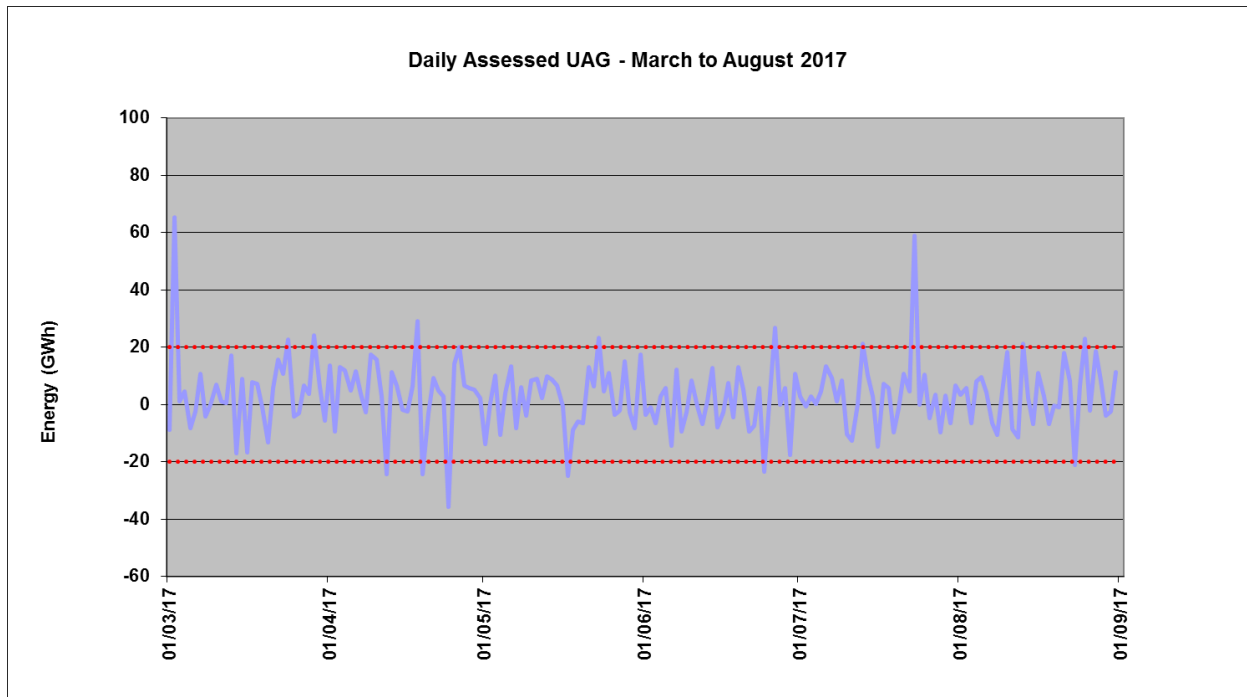


Figure 4: Daily assessed UAG – March to August 2017

There were 72 days (39.1% of occasions) subject to negative UAG during this period. This is a significant decrease from the 87 days (48.1% of occasions) subject to negative UAG during the previous 6 months.

National Grid reviews and investigates the assessed UAG values on a daily basis paying particular attention to any values that exceed ± 20 GWh. These baseline UAG quantities are provided as red dotted lines in the above figure. During the period of March to August 2017 there were 17 days when daily assessed UAG exceeded ± 20 GWh (9.2% of occasions). This is a decrease on the 20 days observed when daily assessed UAG exceeded ± 20 GWh (11.0% of occasions) during the previous 6 month period.

There were two instances of very high positive UAG during the March to August 2017 period: 2nd March (65.3 GWh) and 23rd July (58.8 GWh). These two instances were discovered to be due to data errors associated with the Moffat and Bacton IUK interconnectors. Reconciliations of these errors are currently being progressed. Further information on reconciliation is provided in section 3.3 of this report.

National Grid is continuing to investigate all days with high levels of positive or negative UAG during the March to August 2017 period. National Grid is also investigating the very low levels of positive UAG observed for June 2017. This includes investigating NTS supply and demand pattern changes over these periods which may have contributed to the levels of UAG observed. National Grid is also continuing to monitor for the presence of any trends.

2.2 Formula Year 2016/17

This section of the report provides data on assessed UAG levels for the April 2016 to March 2017 period. It expands on the reporting on the first 11 months of this Formula Year included in the October 2016 and April 2017 UAG reports. This is the first opportunity to report on assessed UAG for all of 2016/17 and allows observations to be presented for the whole year.

2016/17	UAG	OUG	CVS	Total
Actual Annual Levels (GWh)	1,272	2,650	50	3,972
Percentage of Total NTS Shrinkage	32.0	66.7	1.3	100.0

Table 3: Actual assessed levels for UAG, OUG and CVS for 2016/17

Table 3 provides the actual assessed levels for UAG, OUG and CVS for Formula Year 2016/17. The table indicates that OUG was the predominant element of NTS Shrinkage during 2016/17. This was due to a decrease in the levels of UAG observed during the year combined with an increase in the levels of OUG observed as a result of increased compressor usage. UAG accounted for approximately a third of the total 2016/17 NTS Shrinkage.

Assessed UAG during 2016/17 was significantly lower than for the previous Formula Year accounting for only 45.7% of the quantity observed during 2015/16.

Figure 5 provides the total monthly assessed UAG for April 2016 to March 2017 compared to the equivalent months of 2015/16. During 2016/17 the total monthly assessed UAG varied from -78.3 GWh (February 2017) to +354.8 GWh (August 2016) with a monthly average of 106.0 GWh.

