

UNC Workgroup Report	At what stage is this document in the process?
<p>UNC 0642 (Urgent), 0642A, 0643 (Urgent) - Changes to settlement regime to address Unidentified Gas issues including retrospective correction</p>	<div style="display: flex; flex-direction: column; gap: 5px;"> <div style="border: 1px solid #ccc; border-radius: 5px; padding: 2px; display: flex; align-items: center; gap: 5px;"> 01 Modification </div> <div style="border: 1px solid #ccc; border-radius: 5px; padding: 2px; display: flex; align-items: center; gap: 5px;"> 02 Workgroup Report </div> <div style="border: 1px solid #ccc; border-radius: 5px; padding: 2px; display: flex; align-items: center; gap: 5px;"> 03 Draft Modification Report </div> <div style="border: 1px solid #ccc; border-radius: 5px; padding: 2px; display: flex; align-items: center; gap: 5px;"> 04 Final Modification Report </div> </div>
<p>Purpose of these Modifications:</p> <p>UNC 0642 implements the proposal set out by the DNV GL on 31 October 2017 to utilise a top-up down allocation and nomination approach for NDM allocation, with resulting volatility reconciled to unread meters.</p> <p>UNC 0642A seeks to introduce a fixed unidentified gas (UIG) value per category across all Shippers and also to introduce a Balancing Quantity to act as an equal/opposite leveller.</p> <p>UNC 0643 backdates the proposals in UNC 0642 to 01 June 2017.</p>	
	<p>The Workgroup notes that these modifications will be issued to consultation in line with the urgent timetable agreed with Ofgem</p>
	<p>High Impact: Shippers, Suppliers, CDSP, National Grid NTS and Customers</p>
	<p>Medium Impact: None</p>
	<p>Low Impact: GDN Transporters and iGTs</p>

Contents		 Any questions?
1	Summary	3
2	Governance	5
3	Why Change?	6
4	Code Specific Matters	9
5	Solution	10
6	Impacts & Other Considerations	20
7	Relevant Objectives	23
8	Implementation	24
9	Legal Text	25
10	Recommendations	25
11	Annex 1 – DNV GL Paper	25
Timetable		 0121 288 2107
Modification timetable:		Proposer: 0642 - Justin Price Corona Energy 0642A – Kirsty Dudley E.ON 0643 - Lorna Lewin Orsted
Initial consideration by Workgroup	04 January 2018	 justin.price@coronaenergy.co.uk Kirsty.Dudley@eonenenergy.com LOLEW@orsted.co.uk
Amended Modification considered by Workgroup	30 January 2018	 0800 804 8589 07816 172 645 020 7451 1974
Workgroup Report issued for consultation	01 February 2018	Transporter: Cadent
Consultation Close-out for representations	08 February 2018	 Chris.Warner@cadentgas.com
Final Modification Report available for Panel	12 February 2018	 07778 150668
Modification Panel recommendation	15 February 2018	Systems Provider: Xoserve
		 UKLink@xoserve.com

1 Summary

What

The energy allocation model, implemented on 01 June 2017 through UNC Modifications 0432 & 0473 as part of Project Nexus, is misallocating gas to the end consumer creating significant consumer detriment. Some industry participants consider this new methodology to handle Unidentified Gas is not fit for purpose. For some it has produced the unintended consequence of perhaps the most volatile, unpredictable and uncertain cost component in the gas market.

UNC 0642 and UNC 0643 - The simulations of this new methodology produced significantly different allocations of Unidentified Gas to those which are now being produced. Some consider this will have a material impact on all Shippers with a natural flow-through to customers.

The key concern for industry is the current calculation of Unidentified Gas post-Nexus at nomination and allocation does not just reflect Unidentified Gas but also estimation error in the NDM allocations, which is then having a material impact on gas customers. The industry volume has an estimated cost of around £18m a month (4.65% of total LDZ throughput, using Xoserve data June to November 2017). Of this around 3.5% is due to inaccuracies in settlement, rather than losses, so the inequitable allocation of costs from the settlement error is around £13.5m a month or over £160m a year. The range of Unidentified Gas levels being experienced by individual shippers is much higher; with most seeing uncorrected demand increases (volatility) to their portfolios between -20% and +25% at an individual LDZ. This leaves Suppliers exposed to market volatility and this has led to customer detriment.

In addition to the cost increase for customers, these costs are never fully formalised due to the rolling 12 month pot of Unidentified Gas, after which costs are smeared. This cost uncertainty for customers will result in significant detriment.

UNC 0642A - It is clear that the concept of Unidentified Gas (UIG) as currently defined in Code has proved confusing across Shippers/Suppliers. While there have been some unforeseen issues, some parties believe the system is operating in line with the simulations published in the three years prior to Nexus go-live. However, there is clearly significant concern about what the system is doing. As such the it is recognised that there is a need to clarify which elements of UIG are transient and which may be expected to remain, without requiring significant system change and without pre-determining which sector of the market should pay.

