

# Unaccounted for Gas Report

National Grid

Gas Transmission

April 2018

## 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.

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 since April 2013, the start of the RIIO-T1 price control, with particular emphasis on 1<sup>st</sup> September 2017 to 28<sup>th</sup> February 2018 inclusive, the period since the publication of the October 2017 UAG report.

The total assessed UAG quantity for the September 2017 to February 2018 period has been significantly less than for the previous six month period. In addition, total monthly assessed UAG values have all been less than the long term average (April 2013 to February 2018) monthly assessed UAG.

It is expected that for Formula Year 2017/18 annual assessed UAG will be significantly 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 a greater quantity of meter or data error reconciliation, in absolute energy terms, for 2017/18 than was reconciled for 2016/17.

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. This is assisting National Grid in identifying and correcting data errors during the pre-closeout period.

Good progress has also been made on obtaining and reviewing meter validation information for NTS entry and exit facilities for 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 programmes.

# Contents

Executive Summary.....	2
1. Introduction.....	4
2. National Transmission System Unaccounted for Gas Trends .....	5
3. UAG Management Activities .....	11
3.1 Meter Validation Report Reviews .....	11
3.2 Meter Witnessing .....	12
3.3 Reconciliation .....	12
3.4 NGage Meter Validation Application .....	15
3.5 Baseline UAG Analysis .....	16
3.6 Ongoing Development of Gas Control Suite.....	16
4. Conclusion.....	20

# 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 since April 2013, the start of the RIIO-T1 price control, with particular emphasis on 1<sup>st</sup> September 2017 to 28<sup>th</sup> February 2018 inclusive, the period since the publication of the October 2017 UAG report. (The October report covered UAG management during the period up to and including 31<sup>st</sup> August 2017). This report 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 new National Grid website via the following link:

<https://www.nationalgrid.com/uk/gas/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 obligations 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](mailto: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 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 September 2017 to February 2018.

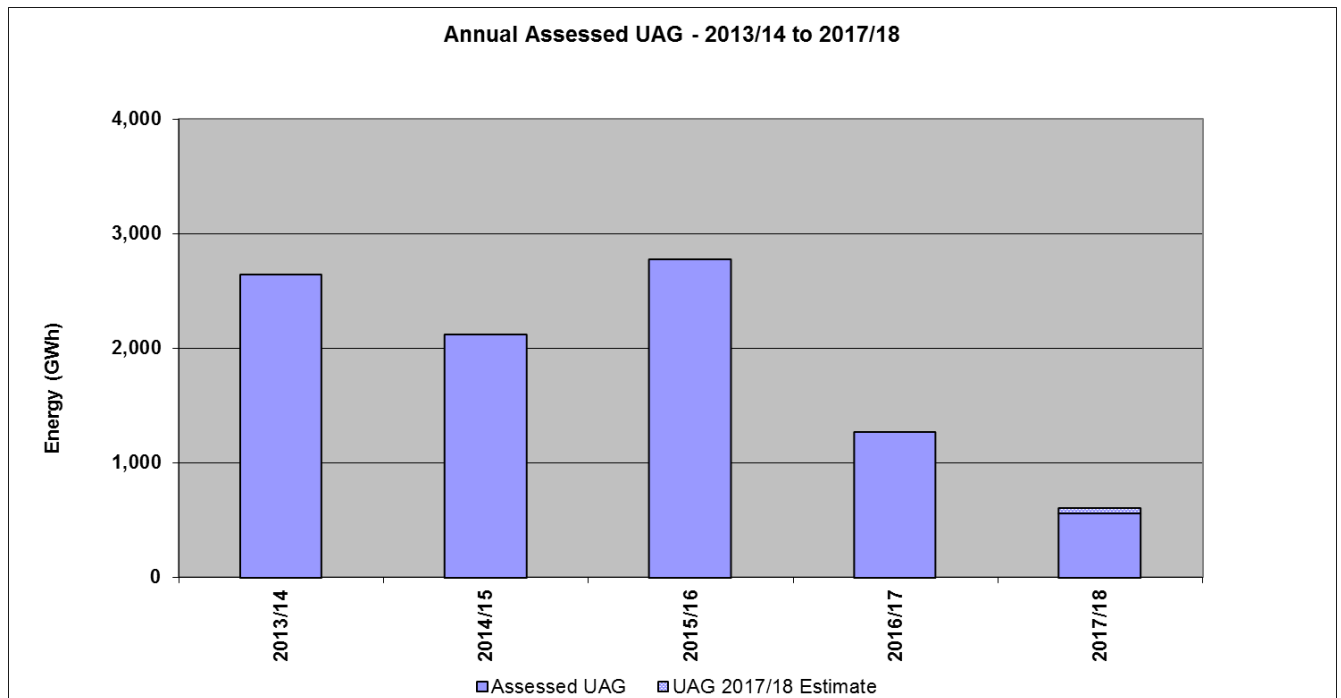


Figure 1: Annual assessed UAG – 2013/14 to 2017/18

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 1<sup>st</sup> April to 31<sup>st</sup> 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 significantly lower than for the previous years and is currently estimated to be over 50% 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 20% of the total estimated 2017/18 NTS Shrinkage. Prior to Formula Year 2016/17 UAG had been the principal element of NTS Shrinkage each year since 2009/10.