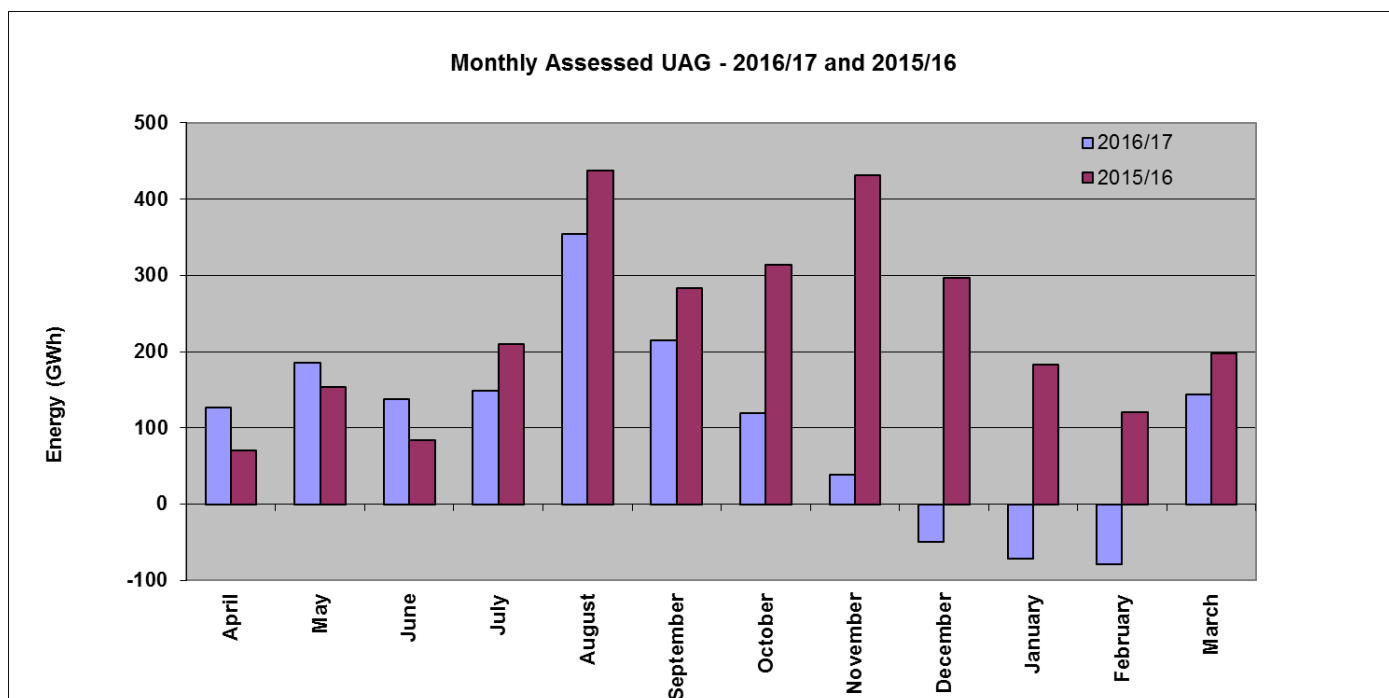


Figure 5: Monthly assessed UAG – 2016/17 and 2015/16

Figure 5 indicates that total monthly assessed UAG for 2016/17 was less than the previous year's monthly values for 75% of the year. Total monthly assessed UAG for the months of December 2016, January 2017 and February 2017 was negative. The quantities of negative UAG observed during this period have not been seen in over 10 years. National Grid is continuing to investigate the potential causes of this negative UAG. These investigations are focussing on identifying potential meter or data errors at one or more NTS entry facilities (meter(s) under reading), at one or more NTS exit facilities (meter(s) over reading) or a combination of both.

Figure 6 provides the daily assessed UAG values for 1st April 2016 to 31st March 2017. Figure 6 indicates that there continued to be large day to day variability in the daily assessed UAG values. During 2016/17 daily UAG varied from -52.9 GWh to +82.7 GWh with a daily average of 3.5 GWh. Negative UAG was observed on 139 days (38.1% of occasions) during 2016/17.

