



Unaccounted for Gas Report

October 2019

nationalgrid

Executive Summary

This report provides a review of National Grid's Unaccounted for Gas (UAG) management since April 2013, the start of the RIIO-T1 price control, with particular emphasis on 1st March 2019 to 31st August 2019 inclusive, the period since the publication of the April 2019 UAG report. It is published to meet National Grid Gas Plc (NTS) Gas Transporter Licence Special Condition 8E.

The total assessed UAG quantity for the March 2019 to August 2019 period is higher than for the previous six-month period. In addition, total monthly assessed UAG values have been greater than the long-term average (April 2013 to August 2019) monthly assessed UAG for five of the last six months.

It is expected that for Formula Year 2019/20 annual assessed UAG will be significantly greater than for 2018/19. Annual assessed UAG over the past six-month period has been more reflective of the levels of UAG seen prior to mid-2016.

National Grid continues to report post-reconciliation assessed UAG enabling a more accurate representation of UAG performance. National Grid has also continued to improve its understanding of the causes of UAG through its baseline UAG, OUG and NTS linepack change analysis work.

Continued support from meter owners has enabled National Grid to obtain and review meter validation information for NTS entry and exit facilities. This data is being used to support the identification of causes of UAG, to enhance National Grid's ability to detect meter error and to inform the preparation of future meter witnessing programmes.

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Unaccounted for Gas Report - October 2019

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 since April 2013, the start of the RIIO-T1 price control, with particular emphasis on 1st March to 31st August 2019 inclusive, the period since the publication of the April 2019 UAG report. 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:
<https://www.nationalgridgas.com/balancing/unaccounted-gas-uag>.

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 National Grid's Meter Assurance team via the following email address:
meterassurance@nationalgrid.com. Meter Assurance, who are part of the Energy Balancing team within the National Grid UK Gas System Operator directorate, are responsible for investigating the causes of and reporting upon UAG.

National Transmission System Unaccounted for Gas Trends

This section of the Unaccounted for Gas report provides information on assessed Unaccounted for Gas quantities since April 2013, with particular emphasis on the period March to August 2019. It also provides a review of the assessed quantities of UAG observed for Formula Year 2018/19.

Formula Years 2013/14 to 2019/20

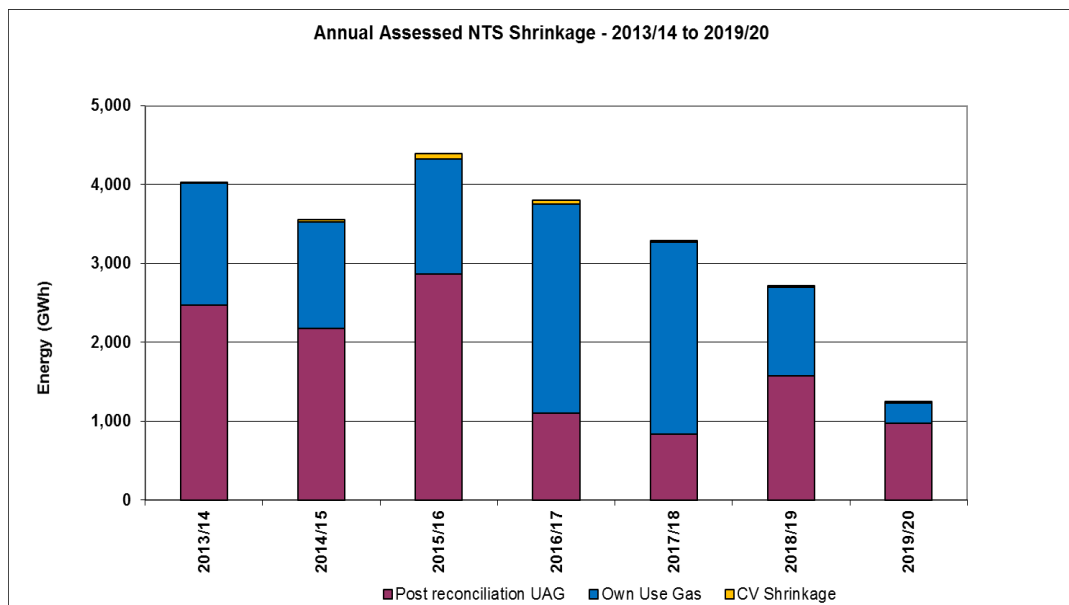


Figure 1: Annual assessed NTS Shrinkage – 2013/14 to 2019/20

Figure 1 provides the annual assessed UAG, OUG and CVS quantities for Formula Years 2013/14 to 2019/20. A Formula Year refers to the period from 1st April to 31st March of the following year. The quantities provided in Figure 1 for 2019/20 cover the five-month period from 1st April 2019 to 31st August 2019.

Figure 1 demonstrates that the current Formula Year's assessed NTS shrinkage for 2019/20 is currently expected to be greater than that observed in 2018/19 and is likely to be similar to levels observed in 2014/15.

Assessed UAG for the current Formula Year already exceeds the 2017/18 value and the annual assessed UAG is expected to reflect the values observed before 2016/17. The figure for 2019/20 also indicates that UAG is expected to be the predominant element of NTS Shrinkage much like 2013/14, 2014/15 and 2015/16, whereas for 2016/17 and 2017/18 OUG was the predominant element. The decrease in OUG has been driven by a large drop in the supplies at the St Fergus terminal, as Liquefied Natural Gas (LNG) supplies increased. UAG currently accounts for 78% of total shrinkage.

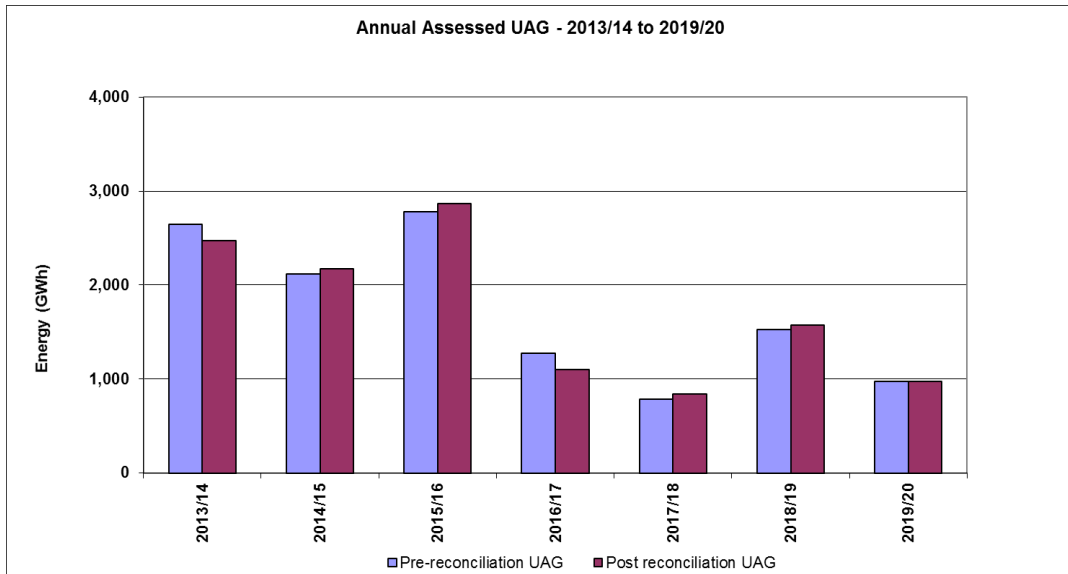


Figure 2: Annual assessed UAG – 2013/14 to 2019/20

Figure 2 provides the annual assessed quantities of UAG for Formula Years 2013/14 to 2019/20. As with Figure 1, the quantities provided for 2019/20 cover the period from 1st April 2019 to 31st August 2019.