2017/18	UAG	OUG	CVS	Total
Actual Assessed Levels - April to February (GWh)	560	2,200	85	2,845
Estimated Levels - March (GWh)	52	204	8	264
Estimated Annual Levels (GWh)	613	2,404	93	3,109
Percentage of Total Estimated Annual Level	19.7	77.3	3.0	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	560
Assessed Daily Average (GWh/d)	7.25	5.81	7.60	3.48	1.68
Percentage of NTS Throughput	0.29	0.23	0.29	0.13	0.06

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

The values provided in the above table for 2017/18 cover the 11 month period from 1<sup>st</sup> April to 28<sup>th</sup> February and indicate that the daily average assessed UAG quantity for the year is expected to be significantly lower than that for the previous year. UAG as a percentage of annual NTS Throughput for 2017/18 is also expected to be significantly lower than that for 2016/17. This indicates that the reduction in UAG is in excess of any reduction in observed NTS Throughput.

Figure 2 provides the total monthly assessed UAG from April 2013 to February 2018. It also provides the average monthly assessed UAG for this period (159.0 GWh). For the last 17 months total monthly assessed UAG has been less than the long term average monthly assessed UAG.

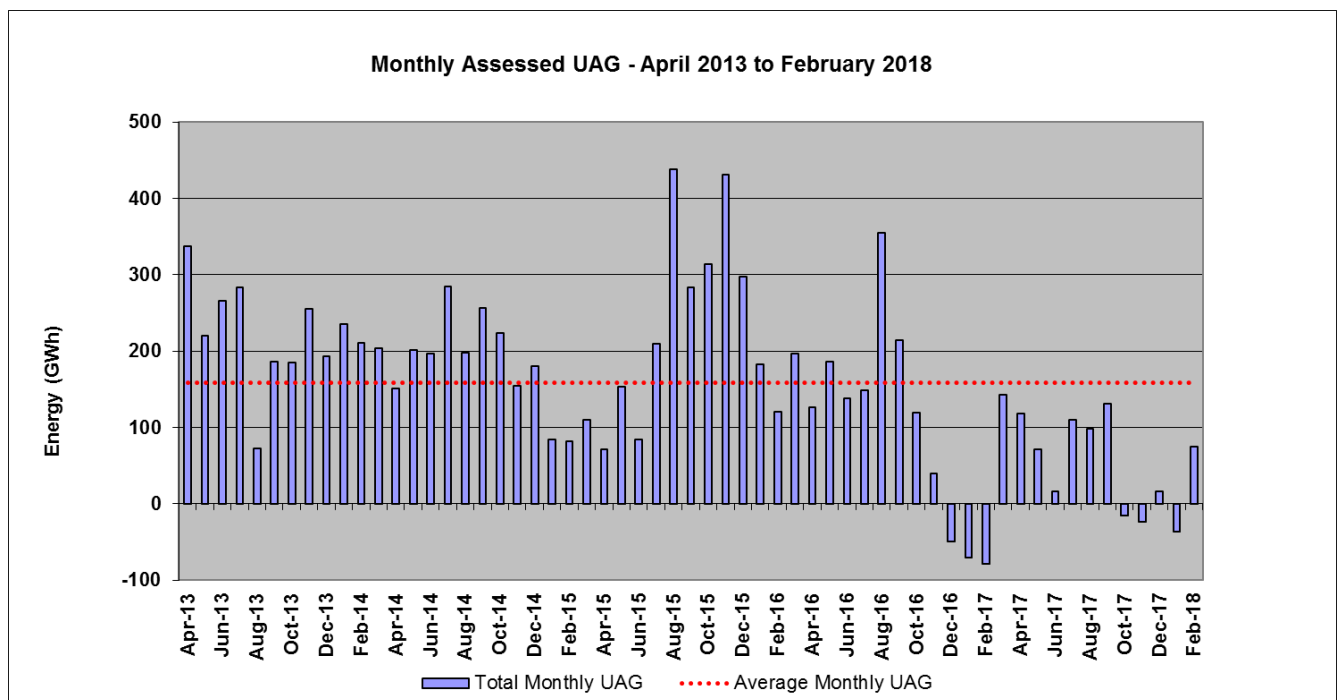


Figure 2: Monthly assessed UAG - April 2013 to February 2018

Very low levels of total monthly assessed UAG have been observed for the majority of the September 2017 to February 2018 period. During this period the total monthly assessed UAG varied from -36.0 GWh to +130.9 GWh with a monthly average of 24.4 GWh. Total monthly assessed UAG has been negative for three of the last six months: October 2017, November 2017 and January 2018.

The period of negative or very low positive monthly UAG during the September 2017 to February 2018 period resembles the period of negative UAG observed during the September 2016 to February 2017 period. Investigations have identified a possible correlation between the low levels of UAG observed and changes in the flow patterns of the interconnectors connected to the gas National Transmission System (NTS).

Figure 3 provides the total monthly assessed UAG for September 2017 to February 2018 compared with the equivalent months of 2016/17. Figure 3 indicates that low levels of positive or negative total monthly assessed UAG were observed during both the same periods of 2016/17 and 2017/18. National Grid is investigating whether the possible correlation between changes in the flow patterns of the interconnectors and low levels of UAG is again observed for the September 2017 to February 2018 period. National Grid is focussing on identifying the causes of this negative UAG as there is potential for industry to be subject to additional costs resulting from the reconciliation of any meter or data errors that are causing these periods of negative UAG.

