Joint Office of Gas Transporters

Stage 02: Workgroup Report

Project Nexus NDM Allocation Formula – DESC Recommendations

At what stage is this document in the process?

01 Modification

02 Workgroup Report

03 Draft Modification Report

04 Final Modification Report

This report sets out the results of analysis by DESC and its recommendations for the future of the NDM Estimation Algorithm.

The Workgroup recommends that Project Nexus UNC Workgroup accepts and adopts its findings.

High Impact:
None identified

Medium Impact:
Medium impact on all Shippers with a portfolio of NDM Supply Points. Medium impact on Demand Estimation processes.

Low Impact:
Transporters and consumers

Contents

About this document:

This report will be presented by the [Demand Estimation Sub-Committee] to the [Project Nexus UNC Workgroup] on xx xxx 2013.

The [Workgroup] will consider whether [the report is sufficiently detailed and evidenced for inclusion in the Project Nexus Requirements].

Any questions?

Contact:
Code Administrator

enquiries@gasgovernance.co.uk

0121 288 2107

Proposer:
Insert name

email address

telephone

Licence Holder:
Insert name

email address.

telephone

Systems Provider:
Xoserve

commercial.enquiries@xoserve.com

telephone

Additional contacts:
Insert name

email address.

telephone

1 Summary

This section is a summary of the Report.

This report has been prepared by the Technical Workgroup (TWG) of the Demand Estimation Sub-Committee (DESC) to be presented to Project Nexus UNC Workgroup to summarise the analysis and recommendations of TWG for the future NDM Estimation Formula.

Why Change?

Project Nexus proposes a number of changes to Gas Settlement arrangements, including the removal of RbD and its replacement with a universal "scaling adjustment". This will require a new approach to Gas Allocation to reduce the likelihood of cross-subsidies arising at the point of Allocation. The current NDM Allocation Algorithm (as defined in UNC H2.2.1) will not be sustainable in a future Project Nexus world.

TWG has developed a range of options for the future NDM Estimation Algorithm, assessed those options and is now making a proposal for a preferred option to operate as part of Project Nexus.

Solution

TWG recommends Option E, which is an adaptation of the current NDM Algorithm. The Scaling Factor would be removed from the Algorithm and the Weather Correction Factor would be amended to be based on the difference between actual and seasonal normal weather.

Implementation

This solution would ideally be implemented at the same time that RbD was removed (i.e. no later than the removal of RbD). An initial view is that the solution should be implemented to coincide with the start of a new Gas Year, to minimise the work of TWG and DESC in developing the NDM Algorithm parameters.

2 Why Change?

The current NDM Allocation formula works in aggregate and is a top-down approach. The current Weather Correction Factor (WCF) does not take account of actual weather measurements. Instead it is simply the ratio of Actual LDZ NDM Demand to Seasonal Normal LDZ NDM Demand. Since Gas Year 2008/09, the view of Seasonal Normal Demand used in NDM Allocation has been based on the LDZ NDM connected load as per the Gemini system, and is no longer dependent on the Transporter's Demand Forecasting processes.

The current Scaling Factor (SF) is a balancing correction to make sure that all NDM Energy is attributed across the NDM Supply Points in the LDZ.

Impacts of Project Nexus Business Requirements

Project Nexus Requirements for the Settlement and Reconciliation Topics include (amongst others) the following significant proposed changes to the gas settlement regime:

- Identification of an amount of Unidentified Gas each day within an LDZ and apportionment of that energy to all live Supply Points in the LDZ ("Allocation Scaling Adjustment")
- Meter Point reconciliation for all Supply Points, including SSPs
- Removal of RbD, to be replaced with an adjustment to the Unidentified Gas across all live Supply Points in the LDZ ("Reconciliation Scaling Adjustment")

The impact of those changes is that a new approach to NDM Allocation would be required: Allocation processes would need to derive a more robust bottom-up estimate of daily demand for NDM Supply Points. These estimates would be combined with DM measurements to derive an initial estimate of Unidentified Gas for the LDZ for the day.

