



# Unaccounted for Gas Report

October 2020

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 1<sup>st</sup> March 2020 to 31<sup>st</sup> August 2020 inclusive, the period since the publication of the April 2020 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 2020 to August 2020 period is lower than the previous six-month period. Monthly assessed UAG is also below the long-term average (April 2013 to August 2020) for 3 of the last 6 months.

It is expected that for Formula Year 2020/21 annual assessed UAG will be less than what was observed in 2019/20 if the current trend remains.

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 the use of data visualisation tools and systematic data handling.

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 2020

## 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 RII0-T1 price control, with particular emphasis on 1<sup>st</sup> March to 31<sup>st</sup> August 2020 inclusive, the period since the publication of the April 2020 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](mailto: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 UAG report provides information on assessed UAG quantities since April 2013, with particular emphasis on the period March 2020 to August 2020. It also provides a review of the assessed quantities of UAG observed for Formula Year 2019/20.

### Formula Years 2013/14 to 2020/21

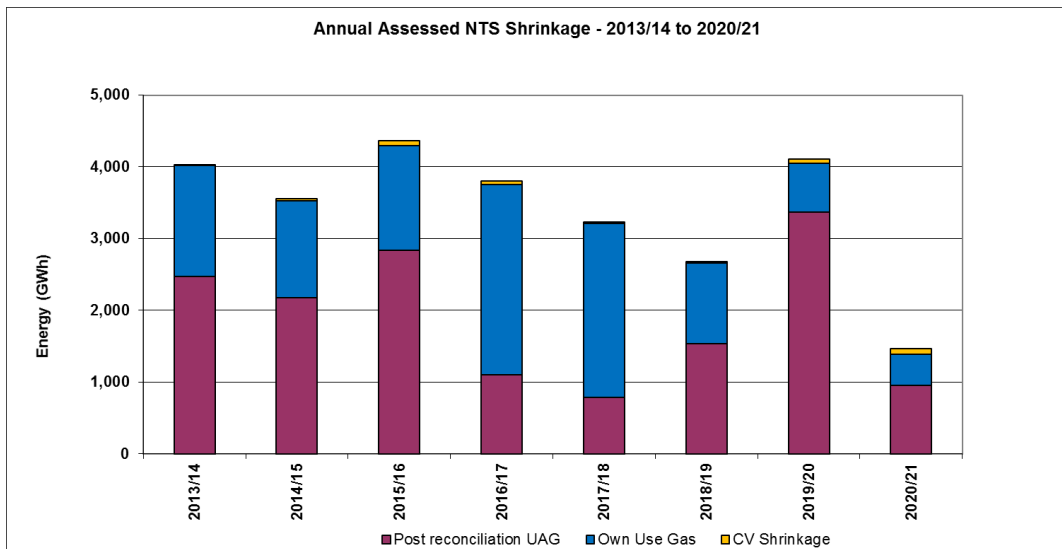


Figure 1: Annual assessed NTS Shrinkage – 2013/14 to 2020/21

Figure 1 provides the annual assessed UAG, OUG and CVS quantities for Formula Years 2013/14 to 2020/21. A Formula Year refers to the period from 1<sup>st</sup> April to 31<sup>st</sup> March of the following year. The quantities provided in Figure 1 for 2020/21 cover the five-month period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> August 2020.

Figure 1 demonstrates that the current Formula Year's assessed NTS shrinkage for 2020/21 aligns to current Shrinkage forecasts. The figure for 2020/21 also indicates that UAG is expected to be the predominant element of NTS Shrinkage.

Assessed UAG for the current Formula Year has been mainly positive and relatively stable. If it carries on this course, it could be closer to the UAG values seen in 2014/15.

OUG is expected to be similar to the levels recorded in 2019/20, which are much lower than previous years. This is due to an improved strategy for managing stock levels which has decreased compressor usage along with a decrease in St Fergus flows due to higher Liquefied Natural Gas (LNG) supplies.

A slight rise in CV Shrinkage to previous years is also expected due to locational CVs in the North East causing CV capping.

UAG currently accounts for 65% of total shrinkage.

Figure 2 provides the annual assessed quantities of UAG for Formula Years 2013/14 to 2020/21. As with Figure 1, the quantities provided for 2020/21 cover the 5-month period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> August 2020.

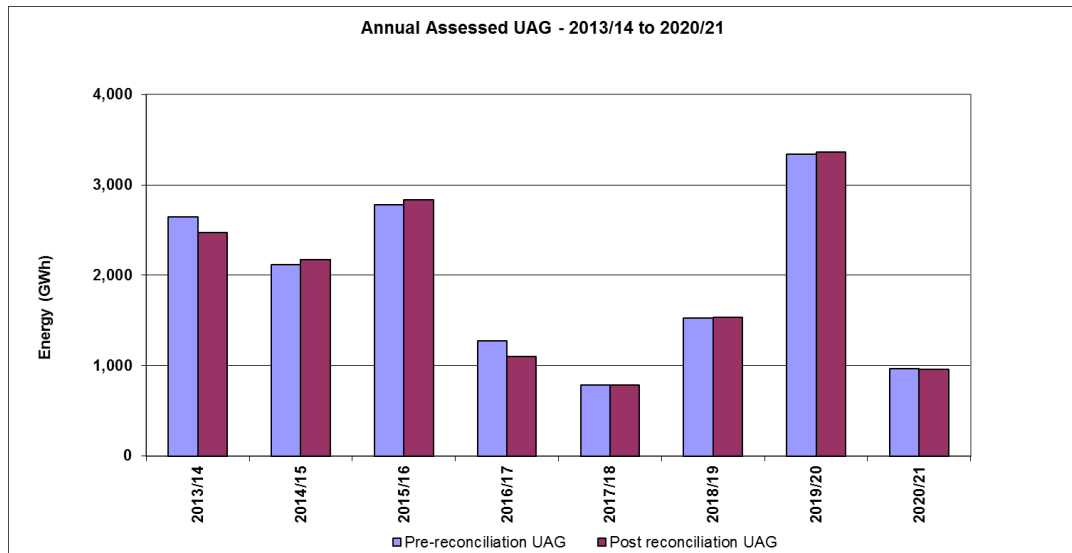


Figure 2: Annual assessed UAG – 2013/14 to 2020/21

Figure 2 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.