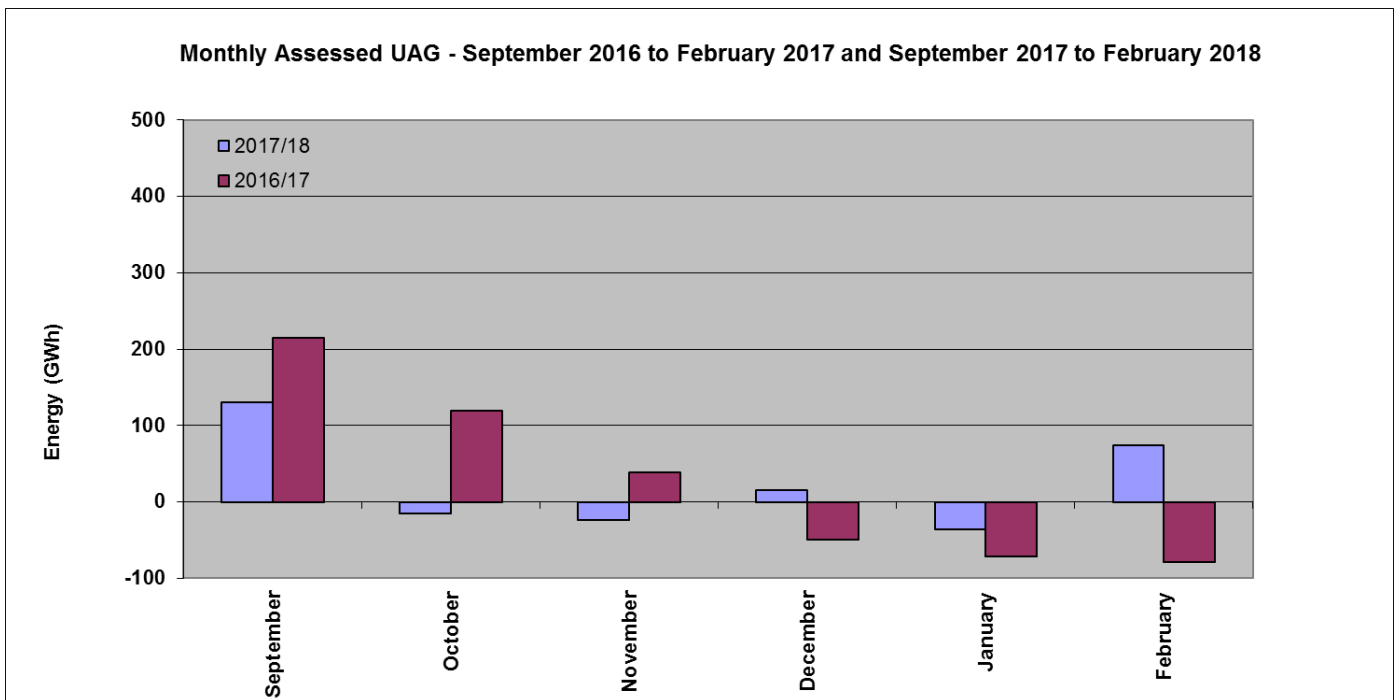


Figure 3: Monthly assessed UAG – September 2016 to February 2017 and September 2017 to February 2018

Figure 4 below provides the daily assessed UAG values for 1<sup>st</sup> September 2017 to 28<sup>th</sup> February 2018. 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 -33.8 GWh to +54.8 GWh.



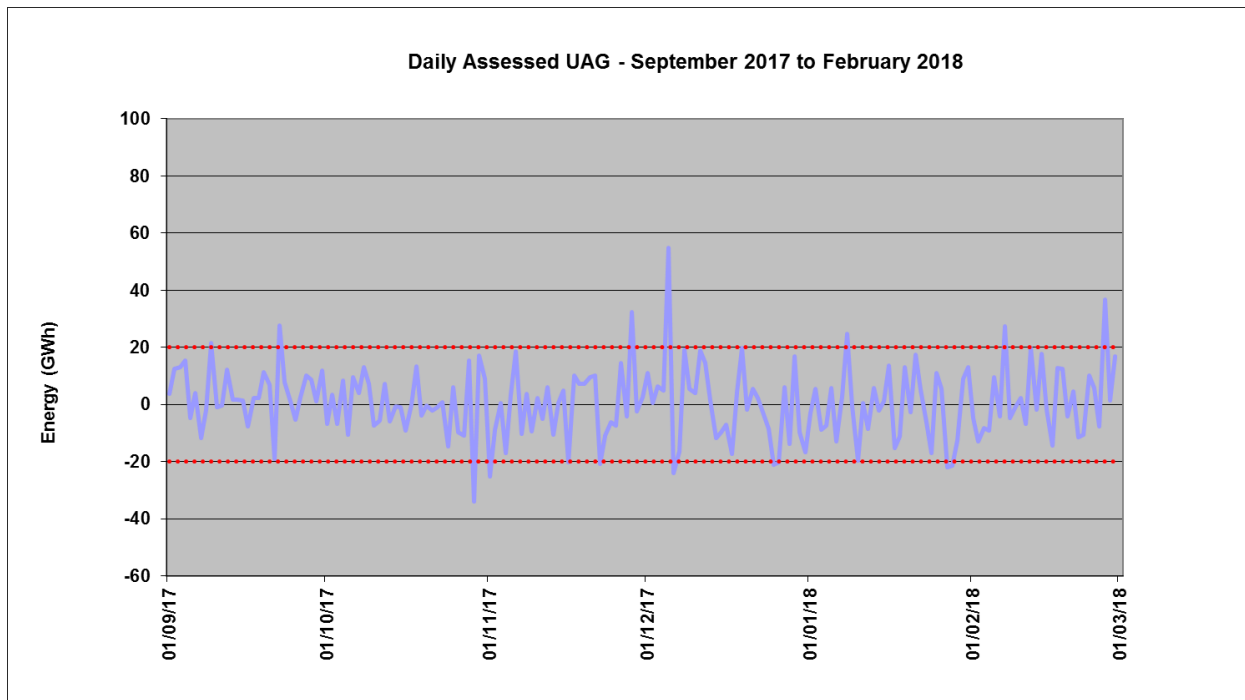


Figure 4: Daily assessed UAG – September 2017 to February 2018

There were 85 days (47.0% of occasions) subject to negative UAG during this period. This is a significant increase from the 72 days (39.1% of occasions) subject to negative UAG during the previous 6 months. It is, however, a similar number of days (48.6% of occasions) to that observed during the September 2016 to February 2017 period.