The above figure represents both pre-reconciliation and post-reconciliation annual assessed UAG quantities. Pre-reconciliation UAG is calculated using the energy measurements reported in the Gemini commercial system at closeout for the NTS entry and exit points. If a meter or data error is identified following closeout for one of these points, the correct measurements are determined. Post-reconciliation UAG is then calculated using the corrected measurements. Further information on reconciliation is provided in the UAG Management Activities section of this report.

As described in previous reports, a year on year reduction in annual assessed UAG was observed up to 2018/19 (with the exception of 2015/16). Assessed UAG since 2018/19 now appears to be increasing and UAG behaviour over the past six months has been similar to that observed pre-2016/17. This increase in assessed UAG has been due to a significant increase in positive daily and monthly assessed UAG levels since September 2018. This recent UAG activity appears to indicate that the period between mid-2016 to mid-2018 was a period of abnormal UAG behaviour.

Figure 2 also indicates that for the majority of the years during the 2013/14 to 2019/20 period, annual post-reconciliation UAG quantities have been greater than the annual pre-reconciliation quantities for the same year.

Unless stated otherwise the remainder of this report will refer to post-reconciliation assessed UAG quantities.

Table 1 provides the annual and daily average assessed UAG quantities for Formula Years 2013/14 to 2019/20. 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	2018/19	2019/20
Annual Assessed Level (GWh)	2,470	2,173	2,866	1,103	840	1,576	976
Assessed Daily Average (GWh/d)	6.77	5.95	7.83	3.02	2.30	4.32	6.38
Percentage of NTS Throughput	0.28	0.24	0.31	0.12	0.09	0.18	0.30

Table 1: Statistical performance of UAG - 2013/14 to 2019/20

The values provided in the above table for 2019/20 cover the period from 1st April 2019 to 31st August 2019 and indicates that the daily average assessed UAG quantity for the year is expected to be higher than that for the previous three years. UAG as a percentage of annual NTS Throughput for 2019/20 is also expected to be much higher than that for 2018/19.

Figure 3 provides the total monthly assessed UAG from April 2013 to August 2019. It also provides the average monthly assessed UAG for this period (155.89 GWh) together with the average monthly assessed UAG for each Formula Year.

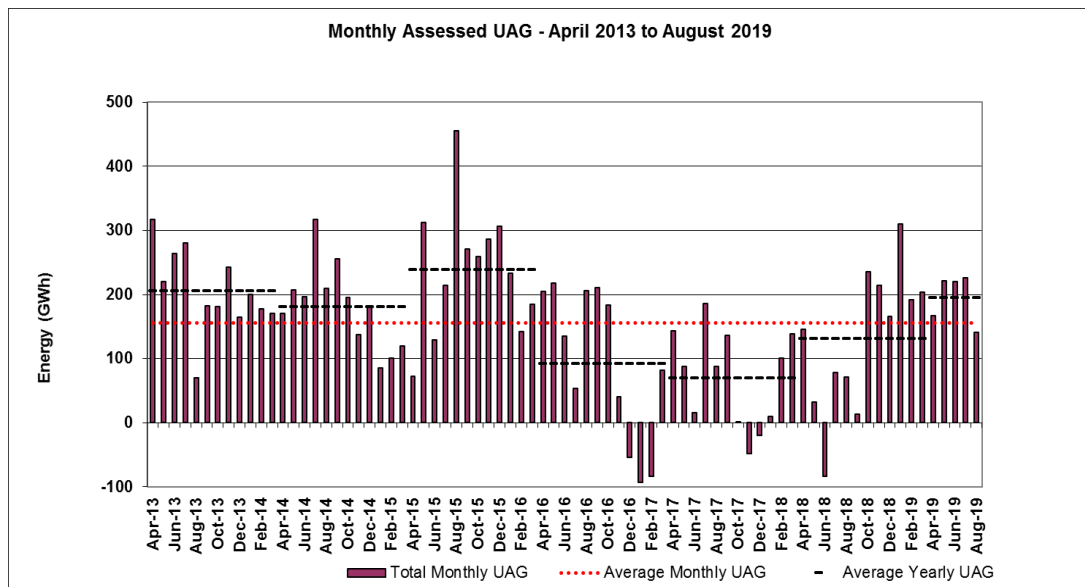


Figure 3: Monthly assessed UAG - April 2013 to August 2019

As Figure 3 indicates, since October 2018, monthly assessed UAG has been higher than the long-term average for 10 of the 11 months. This is after a 23-month period, from November 2016 to September 2018, when monthly assessed UAG was significantly less than the long-term average. UAG has been relatively stable over the past six-months with no monthly periods of negative UAG observed. Increased annual assessed UAG for 2019/20 is expected if high levels of positive monthly UAG continue to be observed.

Recent UAG activity appears to indicate that the 23-month period between November 2016 and September 2018 was a period of abnormal UAG performance. National Grid are focussing its investigations on this 23-month period.

Figure 4 provides the total monthly assessed UAG for March 2019 to August 2019 compared with the equivalent months of 2018. The figure indicates a very different pattern of behaviour during the period between May and August 2019 to that observed during the same period in 2018.

Consistent higher levels of positive monthly UAG have been observed over the last six months and in contrast, lower levels of UAG was being observed during the same period for the previous year due to greater levels of negative UAG.

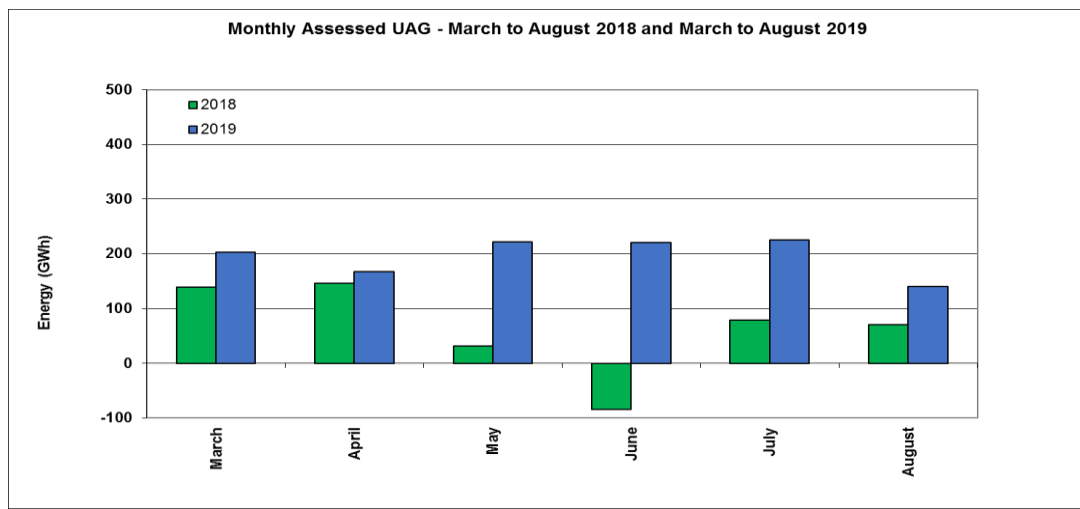


Figure 4: Monthly assessed UAG – March 2018 to August 2018 and March 2019 to August 2019

During the last six-months, the total monthly assessed UAG varied from +140.5 GWh to +225.9 GWh with a monthly average of 196.5 GWh. In comparison, during the March 2018 to August 2018 period total monthly assessed UAG varied from -84.0 GWh to +146.0 GWh with a monthly average of 63.7 GWh.