Assessed UAG since 2018/19 appears to be increasing but UAG behaviour over the past six months has been more similar to values witnessed in 2014/15 where UAG was predominantly positive but with no particular trends in behaviour. 2016/17 to 2018/19 included prolonged durations of negative UAG which reduced the net total for that year. The increase in assessed UAG witnessed in 2019/20 indicates that the period between October 2019 to March 2020 was a period of irregular and high UAG behaviour continues to be investigated. Any resultant findings will be included in a future UAG report.

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 2020/21. 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	2020/21
Annual Assessed Level (GWh)	2,472	2,173	2,838	1,103	784	1,533	3,366	995
Assessed Daily Average (GWh/d)	6.77	5.95	7.75	3.02	2.15	4.20	9.20	6.24
Percentage of NTS Throughput	0.28	0.24	0.31	0.12	0.08	0.17	0.37	0.31

Table 1: Statistical performance of UAG - 2013/14 to 2020/21

The values provided in the above table for 2020/21 covers the 5 month period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> August 2020 and indicates that annual assessed UAG, assessed daily average UAG and percentage of annual throughput for the year is expected to be lower than the previous year.

Figure 3 provides the total monthly assessed UAG from April 2013 to August 2020. It also provides the average monthly assessed UAG for this period (191.01 GWh) depicted as a dotted black line, together with the long-term average assessed UAG for the entire period (171.05 GWh) depicted as a dotted red line.

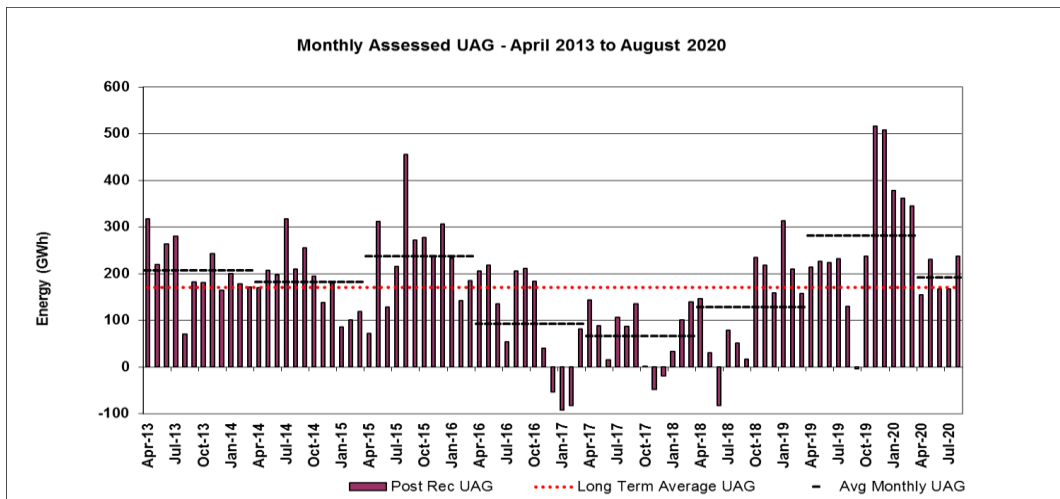


Figure 3: Monthly assessed UAG - April 2013 to August 2020

As Figure 3 indicates, since the start of Formula Year 2020/21, monthly assessed UAG for most of this period (3 months out of 5) has seen monthly assessed UAG being below the long-term average. However due to higher positive UAG for May and August 2020, the monthly average UAG for this Formula Year is higher than the long-term average.

The period between November 2016 and September 2018 saw 23 consecutive months below the long-term monthly average, this is due to increased negative UAG throughout that period. This period along with the period between October 2019 and March 2020 where step changes in UAG behaviour were observed, are of interest to determine both trends and the source of the unusual UAG performance. National Grid is investigating these behaviours and will provide a summary of its findings in future UAG reports.

Figure 4 provides the total monthly assessed UAG for March 2020 to August 2020 compared with the equivalent months of 2019 and indicates a pattern of positive UAG behaviour.

The higher levels of UAG witnessed in March 2020 are caused by consistent levels of positive high UAG over the 2019/20 winter months, which are referred to later in the report in Figure 11. The high levels observed in August 2020 display mostly positive UAG whereas the other months in 2019 and 2020 display a combination of positive and negative UAG.

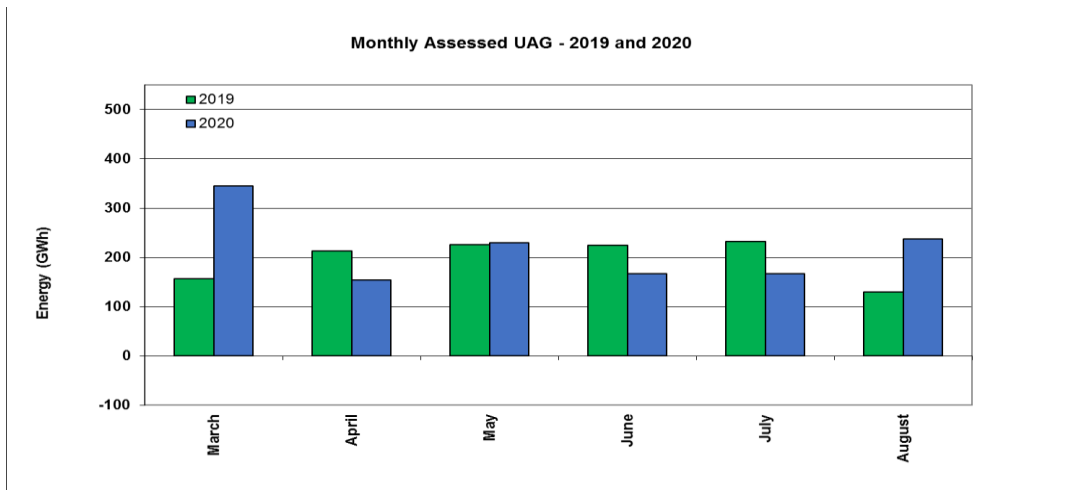


Figure 4: Monthly assessed UAG – March 2019 to August 2019 and March 2020 to August 2020

During the last six-months, the total monthly assessed UAG varied from +154.44 GWh to +344.46 GWh with a monthly average of 216.59 GWh. During the March 2019 to August 2019 period total monthly assessed UAG varied from +129.57 GWh to +231.73 GWh with a monthly average of 196.84 GWh.