The current NDM Allocation Algorithm would not be sustainable in a Project Nexus world, as it includes a scaling factor to ensure that all remaining NDM Energy is allocated. It would not be feasible to simply remove the scaling factor from the current formula, as the Weather Correction Factor uses actual LDZ NDM Energy as its start point. NDM Energy is the balancing figure in today's allocation, whereas in the future world a stand-alone estimate of NDM Energy is required. Therefore a new NDM Estimation formula for Supply Point Demand is required, which is a better estimate of demand under the prevailing weather conditions. The current NDM Allocation Algorithm would be replaced by an NDM Estimation Algorithm.

Project Nexus UNC Workgroup asked DESC to develop a new NDM Estimation Algorithm which would support the future state envisaged in the various Business Requirements Documents, especially the Settlement Business Requirements. Having agreed success criteria for a future Allocation Algorithm, DESC delegated the detailed investigations to TWG. TWG has been investigating options since May 2012.

Insert subheading here

3 Solution

DESC identified a number of potential options for a future Estimation Algorithm. DESC then assessed and prioritised those options and selected three leading options for further analysis. In summary those options were:

- Option A – average demand from a sample of smart meters / AMRs scaled up/down to other sites in the same "class" (EUC or similar grouping)
- Option C – regression formula based on relationship of gas demand for a "class" to up to six weather data items and other non-weather parameters such as day of week, time of year; use of actual weather data each day to predict demand for that "class" based on the formula
- Options E – amendment to current allocation formula, to use actual weather data in deriving the weather correction factor (WCF), amend the Daily Adjustment Factor to align with the new WCF and to remove the Scaling Factor from the formula

Analysis undertaken

The analysis workload was shared out amongst TWG members, with Xoserve plus 2 Shipper members each analysing an Option. In each case the predictions generated by the option were compared to the actual consumption recorded by the NDM Sample meter points as used by Xoserve in the NDM Demand Estimation processes. The actual consumptions were aggregated from the sample meter points, and could not be traced back to individual consumers or addresses. Xoserve also provided Estimated AQs for the sample meter points to assist with the analysis.

The key comparator between the three options was the MAPE (Mean Absolute Percentage Error) which is a measure of the accuracy of a method and is expressed as a percentage. The lower the percentage, the closer the fit of the method to the actual data.

Where data was available, each of the three options was used to calculate a predicted demand for the sample of meter points, which was then compared to the actual recorded demand for those meter points.

Availability of data

Option A relies on the availability of a reliable stream of daily read or consumption data from a sample of Smart meters or AMR devices. Data availability was low, especially in the earlier gas years under review. In summary, the LDZs and EUCs compared was as follows:

	Option A	Option C	Option E
2010/11	Completed for 2 LDZs (EM / WM) for 01B Completed for NW LDZ for 04B	Completed for 10 LDZs for 8 EUCs	Complete for 12 LDZs for 8 EUCs
2011/12	Complete for 4 LDZs (EM/NW/SO/WM) for 01B Complete for NW LDZ for 04B	Complete for 10 LDZs for 8 EUCs NB Additional data set C2 provided where 2 years data used to train model	Complete for 12 LDZs for 8 EUCs

Option A analysis was performed by a Shipper, using daily consumption data from a sample of meter points within their own portfolio. The scale of the available data was dependent on their roll-out of Smart meters/AMR equipment.

Nature of the analysis

Analysis was performed on the "Consumption Band" EUCs only (e.g. 06B, 07B), i.e. WAR Band EUCs were not assessed. This was due to the lower sample numbers when split down to WAR Bands, which would have made it harder to draw reliable conclusions. EUC 9 was not assessed, because it is a fallback-only profile for supply points which should be DM under UNC rules.

