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To:
Shippers, Suppliers, Customers, Transmission and Transportation System Owners and other Interested Parties

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Dear Colleague

Industry Update: Unaccounted for Gas System Operator Incentive

This letter seeks to inform industry participants on the progress achieved to date by National Grid NTS (National Grid) in reducing Unaccounted for Gas (UAG) together with an overview of the ongoing projects seeking to reduce the volume of UAG further.

In late 2010, National Grid met with a number of industry parties to understand their priorities in Shrinkage provision. Through this process a number of parties asked National Grid to provide an update on the progress made to reduce UAG as part of the existing UAG incentive. In response to these requests, this letter has been produced to inform all interested parties of the progress achieved to date in reducing UAG through current work, together with an overview of the ongoing projects seeking to reduce UAG further.

Background

UAG is the difference between the measured inputs and outputs of the National Transmission System (NTS) which cannot be attributed to known changes to the pipeline system such as the differing daily energy stored within the NTS at a variety of pressures (NTS Linepack)

The gas required to replace UAG is procured by National Grid on behalf of the shipper community in its role as 'NTS Shrinkage Provider' through market trades. In 2009/10, the volume of UAG was some gross[1] 7720GWh, at an approximate total cost of £100m. (If UAG is positive the system is short and gas has to be purchased to bring the system back into balance. If UAG is negative the system is long and less Shrinkage is required to be purchased to achieve a balance.)

In April 2009 National Grid accepted a new System Operator (SO) incentive[2] to reduce the volume of UAG. This incentive encourages National Grid to invest in projects to research the causes of UAG and ultimately reduce the volume and associated costs of UAG. As of April 2009 National Grid could receive a payment of £4.67k for every GWh that gross annual UAG is below the 2,862GWh target set as part of the UAG Incentive. Performance against incentive is shown in the following table.

1 UAG can be positive or negative on any given gas day. Gross UAG is defined as the absolute level of UAG on the day.

[2] Further information on UAG incentive and the other System Operator (SO) Incentives can be found on the National Grid website at http://www.nationalgrid.com/uk/Gas/soincentives/.

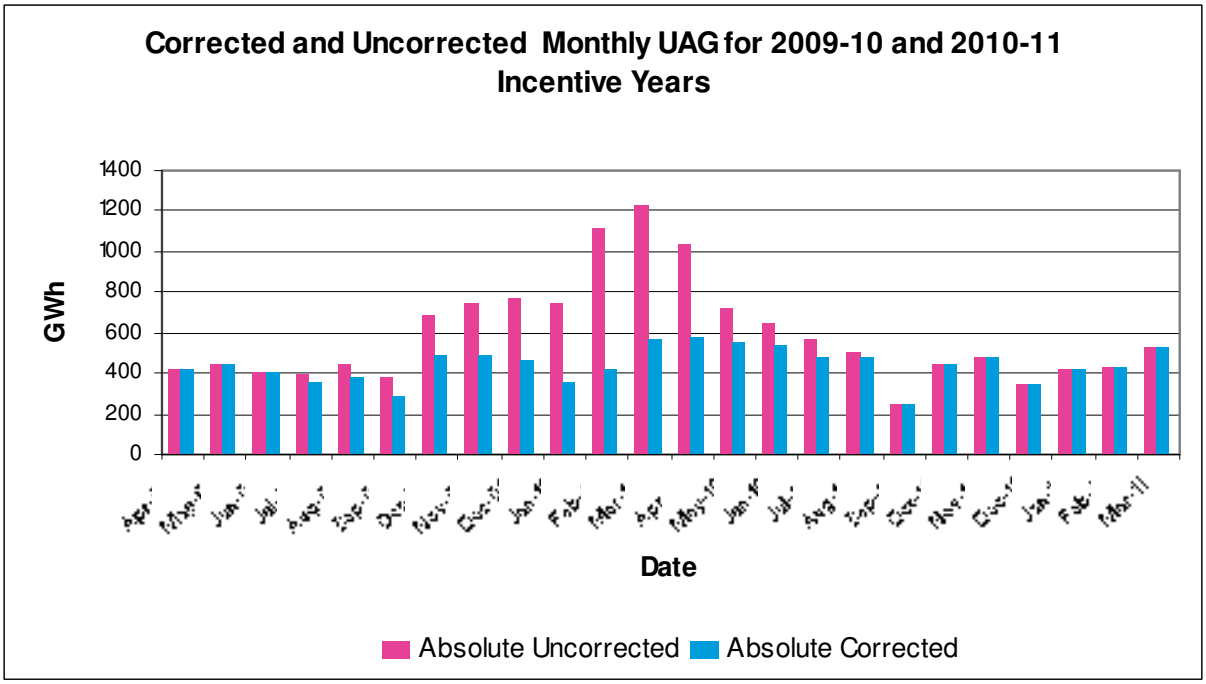
Incentive Year	Incentive target	Gross UAG Performance	Incentive performance
2009/10	2,862 GWh	7,716GWh	£0m
2010/11	2,862 GWh	6314GWh	£0m