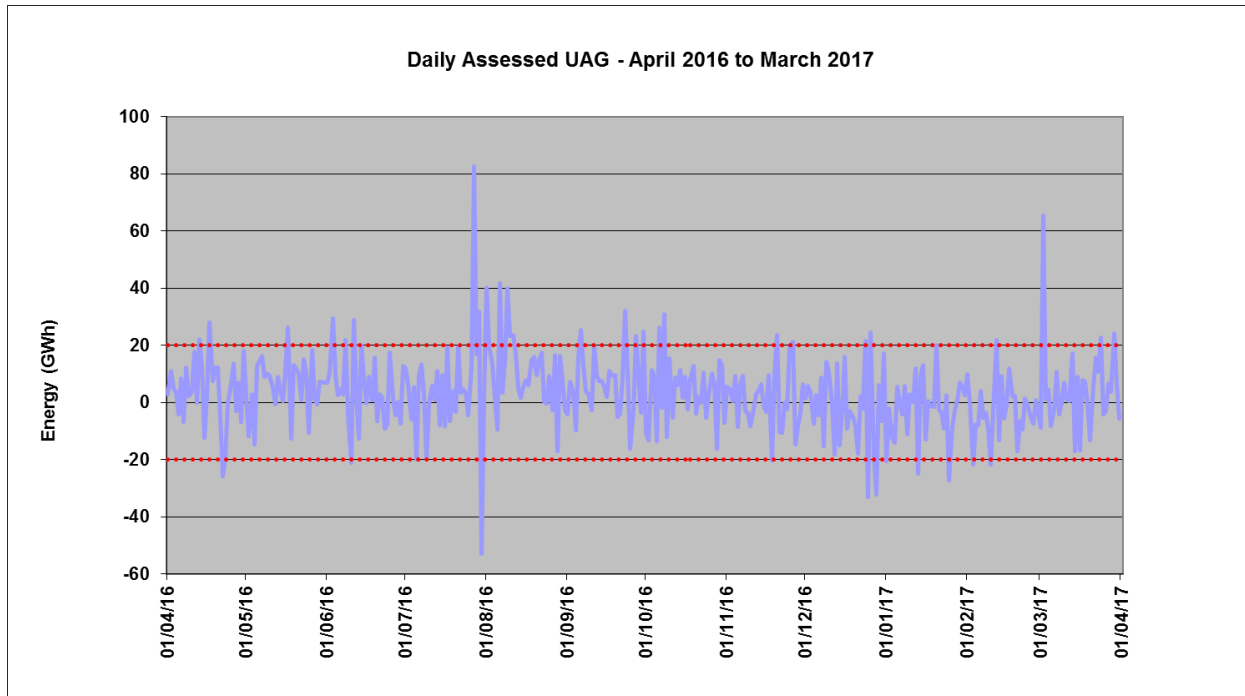


Figure 6: Daily assessed UAG – April 2016 to March 2017

As discussed previously in this report National Grid reviews and investigates the assessed UAG values on a daily basis paying particular attention to any values that exceed ± 20 GWh. These baseline UAG quantities are again provided as red dotted lines in the above figure. During 2016/17 there were 40 days when daily assessed UAG exceeded ± 20 GWh (11.0% of occasions).

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 Gas Control Suite (GCS) system.

The instance of high positive UAG observed at the start of March was investigated and discovered to be due to a data error associated with the Moffat interconnector.

National Grid is continuing to investigate all days with high levels of positive or negative UAG during 2016/17. This includes investigating NTS supply and demand pattern changes over this period which may have contributed to the levels of UAG observed.

The UAG, OUG and CVS data provided in this section of the report was the data National Grid included in its Regulatory Reporting Pack (RRP) submission to Ofgem for 2016/17. The process of preparing the data for the RRP submission highlighted a number of errors in the UAG, OUG and CVS data published in the October 2016 and April 2017 UAG reports which have been corrected this report. These data errors have been reviewed and would not have materially altered the conclusions reached in the earlier reports.

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 Validation Report Reviews

Meter owners are expected to undertake meter validations for each of their metering installations on at least an annual basis to confirm that the metering equipment is functioning correctly. The results of this testing should be documented within a meter validation report.

National Grid has traditionally received a relatively modest sample of meter validation reports from meter owners, typically from the operators of power stations or gas distribution networks. Over the past 12 months National Grid has contacted all meter owners to request meter validation reports for all entry and exit facilities connected to the NTS including, for the first time, terminals and storage facilities.

For Formula Year 2016/17 National Grid received meter validation reports for 98.5% of all the NTS entry and exit facilities. These reports were for validations that had taken place between April 2016 and March 2017. Only three meter owners failed to provide validation reports for their installations.

The Meter Assurance team reviewed all the reports received and, where necessary, raised queries with meter owners. Only four meter installations (2% of all NTS entry and exit facilities) were assessed to have failed their meter validations. National Grid has been liaising with these meter owners to agree actions to rectify the issues identified during the 2016/17 validations. The impact of these metering issues on assessed UAG levels is being investigated.

The reviews of the meter validation reports received during 2016/17 were used to inform the preparation of the meter witnessing campaign for 2017/18.

For Formula Year 2017/18 National Grid has to date received validation reports for 35.5% of all the NTS entry and exit facilities. The Meter Assurance team has reviewed all the reports received and only one meter installation has been assessed to have failed its meter validation.

Over the next six months the Meter Assurance team will continue to request the remaining meter validation reports, review the reports and use the data provided to assist with the identification of causes of UAG and to inform the preparation of future meter witnessing.

3.2 Meter Witnessing

National Grid plans and undertakes an annual meter witnessing campaign. This involves National Grid personnel attending metering installations throughout the UK during meter validations to observe and document the testing taking place to ensure the measurement equipment comprising the metering installation continues to measure without bias and within the agreed measurement uncertainties. For 2017/18 the annual meter witnessing programme comprises 17 visits to a range of different metering installations including terminal, NTS storage, power station and gas distribution network facilities.

During the March to August 2017 period National Grid planned to attend four witnessing visits. One visit to an industrial metering installation was completed during June. The other three planned visits to gas distribution network meter installations during July and August were not completed. National Grid personnel were available to attend, however, the meter owners were unable to accommodate the visits.

During the next six months National Grid is planning to attend 13 meter witnessing visits. National Grid is confident that it should be able to complete the majority of visits included in the 2017/18 annual meter witnessing campaign.

3.3 Reconciliation

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

Over the past six months National Grid has successfully processed 131.85 GWh of reconciliations in absolute energy terms. This comprises 23 instances of reconciliation at individual NTS exit facilities, each instance comprising of one or more days of reconciliation. The majority of these reconciliations concern days in Formula Years 2016/17 and 2017/18, however, reconciliations have also been processed for Formula Years 2014/15 and 2015/16.

Figure 7 provides the annual reconciliation quantities, in absolute energy terms, for Formula Years 2013/14 to 2017/18. The red coloured bars indicate the reconciliation quantities successfully processed since the publication of the April 2017 UAG report.

