March 2016

Shrinkage Incentive Methodology Statement Review

UK Gas Transmission

Contents

1 Executive Summary

The NTS Shrinkage Incentive Methodology Statement describes the methodology that is employed to calculate specific components within the shrinkage incentive scheme.

National Grid Gas Transmission (NGGT) has an obligation under Special Condition 3D of the Licence to undertake a full review of the shrinkage methodology statement, such that any consequential modification can be achieved prior to commencement of the Formula Year 1st April 2017.

The review has considered the extent that the methodology statement delivers against the three key principles of:

- Cost minimisation for customers.
- Delivering appropriate cost risk management.
- Incentivising reductions in volumes where NGGT is able to influence.

The structure of the Shrinkage Incentive scheme as defined in the Licence is not part of this methodology review.

This document presents the results of the review, provides a summary of the options that were considered and makes firm proposals to modify the methodology statement accordingly.

NGGT are keen to explore views from stakeholders on the proposals and welcome responses to specific questions raised[1]

Responses to these questions and any other comments should be provided by **4th April 2016** to the following email address box.soincentives.gas@nationalgrid.com

[1] Questions can be found in Section 8 of this document

An overall summary of the review is presented below.

Component	Current Method	Options explored	Assessment of value add with recommended proposal	Proposal
CFU baseline	Ex-ante, using regression model of historical CFU and St Fergus supply	Other supply drivers, reduced historical range and sub-annual models	Low value – modest improvement in forecast error	Ex-ante, using regression model of historical CFU and St Fergus supply with reduced historic data range.
CVS baseline	Ex-ante, using network analysis of forecast supply and demand for 7 representative days	Using historical averages similar to UAG	Low value – improvement in forecast error, but small volumes	Ex-ante, using 150 day historical average. Combined UAG and CVS.
UAG baseline	Ex-ante, using 90 day historical average	Using shorter or longer term averages of historical UAG	Low value - due to nature of UAG	Ex-ante, using 150 day historical average. Combined UAG and CVS.
CFU efficiency	Ex-post, using baseline model with outturn St Fergus supply	Assessing against expected range of model	Medium/High value – mitigation of windfall cost variances, trade-off with continuous improvement	Ex-post, using revised baseline CFU model with outturn supplies. Introduction of tolerance band.
CVS efficiency	Ex-post, using network analysis of actual supply & demand for 7 representative days	Assessing against expected level or range, based on historic performance	Medium/High value – mitigation of windfall cost variances, trade-off with continuous improvement	Ex-post, using historic 3 year average CVS. Introduction of tolerance band.

Next Steps

Following review of responses received against this document, a report will be published by NGGT on the associated recommendations.

The updated Methodology Statement will then be presented to The Authority for approval prior to baselines being set for formula year 2017/18 in June 2016.

2 Background

2.1 Introduction

National Grid Gas Transmission (NGGT) is incentivised to minimise the costs incurred in the role of NTS Shrinkage Provider. Incentive performance is evaluated against how successful NGGT has been in delivering two key drivers, these being;

- Price risk management, measured against a market benchmark
- Volume efficiency, assessed post-year based on outturn conditions

The NTS Shrinkage Incentive Methodology Statement[2] describes the methodology that is employed to calculate the specific components within the shrinkage incentive scheme.

NGGT has an obligation under Special Condition 3D of the Licence to undertake a full review of the statement, such that any consequential modification can be achieved prior to commencement of the Formula Year commencing on 1 April 2017.

This document presents the findings from the review process and asks stakeholders a number of questions. The responses to these questions will be taken in to account in determining final proposals.

2.2 Overview of NTS Shrinkage

NTS Shrinkage is energy used in operating the system and other energy which can't be charged to consumers or accounted for in the measurement and allocation process. This energy (gas and electricity) is bought by NGGT and recharged back to system users as part of NTS Commodity Invoice charges, with a total cost of £80-100m per annum.

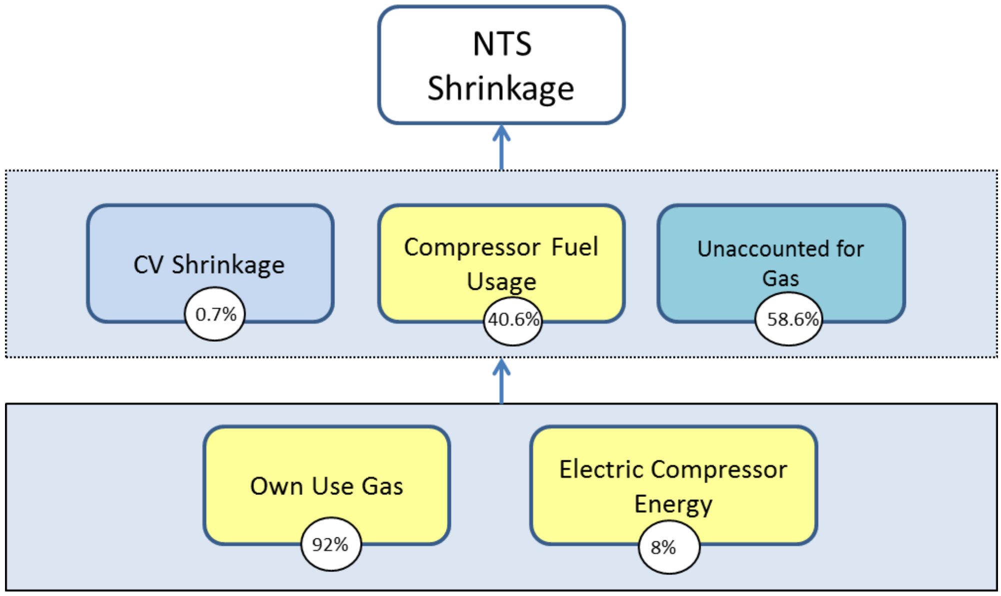
NTS Shrinkage is procured for three components: Compressor Fuel Usage, Calorific Value Shrinkage and Unaccounted for Gas.

- Compressor Fuel Usage (CFU) is the energy used to run compressors to manage pressures within the gas transmission system. This can either be gas or electricity, depending on the power source for the specific compressor.
- Calorific Value Shrinkage (CVS) is gas which cannot be billed due to application of the Gas (Calculation of Thermal Energy) Regulations 1996 (amended 1997).
- Unaccounted for Gas (UAG) is the remaining quantity of gas which is unallocated after taking into account all measured inputs and outputs from the system.

[2] The statement is published on the National Grid website via the "Supporting Information" section on http://www2.nationalgrid.com/uk/industry-information/gas-system-operator-incentives/nts-shrinkage/

For the formula year ending 31 March 2015, NTS Shrinkage totalled 3618GWh (gas equivalent). This was around 0.4% of the annual system demand. The breakdown percentages of each component are shown in the diagram below.

Diagram 1 – NTS Shrinkage Breakdown against total volume 2014/15.



2.3 The Methodology Statement

Why it is needed?

The shrinkage incentive target (specified in licence) for each year is based on parameters including forward procurement volumes and efficiency benchmarks. It was not possible to set forward purchase volumes for eight years at the outset of RIIO, so these are determined in an annual methodology statement. It was also not possible to set efficiency measure standards for whole RIIO period, so these too are set ahead of each operational year in the statement. This ensures that the objectives of the shrinkage incentive are met for each year.

Baseline volumes

Price risk management is achieved by forward purchases of volumes of gas and electricity. The baseline volumes are a best available forecast at the time of the forward purchases. Through this activity the hedging strategy is delivered for customers that was agreed for the RIIO period, and is reflected in the incentive scheme and set out in the Licence. The effectiveness of price hedging is influenced by the forecast error of the baseline volumes.

The calculation of the baseline volumes of gas and electricity for each quarter is defined in the Methodology Statement which is published for each incentive year.

As an indication of the materiality, based on 2014/15, 10% less forecast error in the baseline volumes would have led to around £0.3m less cost risk exposure for customers.

Volume efficiency

Shrinkage volumes are dependent on prevailing supply and demand and National Grid NTS optimisation decisions. Volume efficiency is incentivised through target levels for Compressor Fuel Usage and Calorific Value (CV) Shrinkage for outturn supply and demand conditions. This drives continuous improvement of areas where National Grid has control or influence. There is no volume efficiency for Unaccounted for Gas.

As for the baseline volumes, the calculation of efficiency volume is included in the Methodology Statement for each year.