Brief details of the approach to the three Options are as follows:

- Option A (average demand from a sample of smart meters / AMRs scaled up/down to other sites in the same "class")
    - compared aggregated daily data from available meter points to the consumption of the Xoserve NDM sample, for each individual gas day, for an EUC (LDZ by LDZ). The success of the prediction was measured by the closeness of the prediction to actual NDM sample demand. As the Shipper's data related to individual consumers, it could not be shared with the rest of TWG/DESC.
- Option C – (regression formula based on relationship of gas demand for a "class" to weather data)
    - the initial analysis developed a relationship between demand and weather for a single gas year and used it to predict demand for the following gas year based on actual weather experience. Six weather data items, plus the existing CWV values, were run through the regression analysis and the strongest influencing factors used in the final formula. The success of the prediction was measured by the closeness of the prediction to actual NDM sample demand.
    - A further phase of analysis developed a relationship between demand and weather for two gas years and used it to predict demand for the third gas year. The success of the prediction was measured by the closeness of the prediction to actual NDM sample demand.
- Options E – amendment to current allocation formula, to use actual weather data in deriving the weather correction factor (WCF)
    - the analysis used the existing NDM Demand models (as smoothed over 3 years) and used them to predict demand for the following gas year based on actual weather experience. The success of the prediction was measured by the closeness of the prediction to actual NDM sample demand.

Outcome of the analysis

Available results for the three Options were compared by day of the week and winter/summer. Detailed findings were presented at TWG on 19 March:
http://www.gasgovernance.co.uk/sites/default/files/TWG_190313_PN_Allocation.pdf

A summary of the results for the four LDZs for which all three options were available is repeated here. The tables summarise the number of "best outcomes" for each Option for each Band or LDZ, based on the Option which has the lowest MAPE, i.e. the lowest difference between actual sample demands and demand predicted by the Option. The coloured cells represent the highest number of best outcomes.

2010/11 (Winter and Summer comparisons)

MAPE Analysis

Oct-Mar	Total for all 4 LDZs		
	OPTION A	OPTION C	OPTION E
01B	9	3	12
02B	0	5	19
03B	0	1	23
04B	0	3	21
05B	0	6	18
06B	0	8	16
07B	0	10	14
08B	0	7	17
	9	**43**	**140**

Apr-Sep	Total for all 4 LDZs		
	OPTION A	OPTION C	OPTION E
01B	1	14	9
02B	0	1	23
03B	0	6	18
04B	0	9	15
05B	0	8	16
06B	0	4	20
07B	0	10	14
08B	0	8	16
	1	**60**	**131**

Total by LDZ	NW	EM	WM	SO
OPTION A	0	5	4	0
OPTION C	0	8	15	20
OPTION E	48	35	29	28

Total by LDZ	NW	EM	WM	SO
OPTION A	0	0	1	0
OPTION C	0	16	22	22
OPTION E	48	32	25	26

2011/12 (Winter and Summer comparisons)

MAPE Analysis

Oct-Mar	Total for all 4 LDZs		
	OPTION A	OPTION C	OPTION E
01B	7	8	9
02B	0	3	21
03B	0	8	16
04B	0	4	20
05B	0	8	16
06B	0	10	14
07B	0	3	21
08B	0	4	20
	7	**48**	**137**

Apr-Sep	Total for all 4 LDZs		
	OPTION A	OPTION C	OPTION E
01B	0	10	14
02B	0	3	21
03B	0	7	17
04B	0	6	18
05B	0	9	15
06B	0	9	15
07B	0	2	22
08B	0	8	16
	0	**54**	**138**

Total by LDZ	NW	EM	WM	SO
OPTION A	0	2	4	1
OPTION C	0	19	18	11
OPTION E	48	27	26	36

Total by LDZ	NW	EM	WM	SO
OPTION A	0	0	0	0
OPTION C	0	18	12	24
OPTION E	48	30	36	24

Review of success criteria

DESC identified 5 success criteria for any new NDM Estimation Algorithm. TWG reviewed these criteria and concluded that an assessment against the factors was not feasible for the following reasons:

Criteria	*Observations*
Allocation process results in the same or better accuracy in apportionment of energy across sectors	The fundamental change to the Allocation process, in particular the attribution of unidentified gas (UG) to the whole market rather than to just the NDM market, means that Allocation outcomes cannot be compared between current and future methods. Because the amount of (UG) in the current market is unknown, it is not possible to predict the size or value of the Allocation Scaling Adjustment prior to the new Settlement arrangements being implemented.
Day ahead gas Nominations are as accurate or more accurate for NDM sector	Because the new approach to unidentified gas will also be applied in the Nominations process, Nominations would not be comparable before and after the implementation of the new arrangements. Because the amount of (UG) in the current market is unknown, it is not possible to predict the size or value of the Nominations Scaling Adjustment prior to the new Settlement arrangements being implemented.
Supported by majority of Users and Transporters within the industry	The majority view of TWG supported the adoption of Option E. [to be updated following DESC discussions]
Solution developed within a reasonable time scale to support Project Nexus	The selection of a preferred option has not included any detailed systems assessment, as UKLink Replacement Programme has not yet reached that phase. It is believed that the timescales for developing the parameters required for Option E would not take any longer than the current processes. A lead time of approximately 12 months would be required to agree an approach and develop parameters to go live at the start of a gas year. DESC/TWG could support an October 2015 implementation of UKLink Replacement Programme.
New process still supports other industry processes, e.g. AQ and SOQ derivation	Option E would also develop the necessary parameters to calculate AQ values expressed in seasonal normal terms and to derive peak loads (SOQs). Option E would also facilitate the calculation of day-ahead gas nominations on a basis consistent with after-the-day allocations.

TWG/[DESC] Conclusions

TWG reviewed the comparison of MAPEs for the three options, focusing on the 4 LDZs for which an analysis of all three options was available.

TWG noted that the results in the summer months were less good, with a poorer fit to actual demand. Overall the majority view of TWG was that Option E was the best option, as it gave the closest results when compared to actual recorded demand from the sample. However TWG noted that if this approach were to be adopted that the Demand Estimation models should be enhanced to improve the fit to actual demand over the summer months and/or during warm weather.

TWG concluded that (with the proviso of additional work on summer/warm weather fits) that it recommended Option E as the approach to NDM Estimation to support the implementation of Project Nexus Settlement and Reconciliation requirements.

4 Implementation

This solution would ideally be implemented at the same time that RbD was removed (i.e. no later than the removal of RbD). An initial view is that the solution should be implemented to coincide with the start of a new Gas Year, to minimise the work of TWG and DESC in developing the NDM Algorithm parameters. This would remove the potential inefficiencies of the industry developing a set of NDM Algorithms under the current process, which would only be used for part of year, and then developing (related but different) parameters to apply later in the same Gas Year, when the new Algorithm went live.

For the recommended option (Option E, amendment to current allocation formula) there is no expectation of any immediate change to other Demand Estimation processes. For instance, the current NDM sample of meter points should still be fit for purpose and not require any immediate change to support the new approach.

A lead time of approximately 12 months would be required, in order for DESC to agree the detailed approach to developing the new Algorithms (similar to the current Spring Approach document) prior to the new Algorithm going live. For instance, agreement in principle by 30 September 2014 for a 1 October 2015 implementation.

At this stage, detailed costs have not been assessed. However this new approach is not expected to be materially different in cost from the current approach.

Impact on processes

The recommended approach, Option E, would require a process very similar to the current arrangements to develop the new NDM Estimation parameters.

- Data is gathered from a geographically distributed sample of GB supply points, across the full range of AQs
- Once validated, data is aggregated by EUC and statistical relationships to weather in the LDZ are determined
- The current weather data items are temperature and wind speed, but future arrangements may include additional weather items, so UNC and its Related Documents must give the flexibility to expand the list of weather items
- The impacts of holidays and weekends on typical behaviours are also evaluated
- The statistical relationships between demand and weather (plus holidays ad weekends) would be combined with the values for weather under seasonal normal conditions to derive the following parameters (to support the new approach)
    - Daily values of the Annual Load Profile for each End User Category (including WAR Band EUCs if DESC determines that these are still required)
    - Daily values of the Daily Adjustment Factor for each End User Category, expressed as a sensitivity to changes in the CWV away from seasonal normal
    - Peak Load Factor, to predict peak day consumption, derived from a long run of actual GB weather experience, mapped against current relationships to demand

5 Legal Text

The text as reviewed by the Workgroup should be inserted at this point.