National Grid believes the primary cause of UAG to be the inherent measurement tolerances associated with entry and exit metering equipment. The permitted tolerance for fiscal metering equipment connected to the NTS is +/-1% (10,000GWh). The value of UAG compared to overall system throughput is below this figure at 0.6% (2009/10 figures). A further factor is meter error, which could be as a result of technical issues[3]. For example, when correcting for recent known meter errors, in particular at the Braishfield and Aberdeen NTS to DNO Network offtakes, we estimate UAG to fall to around 5100GWh gross which is less than 0.5% of overall system throughput.

As stated earlier, National Grid has an incentive to reduce UAG, the main contributors to the increasing values in recent years have been meter errors. Whilst National Grid has a meter assurance role the NTS connected meter assets are predominately owned by Distribution Networks, Terminal Operators and / or large industrial End Consumers. Our success under this incentive is significantly reliant therefore on mutual working and collaboration with these stakeholders who own and are responsible for the majority of this equipment.

Volume of UAG

For incentive year 2009/10 the final absolute UAG was 7720GWh but when corrected for known errors the figure is 5037GWh. For the latest incentive year 2010/11 the final absolute UAG was 6314GWh when corrected for known errors the figure is 5272 GWh. The graph below shows the position before and after corrections have been made to account for known errors. These corrections were made after closure of the Daily Quantity calculations and therefore have no bearing on the reported position for UAG. The figures are included for information only. The projected actual position for 2011/12 is 5000GWh.



[3] Measurement Error Reports are available on the Joint Office website at http://www.gasgovernance.co.uk/MER

UAG Analysis Projects

UAG energy volumes show a high level of volatility on a daily basis meaning that identifying and mitigating each and every underlying cause of UAG is a complex task. Even so, due to the large volume of gas included within UAG, a reduction in this volume through investigation and subsequent mitigating actions could lead to a large reduction in the costs incurred by the shipper community.

In order to effectively coordinate a range of individual UAG reduction projects and to ensure all possible causes of UAG are under investigation, National Grid appointed a Project Manager in July 2010 supported by two team members to undertake a year long study. The following information provides details of the work managed by this team including previously completed projects, current ongoing projects and future projects planned to better understand the variable components of UAG and ultimately reduce overall UAG.

1. Previous Projects

- **Linepack model**

As stated earlier in this letter, the consideration of the change in NTS linepack from one day to another is an important component in assessing UAG. As such, a project was initiated to ensure that the National Grid linepack model used to assess the volume of gas stored within the National Transmission System infrastructure was suitably robust and included all sections of pipeline and thus the gas stored as linepack.

Following a thorough review of the linepack model, National Grid has a high level of confidence that the linepack model continues to provide a robust representation of the National Transmission System infrastructure. Further investigations will be targeted at the inputs to the model. We constantly maintain, review, oversee and audit this process to ensure continuing resilience and confidence.

- **Exit Connections**

To further understand the metering assets that measure the gas flowing out of the NTS a number of independent research programmes have been conducted with the TUV NEL laboratories in Glasgow. These have included Computational Fluid Dynamics (CFD) analyses of meter systems and orifice plate installations.