As an indication of materiality, based on 2014/15, 1% lower volumes of CFU and CVS would have led to around ~ £0.3m less cost for customers.

2.4 Scope of Review

The review is on the methodology statement to ensure the calculations of baseline volumes and volume efficiencies best deliver on the key objectives defined within Ofgem's Incentive Scheme Final Proposals 2013.[3] The objectives are summarised in the table below, with a high level description on how NGGT looks to ensure that these objectives are met, linked to the methodology statement.

Table 1: Objectives of the Shrinkage Incentive

Objective	NGGT Commitment	How the Methodology Statement supports
Support cost minimisation for customers.	Management focus on minimising volumes and price of shrinkage energy.	Facilitates the benchmark procurement strategy and defines efficiency benchmark defined in licence.
Deliver cost risk management.	Take appropriate level of risk against the benchmark procurement strategy.	Minimises the forecast error of the baseline forward volume target.
Incentivise reductions in volumes where National Grid Gas is able to influence.	Aim for continuous improvement on processes where National Grid can influence shrinkage volumes.	Ahead of incentive year, defines assessment model for ex-post efficiency measures.

[3] Included in the "Gas System Operator incentive schemes from 2013 Final Proposals" https://www.ofgem.gov.uk/sites/default/files/docs/2012/12/gas-so-incentives-2013-final-proposals-consultation.pdf

For the avoidance of doubt, the review is on the methodology statement against the key principles and not the wider licence or Incentive scheme parameters.

This review will consider these principles with evidence based recommendations.

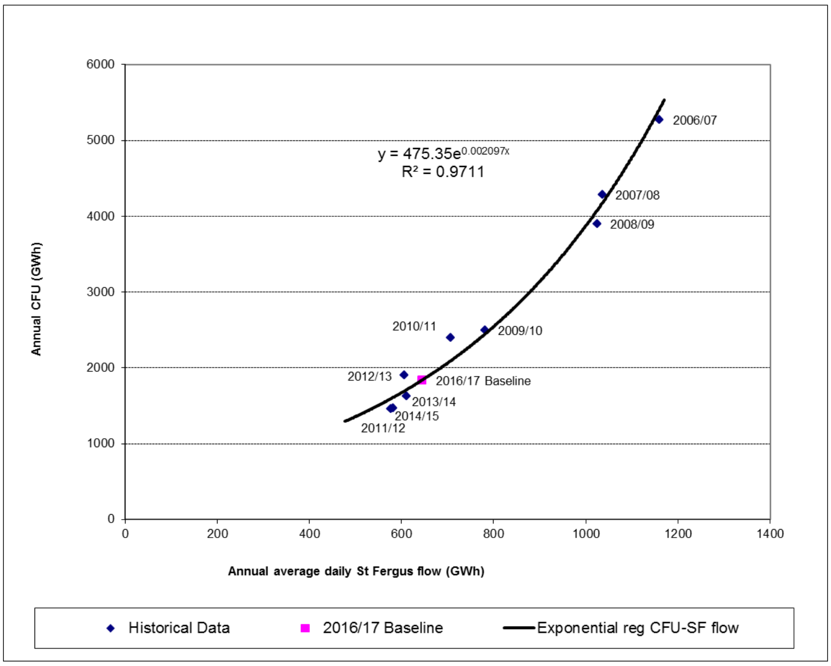
3 Compressor Fuel Usage (CFU) Baseline

3.1 Current Methodology

The CFU baseline is currently determined as follows.

- The baselines for an incentive year are calculated in June of the year before the start of that incentive year (i.e. ahead of the forward procurement reference period defined in Licence).
- They are based on the relationship between historical annual total CFU and annual average St Fergus supply. Data is used from 2006/07 to the most recent complete incentive year. The total CFU is calculated in gas equivalent units, by converting electricity usage into the equivalent gas usage that would achieve the same compression. An exponential fit is made of this data.
- The forecast supply at St Fergus for the incentive year ahead is taken from the data published as part of the Gas 10 year statement[4], and an exponential fit applied to forecast, to give a forecast CFU for the incentive year ahead. The baselines for 2016/17 were calculated in June 2015. The historical annual data and exponential fit are shown in diagram below.

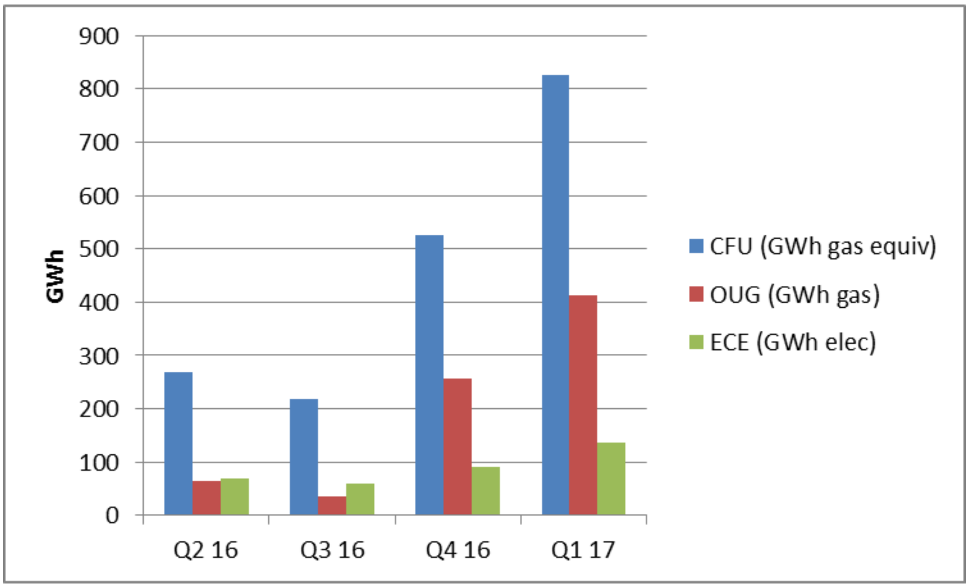
Diagram 2: Calculation of forecast annual CFU for 2016/17 baselines



[4] The Gas ten year statement is available at http://www2.nationalgrid.com/UK/Industry-information/Future-of-Energy/Gas-Ten-Year-Statement/

- Forecast annual CFU is then disaggregated into forecasts for each quarter of the year, using the same proportions as outturned in the most recent complete incentive year.
- Finally, each forecast quarterly CFU (still in gas equivalent units) is divided into gas and electricity components. This is based on expected operation of electric drives, given the commissioning plan. The disaggregation into quarterly gas and electricity forecasts is shown in the diagram below for the formula year 2016/17.

Diagram 3: Disaggregation of forecast annual CFU for 2016/17 into quarterly gas and electricity baseline volumes[5].



3.2 Current Method Performance

To assess the extent that the current methodology is delivering against the key objectives, the CFU baselines have been analysed against actuals.

To date (Q213 to Q315), the absolute error of the quarterly CFU baseline is 68GWh. This is equivalent to 18% of the average quarterly CFU. Baselines and actuals are shown in Diagram 4.

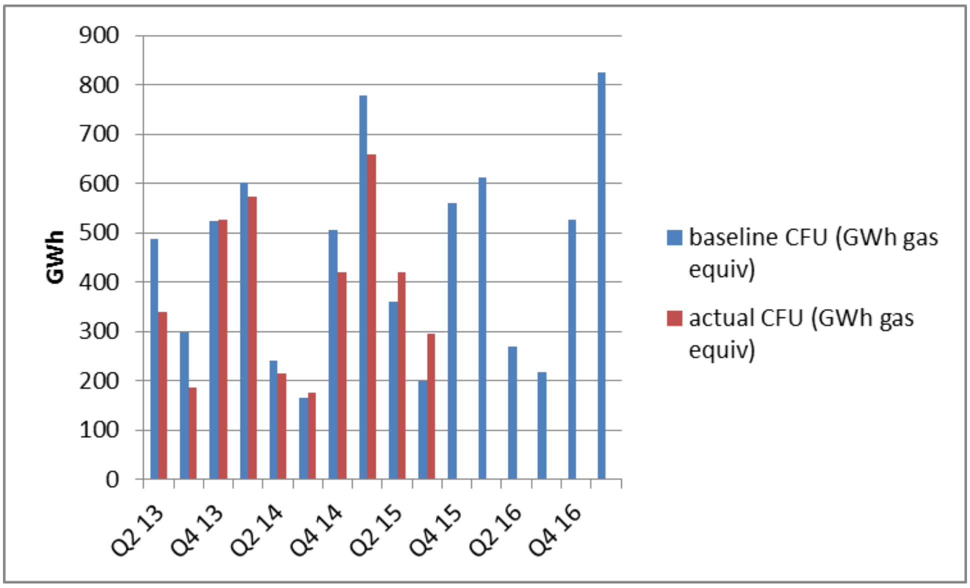
The associated cost risk exposure (i.e. the missed opportunity to hedge the forecast error) is around £90k/year per 1p/th price movement.