Figure 5 provides the daily assessed UAG values for 1st March 2019 to August 2019 and indicates that UAG has been relatively stable, apart from two high UAG spikes in June and July. This is confirmed by the largely flat 30 day rolling average included in the figure.

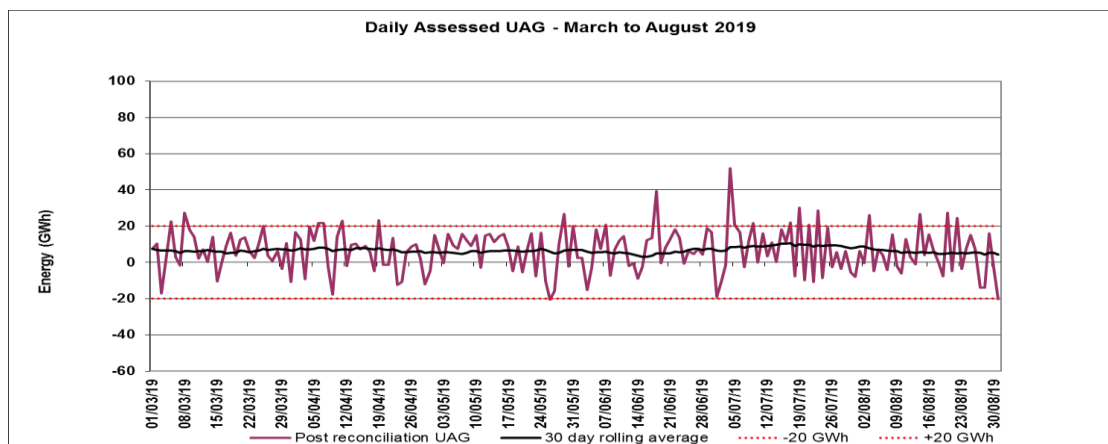


Figure 5: Daily assessed UAG – March 2019 to August 2019

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 2019 to

August 2019 there were 24 days when daily assessed UAG exceeded ± 20 GWh (13.0% of occasions). This is more than the 19 days observed when daily assessed UAG exceeded ± 20 GWh (10.3% of occasions) during the same period in 2018.

National Grid has investigated the majority of the 24 days with high levels of positive or negative UAG. So far, UAG has been identified for gas days 20th and 22nd August 2019, when approximately 14.4 GWh of UAG was identified as a result of a data error associated with Sutton Bridge Power Station.

National Grid are paying particular attention to 18th June and 4th July 2019 as the two highest days of UAG over the last six-month period.

National Grid has been investigating possible causes for the UAG behaviour observed between November 2016 and September 2018, including analysing changes in NTS supply and demand patterns. Figures 6 and 7 below provide the monthly NTS supply and demand breakdown for the period of April 2016 to August 2019.

Figure 6 indicates expected seasonal patterns for Terminal and Interconnector imports over the period between November 2016 and September 2018. However, the figure did indicate that increased levels of LNG (Liquefied Natural Gas) and decreased levels of Interconnector imports been observed since October 2018.

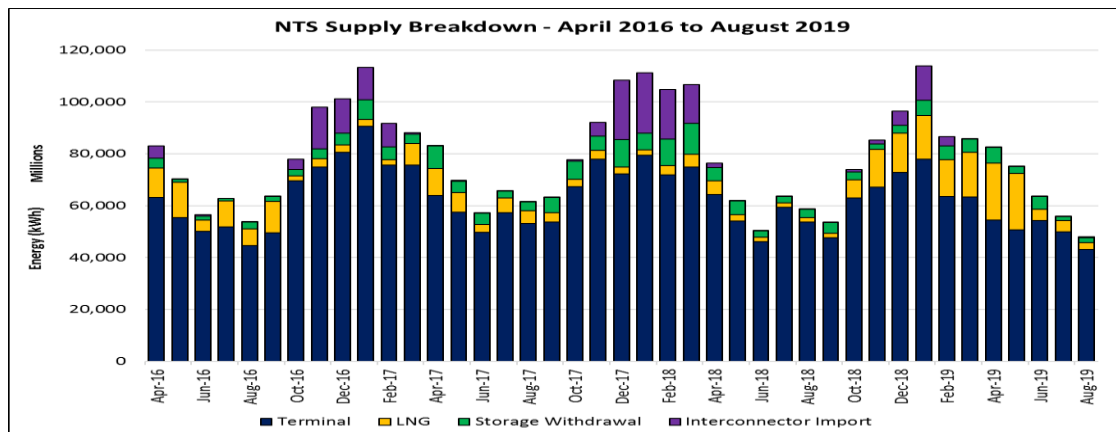


Figure 6: NTS supply breakdown – April 2016 to August 2019

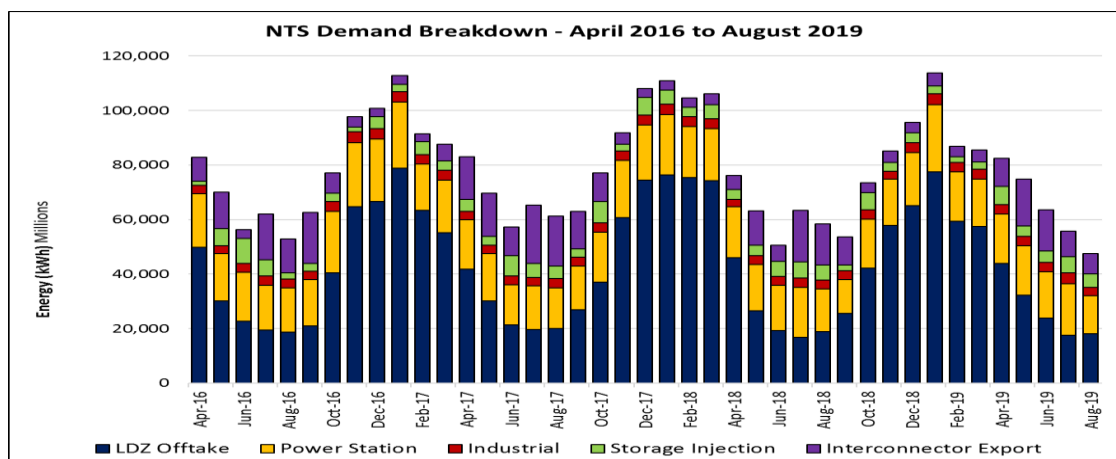


Figure 7: NTS demand breakdown – April 2016 to August 2019

Demand patterns identified in Figure 7 do not display any obvious changes over this period. Gas Offtakes display a seasonal pattern throughout and Industrial and Power Station demand demonstrates a steady annual offtake.

As mentioned in the April 2019 report, LNG changes in supply pattern were observed during the second half of 2018/19. LNG over this period was much greater than in comparison to previous years. This is due to increased quantities of LNG delivered to the NTS from the Isle of Grain and Milford Haven LNG importation facilities, combined with the reduced imports to the system from the Bacton interconnectors over that period.

The LNG breakdown as seen in Figure 8 below, shows the increase in LNG was predominantly from October 2018 to May 2019 which is consistent with high monthly UAG. However, for the subsequent months from June to August 2019, UAG has remained high whilst LNG has reduced significantly. National Grid will continue to investigate this further.