Some participants consider that a guiding principle of Nexus was to allow the industry to have full visibility of what the unidentified gas volumes actually were post reconciliation across the industry and that it is important to retain this principle and remove the reliance on an estimation mechanism. This is key to allowing the industry as a whole to quantify and tackle the true volumes and causes.

This alternative proposal can introduce refinements to the approved Project Nexus modelling which will enhance what has already been implemented; it would be based on actuals with a transparent approach and would apply to all without any sector bias.

Why

UNC 0642 and UNC 0643 intend to ensure Unidentified Gas is allocated more accurately at nomination and allocation without the detrimental effects of estimation error being smeared across the industry in an unpredictable manner.

UNC 0642A would not seek to roll-back to the pre-Nexus approach, as that methodology has already been superseded and was deemed a necessary progressive move. There is a concern that following investment of significant cost and resources over the last nine years in the development of Nexus, the industry should not now force additional system changes unless absolutely necessary.

UIG has impacted some parties more than others and the solution proposed is aimed to be a fairly distributed mechanism with anticipated minimal cost compared to other potential options.

This Modification would be an enhancement of what has been introduced, in a manner which is owned and driven by the industry on factual data rather than by further estimated methodologies. This would be more beneficial than to move to a model which parties may not be able to replicate.

How

UNC 0642 and UNC 0643 - The solution(s) have been developed in order to minimise the impact on the existing central system architecture; where this has dictated the solution this is indicated:

- Utilise the Pre-Nexus nomination and allocation process for NDM meters to improve the overall performance of energy allocation to those customers.
- Set Unidentified Gas as a percentage of throughput for each LDZ, set at 1.1% (utilising the latest AUGE statement assessment) for the remainder of the Gas Year 2017/18. For subsequent gas years, the AUGE will be required to determine the percentage of Unidentified Gas in each LDZ.
- Market reconciliation processes will be revised so that any reconciliation volumes are only applied to those sites that cause the settlement error; namely those NDM sites that do not undertake a reconciliation, or DM sites that did not submit a valid meter read, unless a Reconciliation Target (defined later) is reached, whereby the reconciliation volume will be smeared across all meter points.
- The AUGE will be required to develop Settlement Error Allocation Factors to apportion reconciliation volumes to the sectors that create them. Until these new factors have been compiled the existing Unidentified Gas Allocation Factors will be used.
- **UNC 0643** proposes the solution will be backdated to 01 June 2017. Xoserve will undertake a one-off reconciliation exercise to correct Shipper positions should this modification be implemented.

UNC 0642A seeks to introduce the following:

- Maintain current allocation methodology to prevent significant system change as the profiles already exist and separate the current UIG into:
 - A fixed volume of throughput called Fixed UIG for each category which is apportioned across all Shippers according to throughput market share – initial values being:
 - Category 1 = Fixed UIG of 0.01%
 - Category 2 = Fixed UIG of 2.5%
 - Category 3 = Fixed UIG of 2.5%
 - Category 4 = Fixed UIG of 2.5%
 - A Balancing Quantity which acts as a leveller to any additional volume which the fixed % does not sweep up or, if the Fixed UIG is too large, it balances things out.
- As sites reconcile; the equal and opposite volume would be applied to the Balancing Quantity and shared to Shippers with category 2, 3 and 4 sites based on throughput market share.

- An annual review of the Fixed UIG which will be based on the residual Balancing Quantity post reconciliation. This will be completed via the Demand Estimation Sub Committee (DESC).
- Creation of an annual 12 month ‘reassessment’ process for how the UIG %s compare to the actual UIG position for each gas year

Any new Fixed UIG value(s) will be implemented at the beginning of each Gas Year if required; the figure can be the same across all Local Distribution Zones (LDZs) or can be a varied value. If no changes are required Fixed UIG values will rollover from one Gas Year to the next.

2 Governance

Justification for Authority Direction

The Authority directed that [UNC 0642](#) and [UNC 0643](#) should follow Urgent procedures, following the timetable below. Panel determined that [UNC 0642A](#) should follow the same timetable as [UNC 0642 \(Urgent\)](#).

Process	Date
First workgroup discussion (further ad hoc workgroups may be held as and when required – to be confirmed by the Joint Office)	04 January 2017
Consultation issued	01 February 2018
Consultation closes	08 February 2018
Modification reports issued to the UNC Panel	12 February 2018
UNC Panel makes its recommendation on the proposal	15 February 2018
Authority decision expected by	End of February 2018

Requested Next Steps

The Workgroup agrees that these modifications should be issued to consultation in line with the approved Ofgem timetable.

It should be noted that some of the principles in these modifications are based on those discussed with the industry at two non UNC Workgroup meetings held on 13 and 22 November 2017. In addition, Xoserve has been consulted on at all stages of development.