Figure 5 provides total monthly assessed UAG quantities between formula year 2013/14 to 2020/21. The values for 2020/21 cover the 5-month period between April 2020 and August 2020. The figure indicates that there is variance from one year to another, for example, November has a UAG spread of +516.64 GWh and -47.64 GWh. This indicates that there are no consistent seasonal trends in assessed UAG. This pattern of UAG will be further investigated using analysis such as machine learning and artificial intelligence (AI).

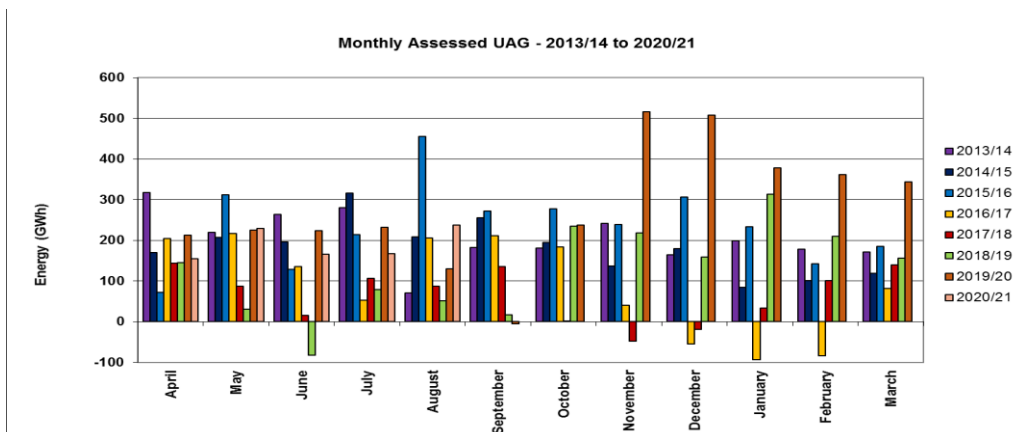


Figure 5: Monthly assessed UAG – 2013/14 to 2020/21



Figure 6 provides the daily assessed UAG values for the period between 1<sup>st</sup> March 2020 and August 2020 and indicates that UAG has been mostly within the  $\pm 20$  GWh limit since May. This is confirmed by the largely flat 30-day rolling average included in the figure (black line).

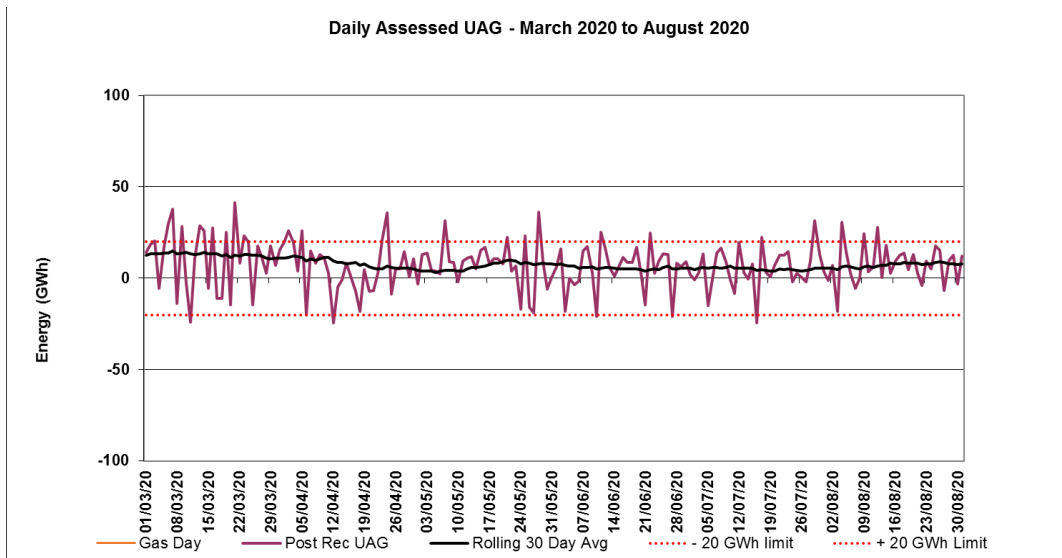


Figure 6: Daily assessed UAG – March 2020 to August 2020

National Grid reviews and investigates the assessed UAG values on a daily basis paying particular attention to any values that exceed  $\pm 20$  GWh. These baseline UAG quantities are provided as red dotted lines in the above figure. During the period of March 2020 to August 2020 there were 31 days when daily assessed UAG exceeded  $\pm 20$  GWh, 11 of those occasions were in March 2020 when the high UAG trend was still being observed. This is 8 more occasions than what was recorded over the same period in 2019 but 22 fewer occasions than the previous 6 months between September 2019 to February 2020.

National Grid has investigated all days with high levels of positive or negative UAG. UAG has been identified for gas days in April and June 2020, where approximately 16.7 GWh of UAG has been identified.

National Grid continues to investigate the UAG behaviour observed between October 2019 and March 2020 via a dedicated project team aimed to tailor the high UAG investigation to this type of UAG trend. The first sprint of the project is underway to determine end to end process and data mapping that can better understand and improve systematic data handling, measurement instrument changes on the network and provide detailed analysis of the NTS input and output flows covering these periods of interest. Details of the project can be found under the UAG Management Activities further on in the report.

Figure 7 outlines the demand breakdown for the period between April 2018 to August 2020 and does not display any noticeable changes over this period. LDZ Offtakes display a seasonal pattern throughout, as does Interconnector Export demand whereas Industrial and Power Station demand demonstrates a more consistent annual offtake.