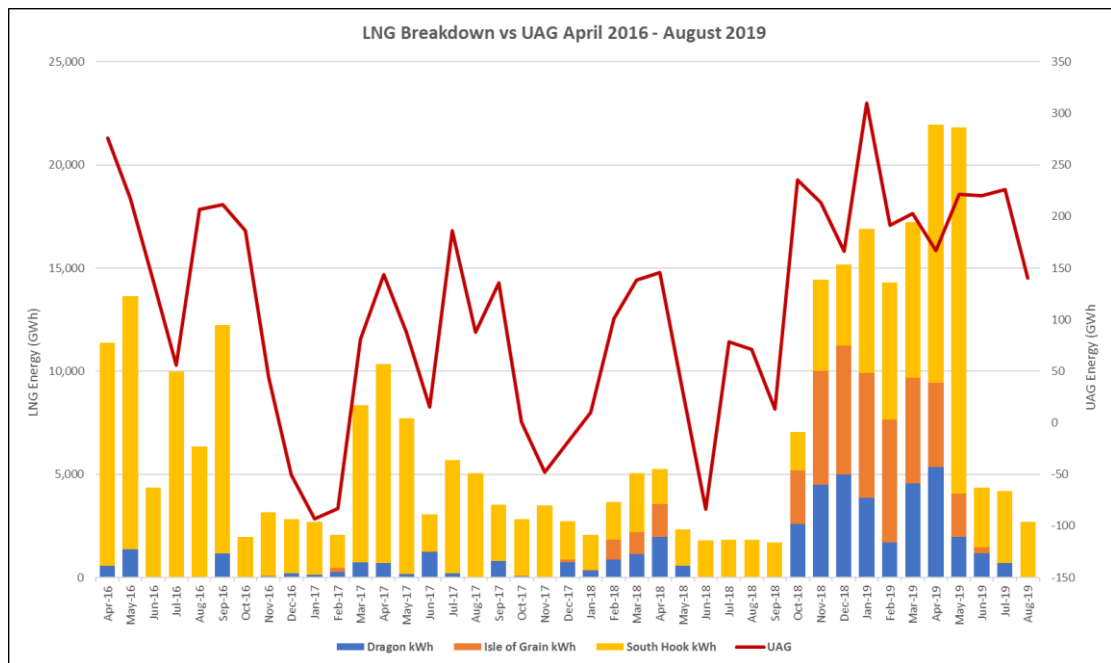


Figure 8: LNG Breakdown vs UAG – April 2016 to August 2019

Figure 9 displays the monthly net Interconnector position (Interconnector imports minus exports) over the same period as Figure 8.

There is a similar pattern of negative values over the winter periods in 2016/17 and 2017/18, whereas this pattern was not observed over the 2018/19 winter period.

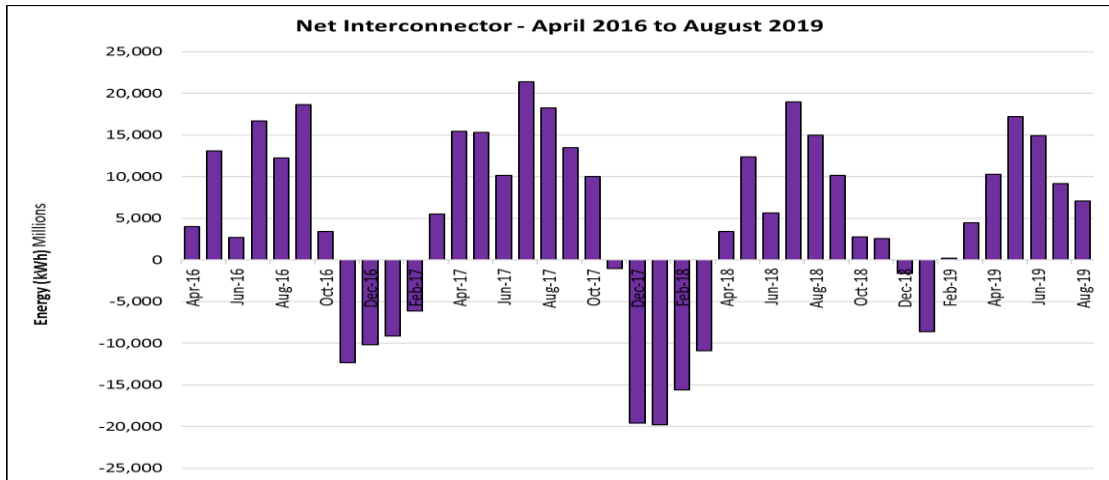


Figure 9: Net Interconnector – April 2016 to August 2019 (LNG)

Analysis so far to identify correlation between LNG and UAG behaviour has not yet drawn any solid conclusions, but National Grid is intending to undertake further analysis on the impact of LNG deliveries on the levels of positive UAG over a wider period going back to April 2013 and at individual site entity level.

Formula Year 2018/19

This section of the report provides data on assessed UAG levels for the April 2018 to March 2019 period. It expands on the reporting on the first 11 months of this Formula Year included in the October 2018 and April 2019 UAG reports. This is the first opportunity to report on assessed UAG for the entirety of 2018/19 and allows observations to be presented for the whole year.

2018/19	UAG	OUG	CVS	Total
Actual Annual Levels (GWh)	1,576	1,127	15	2,718
Percentage of Total NTS Shrinkage	58.0	41.4	0.6	100.0

Table 2: Actual Assessed Levels for UAG, OUG and CVS – 2018/19

Table 2 provides the actual assessed levels for UAG, OUG and CVS for the 2018/19 Formula Year. The table indicates that UAG was the predominant element of NTS Shrinkage which hasn't occurred since Formula Year 2015/16.

The increase in the levels of UAG observed during the last year is combined with a decrease in the levels of OUG observed. UAG accounted for approximately 60% of the total 2018/19 NTS Shrinkage.

Assessed UAG during 2018/19 was significantly higher than for the previous Formula Year, an 87.6% increase on the quantity observed during 2017/18.

Figure 10 provides the total monthly assessed UAG for April 2018 to March 2019 compared to the equivalent months of 2017/18. During 2018/19, the total monthly assessed UAG varied from -84.0 GWh (June 2018) to +309.8 GWh (January 2019) with a monthly average of 131.3 GWh.