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 September 2017 to February 2018 there were 16 days when daily assessed UAG exceeded  $\pm 20$  GWh (8.8% of occasions). This is slightly less than the 17 days observed when daily assessed UAG exceeded  $\pm 20$  GWh (9.2% of occasions) during the previous 6 month period.

There were four instances of very high positive or negative UAG during the September 2017 to February 2018 period: 29<sup>th</sup> October (-33.8 GWh), 28<sup>th</sup> November (+32.5 GWh), 5<sup>th</sup> December (+54.8 GWh) and 26<sup>th</sup> February (+36.6 GWh). The instances of very high positive UAG in November and December were identified as data errors associated with the Stallingborough power stations. Reconciliations of these errors are currently being progressed. Further information on reconciliation is provided in section 3.3 of this report. To date the investigations into the instances of very high negative UAG in October and February have not yet been identified as meter or data errors, however, work continues to investigate the causes of these UAG levels.

A new procedure has been introduced over the last six months for investigating days with high levels of positive or negative UAG. This procedure comprises a series of 10 different tests to confirm the completeness and accuracy of the data used to calculate daily assessed UAG. New data visualisations have been developed to assist in identifying missing or erroneous data. Further information on the development of these visualisations is provided in section 3.6 of this report. National Grid is continuing to improve its ability to investigate days with high levels of positive or negative UAG and will introduce new tests for identifying the possible causes.

National Grid is also continuing to investigate all days with high levels of positive or negative UAG during the September 2017 to February 2018 period. In addition National Grid is monitoring for the presence of any trends.

### **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 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 this testing should be documented within a meter validation report and provided to National Grid.

Historically National Grid has 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 18 months National Grid has contacted all meter owners to request meter validation reports for all entry and exit facilities connected to the NTS. This initiative has coincided with the lower levels of UAG observed since October 2016.

For Formula Year 2017/18 National Grid has to date received meter validation reports for 93% of all the NTS entry and exit facilities. These reports were for validations that had taken place between April 2017 and February 2018.

The Meter Assurance team has reviewed all the reports received and, where necessary, raised queries with meter owners. Only three meter installations (1.3% of all NTS entry and exit facilities accounting for 0.3% of typical NTS input and output quantities) were assessed to have failed their meter validations. National Grid has been liaising with these meter owners to agree actions to rectify the identified issues and assess the impact of these metering issues on assessed UAG levels.

Over the next six months the Meter Assurance team will continue to request and review the remaining 2017/18 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. The team will also begin obtaining meter validation reports for Formula Year 2018/19.

## **3.2 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 comprising the metering installation continues to measure the gas delivered to or taken from the NTS 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.

12 witnessing visits were scheduled within the September 2017 to February 2018 period. Seven visits were completed to metering installations which included terminal, interconnector, NTS storage and gas distribution network facilities. Meter Assurance team members were not able to attend four of the other planned visits due to resource constraints or conflicting meter witnessing activities. For the remaining planned visit the meter owner only confirmed the date of the validation to National Grid on the day it took place providing the Meter Assurance team insufficient time to attend site. The meter installations which were visited by National Grid were all observed to be measuring accurately.

During the next six months National Grid is planning to attend the remaining meter witnessing visit of the 2017/18 annual meter witnessing programme and prepare a new programme for 2018/19. The meter installations to be included in this programme will be identified from the 2017/18 meter validation report reviews discussed in section 3.1 of this report. Following the recruitment of an additional member of the Meter Assurance team at the end of 2017 National Grid is confident that it should be able to complete the visits in the 2018/19 programme.

## **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 processed 166.4 GWh of reconciliations in absolute energy terms. This comprises 24 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 2017/18, however, reconciliations have also been processed for Formula Years 2015/16 and 2016/17. This is a greater quantity of reconciled energy than was processed during the previous six month period.

Figure 5 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 processed since the publication of the October 2017 UAG report.