3 Why Change?

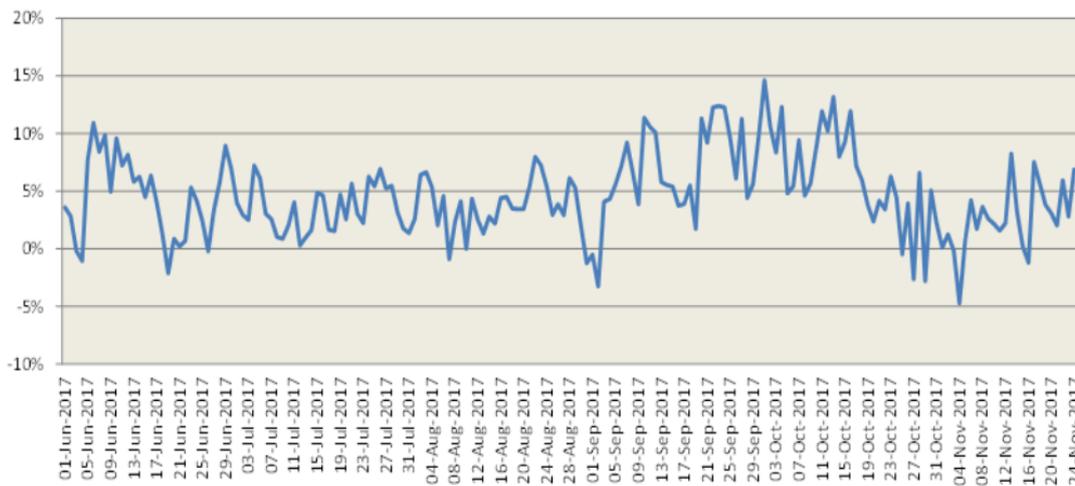
As part of Project Nexus, the industry moved from a top-down settlement approach for determining and allocating daily NDM consumption to one that attempted to use a bottom-up calculation, using individual site profiles and external weather information to build up a shipper's, and so ultimately the industry's, total supply demand, with any remainder being smeared across the market

Unidentified Gas is the term given to any residual gas that is not directly allocated each day to a meter or transporters to represent network losses (Shrinkage). At allocation, the term Unidentified Gas is misleading; the vast majority of Unidentified Gas is in fact estimation error caused by inaccuracies in the NDM estimation process which is used for large portions of industry volume.

For UNC 0642 and UNC 0643

This problem has been created due to issues with the new settlement process brought in by recent changes to the gas market regime¹, which went live in June 2017. The nature of how Unidentified Gas is now calculated means it is unpredictable in both how it varies and its total volume. It was expected however that the estimation error component would be relatively constant and so Unidentified Gas would approach a value of 1% (the estimated levels of losses through mainly theft and registration errors as calculated by both the 3rd party industry expert² and the industry's settlement committee).

Unidentified Gas volumes have however not approached this level or exhibited the expected characteristic on the day. Since the start of the new settlement regime, Unidentified Gas has averaged around 4.65% of total demand. Of this around 3.5% is due to inaccuracies in settlement, rather than losses, so the inequitable allocation of costs from the settlement error is around £13.5m a month or over £160m a year. The average movement across the market is below:

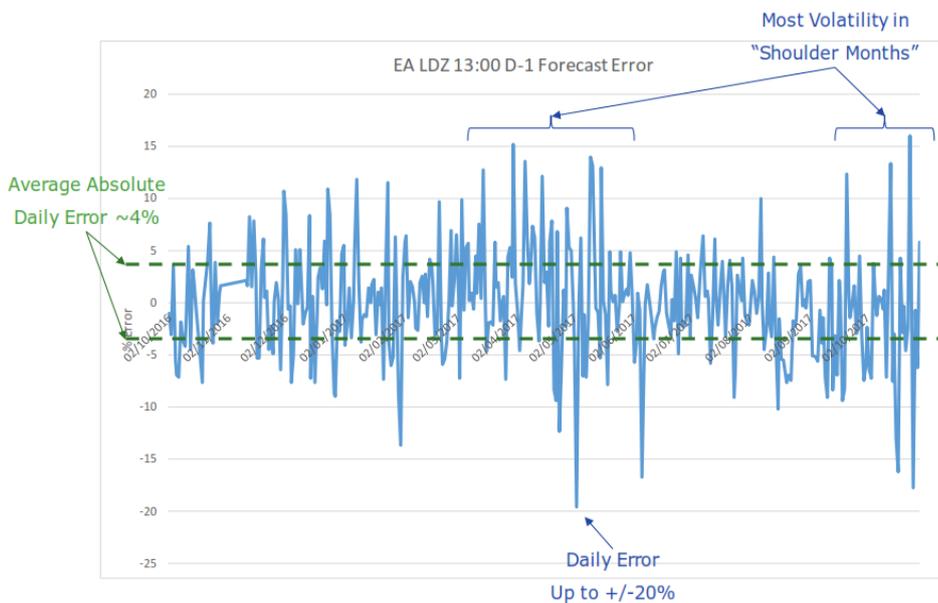


Source: Xoserve: UIG Weekly Update 1st December 2017

In reality as Unidentified Gas is calculated regionally and on a daily basis as information is received Unidentified Gas is much more volatile on a daily basis, as shown below for the East Anglia Region.