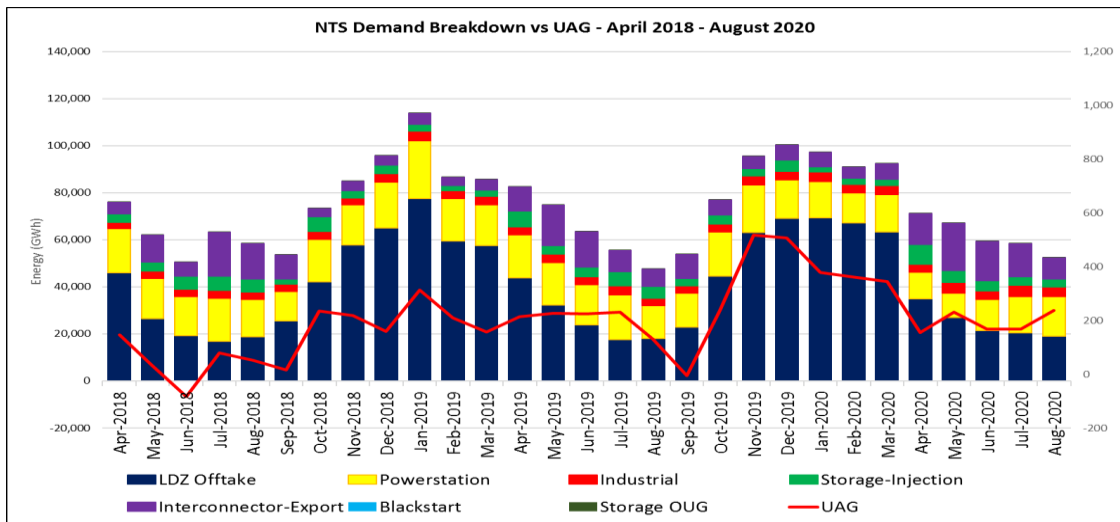


Figure 7: NTS demand breakdown – April 2018 to August 2020

NTS to LDZ Offtakes are the largest contributor to demand over the winter periods and correlating flow profiles with high UAG between October 2019 to March 2020 are likely to be coincidental. There are 122 NTS to LDZ Offtakes, although 93% of those sites are unlikely to be contributing factors to the high UAG period due to small or expected flow profiles. The remaining 7% are being investigated further.

Figure 8 illustrates Supply patterns between April 2018 to August 2020 and demonstrates a seasonal supply pattern which has been observed in previous UAG reports. Increased levels of LNG (Liquefied Natural Gas) were observed over the 2019/20 winter period along with decreased levels of Interconnector imports. Over the past 6 months the LNG supply has remained higher than previous years over the same period although UAG reduced significantly in April 2020.

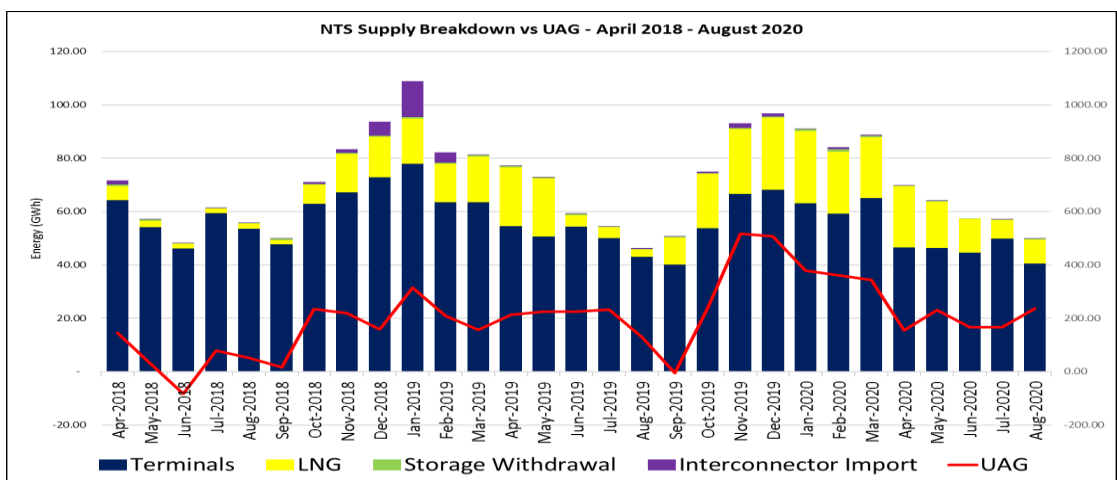


Figure 8: NTS supply breakdown – April 2018 to August 2020

LNG changes in supply pattern were observed during the 2018/19 winter period with LNG imports increasing when compared to previous years. A further increase in LNG was witnessed over the 2019/20 winter period and remained high until May. With a reduction in UAG in April along with LNG remaining high until May, this implies that other factors have contributed to the high UAG trend in 2019/20.

The LNG breakdown as seen in Figure 9, shows the increase in LNG from November 2018 with deliveries predominantly from South Hook over the 2018/19 period. High levels were then observed again in October 2019 to March 2020 with predominant deliveries from both South Hook and Isle of Grain. Both formula years show some correlation between the Isle of Grain deliveries with high monthly UAG which is depicted by the red line.

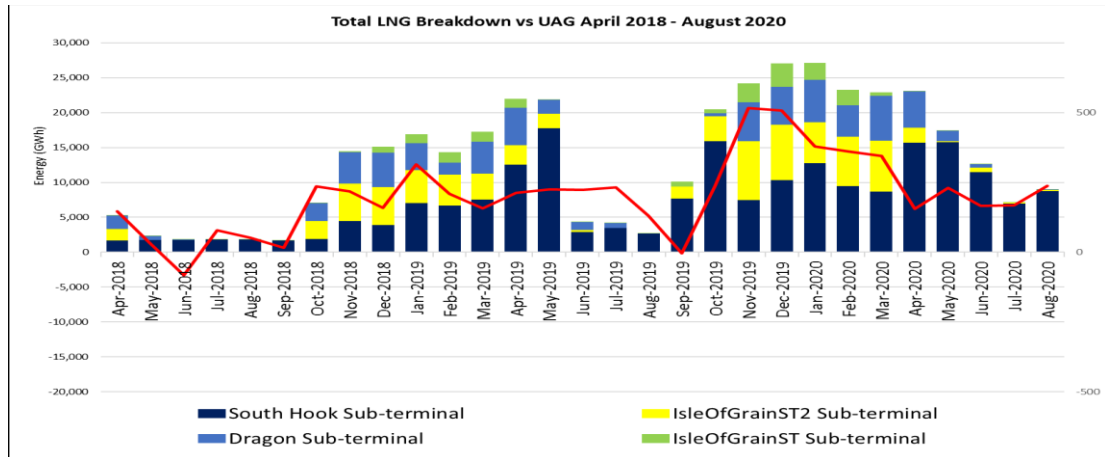


Figure 9: LNG Breakdown n vs UAG – April 2018 to August 2020

Although correlation has been witnessed between LNG and UAG behaviour, data and intelligence from the LNG terminals have so far has not indicated there is any causation. Further data analytics will be explored to look at data more holistically as well as at site level.