Given the 9 to 21 month forecast horizon, the methodology has given reasonable forecast performance for the required volume, and delivering appropriate price risk management.

This review considers potential alternative methods to improve the forecast error.

[5] The conversion used in the methodology is that 1 GWh electric is equivalent to 3 GWh gas compression energy.

Diagram 4: Difference between actual and baseline CFU since start of RIIO-T1 period.



3.3 Alternative Approaches

The performance of the current model has been assessed against alternatives. These include using a different historic model range, using different drivers, and using sub-annual models.

Data Range

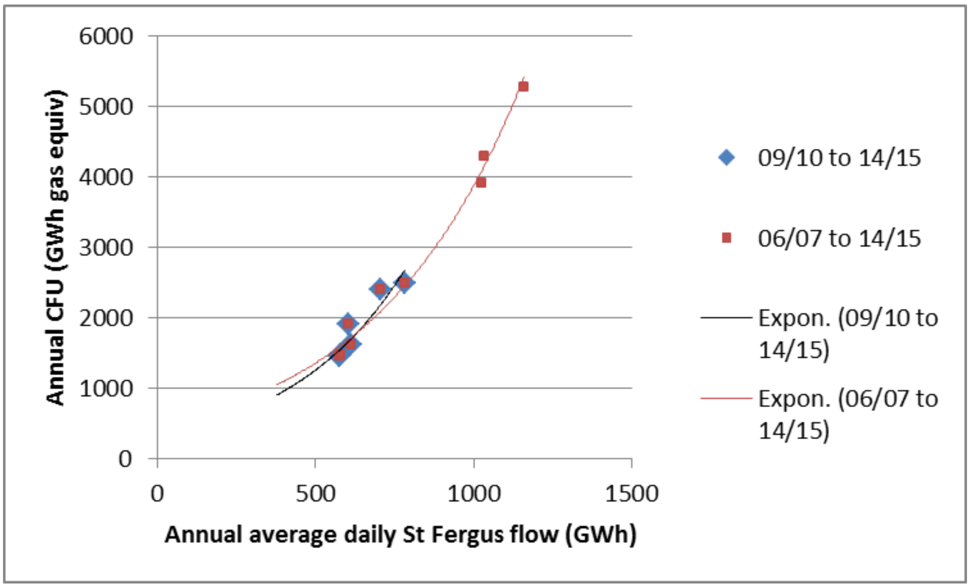
The historical data shows a significant decrease in St Fergus supply and CFU from 2006/07. To support this review, the Gas 10 year statement forecast supply has been analysed for each scenario against St Fergus flow, for the formula years 2017/18 through to 2020/21. The forecasts all fall within the range of 534 and 666 GWh/d. This range is comparable to recent history, and is between 8% lower and 15% higher than the 2014/15 outturn of 581GWh. Based on this forecast range it would therefore be appropriate to modify the methodology to remove the three earliest years, 2006/07 to 2008/09, which are all significantly higher than this range. Retaining data from 2009/10 onwards provides a representative historical basis and better represents the range of potential future outturns.

The diagram below shows the current methodology as used for the 16/17 baselines, and how this would have changed by removing the three earliest years. Doing this improves the fit for the six later years. This can be measured by the residuals of the fit (how far the data points are from the curve). Using the current methodology, the average of the absolute values of the residuals for the six later years is 153GWh. Changing the methodology to remove the three early years means that this average decreases to 144GWh, in other words, the actual CFU is closer to the curve.

This can be also be measured using the R squared statistic[6]. Using the current model, the R squared statistic evaluated for the six later years gives a value of 0.82. When the three early years are removed from the model, the R squared improves to 0.86, indicating that this model fit is better.

Removing the early years steepens the curve, lowering the baseline for relatively low St Fergus forecasts, and raising it for higher forecasts. For 16/17, this would have resulted in a change to the annual baseline of +15GWh. This movement is 1% of CFU, but 20% of the historic mean absolute error (68GWh) described above. This could have delivered a reduction in cost risk exposure of around £20k/year per 1p/th price movement.

Diagram 5: Impact of removing 2006/07 through to 2008/09 on CFU baseline.

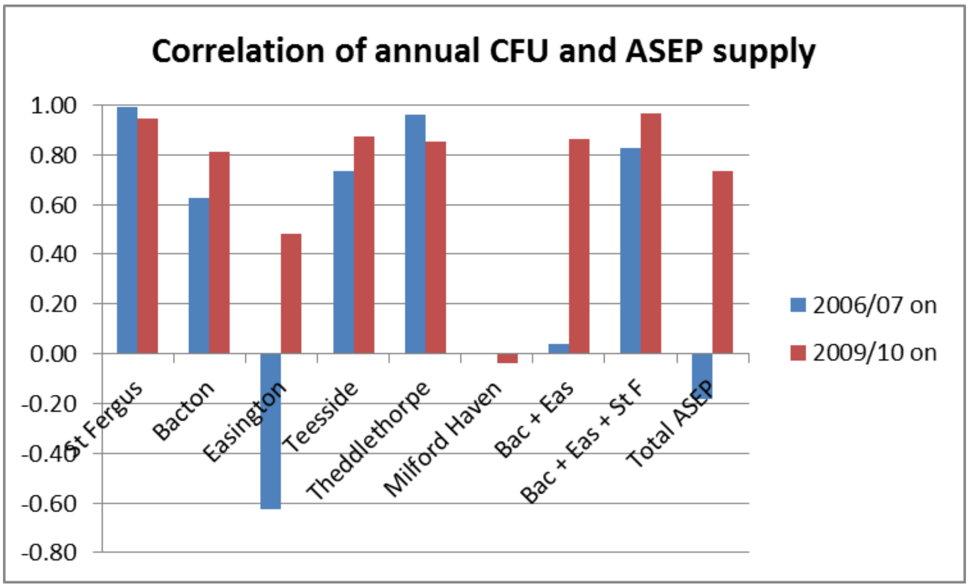


Alternative Supply Drivers

Other supply drivers have been reviewed to determine the suitability of the current approach. To indicate likely alternatives, the correlation coefficient[7] of annual CFU with major ASEP supplies, subtotals of supplies, and total ASEP supply has been calculated. The assessment has been undertaken for the full data period 2006/07 to 2014/15 and for the alternative period of 2009/10 to 2014/15 and is shown in the diagram below.

[6] Statistical measure indicating how well data fits a regression model (see glossary for more details)
[7] Measures the statistical measure of the degree of linear dependence between two variables

Diagram 6 - Correlation of annual CFU and ASEP supply scenarios.



The highest correlation is for St Fergus supply against the full data period and for the combination of St Fergus, Bacton and Easington for the alternative range.

Further analysis has been undertaken on this combination of supplies as an alternative basis for the methodology. The R squared statistic for models based on St Fergus and on this combination, using both exponential models (as now) and linear models, for the six most recent years. The results are shown in the table below.

Table 2 - Values of R squared statistic

Supply	Linear regression	Exponential regression
St Fergus	0.892	0.863
St Fergus, Bacton and Easington total	0.930	0.933

The highest R squared value is for the exponential model based on the Bacton, Easington and St Fergus total. This indicates that this could be a good model to use to minimise the forecast error of the CFU baselines, provided future supplies are similar to the historical range.