¹ Project Nexus

² Allocation of Unidentified Expert or AUGÉ



Source: DNV GL: 31 October 2017 UIG Calculation Issues (provided by the AUGE)³

This volatility means that shippers incur significant costs in attempting to handle these unpredictable swings in demand. In particular smaller shippers are obliged to buy to peak estimates as failure to balance on the day result in substantial credit requirements.

These swings are not being reduced by the reconciliations of allocations. Despite over 80% of sites being reconciled since June, as reported by Xoserve to DESC, only 15% of the total of Unidentified Gas has been reallocated for June as of middle of November 2017. Similarly the issues that were experienced in loading Valid Meter Reads from daily metered sites have been largely tackled as part of an industry-wide project lead by Xoserve. Xoserve estimates that this error would only account for 1% of Unidentified Gas. The industry have engaged with Xoserve since implementation of Project Nexus to investigate and then resolve the data issues present in Unidentified Gas, but this has not substantially reduced either the volatility or overall level. A number of UNC modifications were raised to address concerns, but none of these will resolve the problem of unpredictable levels of UIG being allocated to shippers on a daily basis

As DNV GL (who provides the AUGE service) has stated *“This calculated difference figure is not Unidentified Gas: it is Unidentified Gas plus allocation algorithm error.”* And *“The most recent figures we have seen show that the daily Mod 432 calculation returned an average Unidentified Gas figure of approximately 7% of throughput for September, with a peak of nearly 15% for the national Unidentified Gas total. Unidentified Gas for individual LDZs is even more variable and ranged between -16.9% and 23.9% of throughput. It is clear, therefore, that the current Unidentified Gas calculation is not fit for purpose.”*⁴

This modification is intended to achieve the following:

- 1) make Unidentified Gas more accurately reflect Permanent Unallocated Gas only

³ <https://www.gasgovernance.co.uk/sites/default/files/ggf/book/2017-10/PAC%20-%20UIG%20Calculation%20Issues%20%28provided%20by%20the%20AUGE%29%20.pdf>

⁴ Ibid.

- 2) improve the NDM estimation profiles; and as a consequence, the within month profiles
- 3) make the industry more cost reflective as it more correctly and more quickly matches actual gas costs to the meter
- 4) encourage the adoption of Smart meters, AMR and the regular submission of these reads, which will be for the benefit of the market as it will reduce initial estimation error
- 5) reduce within day volatility in the nominations issued, trading costs and therefore customer costs
- 6) match estimate error to those meters which are estimating in the first rec run for that period
- 7) give clearer and more understandable cost for customers
- 8) remove an unintended source of customer detriment

For UNC 0642A

The original Modifications 0432 - *Project Nexus – Gas Demand Estimation, Allocation, Settlement and Reconciliation Reform* and 0473 - *Project Nexus – Allocation of Unidentified Gas* were intended to achieve the benefits below.

Additional enhancements provided by this Modification are also suggested below and give further benefits to what was originally implemented. Where applicable, it is shown how this alternative proposal will deliver reduced volatility for UIG.

- 1) Make Unidentified Gas more accurately reflect permanent *Unallocated Gas* only.

This has been delivered when considering both allocation and reconciliation, but the introduction of a Fixed UIG values per category will give a clear and fixed position which Shippers can easily introduce into any forecasting model they currently have, rather than having to build a new model, leading to increased development and implementation costs.

- 2) Improve the NDM estimation profiles; as a consequence of the within month profiles.

This has been delivered, however EUC01B/EUC02B could benefit from segmentation and this is already being reviewed/developed through Modification 0631R *Review of NDM algorithm post-Nexus* and Modification 0644 *Improvements to nomination and reconciliation through the introduction of new EUC bands and improvements in the CWV* and via the Business As Usual (BAU) work completed by Demand Estimation Sub Committee (DESC). Returning to the historic allocation would only hide the issue as Scaling Factors (SF) was less visible.

- 3) Make the industry more cost reflective, as it more correctly and more quickly matches actual gas costs to the meter.

Suggested enhancements to introduce the Fixed UIG values per category plus the Balancing Quantity will deliver further benefits of reduced volatility with increased transparency. In addition, the focus will be on the industry to maintain the values going forward which would create a mechanism to seek to reduce UIG or identify actual UIG contributing issues.

- 4) Encourage the adoption of Smart meters, Automatic Meter Reading (AMR) devices and the regular submission of these reads, which will be for the benefit of the market as it will reduce initial estimation error.