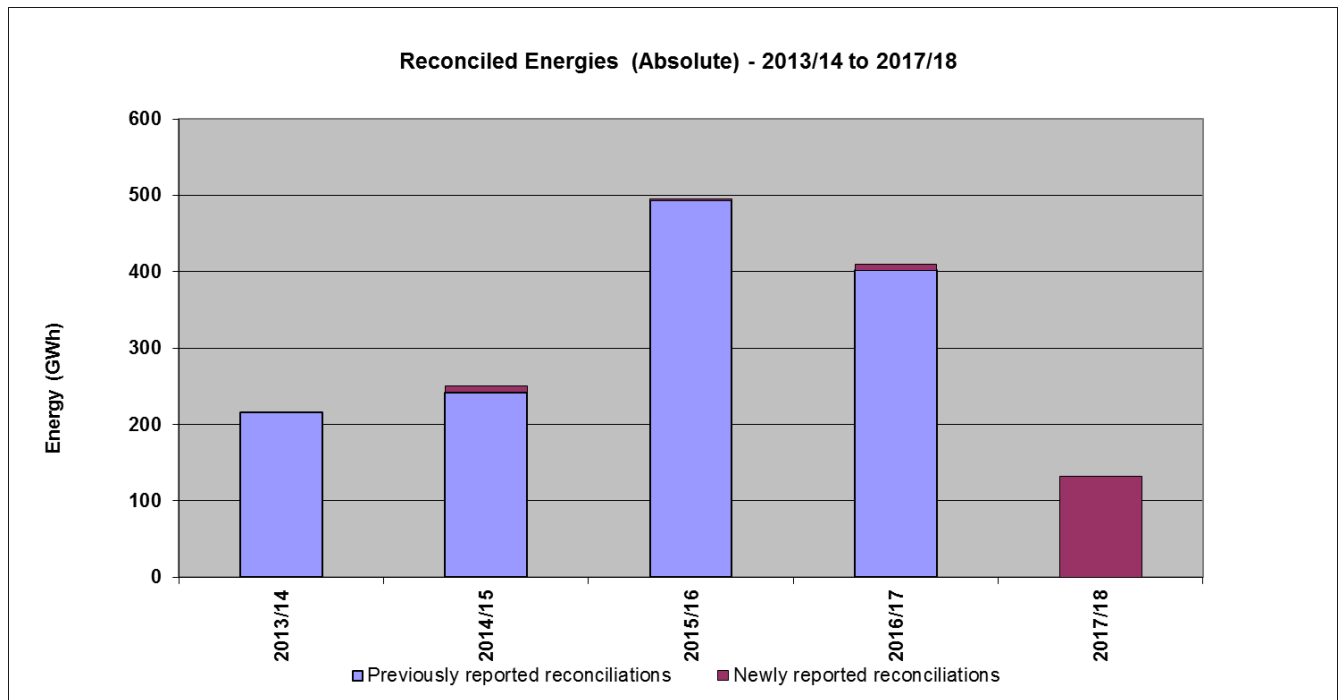


Figure 7: Reconciled energies (absolute) – 2013/14 to 2017/18

Of the 23 instances of reconciliation processed six related to meter errors (26.1% of instances) and 17 related to data errors (73.9% of instances).

National Grid is reviewing the data error reconciliations to improve its understanding of the causes of these errors which should help address the data quality challenges being experienced during the pre-closeout period.

Figure 8 provides the annual assessed UAG levels for Formula Years 2013/14 to 2017/18 compared with the annual reconciliation quantities, in absolute terms, for this period. It also provides the annual reconciliation quantities as a percentage of annual assessed UAG. The values provided in the figure for 2017/18 cover the period from 1st April to 31st August 2017.

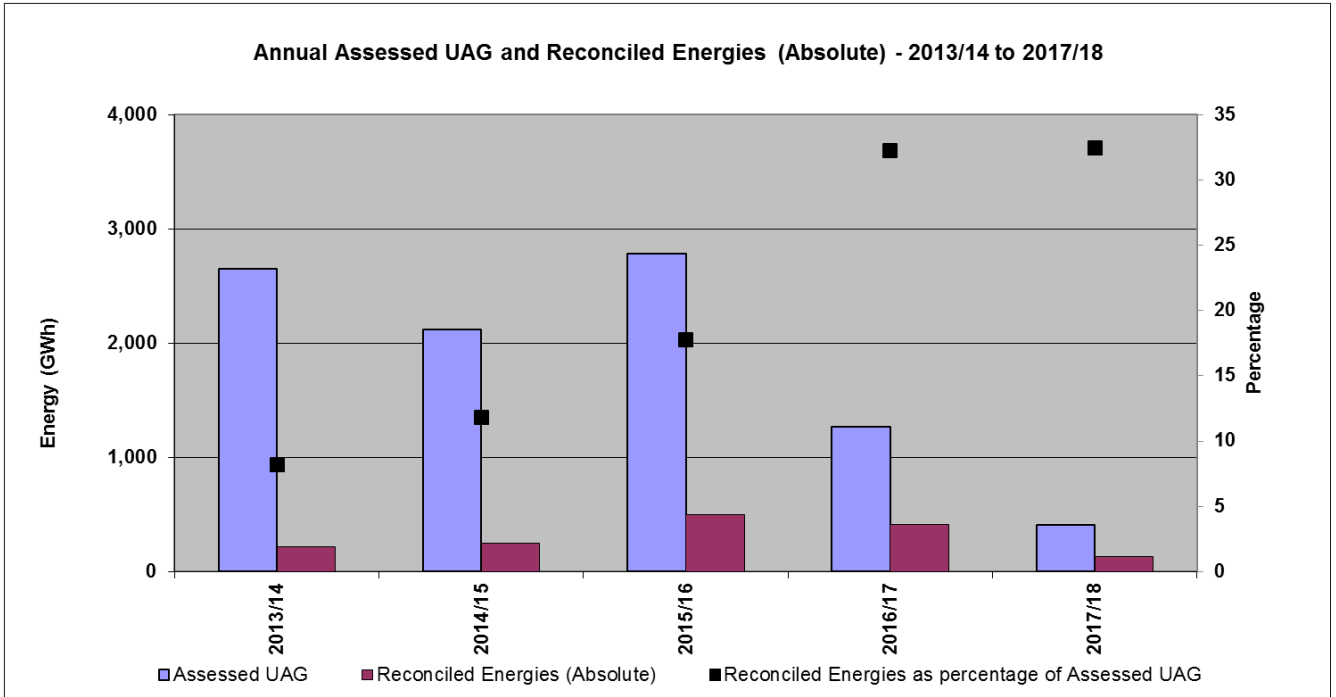


Figure 8: Annual assessed UAG and reconciled energies (absolute) – 2013/14 to 2017/18

Figure 8 demonstrates an upward trend in annual reconciliation quantities as a percentage of annual assessed UAG for Formula Years 2013/14 to 2016/17. It is currently expected that this trend will continue for 2017/18.