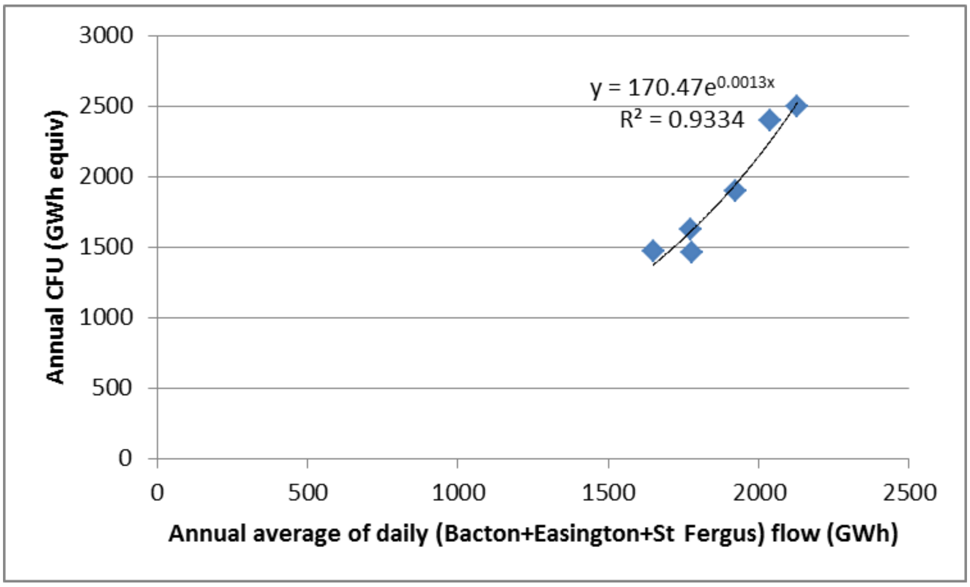
To test this, the Future Energy Scenarios 2015[8] forecast supply has been taken for each scenario against the total Bacton, Easington and St Fergus flow and formula years 2017/18 through to 2020/21. This shows forecasts fall within the range of 1243 and 1884 GWh/d. This is a wide range, between 25% lower and 14% higher than the 2014/15 outturn of 1649GWh (which is the lowest historical outturn). Because the range of forecasts extends well below the

[8] The Future Energy Scenarios can be reviewed at http://fes.nationalgrid.com/

historical data, there is less confidence that the historical relationship will remain relevant in the future than using the St Fergus supply only. Hence although this model better fits historical actuals, the St Fergus supply driver is likely to be the more robust model going forward.

The data and exponential fit is shown in the diagram below.

Diagram 7: CFU vs. aggregate supply from Bacton, Easington and St Fergus.

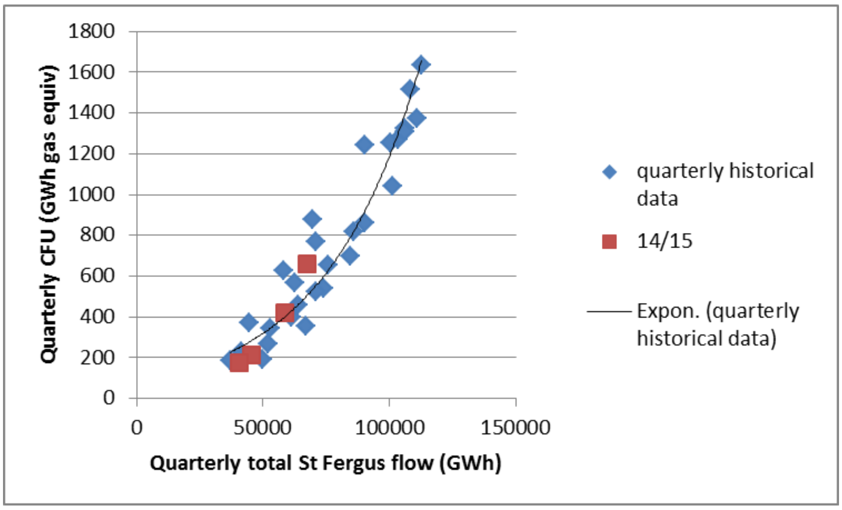


Quarterly Breakdown

The current methodology forecasts annual CFU and then disaggregates this into forecasts for each quarter. An alternative is to directly forecast the quarterly values using a similar method as now but using historical quarterly actual CFU and St Fergus supply. This is illustrated in the diagram below, which shows the fit of historical data from Q2 2006 to Q1 2013, and the 14/15 actuals.

Using this method for 13/14 and 14/15, and assuming perfect foresight of quarterly St Fergus supply, the average absolute error of the quarterly CFU baselines is 102GWh. For comparison, using the current method, again with perfect foresight of St Fergus supply, gives an average absolute error of 63GWh.

Diagram 8: Illustration of quarterly model of CFU vs St Fergus.



3.4 Options

From the analysis, there are three options to consider for the future CFU baseline that best deliver customer price risk management:

- Option 1 – as is, based on annual analysis of historic St Fergus supply and CFU from 2006/07. The materiality (cost risk exposure) of the current methodology is relatively low.
- Option 2 – as is but based on historics from 2009/10. This is a minor change to the methodology which is expected to give a small decrease in forecast error. This has been valued for the 16/17 year at £20k/year reduction in cost risk exposure per 1p/th price movement.
- Option 3 – based on annual analysis of historic aggregate supply from Bacton, Easington and St Fergus, and CFU, from 2009/10. Although this is a better historical fit, the range of aggregate supply forecasts extending well below the recent historical range means there is less confidence in using this model.

3.5 Proposal

As a result of this review, using the numerical evidence above - in particular the R squared statistic - the recommendation is to proceed with Option 2. This is expected to continue to provide appropriate price risk management benchmark for customers, by minimising the baseline forecast error over the period.

3.6 Consultation question:

Do you agree with our proposal to amend the methodology for the CFU baseline?

4 Calorific Value Shrinkage (CVS) Baseline

4.1 Current Methodology

The CVS baseline is determined as follows.

- The baselines for an incentive year are calculated in June of the year before the start of that incentive year.
- The current methodology uses seven days from the annual forecast NTS demand curve (Peak, D2, D13, D30, D46, D150 and D300). Using central case supply and demand profiles for these seven days and network analysis that optimises for balanced pressures and minimal compressor use, the end of day volumes and CVs are calculated for each day and are used to calculate the flow weighted average CV shrinkage for each distribution network.
- Each distribution network is then aggregated to give a daily total for each of the seven days.
- These are then applied to give a yearly CV shrinkage total whereby D2 applies for days two through twelve; D13 applies for days thirteen to twenty-nine and so on.
- This annual figure is then adjusted to exclude any capped volumes for Ross, Dyffryn Clydach and Cowpen Bewley NTS offtakes as well as any gas entering a distribution network that has not passed through the NTS.
- The result is then divided by four to give the forecast quarterly CVS.

4.2 Current Method Performance

The methodology has been used to calculate CVS baselines for 2013/14 to 2016/17. Results are on an annual level and are summarised in the table below.

Table 3 – Current baselines and outturn details

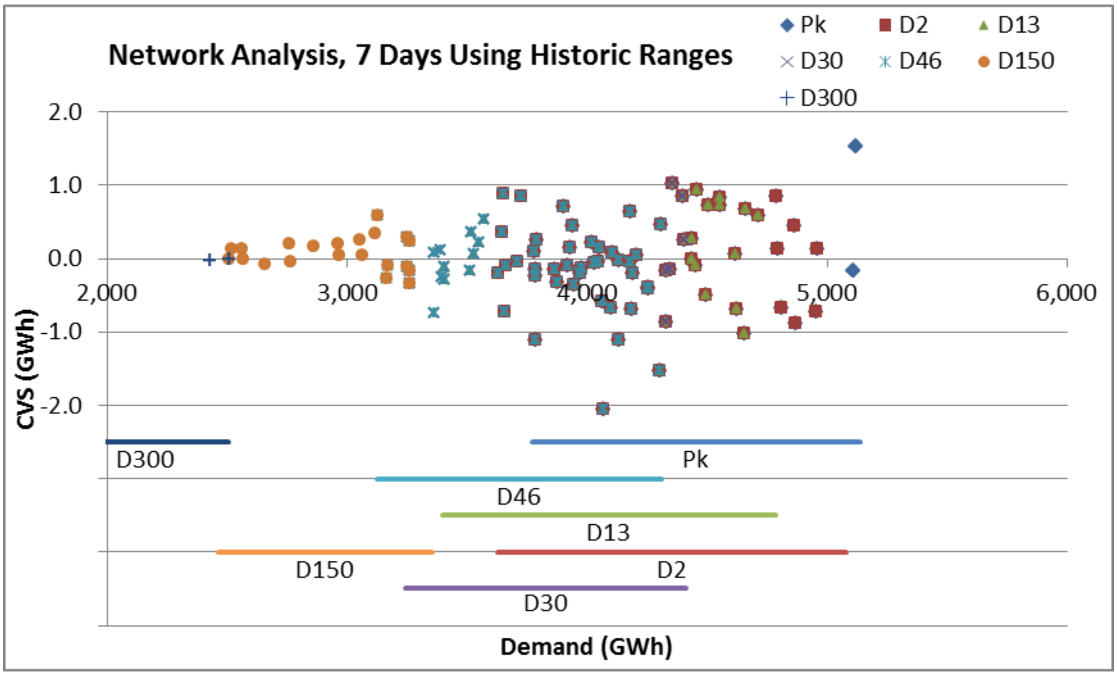
Incentive Year	Baseline (GWh)	Outturn (GWh)	Error (GWh)
2013/14	103	6	97
2014/15	-7	27	-34
2015/16	112		
2016/17	107		

To date (Q213 to Q315) the absolute error of the quarterly CVS baseline averaged 14GWh. This was 187% of average quarterly CVS. The associated cost risk exposure is around £20k/year per 1 p/th price movement. Hence the materiality is relatively low.