This proposal does not suggest any enhancements for this element but the the BAU work completed by DESC will build on this as rollout ramps up. The proposer believes that PAC is also looking into this area and any changes here will support PAC's work.

- 5) Reduce within day volatility in the nominations issued, trading costs and therefore customer costs.

Creation of the Fixed UIG values per category and the Balancing Quantity with ongoing reviews by DESC will ensure a stable approach is applied; further enhancements from Modification 0631R and Modification 0644 will further contribute to positive impacts to this element.

- 6) Match estimate error to those meters which are estimating in the first reconciliation run for that period.

Creation of the Fixed UIG values per category and the Balancing Quantity will deliver a combined way to ensure UIG is fairly, transparently and reflectively applied across all parties. It also allows the ability to forecast with more accuracy. This approach can be implemented without requiring complicated system enhancements to the reconciliation process.

- 7) Give clearer and more understandable cost for customers.

When the end to end process is considered, the proposer believes this has been delivered but when looking just at reconciliation, this could be perceived as not being delivered. However, the delivery of the Fixed UIG values per category and the Balancing Quantity will allow parties to assess exposure of the known and mitigate the unknown. The regular reviews will flex the figures to seek to keep a stable position.

- 8) Remove an unintended source of customer detriment.

Although quantifying this will be completed through the reviews of the values at a later stage, based on a review of the proposer's own portfolio, it is considered that when the end to end process is reviewed there has been an improvement compared to the old model.

The introduction of the Fixed UIG values per category and the Balancing Quantity as an alternative does not significantly change the current modelling. It does however enhance it with improved transparency and stability. In addition, the developments proposed would allow the introduction of parameters which can be easily flexed to ensure parties remain on top of the UIG position.

Although the suggestion would be an annual review of the values by both DESC and PAC, either of these committees could invoke an earlier review if required.

These enhancements would see tangible and quantifiable data outputs which can then be used to make decisions to keep the market moving and it would not seek to introduce convoluted forecasting which parties would struggle to replicate. It brings in a simplistic change to what has already been developed, invested in and delivered.

Analysis has been conducted on our portfolio and we have determined 0.01% for category 1 and 2.5% for category 2, 3 and 4 as the initial Fixed UIG % is justifiable. This analysis will be shared with the authority confidentially – a request to the CDSP has been submitted to try and conduct a wider analysis piece.

4 Code Specific Matters

Reference Documents

- NDM Demand Estimation Methodology (UNC Related Document)
- AUGE Framework document (UNC Related Document)

Knowledge/Skills

Xoserve has already committed significant levels of resource to attempt to identify and address the issue of Unidentified Gas volatility. The learnings from this exercise will be of great benefit in assessing the proposed solution and can be found on the Xoserve website⁵.

The solutions developed for **UNC 0642 and UNC 0643** have been based on the option paper developed by DNV GL (see Annex 1) and the current solution will expand the AUGE role substantially.

UNC 0642A advises that knowledge of UIG, statistical analysis, demand modelling, nomination process and the reconciliation process would be beneficial.

5 Solution

Summary of differences between the proposals:

	UNC 0642	UNC 0642A	UNC 0643
Utilise the Pre-Nexus nomination and allocation process for NDM	✓	X	✓
Set Unidentified Gas as a percentage of throughput for each LDZ, set at 1.1%	✓	X	✓
The AUGE will be required to develop Settlement Error Allocation Factors to apportion reconciliation volumes to the sectors that create them.	✓	X	✓
Effect backdated to 01 June 2017	X	X	✓
Smears all reconciliation across all unreconciled meter points over 1 month	✓	X	X
Smears all reconciliation across all unreconciled meter points over 12 months	X	X	✓
Classes included in the reconciliation smearing process:			
<ul style="list-style-type: none"> • Class 1 	X	X	✓
<ul style="list-style-type: none"> • Class 2 	X	✓	✓
<ul style="list-style-type: none"> • Class 3 	✓	✓	✓

⁵ www.xoserve.com/index.php/unidentified-gas-ug/

• Class 4	✓	✓	✓
Fixed UIG Category per Product Class	X	✓	X
Utilise Balancing Quantity for any positive/negative volumes	X	✓	X
Annual Review of Fixed UIG factors	X	✓	X
Annual Review by UNC Committees (DESC and PAC)	X	✓	X
Removal of the AUG Process	X	✓	X

UNC 0642 and UNC 0643 propose the following changes to the current market business rules:

Allocation

There are two main changes that are proposed to the current NDM forecast and allocation process. The high-level intention is to reinstate the NDM allocation and forecasting processes that were successfully utilised by the industry, prior to implementation of Project Nexus, with the retention of the allocation of Unidentified Gas as a fixed proportion of throughput for the day.