Figure 10 displays the monthly net Interconnector position (Interconnector exports minus imports) over the period between April 2016 and August 2020.

A similar pattern of negative values over the 2016/17 and 2017/18 winter periods have been observed, whereas the same pattern has not been witnessed since. This is due to the interconnector facilities predominantly exporting gas. BBL also commissioned NTS exit capabilities in October 2020.

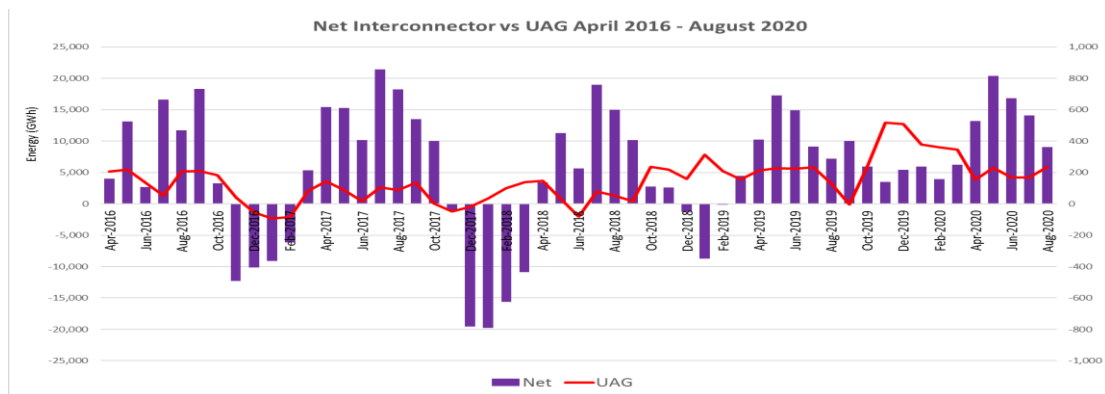


Figure 10: Net Interconnector – April 2016 to August 2020 (LNG)

## Formula Year 2019/20

This section of the report provides data on assessed UAG levels for the April 2019 to March 2020 period. It expands on the reporting on the first 11 months of this Formula Year included in the October 2019 and April 2020 UAG reports. This is the first opportunity to report on assessed UAG for the entirety of 2019/20 and allows observations to be presented for the whole year.

2019/20	UAG	OUG	CVS	Total
Actual Annual Levels(GWh)	3,366	687	57	4,111
Percentage of Total NTS Shrinkage	81.9	16.7	1.4	100.0

Table 2: Actual Assessed Levels for UAG, OUG and CVS – 2019/20

Table 2 provides the actual assessed levels for UAG, OUG and CVS for the 2019/20 Formula Year. The table indicates that UAG was the predominant element of NTS Shrinkage.

Assessed UAG during 2019/20 was greater than for the previous Formula Year, a 120% increase in the quantity observed in comparison to the figures witnessed in 2018/19.

The increased levels of UAG observed during 2019/20 was due to an unusually high trend in UAG. This, combined with a large decrease in the levels of OUG meant that UAG accounted for 82% of the total 2019/20 NTS Shrinkage.

Figure 11 provides the total monthly assessed UAG for April 2019 to March 2020 compared to the equivalent months of 2018/19. During 2019/20, the total monthly assessed UAG varied from -4.65 GWh (September 2019) to +516.64 GWh (November 2019) with a monthly average of 280.53 GWh.

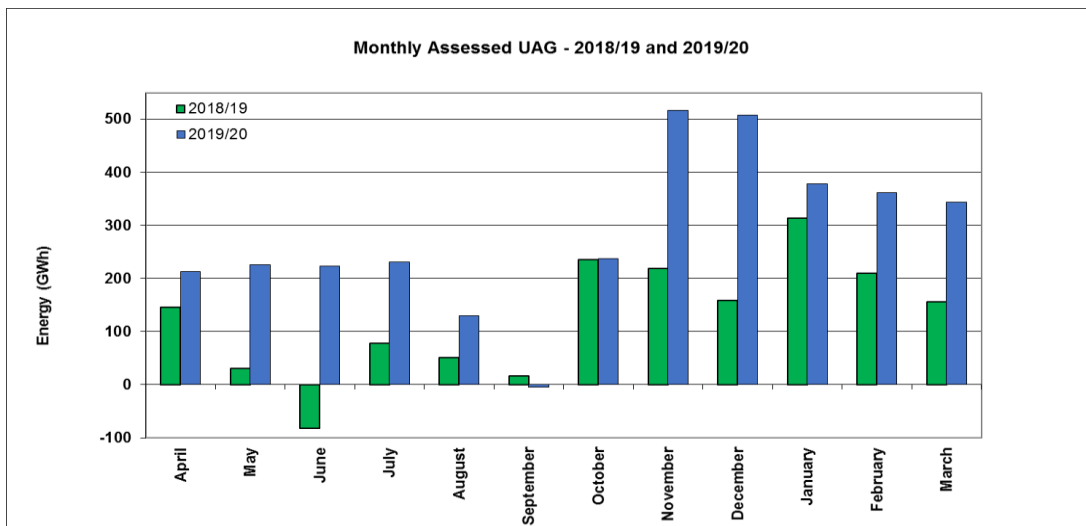


Figure 11: Monthly Assessed UAG – 2018/19 and 2019/20

As indicated in Figure 11, total monthly assessed UAG for 2019/20 was very different to that observed in 2018/19. Similarly, monthly UAG has been positive for 11 months out of the 12, with September 2019 being slightly negative. The first half of 2019/20 displayed consistent UAG levels at around 200 GWh, UAG then decreased in August and is negative in September. The second half of 2019/20 then witnessed a large increase in UAG behaviour and remained until March 2020. The period between October 2018 and March 2019 also saw consistent positive UAG but much lower than 2019/20.

The quantities of positive UAG that have been observed during 2019/20 (excluding September 2019) seems to be a trend since October 2018. Positive UAG behaviour on this scale has not been previously witnessed since before 2016. These changes in UAG trends are still an area of investigation and Machine Learning and Artificial Intelligence (AI) are potential analytics to be explored.