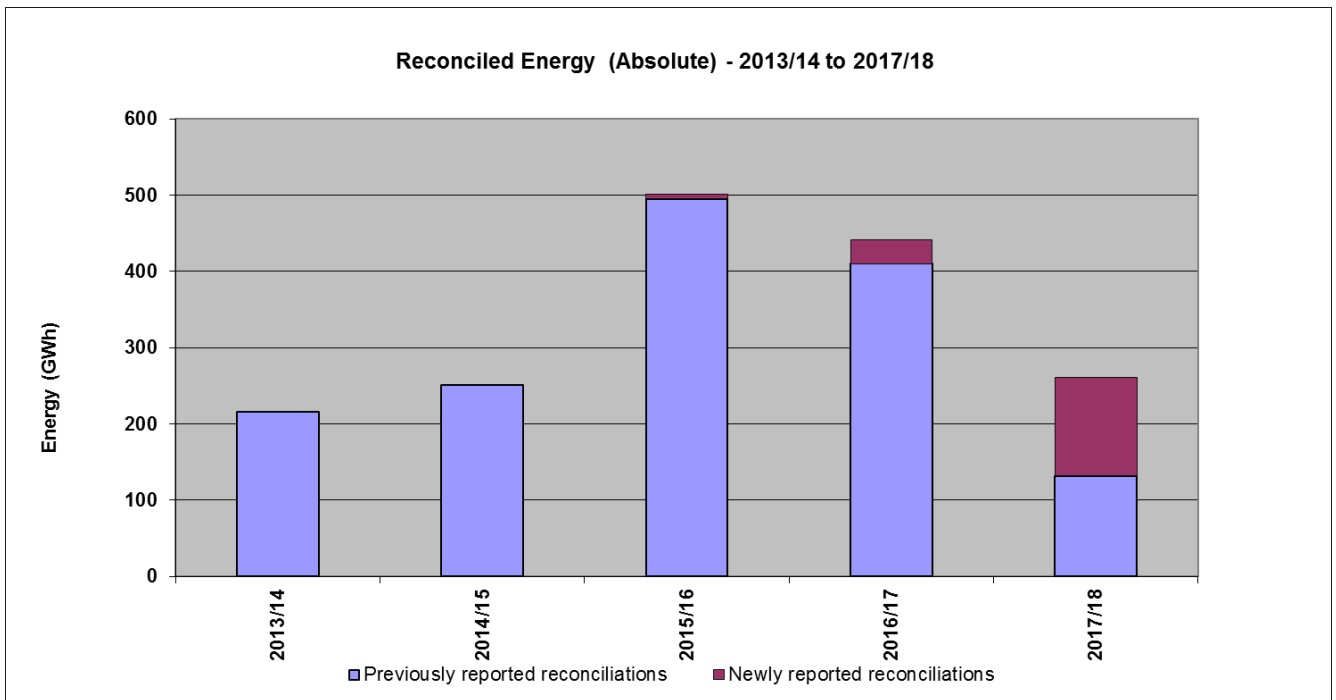


Figure 5: Reconciled energy (absolute) – 2013/14 to 2017/18

Of the 24 instances of reconciliation processed seven related to meter error (29.2% of instances) and 17 related to data error (70.8% of instances).

Figure 6 below 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 1<sup>st</sup> April to 28<sup>th</sup> February.

Figure 6 demonstrates an upward trend in annual reconciliation quantities as a percentage of annual assessed UAG for Formula Years 2013/14 to 2016/17 which has continued throughout 2017/18. This is based on the assumption that the proportion of assessed UAG that can be reconciled remains unchanged.

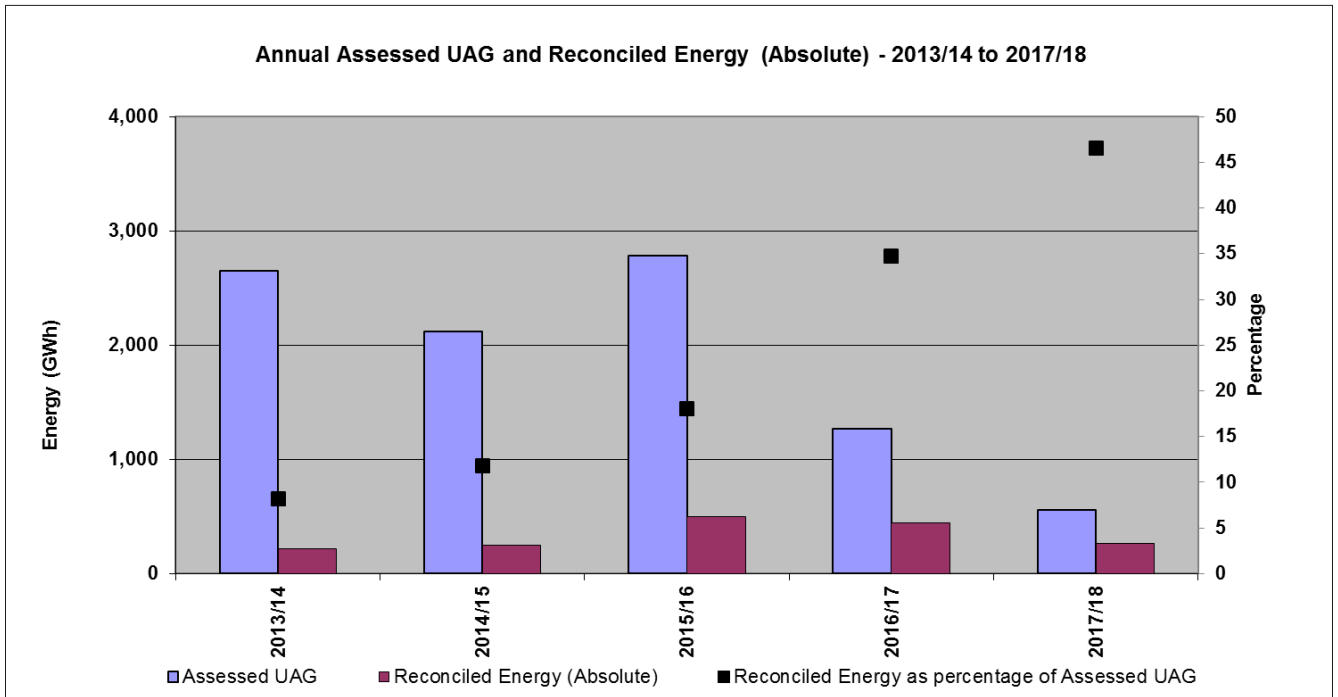


Figure 6: Annual assessed UAG and reconciled energy (absolute) – 2013/14 to 2017/18

National Grid has reviewed the data error reconciliations that have been processed over the last 12 months (March 2017 to February 2018) to improve its understanding of the causes of these errors and to allow mitigations to be introduced. Figure 7 provides a breakdown of the identified causes of these data error reconciliations.