Although CVS is a small proportion of shrinkage, accounting for 0.7% of total Shrinkage in 2014/15, the forecast error using the current methodology is higher than expected, and thus may not have best delivered price risk management for this component.

Enhancements in National Grid's network analysis scenario modelling has highlighted the limitations of using seven representative days to calculate a weighted average CVS for the year to an appropriate confidence level. This is because there is too much variation in CVS for similar demand levels. The diagram below shows the range in CVS calculated by network analysis over a range of demand levels.

Diagram 9 – Results for a range of demand levels showing the range of CVS for each of the 7 days chosen for network analysis based on historic demand ranges.



Analysis of the spread of these results shows that based on the seven sample demand days the expected annual baseline could in fact range from – (negative) 237GWh to 157GWh.

Undertaking network analysis for a larger sample of days would generate a more robust (tighter confidence range) for a full year simulation. However, the CVS results based on network analysis shows the same variation as actuals of recent years, shown in the two diagrams below. With no model parameters able to explain the observed variation, there is no added value in identifying an efficient number of days to undertake network analysis over sampling from historic data.

Diagram 10 - National Demand (GWh) vs CV Shrinkage (GWh) for incentive year 2013/14.

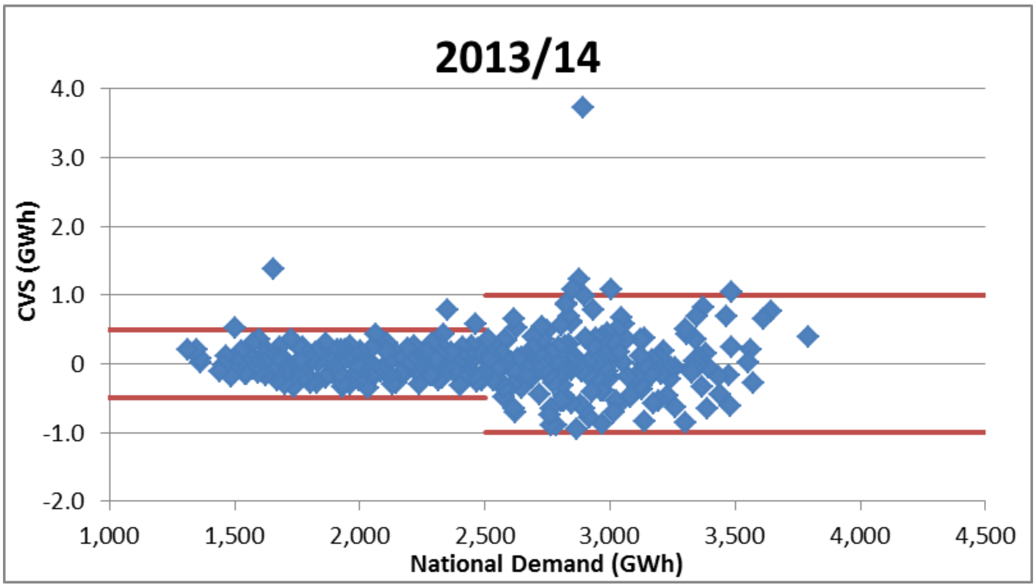
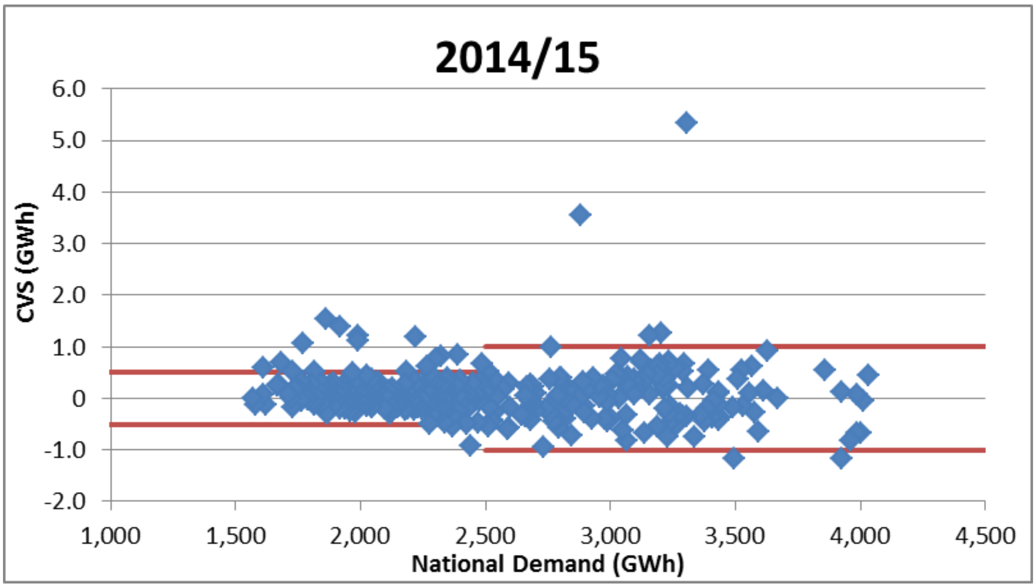


Diagram 11: National Demand (GWh) vs CV Shrinkage (GWh) for incentive year 2014/15.



4.3 Alternative Approaches

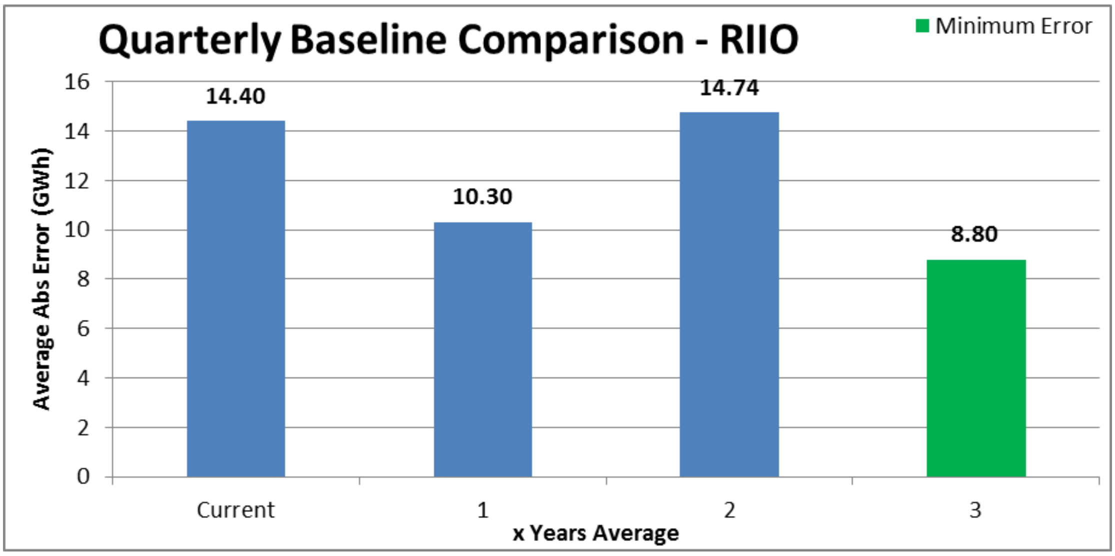
Supply Model

We have looked for alternative drivers to use in calculating the CVS baselines, by analysing CVS and different terminal supplies using the results of network analysis. This shows there is no significant correlation of national (or LDZ) CVS with supplies. The highest correlation coefficient of national CVS with a terminal supply is only 0.16, which does not provide a suitable basis for further consideration.