Figure 12 provides the daily assessed UAG values for 1<sup>st</sup> April 2019 to 31<sup>st</sup> March 2020. Large day to day variability in the daily assessed UAG values has continued with daily UAG varying from -40.48 GWh to +63.52 GWh with a daily average of 9.20 GWh. Negative UAG was observed on 97 days (26.6% of occasions) during 2019/20. A reduction to the previous year's 128 negative UAG days. The black line in the centre illustrates a 30-day rolling average and Baseline UAG quantities are provided as red dotted lines.

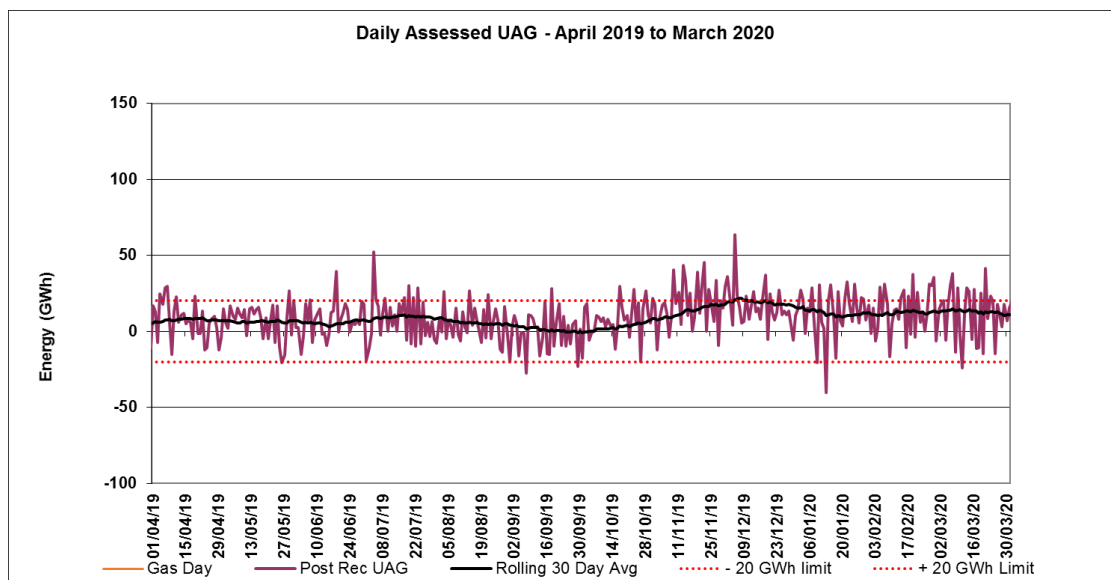


Figure 12: Daily Assessed UAG – April 2019 to March 2020

During 2019/20 there were 84 days when daily assessed UAG exceeded  $\pm 20$  GWh (23.0% of occasions). This is an increase compared to the 51 days observed when daily assessed UAG exceeded  $\pm 20$  GWh during 2018/19, this is due to the high UAG trend in the 2019/20 winter period.

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  $\pm 20$  GWh. We have a dedicated project to tailor the high UAG investigation to this type of UAG trend. Details of this project can be found under the UAG Management Activities later in the report.

Conventional High UAG checks outside this trend have identified UAG in all months apart from December 2019 and February 2020. 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, will be included within the scope of the project.

The UAG investigation project will enable an end to end review and improvement of current process and systems, improved system validation checks, data automation, data visualisation with enhancements to current and new tools for more accurate analysis.

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 2019/20.

## UAG Management Activities

This section of the UAG 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 2020/21 National Grid has so far received meter validation reports for 55 NTS entry and exit facilities (16% of all NTS connected sites). These reports are for validations that take place between April 2020 and March 2021.

The Meter Assurance team has reviewed all of the 55 Meter validation reports received so far. National Grid are in the process of raising queries with relevant meter owners to confirm if any instruments tested outside of tolerance would have introduced measurement error, thus impacting assessed UAG levels.

The Meter Assurance team will continue to request and review the remaining 2020/21 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

Witnessing involves National Grid personnel attending metering installations throughout the UK during meter validations to observe and document the testing taking place. Due to COVID-19 restrictions and social distancing, National Grid is unable to physically witness any annual meter validations, this will be kept under review in line with government guidance and advice.

The purpose of witnessing the validations 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. The new witnessing programme still highlights any site that National Grid has concerns with

metering but instead a phone call is carried out shortly after the validation to discuss the testing and general health of the metering, this will provide the assurance required.

For Formula Year 2020/21 the new witnessing programme comprises of 10 sites with 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 10 meter witnessing visits that were planned for Formula Year 2020/21, none have been completed to COVID-19 restrictions. Engagement with Asset owners will continue with regards to the telephone conversations and if the restrictions are eased, physical witnessing may resume.

During the next six months, National Grid is planning to contact the remaining sites from the 2020/21 new witnessing programme and prepare the programme for Formula Year 2021/22. The meter installations to be included in this programme will be identified from the 2020/21 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 57.68 GWh of reconciliations in absolute energy terms. This comprises 16 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 2019/20, however, reconciliations have also been processed for 2017/18, 2018/19 and 2020/21.

Figure 13 provides the annual reconciliation quantities, in absolute energy terms, for 2013/14 to 2020/21. The red coloured bars indicate the reconciliation quantities processed since the publication of the April 2020 UAG report.

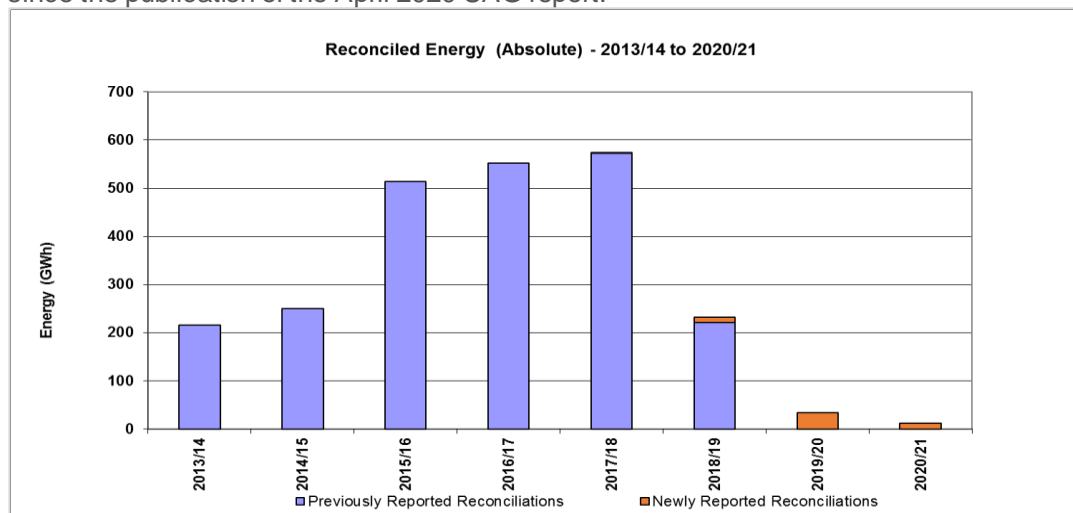


Figure 13: Reconciled energies (absolute) – 2013/14 to 2020/21

Of the 16 instances of reconciliation processed, two related to meter error (12% of instances) and 14 related to data error (88% 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.