NDM Allocation

The pre-nexus calculation for determining the allocation of a NDM supply point, as set on in Version 5.01 of the UNC, will be reintroduced in full, namely:

$$SPD = \frac{AQ}{365} \times ALP_t \times (1 + (WCF_t \times DAF_t)) \times SF_t$$

where:

Annual Quantity (AQ) is an estimate of consumption (for every site) based on Seasonal Normal Demand (SND).

ALP_t is the value of the Annual Load Profile for the Applicable End User Category. is a profiled estimate of consumption using average weather conditions and based on the End User Category (EUC) for that site (defined from its LDZ, AQ and winter consumption, where applicable). The profile is divided by 365 to give a daily forecast on how much that site will use on a gas day (under SND conditions). EUC 'bands' are managed by DESC each year and can be changed on an annual basis (usually 1 October)

DAF_t is the value of the Daily Adjustment Factor for the Applicable End User Category. It is an adjustment to weather sensitivity at the EUC

WCF_t is the Weather Correction Factor for the relevant LDZ. It is an adjustment made to the algorithm that takes into account external factors like the weather with an adjustment to SND where a negative value (<0) indicates weather warmer than SND and a positive value (>0) indicates colder weather than SND. A value of 0 is SND

SF_t is the Scaling Factor for the relevant LDZ. It is a net adjustment of NDM sites in line with NDM LDZ consumption using values to increase allocations and based on LDZ forecast (for Nominations) or LDZ actual (for Allocations)

The following components of this calculation will be derived as follows. For the avoidance of doubt it is intended that the pre-nexus calculation is reinstated in full.

Annual Load Profile (ALP_t)

The process for determining this was unchanged by Project Nexus and will continue to be derived in accordance with the NDM Demand Estimation Methodology, and for the avoidance of doubt will be unchanged and is provided here for provide clarity on the completeness of the solution.

Daily Adjustment Factor (DAF_t)

The DAF will be derived as pre-nexus and so will be derived as follows:

$$DAF_t = \frac{(WVCE_t / SNDE_t)}{(WVCN_t / SNDN_t)}$$

WVCN_t is defined as the value of the Weather Variable Coefficient (the element of demand which varies with weather as represented by the Composite Weather Variable) in the Demand Model for the LDZ Aggregate NDM Points for the relevant LDZ.

SNDN_t is defined as the value of seasonal normal demand for LDZ Aggregate NDM Points for the relevant LDZ.

WVCE_t is defined in the NDM Demand Estimation Methodology and is the value of the Weather Variable Coefficient in the Demand Model for the End User Category.

SNDE_t defined in the NDM Estimation as the seasonal normal demand for the End User Category.

Weather Correction Factor (WCF_t)

The Weather Correction Factor will be derived as pre-nexus and so will be derived as follows:

$$WCF_t = (ASD_t - \sum ((AQ_{EUC}/365)*ALP_t)_{LDZ}) / \sum ((AQ_{EUC}/365)*ALP_t)_{LDZ}$$

ALP_t is defined above.

AQ is defined within the UNC.

ASD_t is defined as

- (a) for the purposes of Nomination Determination, Forecast LDZ Demand (at the relevant time of Nomination Determination) less the aggregate sum of DM Output Nominations, shrinkage and Unidentified Gas.
- (b) for the purposes of Offtake Determination, that quantity comprised in the LDZ Daily Quantity Offtaken attributable to NDM Supply Points (determined as the LDZ Daily Quantity Offtaken less the aggregate sum for quantities offtaken at all DM Supply Points, shrinkage and Unidentified Gas (This definition has been altered slightly from the pre-Nexus code definition as it now includes Unidentified Gas)

Scaling Factor (SF_t)

Scaling Factor will be derived as pre-nexus and so is defined as:

$$SF_t = ASD_t / NDMD_t$$

ASD_t is defined above.

NDMD_t is the aggregate for all NDM Supply Points in the LDZ of the amounts determined by calculating Supply Point Demand for Day t.

NDMD review

It will be necessary to also reinstate the review process brought in by UNC Modification 0204 to ensure the WCF continues to follow the current position, though it will increased in frequency to monthly:

In respect of each Gas Year, the CDSP will, on the day AQ files are issued out will compare the AQ change at each LDZ and AQ at the last application date.

Where the comparison made determines that the aggregate NDM LDZ AQ has increased or decreased by an amount of more than 1%, the CDSP will:

- a) on the last working day of the month before the AQ's take effect, publish the revised values that will apply in respect of $\sum((AQ_{EUC}/365)*ALP)$ for each LDZ;
- b) apply such revised values from the first Gas Day of the month; in line with when the AQ's take effect.

In addition there will be an annual process, to coincide with the start of the Gas Year, where the CDSP will be required to undertake of full refresh of WCF values irrespective of their position.