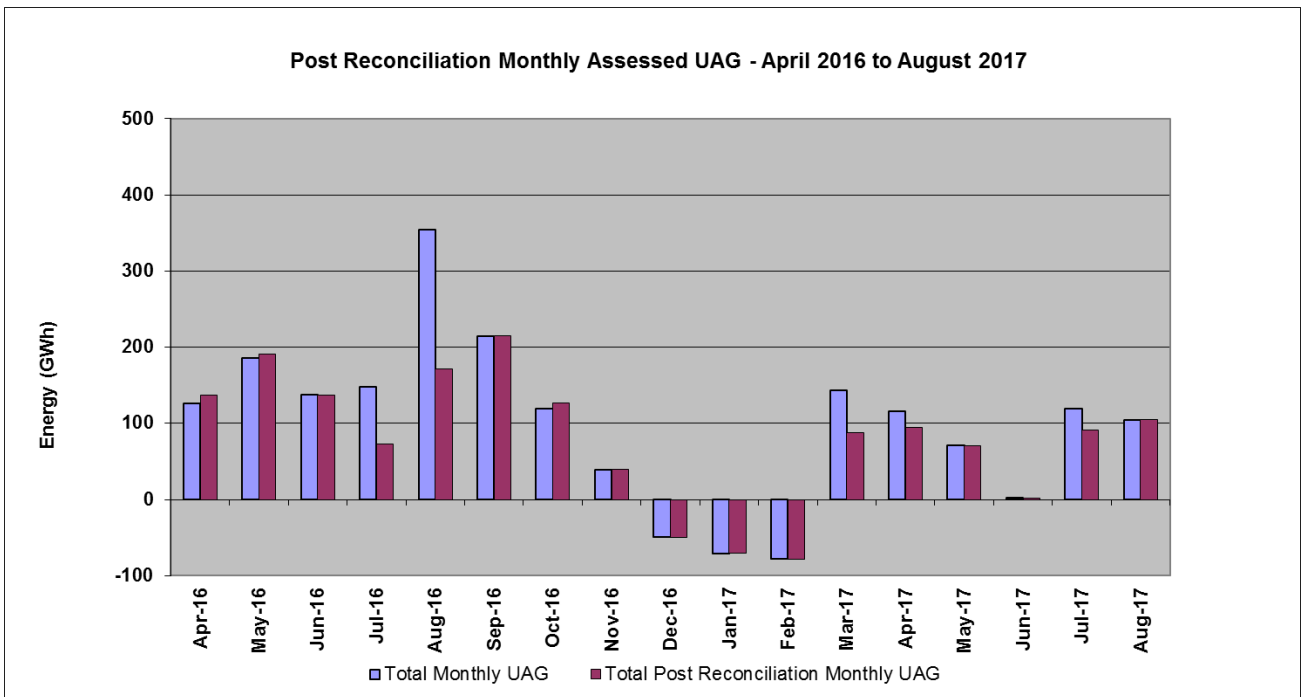


Figure 9: Post reconciliation monthly assessed UAG – April 2016 to August 2017

Figure 9 provides the total monthly assessed UAG from April 2016 to August 2017 compared with the total post reconciliation monthly assessed UAG for the same period which takes into account the reconciliations that have been processed by National Grid.

It can be observed from the figure that the post reconciliation monthly assessed UAG is significantly lower for July 2016, August 2016 and March 2017. The post reconciliation monthly UAG quantities for July and August 2016 are both more than 50% less than the pre-reconciliation UAG quantities. This indicates the impact on UAG of the data errors associated with the implementation of GCS. The post reconciliation monthly assessed UAG quantity for March 2017 is nearly 40% less than the pre-reconciliation UAG quantity. This indicates the impact on UAG of the Moffat interconnector data error.

In the April 2017 UAG report it was highlighted that the post reconciliation monthly assessed UAG quantity for October 2016 was more than 60% higher than the pre-reconciliation UAG quantity. This appeared to indicate that the substantial reduction in total monthly assessed UAG observed in the second half of 2016/17 had actually begun later when taking account of the reconciliations that had been processed. Further investigations by National Grid identified that the increase in post reconciliation UAG was actually due to a data error reconciliation having been erroneously recorded. This error has been corrected in this report. It now appears that the substantial reduction in total monthly assessed UAG observed during the last Formula Year began in October 2016. Improvements to the recording of reconciliations have been implemented.