### **UAG Investigation Project**

National Grid are managing a dedicated project team to investigate the increase of assessed UAG that was observed between October 2019 and March 2020. The analysis will also include historical UAG patterns.

The project is managed in sprints to try and maximise the output from the allocated resource. The projects ambition is to better understand end to end data flows to identify and mitigate systematic data error, to automate and validate all data points and have the tools to identify meter error.

The scope of the project is outlined below:

- Effectiveness of systematic data streams and handling through comprehensive end to end process and data mapping;
- New data model design to allow improved systematised data validation;
- Review system updates and potential downstream impact;
- Site flow profiling to initially eliminate sites that would not have impacted UAG over period;
- Investigate the possible relationship between LNG flows and UAG;
- Investigate Linepack calculation and any potential bias;
- AI & Machine learning to analyse Input and Output data;
- Resolve outstanding Entry & Exit meter and telemetry faults;
- Calculate UAG in volumetric terms and investigate possible differences;
- Identify any metering upgrades / issues by improving customer communication.

To date, the following project milestones have been completed:

- All end to end process flow maps have been created allowing the next phase of data mapping.
- There have been no system upgrades that could have introduced system error over that period.
- Site profiling has been completed; out of the 244 NTS connected sites, 95% have been initially eliminated as the cause for the high UAG trend, including:
  - 100% of Storage Facilities,
  - 100% of Interconnectors,
  - 100% of Power Stations and Large Industrial sites,
  - 33% of LNG Terminals,
  - 88% of Sub Terminals,
  - 93% of Offtakes.
- The remaining sites are still under further investigation although all sites will be analysed as the project and tools progress.
- UAG is now available in both Energy and Volumetric terms, over the High UAG period, both volume and energy aligned, implying that the correct data was used.

Over the period of High UAG (between October 2019 and March 2020), 197 GWh (11% of UAG exceeding +/-20GWh) has been identified to date.

National Grid continues to manage the UAG project and develop tools to better identify the causes of UAG and UAG trends.

### **Tableau Analysis**

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

We can now visualise UAG and site data in volumetric and energy terms, also identify the impact of UAG as a percentage of NTS Throughput. Process completeness checks enable the teams to identify missing data within the close out periods.

National Grid are continually improving its processes and data accuracy through the utilisation of Tableau.

## Conclusion

The total assessed UAG quantity for the March 2020 to August 2020 period is lower than the previous six-month period. Monthly assessed UAG is also below the long-term average (April 2013 to August 2020) for 3 of the last 6 months.

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It is expected that for Formula Year 2020/21 annual assessed UAG will be less than what was observed in 2019/20 if the current trend remains.

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 the use of data visualisation tools and systematic data handling.

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 2020 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	2,472	1,548	6
2014/15	2,173	1,358	27
2015/16	2,838	1,458	71
2016/17	1,103	2,650	51
2017/18	784	2,427	23
2018/19	1,533	1,127	15
2019/20	3,366	687	57
2020/21	955	431	82

The annual assessed values for 2020/21 cover the period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> August 2020.

**Figure 2:**

Formula Year	Annual pre-reconciliation assessed Unaccounted for Gas (GWh)	Annual post-reconciliation assessed Unaccounted for Gas (GWh)
2013/14	2,648	2,472
2014/15	2,121	2,173
2015/16	2,782	2,838
2016/17	1,272	1,103
2017/18	783	784
2018/19	1,528	1,533
2019/20	3,342	3,366
2020/21	967	955

The annual assessed values for 2020/21 cover the period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> August 2020.

**Figure 3:**

<b>Month</b>	<b>Monthly post-Reconciliation assessed Unaccounted for Gas (GWh)</b>	<b>Long-term average monthly post-reconciliation assessed Unaccounted for Gas (GWh)</b>	<b>Average monthly post-reconciliation assessed Unaccounted for Gas for Formula Year (GWh)</b>
Apr-13	317.44	171.05	205.96
May-13	219.73	171.05	205.96
Jun-13	263.95	171.05	205.96
Jul-13	280.72	171.05	205.96
Aug-13	70.32	171.05	205.96
Sep-13	182.42	171.05	205.96
Oct-13	181.28	171.05	205.96
Nov-13	242.19	171.05	205.96
Dec-13	164.73	171.05	205.96
Jan-14	199.55	171.05	205.96
Feb-14	178.06	171.05	205.96
Mar-14	171.13	171.05	205.96
Apr-14	170.10	171.05	181.05
May-14	206.87	171.05	181.05
Jun-14	196.66	171.05	181.05
Jul-14	316.85	171.05	181.05
Aug-14	209.14	171.05	181.05
Sep-14	255.07	171.05	181.05
Oct-14	195.17	171.05	181.05
Nov-14	137.43	171.05	181.05
Dec-14	180.02	171.05	181.05
Jan-15	85.04	171.05	181.05
Feb-15	101.03	171.05	181.05
Mar-15	119.23	171.05	181.05
Apr-15	72.17	171.05	236.48
May-15	312.16	171.05	236.48
Jun-15	128.85	171.05	236.48
Jul-15	214.60	171.05	236.48
Aug-15	455.12	171.05	236.48
Sep-15	271.54	171.05	236.48
Oct-15	277.74	171.05	236.48
Nov-15	238.92	171.05	236.48
Dec-15	306.21	171.05	236.48