Although formal Legal Text has not been developed, the anticipated impacts on UNC have been assessed. DESC's preferred approach is that UNC is amended to describe the Estimation process at a high level, but that the details, including any formulae are set out in a UNC Related Document, which would require the approval of UNCC for any amendments.

UNC Impacts

Determination of Supply Meter Point Demand

UNC Sections H2.2 to H2.5 set out the details of the key parameters used in NDM Demand Estimation. It is suggested that the sections are removed from UNC and form the basis of a UNC Related Document which describes the parameters and high level data sources and processes.
In its place, UNC H2.2 could refer to the UNC Related Document, set out the arrangements and governance for updating it and summarise the process, along the following lines:

> "NDM Supply Point demand for a day is determined by the relationship of historic demand for that End User Category to Composite Weather Variable and other factors, including day of the week and holidays, and by applying actual CWV values for the Gas Day in question in the derived demand model."

The intention is that the future Section H gives a high level overview which explains to current and future market participants what the key inputs are, and directs the user to the relevant document(s) to gain a fuller understanding. The aim is to balance flexibility for DESC in defining the Estimation Algorithm (subject to system requirements) with transparency for other market participants.

The determination of the values of the parameters (ALP, DAF, CWV, SNCWV) would remain the responsibility of DESC.

Estimated Reads for use in NDM Reconciliation

UNC H2.2.2 currently sets out the formula for defining NDM Demand when estimating a Change of Shipper Read for use in NDM Reconciliation. That formula is somewhat simpler than the full estimation formula. The H2.2.2 formula could be left unchanged, or subject to systems/process limitations, could be aligned more closely with the new Estimation Algorithm.

NDM Annual Quantities

UNC H3 currently sets out the process and formula for setting and NDM AQ. That formula for AQ could be amended to use WCF in the denominator, as it will be based on actual weather data. EWCF would no longer be needed for AQ calculation.

NDM Capacity

UNC H4 currently sets out the formulae for defining NDM Capacity. Option E would still allow for the calculation of a peak day demand, so this section could remain unchanged.

UNC Related Document

Much of current UNC Sections H2.2 to H2.5 could form the basis of a UNC Related Document, with amendment as necessary to reflect the requirements of Option E.
In summary:

SPD_t (NDM Supply Meter Point Demand for a Day) = ((AQ/365) * ALP_t * (1 + (DAF_t * WCF_t)))

Where, WCF = CWV_t – $SNCWV_t$ (Seasonal Normal CWV for a Day)

And, DAF_t = $WSENS_t$ / SND_t

The formula for the ALP would be unchanged.

The derivation of the new Allocations Scaling Adjustment and Reconciliation Scaling Adjustment would no longer be (directly) a part of Demand Estimation and would be defined elsewhere in the main body of UNC.

NDM Nominations

UNC C1.5 (NDM Output Nominations) currently refers to H2 for the determination of demands ahead of the Gas Day (i.e. Nominations). For the purpose of Nominations, the UNC Related Document would specify that NDM Supply Point predicted demand for a day would be determined using the Supply Point Demand formula, substituting a forecast value for CWV for the day:

SPD_t = ((AQ/365) * ALP_t * (1 + (DAF_t * WCF_t)))

Where, WCF = Forecast CWV_t – $SNCWV_t$

6 Recommendation

- TWG recommends [that DESC accepts its proposal of the adoption of Option E and that DESC should recommend this approach to Project Nexus UNC Workgroup. DESC may choose to base its recommendation to PN UNC Workgroup on this report.]