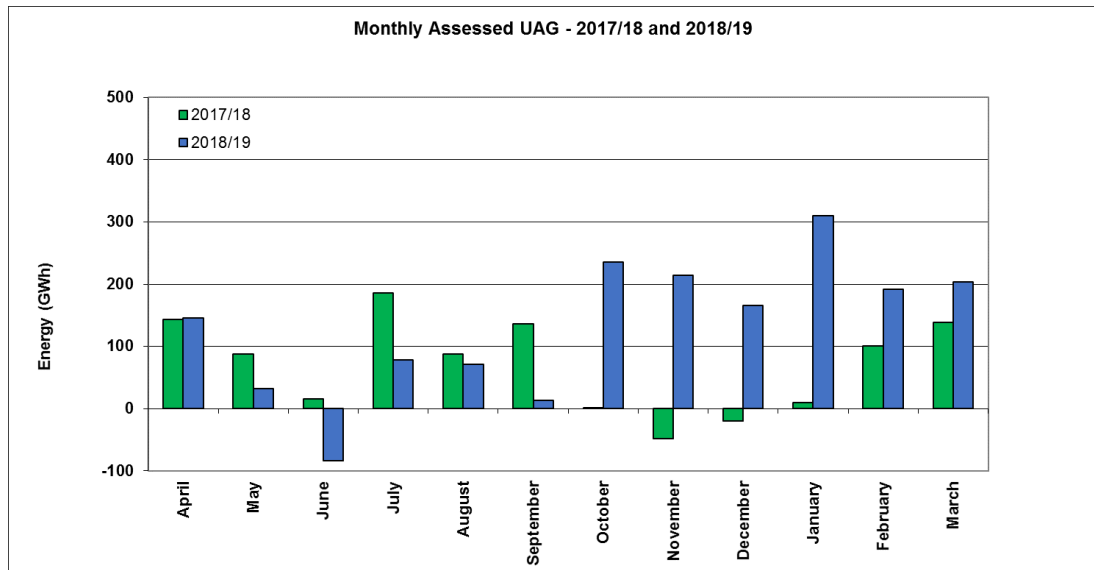


Figure 10: Monthly Assessed UAG – 2017/18 and 2018/19

As indicated in Figure 10, total monthly assessed UAG for 2018/19 was very different to that observed in 2017/18. Monthly UAG has been positive for each month other than June. Two patterns of UAG behaviour have been witnessed during 2017/18. For the majority of the first half of the Formula Year, monthly UAG was less than that observed in 2017/18. During the second half of the year, high levels of positive monthly UAG, in excess of those seen in 2017/18, were observed.

The quantities of positive UAG that were witnessed during the October 2018 to March 2019 period has not been seen since mid-2016. UAG behaviour seems to be trending to what was observed from 2013 to mid-2016. National Grid is focusing on the period of low UAG from July 2016 to September 2018 and the potential causes of the negative UAG that was witnessed over this period.

Figure 11 provides the daily assessed UAG values for 1st April 2018 to 31st March 2019. Large day to day variability in the daily assessed UAG values has continued with daily UAG varying from -38.3 GWh to +41.4 GWh with a daily average of 4.3 GWh. Negative UAG was observed on 126 days (34.5% of occasions) during 2018/19. The black line in the centre illustrates a 30-day rolling average and Baseline UAG quantities are provided as red dotted lines.

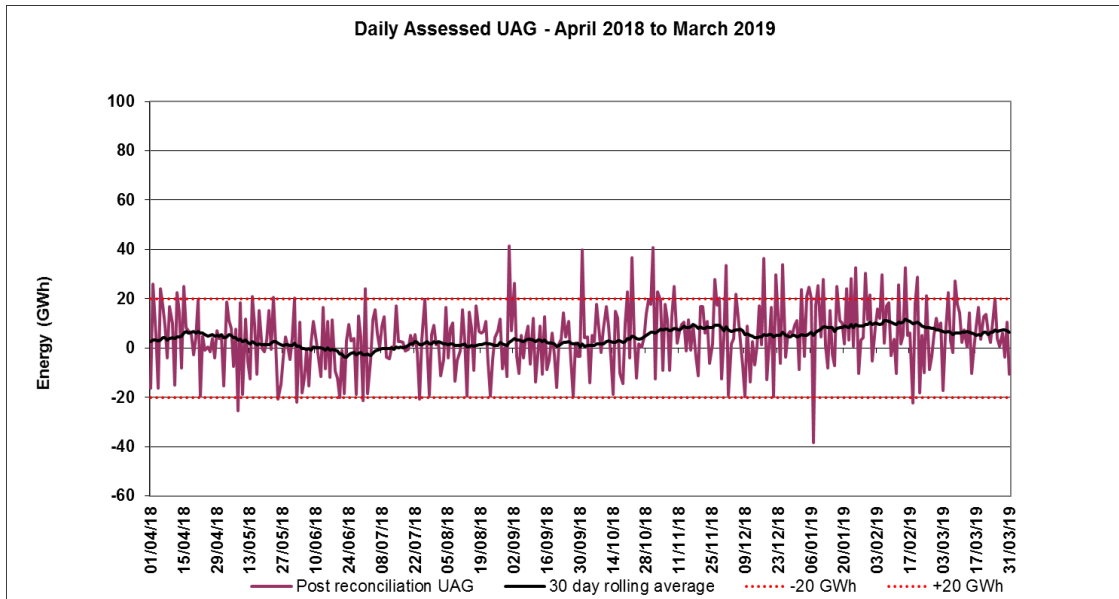


Figure 11: Daily Assessed UAG – April 2018 to March 2019

As described previously in this report, National Grid reviews and investigates the assessed UAG on a daily basis, paying particular attention to any values that exceed ± 20 GWh. National Grid has investigated each of the days with high UAG levels of positive and negative UAG. UAG has been identified on 16 of these days.

During 2018/19 there were 51 days when daily assessed UAG exceeded ± 20 GWh (14.0% of occasions). This is significantly more than the 32 days observed when daily assessed UAG exceeded ± 20 GWh during 2017/18, however there have been fewer large spikes in UAG.

One of the instances of very high positive UAG in August was identified as a system error associated with the IUK Interconnector and an instance in December was associated to a system error at the BBL Interconnector. In May, large data errors were identified associated to Teesside Amoco sub-terminal and Epping Green power station and in January data errors were associated to Spalding power station. Reconciliation of all the errors that have been identified have been or are being progressed. The remaining high UAG days have not yet been identified as meter or data errors, however work continues to investigate the causes of these UAG levels. Further information on reconciliation is provided in the Reconciliation section of this report.

Continual review and improvement of current systems, validation checks, data visualisation and analysis tools, including the mathematical analysis Shiny application will assist with future identification of error.

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 2018/19.

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.

Meter Validation Report Reviews

Meter owners are obliged 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 these tests should be documented within a meter validation report and provided to National Grid.

The validation reports provide essential information that allows National Grid to assess the asset health and accuracy of the metering connected to its network. This enables a better understanding of the impact that meter error will have on assessed UAG.

For Formula Year 2019/20 National Grid has to date received meter validation reports for 26% of all the NTS entry and exit facilities. These reports are for validations that take place between April 2019 and March 2020.

The Meter Assurance team has reviewed the majority of the reports received and, where necessary, raised queries with meter owners. So far only two meter installations were assessed to have failed their meter validations. National Grid's liaison with these meter owners has confirmed that the meter error would be negligible to assessed UAG levels.

The Meter Assurance team will continue to request and review the remaining 2019/20 meter validation reports and use the data provided to assist with the identification of causes of UAG and to inform the preparation of future meter witnessing.

During meter validations, the meter installation equipment is interfered with by the personnel undertaking the testing. This may include making modifications to the metering system in order to simulate and record values which entails disconnecting physical instruments, wires and software. There is a risk that meter error could be introduced through these activities. National Grid is continuing to investigate the potential to identify assessed UAG when meter validations are known to be taking place.

National Grid is focussing on validation tests that have the potential to cause significant measurement error, to gain a better understanding of different calibration equipment and different tolerances. The asset owners are assisting with our queries associated to these tests.

Meter Witnessing

National Grid plans and undertakes an annual meter witnessing programme. This involves National Grid personnel attending metering installations throughout the UK during meter validations to observe and document the testing taking place. This is to gain assurance that the measurement equipment within the metering installation continues to measure the gas delivered to or taken from the NTS without bias and within the agreed measurement uncertainties.

For Formula Year 2019/20 the annual meter witnessing programme comprises of 12 visits to a range of different metering installations. These installations have been selected based upon National Grid's assessment of the previous validation report or if the site has current measurement issues.