Historical Averages

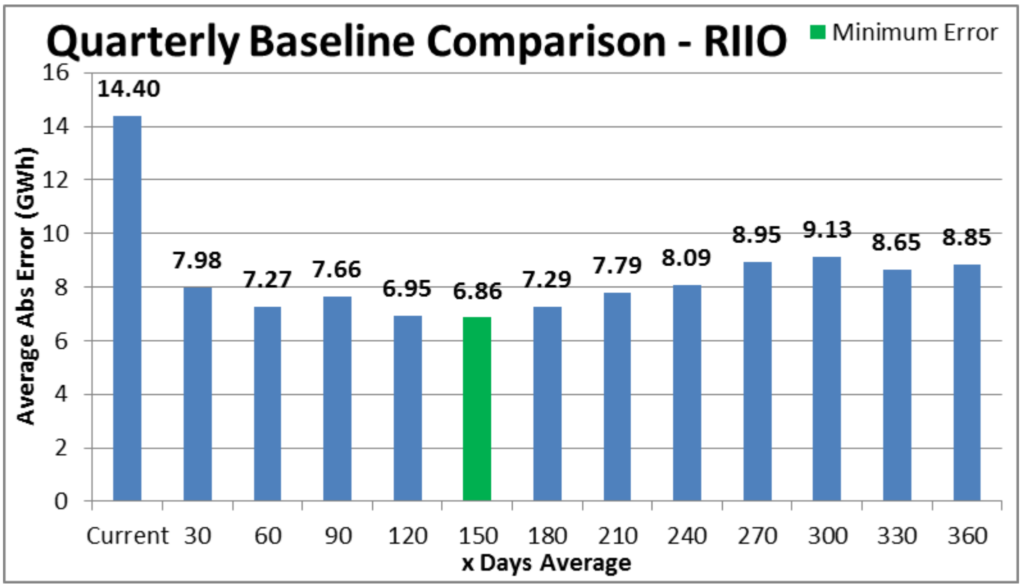
An alternative approach for setting baselines is to use a historical average. The first approach considered is to calculate an annual forecast based on the average outturn in the last year or number of years. This is then divided into four to give a quarterly forecast. The diagram below shows the results that would have been obtained for Q2 13 to Q3 15. Using a 3 year average, equivalent to the previous year’s outturn, gives a much lower forecast error than the current methodology.

Diagram 12 - Quarterly performance from splitting an annual baseline into quarters.



Another alternative approach is to use the same method that is currently used to calculate the UAG baseline, by taking an average of closed out data of a chosen number of days leading up to the forecast day (10 months ahead of the delivery quarter). This method is used four times a year, once before each forecast day. The performance of this method for CV shrinkage across the RIIO quarters is shown in the diagram below using a different number of days for the average.

Diagram 13: Average absolute error (GWh) over the RIIO quarters (Q2 13 to Q3 15) for a range of days for the average.



All averaging periods significantly reduce the forecast error compared to the current methodology. Using 150 days gives the lowest error, again around half of the error using the current methodology.

A third alternative is to combine the CVS baseline with the UAG baseline, which is explored in the section on UAG baseline, as it offers improvement on forecast error over independently forecasting these components.

4.4 Options

From the analysis, there are three options considered for the CVS baseline:

- Option 1 – publish in June year ahead, using annual outturn of previous year.
- Option 2 – publish ten months ahead, using rolling 150 day average.
- Option 3 – combine with UAG baseline

4.5 Proposal

As a result of this review, the recommendation is to proceed with Option 3 as the most efficient method for forecasting the required volumes of the UAG and CVS components, as discussed in the next section.

4.6 Consultation question/s:

Do you agree with our proposal to amend the methodology for the CVS baseline

Do you agree with our proposal to merge the methodology together with the UAG baseline?

5 Unaccounted for Gas (UAG) Baseline

5.1 Current methodology

The UAG baselines for each quarter are calculated in the month that is ten months before the start of the quarter – i.e. in the month ahead of the reference period for each quarter. This is in contrast to the CFU and CVS baselines which are all calculated in June, based on supply and demand drivers. This is because there is no robust driver for UAG.

The UAG baseline is 90 day average of actual UAG, up to and including the last day of the previous month. The timetable allows full close out of the data (M+15) before the average is calculated.

5.2 Current Method Performance

Unaccounted for Gas primarily arises due to meter errors, over which National Grid Gas lack control and influence. National Grid are progressing projects to investigate the causes of UAG[9], in the meantime there is no known driver, and it is not seasonal. Hence a methodology based on historical average is considered the most appropriate.

To date (Q213 to Q315), the average absolute error in the quarterly UAG baselines is 167GWh, which is 28% of average UAG. This is higher than CFU, but reflects the unpredictability of UAG.

The associated cost risk exposure is around £230k/year per 1p/th price movement.

5.3 Alternative Approaches

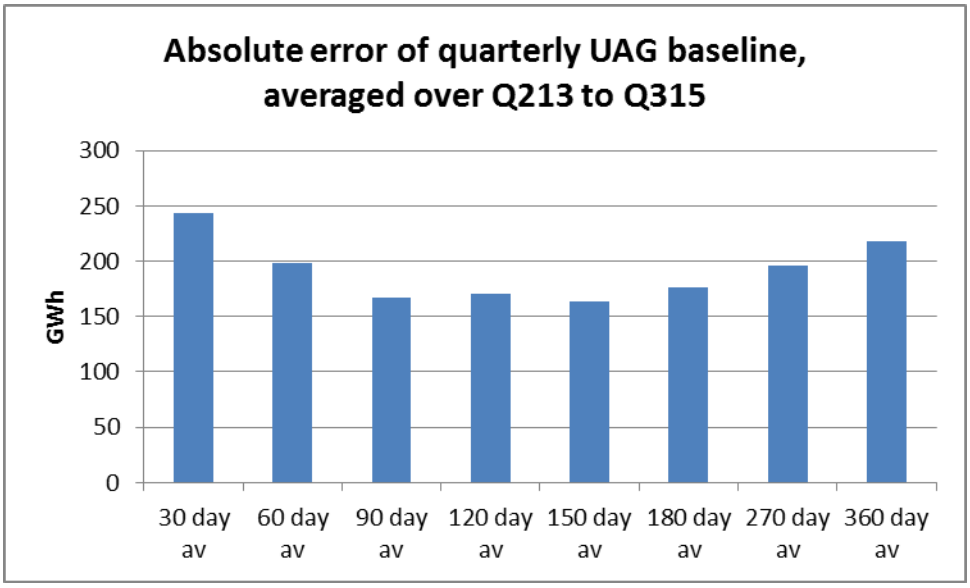
Alternative historical average

Appropriate alternatives to the current methodology involve using shorter or longer term averages of historical UAG.

To explore this, analysis has been done on the relative performance of different averaging periods, measured by the average absolute error. The following diagram shows the results.