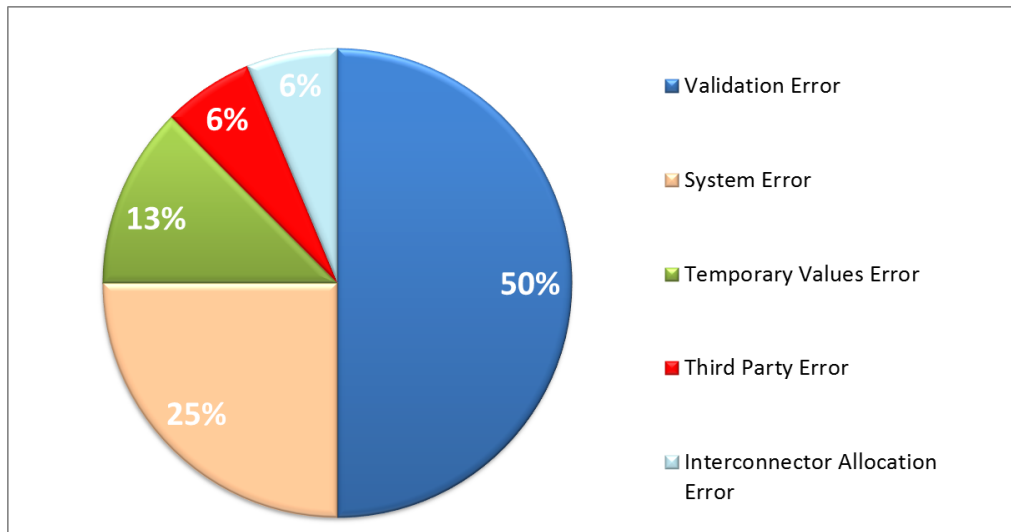


Figure 7: Breakdown of causes of data error reconciliations processed during March 2017 to February 2018 period

Figure 7 indicates that the principal causes of the data error reconciliations are errors introduced during the validation of end of day measurements for NTS entry and exit facilities received by National Grid and system issues concerned with the Gas Control Suite (GCS) and Gemini. Further information on GCS and Gemini is provided in section 3.6 of this report. National Grid is planning to implement improved checking procedures into its validation of end of day measurements to help address the data quality challenges being experienced during the pre-closeout period. National Grid is also continuing to work with GCS and Gemini support teams to ensure that the appropriate measurement data is passed from GCS to Gemini.

National Grid is currently processing a further 33 meter or data reconciliations which will be included in future UAG reports. This is estimated to account for over 150 GWh of reconciled energy in absolute terms. 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 of its impact on assessed UAG.

### **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.

Following completion of NGage version 2.0 last summer unexpected delays were experienced in making the application available on both the App store and Google Play Store. The issues in publishing NGage on these stores have finally been resolved within the last month. This has allowed National Grid to begin rolling out NGage to meter owners.

Over the coming months National Grid is planning to roll out version 2.0 of the NGage application to a range of meter owners. National Grid will support meter owners in using this application during their future meter validations. Use of NGage will assist National Grid in efficiently obtaining up to date meter validation reports as discussed in section 3.1 of this 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. 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 in section 2 of this report National Grid currently uses UAG baseline values of  $\pm 20$  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.

During January 2018 the PhD student spent a month with National Grid. During this time he developed the prototype of an application to undertake change points analysis on the assessed UAG values published on the National Grid website. The application was developed on Shiny, an open source R statistical computing package.

Over the next six months it is intended that the PhD student will continue work on the baseline UAG analysis focussing on the development of novel change point analysis techniques. These new techniques will be incorporated into the prototype application which will then undergo testing by National Grid. It is intended that this application will be used for investigating periods when high levels of positive or negative UAG are observed.

### **3.6 Ongoing Development of Gas Control Suite**

At the end of July 2016 National Grid implemented its new Gas Control Suite system. GCS 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 NTS input and output measurements. 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 previous UAG reports, the Meter Assurance team has continued to work closely with the GCS developers since implementation to ensure that the best available data is used by the system to calculate UAG. The team has also continued to specify new system functionality that will improve the day to day management of UAG.

Over the past six months National Grid has undertaken a review of the UAG calculation performed by GCS in light of recent EU regulatory changes, e.g. the introduction of Operational Balancing Account (OBA) arrangements at the interconnectors. This review has resulted in the implementation of a number of changes to GCS to ensure that the system calculates assessed UAG using the best available data. These changes relate to the treatment in the UAG calculation of OBA quantities, the differences between the shippers' nominated quantities and the quantities which the interconnector operators actually import into or export from the NTS. This should prevent National Grid from unnecessarily procuring NTS shrinkage relating to the interconnector operator's OBA quantities. Work is continuing to implement this change for all three interconnectors.

The Meter Assurance team has continued developing a suite of new data visualisations to assist the identification of causes of UAG. This has involved the use of Tableau data visualisation software, one of the components of GCS, to create a suite of Tableau dashboards. Figures 8 and 9 provide examples of Tableau dashboards that have been developed and which are currently being trialled.