Out of the 12 witnessing visits, three have been completed, comprising two power stations and a large industrial facility. On two occasions in April and July 2019 the asset owners have cancelled the scheduled witnessing visits due to other third party audits occurring over the validation period. The three meter installations which were visited by National Grid were all observed to be measuring accurately.

Figure 12 provides a summary of the annual meter witnessing programme for 2019/20.

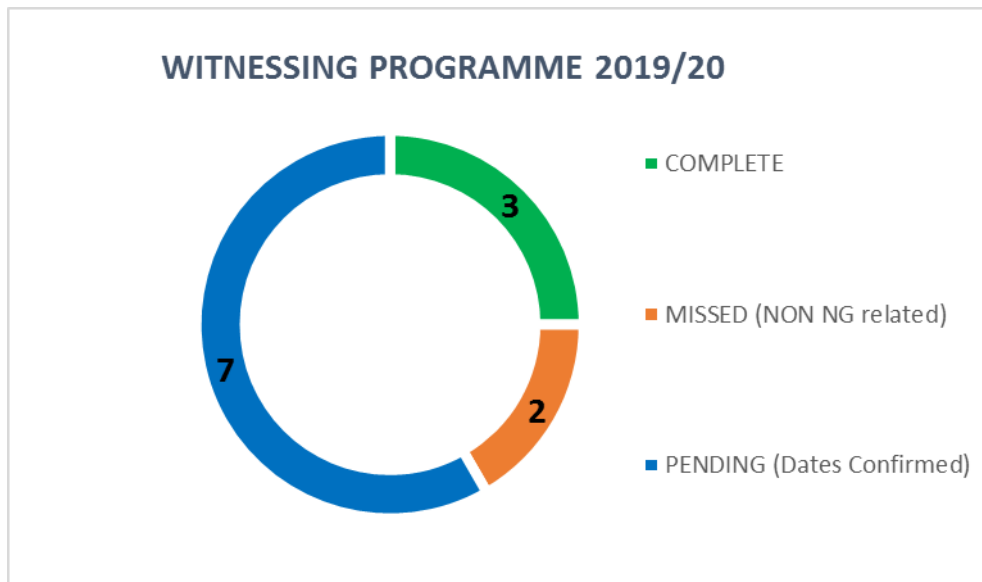


Figure 12: Meter witnessing programme for 2019/20

During the next six months, National Grid is planning to attend the remaining meter witnessing visit of the 2019/20 annual meter witnessing programme and prepare a new programme for 2020/21. The meter installations to be included in this programme will be identified from the 2019/20 meter validation report reviews discussed in the previous section of this report.

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 processed 147.59 GWh of reconciliations in absolute energy terms. This comprises 26 instances of reconciliation at individual NTS entry and exit facilities, each instance comprising of one or more days of reconciliation. The majority of these reconciliations concern days in Formula Year 2018/19, however, reconciliations have also been processed for 2015/16, 2016/17, 2017/18 and 2019/20.

Figure 13 provides the annual reconciliation quantities, in absolute energy terms, for 2013/14 to 2019/20. The red coloured bars indicate the reconciliation quantities processed since the publication of the April 2019 UAG report.

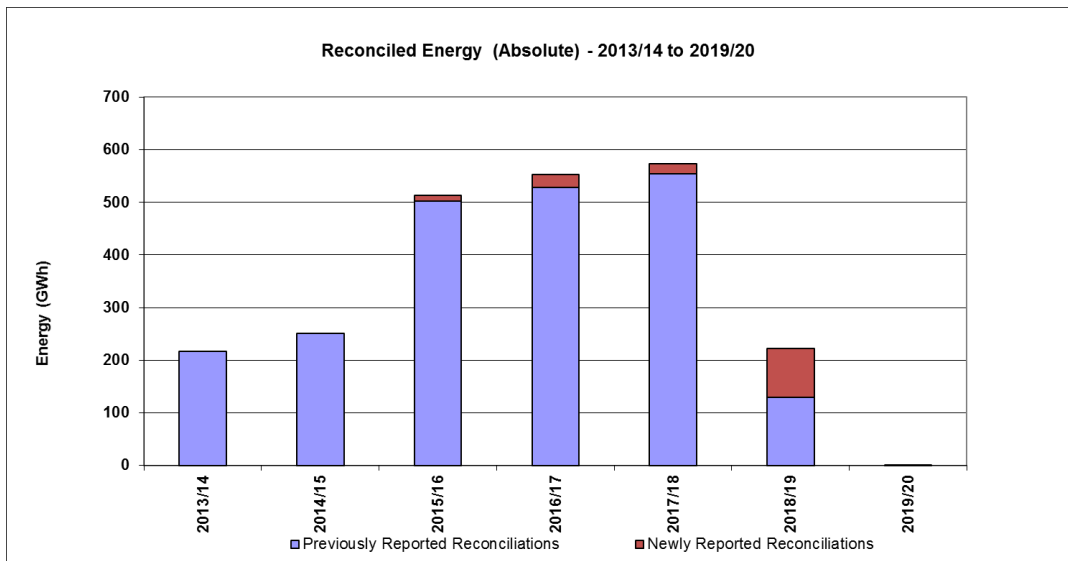


Figure 13: Reconciled energies (absolute) – 2013/14 to 2019/20

Of the 26 instances of reconciliation processed, seven related to meter error (27% of instances) and nineteen related to data error (73% of instances).

National Grid is continuing to improve its validation of end of day measurements to help address data quality challenges experienced during the pre-closeout period. Initiatives to automate the handling of data are being introduced over the next six months. These initiatives, together with the continued use of analysis tools are expected to reduce the requirement for data error reconciliations.

National Grid is continuing to process meter or data error reconciliations which will be included in future Unaccounted for Gas reports.

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. A PhD student has been appointed under a National Grid sponsored ICASE (Industrial Cooperative Awards in Science and Technology) award to undertake this assessment. As discussed earlier in this report National Grid currently uses UAG baseline values of ± 20 GWh as triggers to investigate potentially high levels of positive or negative UAG. This study is intended 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.

Over the past six months the PhD student has completed and presented his third year academic paper and has written a paper for publication in an academic journal.

These studies have confirmed the challenges of reliably identifying meter errors from assessed UAG in light of the very large number of variables associated with the day to day operation of the NTS and his work to date has concluded that UAG in the UK does not follow a seasonal pattern.

His work on developing an analytical application using Shiny, an open source R statistical computing package, has so far concluded that no statistically significant meter errors are currently being detected for the period since April 2013.

Over the next six months, it is intended that the PhD student will complete his internship with National Grid. During this time, he will finalise the delivery of the analytical application to undertake change point analysis on the assessed UAG values published on the National Grid website. The student will also be preparing his PhD thesis.

NTS Own Use Gas Analysis

Over the last six months, National Grid has investigated a possible inverse correlation between UAG and OUG levels as demonstrated in Figure 14.