[9]Further details can be found in the UAG reports at http://www2.nationalgrid.com/uk/industry-information/gas-transmission-system-operations/balancing/unaccounted-for-gas/

Diagram 14: Absolute error of quarterly UAG baseline



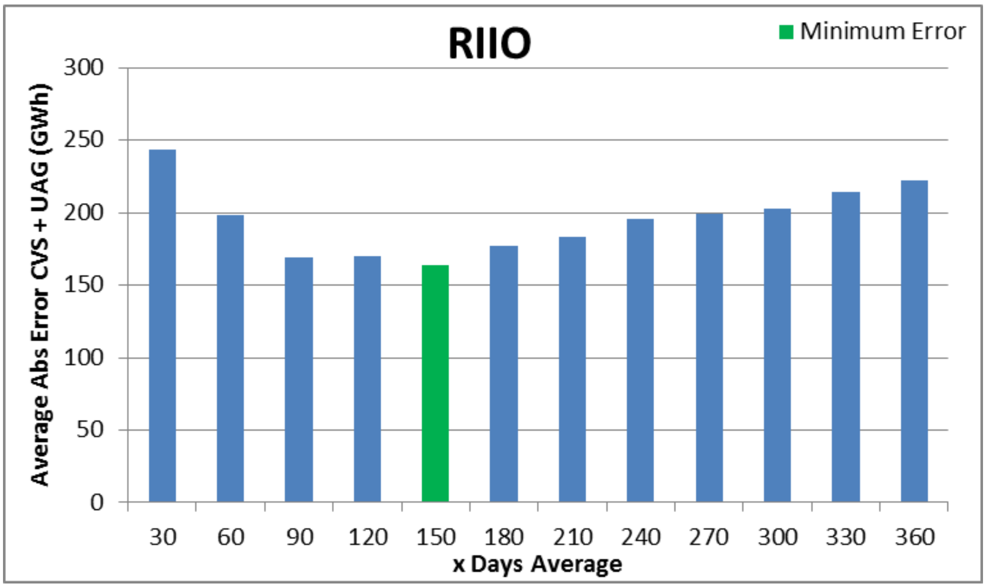
The above figure shows that a medium term average (90 to 150 days) has given better performance than a short term or long term average. Over the analysis period, the performance of the 150 day average (average absolute error 164GWh) is marginally better than the current 90 day average (167GWh).

Combining the UAG and CVS baselines

In the section above on CVS baselines, the option of using historical averages was analysed. CVS volumes are much smaller than UAG, and historical averaging gives much smaller errors. Hence another alternative is to calculate a combined baseline for UAG and CVS.

Repeating the previous analysis for the combination of UAG and CVS gives the results shown in the diagram below. As before, a medium term average performs better than short or long term averages. Using a 150 day average for the combination gives an error of 164GWh, which is the same as for UAG only if separately calculated. It is therefore an appropriate alternative to use a medium term historical average for a combined baseline for UAG and CVS.

Diagram 15 – Combined average absolute error for CVS & UAG



5.4 Options

In our view there are three options

- Option 1 – as is, based on 90 day average.
- Option 2 – based on 150 day average.
- Option 3 – combined baseline for UAG and CVS, based on 150 day average.

5.5 Proposal

As a result of this review, the recommendation is to proceed with Option 3. This option is an efficient method for forecasting the required volumes of the UAG and CVS components. It reduces the historic forecast error from an aggregate of 181GWh (based on 167GWh for UAG, and 14GWh for CVS) to 164GWh. This reduction of around 17GWh would reduce the cost risk exposure by around £23k/year per 1p/th price movement. This should best support price risk management for customers.

5.6 Consultation question:

Do you agree with our proposal to amend the methodology for the UAG baseline merging together with the CVS baseline?

6 *Compressor Fuel Usage Efficiency*

6.1 Current methodology

The annual CFU efficiency target is currently calculated ex-post, using the same method as the baseline, but using outturn instead of forecast St Fergus flows.

The CFU efficiency performance is then calculated as the target minus outturn CFU.

6.2 Current Method Performance

For 13/14 and 14/15 this methodology deemed outturns efficient, with CFU efficiencies of +112GWh in 13/14 and +219GWh in 14/15.

Whilst the methodology gives a reasonable forecast for the annual baseline, the spread of the outturn and historical residuals impacts on the efficiency calculation.

The outturn CFU is assessed within the uncertainty of the regression model, which is around +/- 140 GWh in the current model. Valuing this at a historical base of 50p/th, creates a risk of windfall cost variances of c£2.4m. This makes it difficult to evaluate the benefit of continuous improvement opportunities over and above the inherent uncertainty.

There is a tension here between the two criteria of incentivising reductions in volume, and mitigating windfall costs.

6.3 Alternative Approaches

Alternative methods of calculating the target volume of CFU are similar to those considered for ex-ante baseline volumes. In particular, these are alternative drivers, alternative historical range and sub-annual models. The methods that minimise the forecast error of the baseline volumes will also minimise the uncertainty of the efficiency assessment. Hence the options and proposal for the CFU target are aligned those for the CFU baseline.

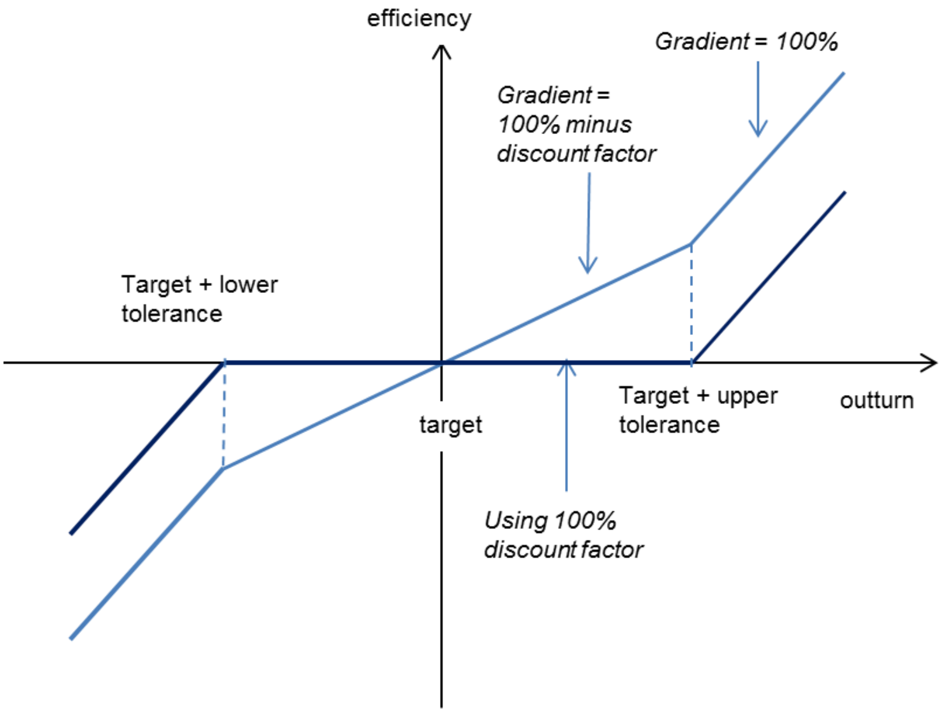
Because the balance between incentivising continuous improvement and mitigating windfall costs is not clear, this review considers the potential to implement a performance tolerance band.

Tolerance band

To recognise the uncertainty of the model fit, outturn CFU could be assessed against an expected range, determined by the quality of the baseline model fit, and thus mitigate potential windfall efficiency within the model uncertainty range.

In this approach, the CFU efficiency target would be calculated as above. Tolerances would be calculated above and below this target, based on the quality of the model fit. A discount factor would be applied to efficiency within the tolerance band. The CFU efficiency would then be calculated as shown in the diagram below.

Diagram 16 - CFU efficiency using tolerance band and discount factor



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Two methods have been considered for calculating the tolerances.
In the first method, the upper and lower tolerances are the same, and equal to the average absolute error of the historical fit.

The second method modifies this to separately recognise the quality of the model fit above and below the curve. In our view this second method better incentivises continuous improvement. For example, suppose a new outturn CFU was significantly low. This would tend to decrease the expected level, and increase the lower tolerance, making it harder to outperform in future years, but would tend to affect the upper tolerance less, not creating room to underperform.

As an illustration of the effect, if these methods had been in place for 13/14 and 14/15, with target calculated using the current methodology, the efficiencies would have been determined as below.

Table 5 – Comparison with tolerance band and discount factors applied to 13/14 & 14/15

Tolerance band		13/14 (GWh)	14/15 (GWh)
None	Tolerance	-	-
	Efficiency	**+112**	**+219**
Method 1	Tolerance	146	136
-With 100% discount factor	**Efficiency**	**0**	**+83**
-With 50% discount factor	**Efficiency**	**+56**	**+151**
Method 2	Upper Tolerance	144	160
	Lower Tolerance	147	118
-With 100% discount factor	**Efficiency**	**0**	**+101**
-With 50% discount factor	Efficiency	**+56**	**+160**

6.4 Options

There are two fundamental options. Both involve the same methodology as the CFU baseline described above. Our recommendation for the CFU baseline is based on annual analysis of historic supply from St Fergus and CFU from 2009/10.

- Option 1 – as CFU baseline, with efficiency equal to target level minus outturn
- Option 2 – as CFU baseline, with tolerance band determined by method 1 or 2, and discount factor of 50%, 100%, or other.