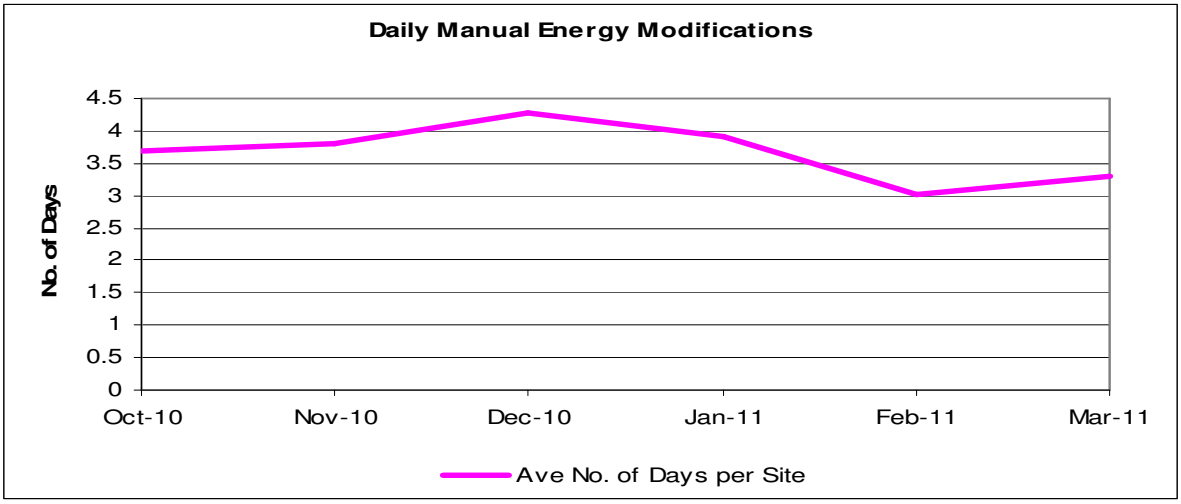
This project has furthered our understanding of metering equipment used at exit supply points such that further possible causes of UAG deriving from metering equipment can be predicted in advance and mitigated accordingly.

- **Data Confidence**

To improve the quality of metering information, and ensure this information is available as soon as possible to identify any adverse impacts to UAG, a project was initiated to review data integrity.

Prior to this review, the vast array of metering information available for all NTS entry and exit points required varying degrees of manual intervention and correction before the data was deemed fit for analysis. (This could be up to 1.7 million pieces of data over the year.) Due to the time period required to manually correct this information there was a risk that this may delay the discovery of some causes of UAG.
Subsequently, to mitigate this identified risk, work is on-going to improve the data quality from the telemetry systems, which in turn has reduced the number of required manual

interventions. As such, a clean dataset of metering information is now available sooner than previously experienced, which has better enabled the rapid investigation of potential sources of UAG.



- **Accounting Calculations – Commissioning Gas**

In order to ensure that strictly unaccounted for gas appears in the calculation a more robust and consistent commercial framework has been developed to ensure robust accounting of pipeline commissioning gas as new gas pipes become operational.

2. Current Projects

- **Data Mining**

There is a vast quantity of metering data available that could provide further insight into the causes of UAG. In an attempt to isolate the influencing factors of UAG within this data National Grid has initiated a data mining project and has enlisted the help of statistical experts from the Industrial Statistical Research Unit (ISRU) at Newcastle University. In addition, this project is using Predictive Analytics SoftWare (PASW) to track changes in daily offtake behaviour against changing levels of UAG on a rolling three month period. When offtakes are identified as potentially contributing to UAG they are investigated further, and if deemed necessary visited to establish whether the configuration of the metering equipment has been compromised and requires resetting.

This data mining identified an issue with the Braishfield offtake. When Scotia Gas were contacted to discuss the issue they also believed there was an issue with this site. Subsequently a meter error caused by an equalising valve being left open was notified to the Joint Office of Gas Transporters. The under-reading of flow at this site accounted for some 1100GWh of UAG and will result in some £14m being returned to the community in the form of reduced transportation charges.

The data mining analysis started in September 2009 and has been updated with the lessons learnt from the recent Aberdeen and Braishfield meter errors in an attempt to further our ability to identify similar significant meter errors in the future.