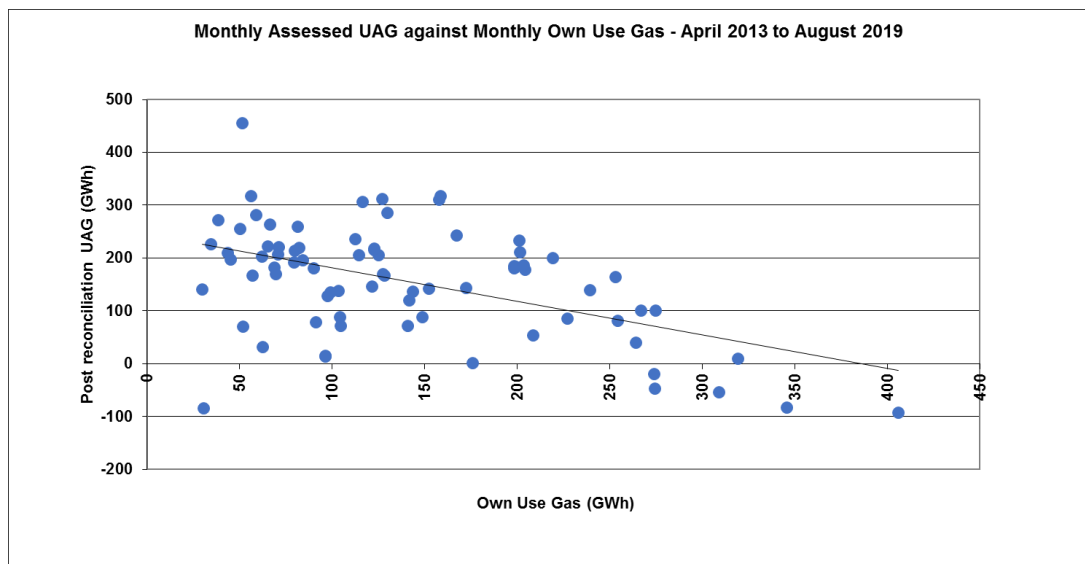


Figure 14: Monthly Assessed UAG against Monthly Own Use Gas - April 2013 – August 2019

Figure 14 displays UAG data between April 2013 to August 2019 that has been plotted against Own Use Gas data over the same period. As seen in the Figure, correlation between UAG and OUG has been observed. When UAG is high (as seen in the y axis), OUG is low and transversely, when UAG is low, OUG is high. The line depicts the trend.

Compressor data has also been analysed which makes up Own Use Gas, the data has been verified as correct. National Grid plan to investigate this further.

Tableau Analysis

National Grid has been utilising Tableau software for some time now to visualise and analyse its data. Current Tableau dashboards are enabling to us to identify and minimise data errors within the closeout period. These are now being enhanced as new data models become available.

Allocation data from the Gemini commercial system is now being adapted into our dashboards which gives National Grid the ability to compare and spot errors in a timelier manner. National Grid is also creating Tableau dashboards to use both energy and volume data that enables better data assurance. These dashboards will be rolled out for use over the coming months.

NTS Linepack Changes Analysis

The amount of gas within the NTS at any time is known as linepack. Linepack changes within a gas day due to imbalances between the instantaneous inputs into and outputs from the system. National Grid are incentivised to minimise day to day changes in NTS linepack. The daily linepack change is included in the calculation of assessed UAG.

Over the last 12 months, National Grid has been investigating the impact of day to day NTS linepack changes on assessed UAG levels as a result of previous analysis of this data. The initial analysis indicated that a positive NTS linepack change is more likely to be seen on a day when negative assessed UAG is observed and a negative NTS linepack change more likely to be seen on a day when positive assessed UAG is observed.

As displayed in Figure 15, this trend in linepack is not constant but for the majority of the months that were analysed, the inverse behaviour of linepack change compared to UAG was apparent.

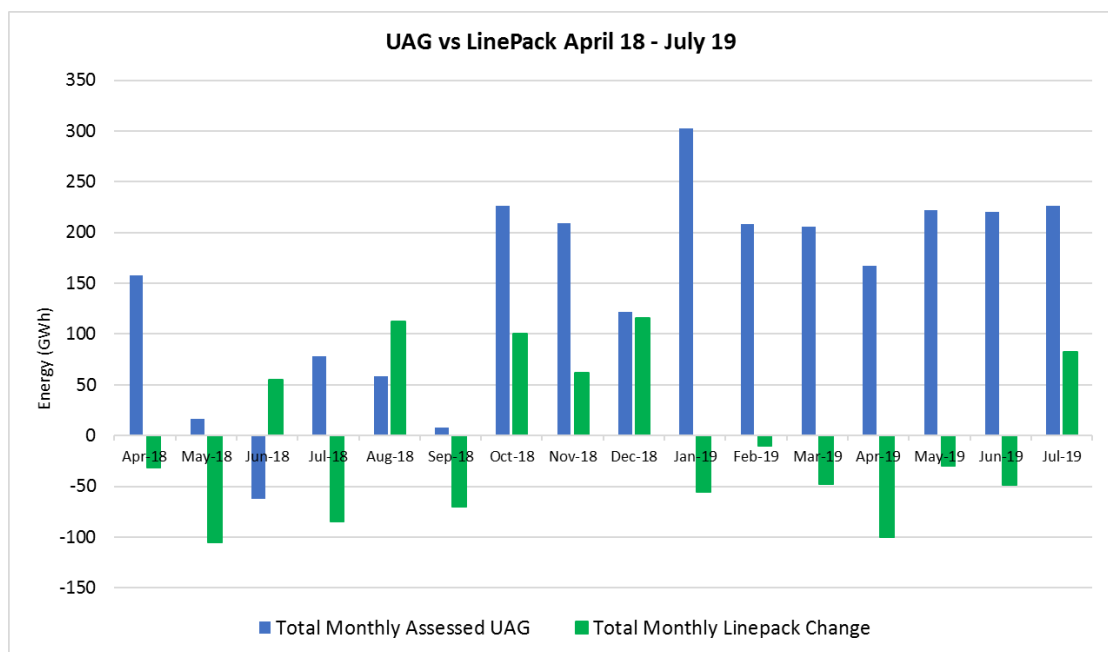


Figure 15: UAG vs Linepack April 2018 – July 2019

National Grid are still investigating the possible relationships between these occurrences of inverse behaviour and will look at date ranges going back to 2013.

Conclusion

The total assessed UAG quantity for the March 2019 to August 2019 period is higher than for the previous six-month period. In addition, total monthly assessed UAG values have been greater than the long-term average (April 2013 to August 2019) monthly assessed UAG for five of the last six months.

It is expected that for Formula Year 2019/20 annual assessed UAG will be significantly greater than for 2018/19. Annual assessed UAG over the past six-month period has been more reflective of the levels of UAG seen prior to mid-2016.

National Grid continues to report post-reconciliation assessed UAG enabling a more accurate representation of UAG performance. National Grid has also continued to improve its understanding of the causes of UAG through its baseline UAG, OUG and NTS linepack change analysis work.

Continued support from meter owners has enabled National Grid to obtain and review meter validation information for NTS entry and exit facilities. This data is being used to support the identification of causes of UAG, to enhance National Grid's ability to detect meter error and to inform the preparation of future meter witnessing programmes.

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:

- (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.

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 2019 Unaccounted for Gas Report

This appendix provides the relevant data used to prepare the figures and tables provided in the report. The assessed 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 post-reconciliation assessed Unaccounted for Gas (GWh)	Annual assessed Own Use Gas (GWh)	Annual assessed CV Shrinkage (GWh)
2013/14	2,470	1,548	6
2014/15	2,173	1,358	27
2015/16	2,866	1,458	71
2016/17	1,103	2,650	51
2017/18	840	2,427	23
2018/19	1,576	1,127	15
2019/20	976	258	17

The annual assessed values for 2019/20 cover the period from 1st April 2019 to 31st August 2019.