Jan-16	233.55	171.05	236.48
Feb-16	141.95	171.05	236.48
Mar-16	184.97	171.05	236.48
Apr-16	205.08	171.05	91.89
May-16	217.46	171.05	91.89
Jun-16	135.27	171.05	91.89
Jul-16	53.27	171.05	91.89
Aug-16	205.62	171.05	91.89
Sep-16	210.84	171.05	91.89
Oct-16	183.72	171.05	91.89
Nov-16	40.17	171.05	91.89
Dec-16	-54.23	171.05	91.89
Jan-17	-92.83	171.05	91.89
Feb-17	-83.14	171.05	91.89
Mar-17	81.41	171.05	91.89
Apr-17	143.65	171.05	65.35
May-17	87.73	171.05	65.35
Jun-17	15.41	171.05	65.35
Jul-17	106.47	171.05	65.35
Aug-17	87.56	171.05	65.35
Sep-17	135.90	171.05	65.35
Oct-17	0.65	171.05	65.35
Nov-17	-47.64	171.05	65.35
Dec-17	-19.32	171.05	65.35
Jan-18	33.41	171.05	65.35
Feb-18	101.15	171.05	65.35
Mar-18	139.27	171.05	65.35
Apr-18	145.85	171.05	127.79
May-18	30.79	171.05	127.79
Jun-18	-82.26	171.05	127.79
Jul-18	78.40	171.05	127.79
Aug-18	51.71	171.05	127.79
Sep-18	16.38	171.05	127.79
Oct-18	235.10	171.05	127.79
Nov-18	218.51	171.05	127.79
Dec-18	158.75	171.05	127.79
Jan-19	313.68	171.05	127.79
Feb-19	209.72	171.05	127.79
Mar-19	156.83	171.05	127.79



Apr-19	213.20	171.05	280.53
May-19	225.73	171.05	280.53
Jun-19	223.99	171.05	280.53
Jul-19	231.73	171.05	280.53
Aug-19	129.57	171.05	280.53
Sep-19	-4.65	171.05	280.53
Oct-19	237.93	171.05	280.53
Nov-19	516.64	171.05	280.53
Dec-19	507.78	171.05	280.53
Jan-20	378.38	171.05	280.53
Feb-20	361.56	171.05	280.53
Mar-20	344.46	171.05	280.53
Apr-20	154.44	171.05	191.01
May-20	229.98	171.05	191.01
Jun-20	166.57	171.05	191.01
Jul-20	166.92	171.05	191.01
Aug-20	237.16	171.05	191.01

**Figure 4:**

Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)	Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)
Mar-19	156.83	Mar-20	344.46
Apr-19	213.20	Apr-20	154.44
May-19	225.73	May-20	229.98
Jun-19	223.99	Jun-20	166.57
Jul-19	231.73	Jul-20	166.92
Aug-19	129.57	Aug-20	237.16

**Figure 5:**

<b>Month</b>	<b>Monthly post-reconciliation assessed Unaccounted for Gas (GWh)</b>	<b>Month</b>	<b>Monthly post-reconciliation assessed Unaccounted for Gas (GWh)</b>
Apr-13	317.44	Jan-17	-92.83
May-13	219.73	Feb-17	-83.14
Jun-13	263.95	Mar-17	81.41
Jul-13	280.72	Apr-17	143.65
Aug-13	70.32	May-17	87.73
Sep-13	182.42	Jun-17	15.41
Oct-13	181.28	Jul-17	106.47
Nov-13	242.19	Aug-17	87.56
Dec-13	164.73	Sep-17	135.90
Jan-14	199.55	Oct-17	0.65
Feb-14	178.06	Nov-17	-47.64
Mar-14	171.13	Dec-17	-19.32
Apr-14	170.10	Jan-18	33.41
May-14	206.87	Feb-18	101.15
Jun-14	196.66	Mar-18	139.27
Jul-14	316.85	Apr-18	145.85
Aug-14	209.14	May-18	30.79
Sep-14	255.07	Jun-18	-82.26
Oct-14	195.17	Jul-18	78.40
Nov-14	137.43	Aug-18	51.71
Dec-14	180.02	Sep-18	16.38
Jan-15	85.04	Oct-18	235.10
Feb-15	101.03	Nov-18	218.51
Mar-15	119.23	Dec-18	158.75
Apr-15	72.17	Jan-19	313.68
May-15	312.16	Feb-19	209.72
Jun-15	128.85	Mar-19	156.83
Jul-15	214.60	Apr-19	213.20
Aug-15	455.12	May-19	225.73

Sep-15	271.54	Jun-19	223.99
Oct-15	277.74	Jul-19	231.73
Nov-15	238.92	Aug-19	129.57
Dec-15	306.21	Sep-19	-4.65
Jan-16	233.55	Oct-19	237.93
Feb-16	141.95	Nov-19	516.64
Mar-16	184.97	Dec-19	507.78
Apr-16	205.08	Jan-20	378.38
May-16	217.46	Feb-20	361.56
Jun-16	135.27	Mar-20	344.46
Jul-16	53.27	Apr-20	154.44
Aug-16	205.62	May-20	229.98
Sep-16	210.84	Jun-20	166.57
Oct-16	183.72	Jul-20	166.92
Nov-16	40.17	Aug-20	237.16
Dec-16	-54.23		

#### Figure 6 & 12:

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 7 to 10:

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>.

**Figure 11:**

Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)	Month	Monthly post-reconciliation assessed Unaccounted for Gas (GWh)
Apr-18	145.85	Apr-19	213.20
May-18	30.79	May-19	225.73
Jun-18	-82.26	Jun-19	223.99
Jul-18	78.40	Jul-19	231.73
Aug-18	51.71	Aug-19	129.57
Sep-18	16.38	Sep-19	-4.65
Oct-18	235.10	Oct-19	237.93
Nov-18	218.51	Nov-19	516.64
Dec-18	158.75	Dec-19	507.78
Jan-19	313.68	Jan-20	378.38
Feb-19	209.72	Feb-20	361.56
Mar-19	156.83	Mar-20	344.46

**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
2014/15	47	250.71	0	0
2015/16	63	513.72	0	0
2016/17	127	552.32	0	0
2017/18	59	573.16	2	0.62
2018/19	31	221.72	5	10.76
2019/20	1	0.09	9	34.29
2020/21	1	0	1	12.01

The reconciliation values for 2020/21 cover the period from 1<sup>st</sup> April 2020 to 31<sup>st</sup> August 2020

\*one reconciliation covers two Formula Years

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

[nationalgrid.com](http://nationalgrid.com)