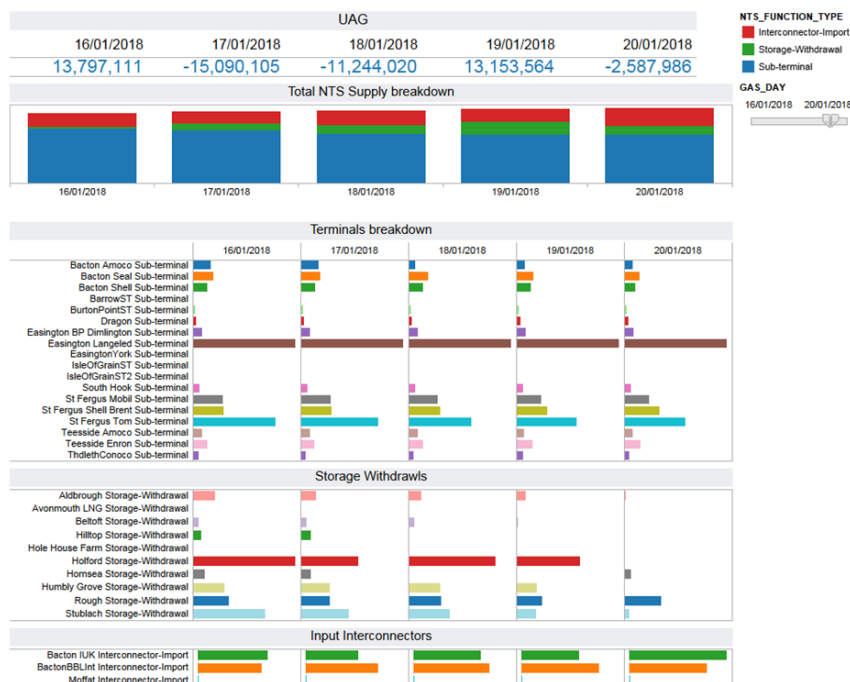


Figure 8: Tableau dashboard visualising system inputs with assessed UAG

Figure 8 shows a dashboard which displays the daily input quantities for the terminals, storage facilities and interconnectors delivering gas to the NTS against daily assessed UAG values for a specified range of gas days. This allows the impact of changes at each input point to be investigated on days with high levels of positive or negative UAG. This dashboard is proving effective in identifying missing or erroneous end of day measurements for system inputs allowing data errors to be corrected within the entry closeout period.

NTS_FUNCNTL..	NTS_FUNCTION_NAME	EoD Energy (kWh)	Telemetry	Notifications	Nomination	% Diff EoD Energy..	% Diff EoD Energy..	% Diff EoD Energy..	
Industrial	BASF Industrial	6,441,111	6,441,111	6,465,000	6,538,996	0.00%	0.37%	1.52%	
	BOC Tees Industrial	4,374,444	4,374,444	4,344,000	4,277,789	0.00%	0.70%	2.21%	
	BP Saltend HP Industrial	4,118,333	4,118,333	4,839,120	4,579,527	0.00%	17.50%	11.20%	
	BPGmgmouthInd Industrial	20,180,000	20,180,000	20,076,000	20,014,663	0.00%	0.52%	0.82%	
	Blackburn Mill Industrial	0	0	0	0	0.00%	0.00%	0.00%	
	Bridgewater Paper Industri..	34,444	34,444	0	32,725	0.00%	100.00%	4.99%	
	Centrax Industrial	0	0	40,000	17,060	0.00%	0.00%	0.00%	
	Goole Glass Industrial	1,410,218	0	1,405,070	1,410,218	100.00%	0.37%	0.00%	
	Hays Chemicals Industrial	95	95	0	0	0.00%	100.00%	100.00%	
	ICI Billingham Industrial	16,305,496	16,274,444	15,840,000	15,800,000	0.19%	2.85%	3.10%	
	ICI Runcorn Industrial	1,038,889	1,038,889	1,050,720	1,034,453	0.00%	1.14%	0.43%	
	Immingham Industrial	37,956,667	37,956,667	38,258,600	38,258,500	0.00%	0.80%	0.80%	
	PhilipsTeesInd Industrial	0	0	0	0	0.00%	0.00%	0.00%	
	ShellStar Industrial	11,140,422	0	10,907,060	10,990,163	100.00%	2.09%	1.35%	
	WinningtonInd Industrial	5,935,556	5,935,556	5,557,000	5,556,324	0.00%	6.38%	6.39%	
	Powerstation	Baglan Bay Powerstation	10,108,296	0	9,739,877	9,741,700	100.00%	3.64%	3.63%
		Blackbridge Powerstation	77,039,753	0	77,260,000	76,548,425	100.00%	0.29%	0.64%
Brigg Powerstation		317	317	0	0	0.00%	100.00%	100.00%	
Burton Point Powerstation		15,472	10,000	0	0	35.37%	100.00%	100.00%	
Carrington Powerstation		10,722,222	10,722,222	10,351,631	10,354,169	0.00%	3.46%	3.43%	
Corby Powerstation		0	0	0	0	0.00%	0.00%	0.00%	
Coryton Powerstation		3,634,711	0	3,615,844	3,627,853	100.00%	0.52%	0.19%	
Cottam Powerstation		14,693,000	14,693,000	14,005,056	14,680,555	0.00%	4.68%	0.08%	
Damhead Creek Powersta..		34,177,778	34,177,778	34,056,000	34,177,210	0.00%	0.36%	0.00%	
Deeside Powerstation		7,165,194	7,165,194	8,072,595	7,152,837	0.00%	12.66%	0.17%	
DidcotB Power Station		401,538	401,111	167,000	167,000	0.11%	58.41%	58.41%	
Epping Green Powerstation		0	0	0	0	0.00%	0.00%	0.00%	
Grain Powerstation		0	0	0	0	0.00%	0.00%	0.00%	
Gt Yarmouth Powerstation		11,913,889	0	11,717,000	11,866,885	100.00%	1.65%	0.39%	
Keadby B Powerstation		0	0	0	0	0.00%	0.00%	0.00%	
Keadby Powerstation		9,823,521	9,823,528	10,286,959	9,859,415	0.00%	4.72%	0.37%	
Kings Lynn Powerstation		0	0	0	0	0.00%	0.00%	0.00%	
Langage Powerstation	6,352,222	6,352,222	6,340,586	6,340,586	0.00%	0.18%	0.18%		

Figure 9: Tableau dashboard highlighting differences between nominations, notifications, telemetered measurements and measurements published in Gemini

Figure 9 shows a dashboard which compares for NTS power station and industrial facilities for a specified gas day the shippers' nominations, the end of day notification quantity which is typically provided to National Grid by the facility's operator, the telemetered end of day measurement recorded by GCS and the validated end of day measurement that is published in Gemini for customer billing purposes. This dashboard allows National Grid to compare and identify differences between the shippers' intention to take gas from the NTS for a particular facility with the facility's planned offtake quantity, the actual recorded end of day measurement and the value used in the calculation of assessed UAG. This dashboard is proving effective in identifying errors during the validation and provision of end of day measurements to Gemini and in highlighting any metering or telemetry issues. This is allowing data errors to be corrected within the exit closeout period.