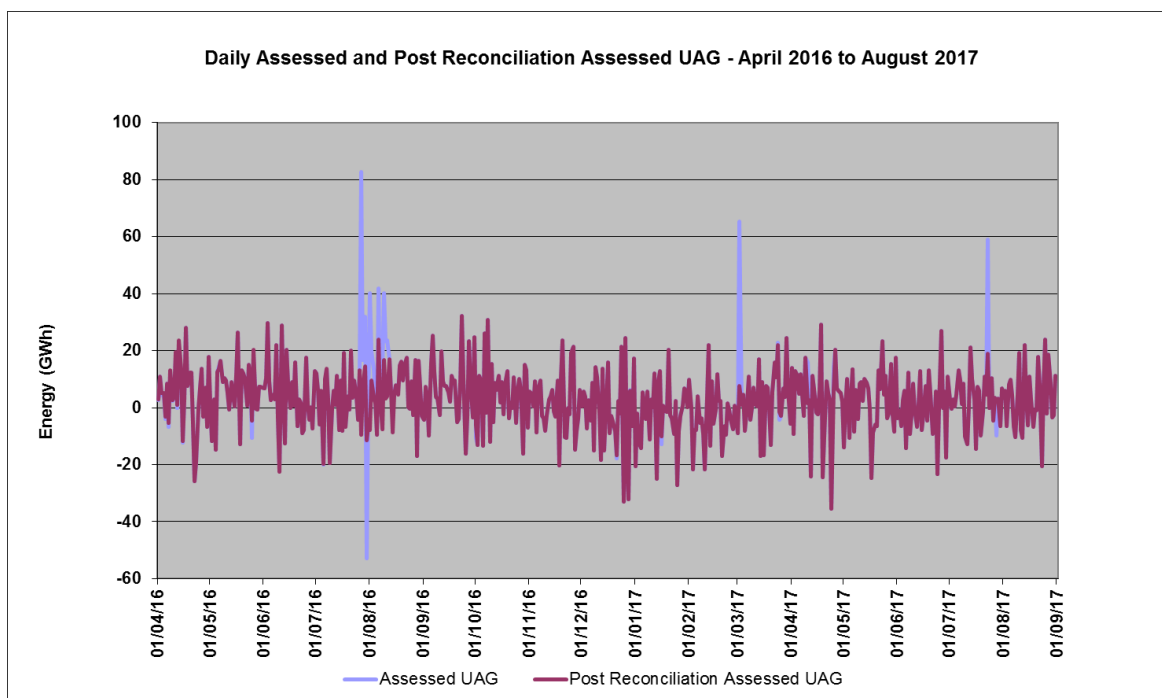


Figure 10: Daily assessed and post reconciliation daily assessed UAG – April 2016 to August 2017

Figure 10 provides the daily assessed UAG values for 1st April 2016 to 31st August 2017 compared with the post reconciliation daily assessed UAG values for the same period. It demonstrates that National Grid has identified and processed reconciliations for the instances of very high or very low daily assessed UAG observed during this period.

National Grid is currently processing a further 24 data and meter reconciliations which will be included in future UAG reports. Over the next six months National Grid is planning to undertake further analysis on reconciliations to be able to provide greater detail in future reports on the impact of reconciliations on assessed UAG. National Grid will also process as much reconciliation as possible.

3.4 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 owners and the third party organisations that 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 meter owner.

Final testing and sign off of version 2.0 of NGage and NGageCalc, National Grid's gas property and flow calculator application, was completed in June 2017. NGage is available on request from the Meter Assurance team. NGageCalc is available via the iTunes App Store or Google Play Store.

Over the coming months National Grid is planning to roll out version 2.0 of the NGage application to as many meter owners as possible. National Grid will support meter owners in using this application during their meter validations scheduled during the second half of 2017/18. Use of NGage will assist National Grid in efficiently obtaining up to date meter validation reports as discussed in section 3.1 of the report. The data provided in the reports will be used to assist with the identification of causes of UAG and to inform the preparation of future meter witnessing.

3.5 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 ± 20 GWh as triggers to investigate potentially high levels of positive or negative UAG. This study is expected to provide a more dynamic UAG baseline quantity which will assist in the future management of UAG. It is also expected to provide a range of improved mathematical methods for identifying potential causes of UAG.

A PhD student has continued work on the baseline UAG analysis focussing on change point analysis with the aim that this analysis will lead to the creation of a number of applications that National Grid will be able to incorporate into its day to day management of UAG.

Working with UAG data covering the 2009 to 2011 period, a period during which major meter errors were experienced, a variety of techniques and models focusing on identifying meter error and identifying an improved baseline have been trialled. There has been some success in using univariate and multivariate change point detection methods to detect changes in the UAG and attribute them to a specific meter. Whilst these methods have to date been highly accurate in determining the time at which large errors occurred, attributing these errors to a meter has proved to be more challenging. The task has been complicated by the correlation between certain meters and the intermittent nature of the data. However, this is an active research area and improvement is expected.

A baseline methodology developed by Arpino et al (2014) which can be used to calculate a dynamic baseline which takes account of metered flow volumes has also been tested. This system should provide a much more reliable baseline level than the static values of ± 20 GWh. Work is in progress to adapt this model to provide better values for the NTS.

Over the next six months it is intended that the PhD student will spend a period of time at National Grid to implement and support the use of new analytical techniques in the day to day management of UAG. These change point methods will be integrated into National Grid's UAG management systems, either via Tableau software or a custom web interface. Work is also planned to assess the value of these tools in identifying the causes of UAG.

3.6 Ongoing Development of Gas Control Suite

At the end of July 2016 National Grid implemented its new Gas Control Suite system. This replaced the existing Integrated Gas Management System and is used to control the physical and commercial operation of the NTS. One of the roles of 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 April 2017 UAG report, there were a number of unexpected data errors associated with the implementation of GCS. The Meter Assurance team has continued to work closely with the GCS development team since implementation to ensure that the best available data is used by the system to calculate UAG and to specify new system functionality that will improve the day to day management of UAG.

Over the past six months the team has begun to develop new data visualisations to assist the identification of UAG. This has involved the use of Tableau software, one of the components of GCS, to create a suite of Tableau dashboards. These include dashboards for investigating NTS supply and demand pattern changes which may have contributed to the levels of UAG observed. Figure 11 provides an example of a Tableau dashboard.