Permanent Unidentified Gas Calculation

There will still be allocated to each User a volume of Unidentified Gas, which will be deducted from the total LDZ offtake. This Unidentified Gas will be a percentage of total LDZ volume. For the Gas Year 2017/18 this will be fixed at 1.1% for all LDZs, in line with the latest level of Unidentified Gas throughput calculated by the AUGÉ in it last statement. For future Gas Years, the AUGÉ will be tasked with determining the expected permanent Unidentified Gas percentage from each LDZ for the Gas Year.

This annual percentage of LDZ throughput will be used to determine the total Unidentified Gas each day for an LDZ, by multiplying the expected LDZ offtake by the percentage. The total volume of Unidentified Gas will vary within day (i.e. from initial forecast to Exit Close Out) as the LDZ offtake (forecast and actual) varies. These Unidentified Gas volumes will then be allocated on a daily basis to all shippers using the Allocation Factors derived by the AUGÉ.

AUGÉ table example:

LDZ	SC	NO	NW	NE	EM	WM	WN	WS	EA	NT	SE	SO	SW
UIG % to be used on day throughput	A%	B%	C%	D%	E%	F%	G%	H%	I%	J%	K%	L%	M%

Calculation:

Assume that an LDZ records an offtake of 1000 Units and Permanent UIG is assumed to be 1.1% of throughput. Throughput * LDZ% = UIG so UIG is 1000*0.011 = 11 Units.

This is shared out at D+5 in the following way:

Shipper	Metered Volume (kWH)	AULOQ	User LDZ Unidentified Gas
A	1,000	111,940	$= \frac{111940}{951490} \times 11 = 1.3$

B	2,000	223,880	2.6
C	1,500	167,910	1.9
D	4,000	447,760	5.2
Total		951,490	11

This position is then fixed.

Reconciliation

There is one significant change to the current reconciliation regime, which is to change how any reconciliation volumes are split across the market when the CDSP undertakes the monthly reconciliation. In order to simplify the systems build and ensure timely delivery, the reconciliation amounts will apply to the NDM market only. In addition, the ability to track reconciliation amounts between months will add significant complexity to the system build and so this requirement has been omitted.

Reconciliation Process

The reconciliation process will be changed so that any reconciled volumes (termed Settlement Error) are smeared across those NDM sites that are not part of the current reconciliation or DM sites that did not load a Valid Meter Read for the most recent calendar month. Note: From discussion with Xoserve we have been advised that it would require a significant amount of work to extend the reconciliation to daily read sites and their inclusion will have little material impact on the process, and so this proposal excludes that portion of the market. In addition, the ability to track reconciliation amounts between months will add significant complexity to the system build and so this requirement has been omitted.

To avoid the possibility of a small number of sites being allocated a significant reconciliation volume if the total absolute volume of the reconciliation volume for that reconciliation month for an LDZ is more than the aggregate demand (defined as the total demand allocated to those site for that month at the point of reconciliation) for the unreconciled sites for that calendar month (the Reconciliation Target), then a different reconciliation process is used. If the Reconciliation Target is reached for that month then instead the reconciliation volume is smeared across all NDM supply meter points. As a necessary consequence of this change, UIG weightings will be fixed at Exit Close-Out. (which for the avoidance of doubt will continue as set out in section E).

Settlement Error Weighting Factors

Settlement Error will be apportioned using weighting factors that are to be developed by the AUGE, split by product class 3/4 and EUC Band).

The Settlement Error development process will follow the same timetable and process as the current AUGE framework document, with the AUGE required to develop a Settlement Error Allocation Statement. For the avoidance of doubt we propose that the same provisions as set out in the AUGE framework document and section UNC TPD E9 would apply to this process, substituting Settlement Error for Unidentified Gas. Until these are developed, the Settlement Error will be split using the Unidentified Gas weighting factors.

Reconciliation Worked Example. An LDZ of 100 meter points all of which are Class 4 EUC Band 1 with equal consumption in each portfolio, with four shippers supplying sites, have the following position at Exit Close Out.

Shipper	Meter points	Total volume (nominal values), kWh	With Scaling factors
A	10	2,000	2,320
B	40	2,000	2,320
C	30	1,500	1,740
D	20	4,000	4,640

The total LDZ offtake minus shrinkage, DM consumption and UIG is 11,000kWh so the scaling factor of 1.16.