Figure 2:

Formula Year	Annual pre-reconciliation assessed Unaccounted for Gas (GWh)	Annual post-reconciliation assessed Unaccounted for Gas (GWh)
2013/14	2,648	2,470
2014/15	2,121	2,173
2015/16	2,782	2,866
2016/17	1,272	1,103
2017/18	783	840
2018/19	1,528	1,576
2019/20	976	976

The annual assessed values for 2019/20 cover the period from 1st April 2019 to 31st August 2019.

Figure 3:

Month	Monthly post-Reconciliation assessed Unaccounted for Gas (GWh)	Long-term average monthly post-reconciliation assessed Unaccounted for Gas (GWh)	Average monthly post-reconciliation assessed Unaccounted for Gas for Formula Year (GWh)
Apr-13	317.44	155.89	205.86
May-13	219.73	155.89	205.86
Jun-13	263.95	155.89	205.86
Jul-13	280.72	155.89	205.86
Aug-13	70.32	155.89	205.86
Sep-13	182.42	155.89	205.86
Oct-13	181.28	155.89	205.86
Nov-13	242.19	155.89	205.86
Dec-13	164.73	155.89	205.86
Jan-14	199.55	155.89	205.86
Feb-14	178.06	155.89	205.86
Mar-14	169.97	155.89	205.86
Apr-14	170.10	155.89	181.05
May-14	206.87	155.89	181.05
Jun-14	196.66	155.89	181.05
Jul-14	316.85	155.89	181.05
Aug-14	209.14	155.89	181.05
Sep-14	255.07	155.89	181.05
Oct-14	195.17	155.89	181.05
Nov-14	137.43	155.89	181.05
Dec-14	180.02	155.89	181.05
Jan-15	85.04	155.89	181.05
Feb-15	101.03	155.89	181.05
Mar-15	119.23	155.89	181.05
Apr-15	72.17	155.89	238.85
May-15	312.16	155.89	238.85
Jun-15	128.85	155.89	238.85
Jul-15	214.60	155.89	238.85
Aug-15	455.12	155.89	238.85
Sep-15	271.54	155.89	238.85
Oct-15	259.03	155.89	238.85
Nov-15	286.04	155.89	238.85
Dec-15	306.21	155.89	238.85

Jan-16	233.55	155.89	238.85
Feb-16	141.95	155.89	238.85
Mar-16	184.97	155.89	238.85
Apr-16	205.08	155.89	91.88
May-16	217.46	155.89	91.88
Jun-16	135.27	155.89	91.88
Jul-16	53.27	155.89	91.88
Aug-16	205.62	155.89	91.88
Sep-16	210.84	155.89	91.88
Oct-16	183.64	155.89	91.88
Nov-16	40.17	155.89	91.88
Dec-16	-54.23	155.89	91.88
Jan-17	-92.83	155.89	91.88
Feb-17	-83.14	155.89	91.88
Mar-17	81.41	155.89	91.88
Apr-17	143.65	155.89	70.01
May-17	87.73	155.89	70.01
Jun-17	15.41	155.89	70.01
Jul-17	186.38	155.89	70.01
Aug-17	87.55	155.89	70.01
Sep-17	135.90	155.89	70.01
Oct-17	0.64	155.89	70.01
Nov-17	-47.64	155.89	70.01
Dec-17	-19.32	155.89	70.01
Jan-18	9.96	155.89	70.01
Feb-18	101.15	155.89	70.01
Mar-18	138.66	155.89	70.01
Apr-18	145.97	155.89	131.34
May-18	32.01	155.89	131.34
Jun-18	-83.99	155.89	131.34
Jul-18	78.40	155.89	131.34
Aug-18	71.13	155.89	131.34
Sep-18	13.01	155.89	131.34
Oct-18	235.39	155.89	131.34
Nov-18	213.74	155.89	131.34
Dec-18	166.25	155.89	131.34
Jan-19	309.75	155.89	131.34
Feb-19	191.28	155.89	131.34
Mar-19	203.20	155.89	131.34

Apr-19	167.06	155.89	195.14
May-19	221.78	155.89	195.14
Jun-19	220.41	155.89	195.14
Jul-19	225.93	155.89	195.14
Aug-19	140.51	155.89	195.14

Figure 4:

Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)	Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)
Mar-18	138.66	Mar-19	203.20
Apr-18	145.97	Apr-19	167.06
May-18	32.01	May-19	221.78
Jun-18	-83.99	Jun-19	220.41
Jul-18	78.40	Jul-19	225.93
Aug-18	71.13	Aug-19	140.51

Figure 5:

Daily assessed UAG values are published on the National Grid website via the following link: <https://www.nationalgridgas.com/balancing/unaccounted-gas-uag>. The upper and lower baseline UAG quantities provided in Figure 5 are respectively -20 GWh and +20 GWh.

Figures 6 to 9:

Daily actual energy values for the NTS entry and exit points are published on the National Grid website via the following link: <https://www.nationalgridgas.com/data-and-operations/transmission-operational-data>.

Daily assessed UAG values are published on the National Grid website via the following link: <https://www.nationalgridgas.com/balancing/unaccounted-gas-uag>.

Figure 10:

Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)	Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)
Apr-17	143.65	Apr-18	145.97
May-17	87.73	May-18	32.01

Jun-17	15.41	Jun-18	-83.99
Jul-17	186.38	Jul-18	78.40
Aug-17	87.55	Aug-18	71.13
Sep-17	135.90	Sep-18	13.01
Oct-17	0.64	Oct-18	235.39
Nov-17	-47.64	Nov-18	213.74
Dec-17	-19.32	Dec-18	166.25
Jan-18	9.96	Jan-19	309.75
Feb-18	101.15	Feb-19	191.28
Mar-18	138.66	Mar-19	203.20

Figure 11:

Daily assessed UAG values are published on the National Grid website via the following link: <https://www.nationalgridgas.com/balancing/unaccounted-gas-uag>. The upper and lower baseline UAG quantities provided in Figure 6 are respectively -20 GWh and +20 GWh.

Figure 12:

Criteria	2019/20 Meter Witnessing Programme
Completed	3
Not attended (meter owner related)	2
Not attended (National Grid related)	0
Future visit (dates confirmed)	7

Figure 13:

Formula Year	Number of instances of reconciliation published in April 2019 UAG report	Reconciled energy (absolute) published in April 2019 UAG report (GWh)	Number of instances of reconciliation processed since publication of April 2018 UAG report	Reconciled energy (absolute) processed since publication of April 2018 UAG Report (GWh)
2013/14	45	216.49	0	0.00
2014/15	47	250.71	0	0.00
2015/16	62	502.19	1	11.53
2016/17	124	527.7	3	24.62
2017/18	50	553.88	9	19.28
2018/19	19	129.65	12	92.07
2019/20	0	0	1	0.09

The reconciliation values for 2019/20 cover the period from 1st April 2019 to 31st August 2019.

Figure 14:

Daily assessed UAG and OUG values are published on the National Grid website via the following link: <https://www.nationalgridgas.com/balancing/unaccounted-gas-uag>.

Figure 15:

Daily assessed UAG values are published on the National Grid website via the following link: <https://www.nationalgridgas.com/balancing/unaccounted-gas-uag>. Daily actual linepack values are published on the National Grid website via the following link: <https://www.nationalgridgas.com/data-and-operations/transmission-operational-data>.

National Grid plc
National Grid House,
Warwick Technology Park,
Gallows Hill, Warwick.
CV34 6DA United Kingdom
Registered in England and Wales
No. 4031152

nationalgrid.com