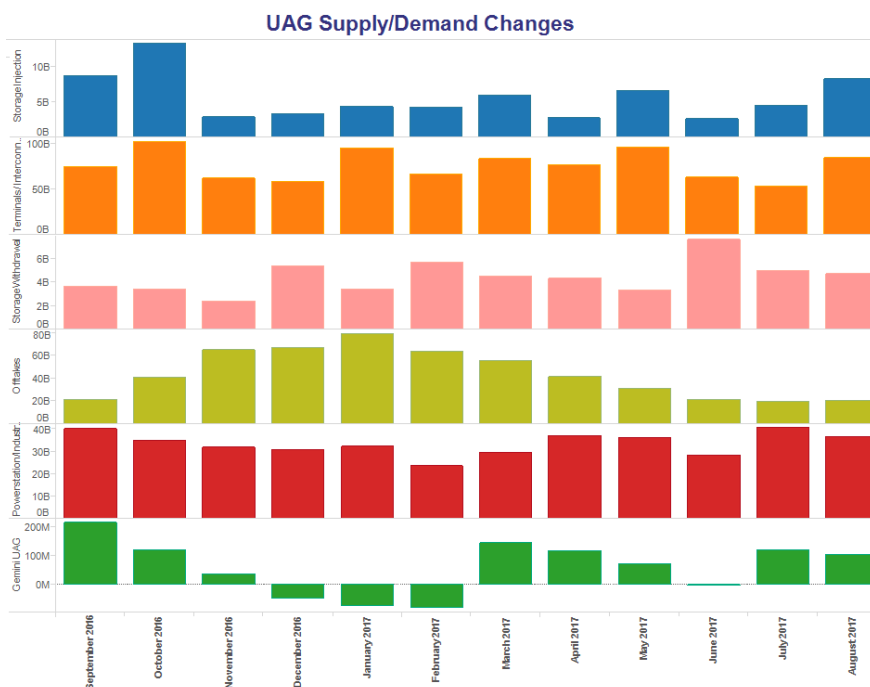


Figure 11: Specimen Tableau dashboard under development

The above Tableau dashboard highlighted a possible correlation between the low levels of positive UAG experienced in June 2017 and a significant increase in gas delivered to the NTS from storage during this period. This possible correlation is being investigated further.

Over the coming months the Meter Assurance team will continue to work with the GCS development team to ensure the best available data is used by the system to calculate UAG and to specify new system functionality that will improve the day to day management of UAG. The team will also continue enhancing its data visualisation capabilities. A particular focus for the team will be to develop Tableau dashboards to improve data quality during the pre-closeout period.

4. Conclusion

The total monthly assessed UAG quantity for each month during the March to August 2017 period has been less than for the equivalent month in 2016. In addition, total monthly assessed UAG has all been less than the five year long term average monthly assessed UAG.

It is expected that for Formula Year 2017/18 annual assessed UAG will be less than for Formula Year 2016/17 and will support the decline in annual quantities observed since 2009/10. Despite the decline in annual assessed UAG National Grid is expecting to process as much meter or data error reconciliation, in absolute energy terms, for 2017/18 as was reconciled for 2016/17.

Testing of the NGage meter validation application has now been completed. The release of version 2.0 of the application to meter owners is expected to take place during the second half of 2017/18.

Progress has been made on enhancing National Grid's analytical capability through the development of improved data visualisation to support its ongoing work into the investigation of the causes of UAG.

Good progress has also been made on obtaining and reviewing meter validation information for NTS entry and exit facilities for 2016/17 and 2017/18. This data is being used to assist with the identification of causes of UAG and to inform the preparation of future meter witnessing campaigns.

Appendix I - National Grid Gas Plc (NTS) Gas Transporter Licence Special Condition 8E

Special Condition 8E: Requirement to undertake UAG Projects to investigate the causes of Unaccounted for Gas (UAG)

Introduction

8E.1 The purpose of this condition is to set out the obligations of the Licensee in respect of undertaking projects for the purposes of investigating the causes of Unaccounted for Gas (UAG) and the publication of the findings of these projects, including relevant data.

Part A: Licensee's obligations under this condition

8E.2 The Licensee shall use reasonable endeavours to undertake the UAG Projects as specified in this condition for the purposes of investigating the causes of Unaccounted for Gas in respect of Formula Year t commencing on 1 April 2013 and each subsequent Formula Year t until 31 March 2021. The UAG Projects shall include but need not be limited to those set out in paragraph 8E.5. Where the Licensee does not undertake certain UAG Projects it shall clearly set out its reasoning in the UAG Reports referred to in paragraph 8E.3.

8E.3 The Licensee shall publish UAG Reports of the findings of these UAG Projects on its website and provide a copy of the UAG Reports to the Authority. The Licensee shall publish the UAG Reports by 1 May 2013, 1 October 2013 and every subsequent six months thereafter or such other dates as agreed by the Authority.

8E.4 Within one month of publishing a UAG Report the Licensee shall publish on its website all the relevant data referred to in the UAG Report. Where there are legitimate reasons for not publishing certain data on the website the Authority may consent for the Licensee not to do so.

Part B: Interpretation

8E.5 For the purposes of this condition:

UAG Projects	means the projects currently undertaken by the Licensee including: <ul style="list-style-type: none">(a) the witnessing by the Licensee of the validation of Measurement Equipment at NTS System Entry Points or Supply Meter Installations at NTS Exit Points; and(b) investigation and analysis of data in order to seek to identify causes of UAG.
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UAG Report

means the report of the findings of the UAG Projects undertaken by the Licensee. The UAG Report shall detail the UAG Projects the Licensee has undertaken in the previous period, the UAG Projects it proposes to undertake in the next period and the Licensee's views on whether, and if so how, the findings of the UAG Projects may be taken forward in order to reduce the volume of UAG. The UAG Report shall also detail the reasons why any UAG Projects that the Licensee proposed to undertake have not been undertaken. The UAG Report shall summarise any relevant discussion concerning UAG at industry fora and with interested parties on a one-to-one basis.

Unaccounted for Gas (UAG)

means the amount of gas (GWh) that remains unaccounted for after the Entry Close-out Date following the assessment of NTS Shrinkage performed in accordance with the network code.

Measurement Equipment; NTS System Entry Points; Supply Meter Installations; NTS Exit Points; Entry Close-out Date; NTS Shrinkage

shall bear the same meanings as are given to those terms in the network code.

Appendix II – Relevant data referred to in October 2017 Unaccounted for Gas Report

This appendix provides the relevant data used to prepare the figures and tables provided in the report. The assessed and estimated UAG, OUG and CVS values used in the figures and tables are calculated from daily assessed values published on the National Grid website.