The Tableau dashboards developed to date have been used to investigate the causes of negative UAG experienced during December 2016, January 2017 and February 2017 and the causes of low levels of positive UAG experienced during June 2017. The dashboards have helped identify a number of possible correlations, e.g. between the periods of negative UAG and changes in the flow patterns of the interconnectors, which are being investigated further.

Over the coming months the Meter Assurance team will continue to work with the GCS developers to ensure the best available data is used by the system to calculate assessed UAG. The team will also continue enhancing its data visualisation capabilities. A particular focus for the team will be to continue to test all the Tableau dashboards that have been created to date to identify their effectiveness in identifying missing or erroneous data used in the calculation of UAG. In particular National Grid intends to develop and make use of data visualisation to improve data quality during the pre-closeout period.

## 4. Conclusion

The total assessed UAG quantity for the September 2017 to February 2018 period has been significantly less than for the previous six month period. In addition, total monthly assessed UAG values have all been less than the long term average (April 2013 to February 2018) monthly assessed UAG.

It is expected that for Formula Year 2017/18 annual assessed UAG will be significantly 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 a greater quantity of meter or data error reconciliation, in absolute energy terms, for 2017/18 than was reconciled for 2016/17.

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. This is assisting National Grid in identifying and correcting data errors during the pre-closeout period.

Good progress has also been made on obtaining and reviewing meter validation information for NTS entry and exit facilities for 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 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 April 2018 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.

The axes on the figures provided in this report have been specified to allow this data to be easily compared with similar data published in previous UAG reports.

**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	560	52

The annual assessed UAG for 2017/18 covers the period 1<sup>st</sup> April 2017 to 28<sup>th</sup> February 2018.

**Figure 2:**

Month	Total monthly assessed UAG (GWh)	Average monthly assessed UAG (GWh)
Apr-13	337.54	159.05
May-13	220.69	159.05
Jun-13	266.17	159.05
Jul-13	283.19	159.05
Aug-13	72.18	159.05
Sep-13	186.56	159.05
Oct-13	184.75	159.05
Nov-13	254.88	159.05
Dec-13	193.15	159.05
Jan-14	235.28	159.05
Feb-14	210.38	159.05
Mar-14	203.22	159.05
Apr-14	150.50	159.05

Month	Total monthly assessed UAG (GWh)	Average monthly assessed UAG (GWh)
May-14	200.90	159.05
Jun-14	197.26	159.05
Jul-14	284.19	159.05
Aug-14	197.98	159.05
Sep-14	256.67	159.05
Oct-14	223.58	159.05
Nov-14	154.41	159.05
Dec-14	179.73	159.05
Jan-15	84.50	159.05
Feb-15	81.31	159.05
Mar-15	110.23	159.05
Apr-15	70.99	159.05
May-15	153.27	159.05
Jun-15	84.29	159.05
Jul-15	209.38	159.05
Aug-15	437.92	159.05
Sep-15	283.13	159.05
Oct-15	313.53	159.05
Nov-15	431.57	159.05
Dec-15	296.88	159.05
Jan-16	183.12	159.05
Feb-16	120.94	159.05
Mar-16	197.22	159.05
Apr-16	126.71	159.05
May-16	185.70	159.05
Jun-16	138.06	159.05
Jul-16	148.50	159.05
Aug-16	354.84	159.05
Sep-16	214.48	159.05
Oct-16	119.22	159.05
Nov-16	39.19	159.05
Dec-16	-48.90	159.05
Jan-17	-71.07	159.05
Feb-17	-78.32	159.05
Mar-17	143.26	159.05
Apr-17	118.29	159.05
May-17	71.05	159.05
Jun-17	15.97	159.05
Jul-17	110.49	159.05
Aug-17	98.25	159.05
Sep-17	130.88	159.05
Oct-17	-15.13	159.05
Nov-17	-23.71	159.05
Dec-17	15.68	159.05
Jan-18	-35.96	159.05
Feb-18	74.70	159.05



**Figure 3:**

Month	Total monthly assessed UAG (GWh)	Month	Total monthly assessed UAG (GWh)
Sep-16	214.48	Sep-17	130.88
Oct-16	119.22	Oct-17	-15.13
Nov-16	39.19	Nov-17	-23.71
Dec-16	-48.90	Dec-17	15.68
Jan-17	-71.07	Jan-18	-35.96
Feb-17	-78.32	Feb-18	74.70

**Figure 4:**

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

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

**Figure 5:**

Formula Year	Number of instances of reconciliation published in October 2017 UAG report	Reconciled energy (absolute) published in October 2017 UAG report (GWh)	Number of instances of reconciliation processed since publication of October 2017 UAG report	Reconciled energy (absolute) processed since publication of October 2017 UAG report (GWh)
2013/14	45	216.49	0	0.00
2014/15	47	250.71	0	0.00
2015/16	57	495.01	3	6.42
2016/17	111	410.11	6	31.12
2017/18	10	131.85	15	128.84

2017/18 covers the period 1<sup>st</sup> April 2017 to 28<sup>th</sup> February 2018.

**Figure 6:**

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	501.43	18.0
2016/17	1,272	441.23	34.7
2017/18	560	260.69	46.5

2017/18 covers the period 1<sup>st</sup> April 2017 to 28<sup>th</sup> February 2018.

**Figure 7:**

Cause of data error reconciliation	Number of instances processed during March 2017 to February 2018 period	Number of instances processed as percentage of total data error reconciliations
Validation Error	24	50.0
System Error	12	25.0
Temporary Values Error	6	12.5
Third Party Error	3	6.25
Interconnector Allocation Error	3	6.25