6.5 Proposal

As a result of this review, the recommendation is to proceed with Option 2, with 100% discount factor. This option is expected to incentivise volume reductions, by supporting continuous improvement, and strongly mitigate the windfall cost variances, estimated at £2.4m, through the full discount factor.

6.6 Consultation questions

What are your views on the appropriate balance between incentivising continuous improvement and mitigating windfall costs - what do you value most?

Do you agree with our proposal for the efficiency target and tolerance band?

7 *Calorific Value Shrinkage Efficiency*

7.1 Current methodology

The annual CVS efficiency target is currently calculated ex-post, using the same method as the CVS baseline, but using the actual supply and demand patterns that occurred on the seven days (Peak, D2,…) from the actual demand curve. As for CVS baselines, the network analysis is done minimising compressor usage.

The CVS efficiency is then calculated as target minus outturn CVS.

The results of using this methodology for 2013/14 and 2014/15 are summarised in the table below.

Table 6 – Current methodology data for 13/14 & 14/15

Incentive Year	Ex-ante Baseline (GWh)	Ex-post Target (GWh)	Outturn (GWh)	Efficiency (GWh)
2013/14	103	44	6	38
2014/15	-7	-85	27	-112

7.2 Current Method Performance

As described above (in the section on CVS baseline), the variation of CVS for similar demand levels means the current methodology for calculating the target is not the best available option. The outturn CVS is assessed within the uncertainty of the model (network analysis of sample days), which is around +/- 85GWh. As an indication of materiality, valuing this at say 50p/th, there is a risk of windfall cost variances of around £1.5m. Hence alternative options have been explored for the target and efficiency. As for CFU, tension exists between the two criteria of incentivising reductions in volume, and mitigating windfall costs.

7.3 Alternative Approaches

Target

A clear alternative for the target is to base this on the outturns of previous years (similar to our first option for the CVS baseline). Safeguards could be added to drive continuous improvement, so if performance was worse than target in one year, this would not automatically lead to increased targets in later years.

For example, the target could be set as follows:

- For year 1, calculate the average annual CVS over the previous 3 years.
    - This is the target for year 1.
- For year 2, calculate the new rolling 3 year average.

- This is the target for year 2, provided it is lower than the target for year 1.
- Otherwise the target for year 2 is equals the target for year 1.

- For subsequent years, set targets as for year 2.

This method has been back tested to calculate targets for 2012/13 to 2014/15. Results are shown in the table below (rounded to the nearest GWh)

Table 7 – Methodology example based on rolling three year with efficiency factor applied

Year	3 year average (GWh)	Target (GWh)	Outturn (GWh)	Efficiency (GWh)
2012/13	36	36	15	20
2013/14	33	33	6	27
2014/15	21	21	27	-6

In this case, the 3 year average has fallen in from year to year, so the safeguard for continuous improvement has not been triggered. This method is expected to reduce the risk of windfall cost variances compared to the current methodology. The uncertainty of the historic annual average is estimated at +/- 11GWh, compared to +/-85GWh for the current model. Hence the indicative materiality (based on 50p/th) is reduced to around £0.19m.

To explore this further, different numbers of years have been used to calculate the historic average. The calculated targets and efficiencies are shown below. The two year minimum has been triggered only once, and this for the 1 year average, indicated by the * in the table. However this feature should support continuous improvement going forward. The targets using a 1 year average are relatively volatile, so using a multi-year average, such as 3 years, should give a more representative target on which to base efficiency.

Table 8 – Using last x years to give a historic average and the minimum from the last two years to give a target.

		Last x Years Average (GWh)				Target (GWh)			
Year	Outturn	x = 1	2	3	4	1	2	3	4
2009	22.17								
2010	41.69	22.17							
2011	42.86	41.69	31.93			22.17			
2012	15.14	42.86	42.27	35.57		41.69*	31.93		
2013	5.80	15.14	29.00	33.23	30.46	15.14	29.00	33.23	
2014	27.04	5.80	10.47	21.27	26.37	5.80	10.47	21.27	26.37

Table 9 – Efficiency performance for different historic averages.

	Efficiency (GWh)			
Year	1	2	3	4
2011	-20.68			
2012	26.55	16.79		
2013	9.33	23.19	27.42	
2014	-21.24	-16.57	-5.77	-0.67
Mean	-1.51	7.81	10.82	-0.67

Tolerance Band

The above method largely mitigates windfall cost variances, and drives continuous improvements. However there is still a risk of windfall cost variances, estimated at £0.19m. To account for this scenario, a tolerance band could be introduced, with a discount factor applied to efficiencies within this band (as discussed for CFU efficiency above).

For example, the tolerance band could be set as the minimum and maximum historic averages from the last two years. The tables below show the calculated tolerance bands and efficiencies using a 100% discount factor.

Table 10 – Tolerance bands calculated using the minimum and maximum historic averages from earlier table.

	Tolerance bands (GWh)							
	1		2		3		4	
Year	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
2011	41.69	22.17						
2012	42.86	41.69	42.27	31.93				
2013	42.86	15.14	42.27	29.00	35.57	33.23		
2014	15.14	5.80	29.00	10.47	33.23	21.27	30.46	26.37

Table 11 – Efficiency performance using a tolerance band and 100% discount factor.

	Efficiency (GWh)			
Year	1	2	3	4
2011	-1.17			
2012	26.55	16.79		
2013	9.33	23.19	27.42	
2014	-11.90	0.00	0.00	0.00
Mean	5.70	13.33	13.71	0.00

This alternative methodology supports continuous improvement year on year, but also recognises that CV shrinkage variation year on year may be outside National Grid's control. The target and tolerance band are known early on in the incentive year in order to incentivise volume reductions and mitigate windfall cost variances.

7.4 Options

There are two fundamental options:

- Option 1 – target based on two-year minimum of the historic average annual outturn, in order to support continuous improvement. Efficiency equal to target minus outturn.
- Option 2 – target as option 1. Efficiency assessed using tolerance band, determined by variation in historical average, and discount factor.

7.5 Proposal

As a result of this review, the recommendation is to proceed with Option 2, using a 3 year historical average, and 100% discount factor.

A 3 year average gives a representative benchmark volume, and the two year minimum supports continuous improvement. The tolerance band with 100% discount factor strongly mitigates the windfall cost variation, which has been estimated at £0.19m.

7.6 Consultation questions

What are your views on the appropriate balance between incentivising continuous improvement and mitigating windfall costs - what do you value most?

Do you agree with our proposal for the efficiency target and tolerance band?

8 Consolidated Consultation Questions

In this review proposals have been made for each methodology area, with a request made for stakeholder's views.

The consultation questions are recreated below for convenience.

8.1 Baselines

Q1: Do you agree with our proposal to amend the methodology for the CFU baseline?

Q2: Do you agree with our proposal to amend the methodology for the CVS baseline?

Q3: Do you agree with our proposal to merge the UAG and CVS baselines?

8.2 Efficiency

Q4: What are your views on the appropriate balance between incentivising continuous improvement and mitigating windfall costs - what do you value most?

Q5: Do you agree with our proposal for the efficiency target and tolerance band for CFU Efficiency?

Q6: Do you agree with our proposal for the efficiency target and tolerance band for CVS Efficiency?

9 Responses

Thank you for taking the time to read this review document. Please send your responses and or feedback by 4th April 2016 to the following email:

Box.soincentives.gas@nationalgrid.com

Or alternatively by post to:

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Contact details

If you wish to discuss any element of this review in further detail, please contact one of the following;

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10 Glossary

In the context of this Methodology review document the following definitions should be applied to the terms outlined below;

Correlation Coefficient – A statistical measure of the degree of linear dependence between two variables. A value of 1 indicates a perfect linear relationship with a positive slope. A value of -1 indicates a perfect linear relationship with a negative slope. A value of 0 indicates no linear relationship.

Ex ante – A value that is based on forecasts rather than actual result.

Ex post – A value that is based on actual results rather than forecast.

Hedging Strategy – A strategy employed to reduce the risk of adverse price movements. Normally, a hedge consists of taking an offsetting position in a related security such as a future contracts

R squared statistic– A statistical measure of how well a regression line approximates real data points. This takes values between 0 and 1, with a value of 1 indicating that the regression line perfectly fits the data, and a value of 0 indicates that the line does not fit the data at all.