Figure 1:

Formula Year	Annual assessed UAG (GWh)	2017/18 UAG Estimate (GWh)
2013/14	2,648	-
2014/15	2,121	-
2015/16	2,782	-
2016/17	1,272	-
2017/18	407	563

The annual assessed UAG for 2017/18 covers the period 1st April to 31st August 2017.

Figure 2:

Month	Total monthly assessed UAG (GWh)	Average monthly assessed UAG (GWh)
Apr-13	337.54	174.15
May-13	220.69	174.15
Jun-13	266.17	174.15
Jul-13	283.19	174.15
Aug-13	72.18	174.15
Sep-13	186.56	174.15
Oct-13	184.75	174.15
Nov-13	254.88	174.15
Dec-13	193.15	174.15
Jan-14	235.28	174.15
Feb-14	210.38	174.15
Mar-14	203.22	174.15
Apr-14	150.50	174.15
May-14	200.90	174.15
Jun-14	197.26	174.15
Jul-14	284.19	174.15
Aug-14	197.98	174.15
Sep-14	256.67	174.15
Oct-14	223.58	174.15

Month	Total monthly assessed UAG (GWh)	Average monthly assessed UAG (GWh)
Nov-14	154.41	174.15
Dec-14	179.73	174.15
Jan-15	84.50	174.15
Feb-15	81.31	174.15
Mar-15	110.23	174.15
Apr-15	70.99	174.15
May-15	153.27	174.15
Jun-15	84.29	174.15
Jul-15	209.38	174.15
Aug-15	437.92	174.15
Sep-15	283.13	174.15
Oct-15	313.53	174.15
Nov-15	431.57	174.15
Dec-15	296.88	174.15
Jan-16	183.12	174.15
Feb-16	120.94	174.15
Mar-16	197.22	174.15
Apr-16	126.71	174.15
May-16	185.70	174.15
Jun-16	138.06	174.15
Jul-16	148.50	174.15
Aug-16	354.84	174.15
Sep-16	214.48	174.15
Oct-16	119.22	174.15
Nov-16	39.19	174.15
Dec-16	-48.90	174.15
Jan-17	-71.07	174.15
Feb-17	-78.32	174.15
Mar-17	143.26	174.15
Apr-17	116.39	174.15
May-17	71.05	174.15
Jun-17	1.97	174.15
Jul-17	118.93	174.15
Aug-17	98.25	174.15

Figure 3:

Month	Total monthly assessed UAG (GWh)	Month	Total monthly assessed UAG (GWh)
Mar-16	197.22	Mar-17	143.26
Apr-16	126.71	Apr-17	116.39
May-16	185.70	May-17	71.05
Jun-16	138.06	Jun-17	1.97
Jul-16	148.50	Jul-17	118.93
Aug-16	354.84	Aug-17	98.25

Figure 4:

Daily assessed UAG values are published on the National Grid website via the following link:
<http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/unaccounted-for-gas/>.

The upper and lower baseline UAG quantities provided in Figure 4 are respectively +20 GWh and -20 GWh.

Figure 5:

Month	Total monthly assessed UAG (GWh)	Month	Total monthly assessed UAG (GWh)
Apr-15	70.99	Apr-16	126.71
May-15	153.27	May-16	185.70
Jun-15	84.29	Jun-16	138.06
Jul-15	209.38	Jul-16	148.50
Aug-15	437.92	Aug-16	354.84
Sep-15	283.13	Sep-16	214.48
Oct-15	313.53	Oct-16	119.22
Nov-15	431.57	Nov-16	39.19
Dec-15	296.88	Dec-16	-48.90
Jan-16	183.12	Jan-17	-71.07
Feb-16	120.94	Feb-17	-78.32
Mar-16	197.22	Mar-17	143.26

Figure 6:

Daily assessed UAG values are published on the National Grid website via the following link:
<http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/unaccounted-for-gas/>.

The upper and lower baseline UAG quantities provided in Figure 6 are respectively +20 GWh and -20 GWh.

Figure 7:

Formula Year	Number of instances of reconciliation published in April 2017 UAG report	Reconciled energy (absolute) published in April 2017 UAG report (GWh)	Number of instances of reconciliation processed since publication of April 2017 UAG report	Reconciled energy (absolute) processed since publication of April 2017 UAG report (GWh)
2013/14	45	216.49	0	0.00
2014/15	45	241.98	2	8.73
2015/16	56	493.21	1	1.80
2016/17	101	401.76*	10	8.35
2017/18	-	-	10	131.85

2017/18 covers the period 1st April to 31st August 2017.

*Value corrected since publication of the April 2017 UAG report following the identification of an erroneously recorded data error reconciliation.

Figure 8:

Formula Year	Annual assessed UAG (GWh)	Reconciled energy (absolute) (GWh)	Reconciled energy (absolute) as percentage of annual assessed UAG (%)
2013/14	2,648	216.49	8.2
2014/15	2,121	250.71	11.8
2015/16	2,782	495.01	17.8
2016/17	1,272	410.11	32.2
2017/18	407	131.85	32.4

2017/18 covers the period 1st April to 31st August 2017.

Figure 9:

Month	Total monthly assessed UAG (GWh)	Total post reconciliation monthly assessed UAG (GWh)
Apr-16	126.71	137.39
May-16	185.70	190.98
Jun-16	138.06	136.67
Jul-16	148.50	72.46
Aug-16	354.84	170.93
Sep-16	214.48	214.48
Oct-16	119.22	127.07
Nov-16	39.19	39.19
Dec-16	-48.90	-50.40
Jan-17	-71.07	-70.48
Feb-17	-78.32	-78.32
Mar-17	143.26	87.38
Apr-17	116.39	94.37
May-17	71.05	71.05
Jun-17	1.97	1.97
Jul-17	118.93	90.88
Aug-17	98.25	98.25

Figure 10:

Daily assessed UAG values are published on the National Grid website via the following link:

[http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/unaccounted-for-gas/.](http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/unaccounted-for-gas/)