To date, the data mining project has investigated seven entry and exit points on the NTS. It is anticipated that further data mining will continue to identify additional areas for investigation.

- **5 Year Data Trending**

The ratio of UAG volume to total system throughput is relatively small so this relative size and day on day UAG volatility means that further causes of UAG can be missed when assessing UAG at a national level.

In an attempt to highlight offtake specific changes National Grid carried out five year data trending for all offtakes. Using the Aberdeen meter error cited earlier as an example; during the period of the meter error the volume of gas originally recorded as UAG registered less than 1% of UK throughput and was almost undetectable at a national level. Looking more closely at historic flows, the offtake was supplying approximately 12-15% of Scottish demand before the meter error occurred. However, during the period of the error this volume fell to around 7-9%. As Aberdeen is the single feed to a discrete geographical area it is simpler to observe reductions in demand. The issue becomes more complex when an offtake is one of a group of offtakes feeding a Local Distribution Zone (LDZ) as it becomes more difficult to see a pattern with demand routinely switched between different offtakes.

The demand forecasting team identified periods of time over the five year study period when LDZ demand and Combined Weather Variable (CWV) were not a closely related as expected. This data was used to target a more detailed investigation over specific time periods in particular LDZs. No additional offtakes were deemed to require additional scrutiny from this work pack.

Annual meter validation dates have also been included within the trend analysis to draw attention to dates when meter errors may have been introduced or resolved as in the case of Aberdeen.

To date, whilst the data trending analysis of offtakes has not identified any further UAG volume we are confident that data mining will identify similar errors in the future.

- **Witness Testing at Entry Points**

As entry terminal and storage sites are some of the largest flows on the National Transmission System they have the potential to contribute significantly to UAG if they have even modest meter errors.

To mitigate this risk National Grid has established a comprehensive storage and terminal witnessing programme building strong links with all the operators of these facilities. The development of these relationships has greatly assisted in establishing a clearer understanding of the respective site's operational issues and potential impacts on NTS shrinkage.

We have worked in close collaboration with one terminal to refine their end of day data to more appropriately reflect the energy delivered to the NTS.

- **Linepack Compressibility Factor Study**

Gas compressibility is utilised in the calculation of linepack. It is not measured at all points on the system and therefore an attribution process takes place to allocate compressibility from a suitable site. This process is under review to ensure that suitable points are being utilised as the system topography has changed significantly in recent years.

3. Future Projects

- **UAG Matrix**

Given that UAG is volatile from day to day we are investigating days of high UAG and the days preceding and following to establish if there is a pattern of behaviour on the system which is worthy of further investigation. This has been in place since October 2010 and is continuing to date. The outcome has not yet shown any consistent pattern of system behaviour.

- **Linepack Compressibility Factor Review**

In the on-going investigation (mentioned above) to improve the data used in the linepack model in order to ensure accuracy, we found that the compressibility assumptions in one part of the network could be improved by utilising data from a new source. Although the impact on overall linepack is small, and the UAG calculation uses the change in linepack over the day, in the interest of accuracy we will pursue this change.

- **Overall NTS Uncertainty**

We are also commissioning work to understand the combined uncertainty of the complete NTS system. While we have a good understanding of metering uncertainty, the other elements impacting on UAG are less well understood (linepack and telemetry for example). Also of interest is how the elements interact with each other. At present we are scoping this work with internal subject experts before drafting a scope of work for an uncertainty expert to undertake the work. The value of this work will be in revealing the level of UAG which could be expected from the inherent uncertainties in the system.

4. Summary

Given the underlying uncertainty in measurement there will always be a level of UAG in the NTS system. The UAG project team has been embedding best practice in the teams within National Grid concerned with the energy balance e.g. data mining, offtake demand trending and scrutiny of the tools used to establish energy values.

Additionally, we are working with meter owners to share any observations we have on their meter equipment to ensure any errors are quickly addressed.

We hope that this letter has helped the industry understand more about the projects ongoing to understand and promote reductions in UAG. If you would like to discuss this further, please do not hesitate to contact Lorraine Weir on 01926 655293 or lorraine.weir.@uk.ngrid.com.

Yours sincerely,

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