By the end of the calendar month, the reconciliation status for that day is the following (in this example it is assumed that LDZ throughput, Shrinkage and DM consumption remain the same). The scaling factor has been set to zero. In reality the calculation is undertaken on a monthly basis, so for the avoidance of doubt the use of a daily regime is simply illustrative:

Shipper	Meter points	Meter Points reconciled	Revised volume (nominal values), kWh	Reconciliation volume, kWh
A	10	5	1,500	-820
B	40	20	4,000	1,680
C	30	20	2,000	260
D	20	0	4,000	-640

These leaves a total volume of 480 kWh to be redistributed. Assuming that the UIG allocation factors will be used (so a weighting factor of 111.94 will apply) then the following calculation would occur:

Shipper	% Meter Points unreconciled	Adjusted User NDM allocation (Settlement Error)	Settlement Error Allocation
A	50	$=(1,500*0.5)*111.94 = 83,955$	48.54
B	50	$=(4,000*0.5)*111.94 = 223,880$	129.43
C	33.3	$=(2,000*0.333)*111.94 = 74,552$	43.10
D	100	$=(4,000*1)*111.94 = 447,760$	258.86
Total		830,259	480

UNC 0642A proposes the following:

- A Fixed UIG value per category which is apportioned across all Shippers according to throughput market share – the initial values would be:

- Category 1 = Fixed UIG of 0.01%
 - Category 2 = Fixed UIG of 2.5%
 - Category 3 = Fixed UIG of 2.5%
 - Category 4 = Fixed UIG of 2.5%
- A Balancing Quantity which acts as a leveller to any additional volume which the fixed % does not sweep up or if the Fixed UIG is too large, it balances things out.

The solution will work by taking the daily position and would:

- Take out class 1 and 2 volumes (DM) as it is currently calculated today,
- Calculate volume for category 3 and 4 (NDM) by utilising the current profiling formula (profiles and system are already available),
- Allocate the Fixed UIG %'s for all categories across all Shippers based on their throughput market share,
- Utilise the Balancing Quantity for any positive/negative remaining volume and based on throughput; apply it to all category 2, 3 and 4 sites (in essence a scaling factor) and

Creation of an annual 12 month 'reassessment' process for how the UIG %s compare to the actual UIG position for each gas year. As sites reconcile; the equal and opposite volume would be applied to the Balancing Quantity and shared to Shippers with category 2, 3 and 4 sites based on throughput market share.

There will be an annual review for Fixed UIGs for each category which will be conducted by DESC and would take into consideration the Balancing Quantity remaining post reconciliation.

The Fixed UIG value(s) would commence at the beginning of each Gas Year and be in place for the entirety of that Gas Year.

Updates to the Fixed UIG % could be a blanket % for all LDZs per category or could vary per LDZ going forward but initially it would be a Fixed UIG % of 0.01% (category 1) and 2.5% (category 2, 3 and 4).

Any ongoing changes would be analysed and determined via DESC; their role would be to review the previous Gas Years Fixed UIG %s and Balancing Quantity to validate if the current Fixed UIG %s are accurate. If the analysis determines the Fixed UIG values are still accurate the current Gas Years fixed %s will rollover to the next Gas Year. If however analysis determines updates are required to the Fixed UIG %s then the proposed Fixed UIG values will be recommend by the CDSP to DESC, no later than 4 months prior to the start of the next gas year, for DESC to validate or challenge – this would just be an additional element to the current DESC annual review process.

Acceptance of the revised Fixed UIG %s per category/LDZ will be on a majority voting basis at DESC. Where a majority decision cannot be reached it will be escalated to the UNCC to determine if the proposed %s or the current Gas Years Fixed UIG % will roll into the next Gas Year.

The dataset which DESC requires for the determination of the Fixed UIG values will be developed via the DSC change process; this is not required for the modification implementation date due to initial values being proposed but it would need to be in place for the end of the first Fixed UIG Gas Year to determine the following Gas Years values.

This solution will enable visibility of the final UIG volumes seen as the sum of UIG and the Balancing Quantity. It will also remove the need for an AUGÉ and will therefore remove an element of cost from the industry while retaining the expected Nexus visibility benefits.

The removal of the AUGÉ is because the weighting factors will be replaced by the process to create the Fixed UIG and Balancing Quantity per category and per LDZ on an annual basis. The DESC approved values will be based on accurate and transparent data which is captured by the CDSP through the BAU process, thus removing the need for estimated values. A guidance document outlining the process will be developed and processes regarding the amendment to AUGÉ requirements will be progressed should this alternative solution be implemented.

It is expected that the PAC will retain a role in monitoring both the speed of reconciliation and size of the Balancing Quantity. Their monitoring can also cover, for example, read performance per category and use the reports which will be created for Fixed UIG and Balancing Quantity to focus their reviews. Development of additional report requirements would be via the PAC but the DESC reports will also be made available to PAC.

The creation of an annual 12 month 'reassessment' process will be required for each Gas Year. This review will be completed by the CDSP to ensure the allocation of financial adjustments made are appropriately apportioned across all categories and where any disparities occur financial adjustments will be completed via a REC adjustment. The reassessment process will also be incorporated within the development of the subsequent Gas Years Fixed UIG processes. An example being:

Gas Year X started with Fixed UIG of Cat 1 = 0.01% Cat 2, 3, 4 = 2.5%

The annual review determined UIG for Gas Year X was actually Cat 1 = 0.51%, Cat 2 = 2% and Cat 3 & 4 = 2.5%

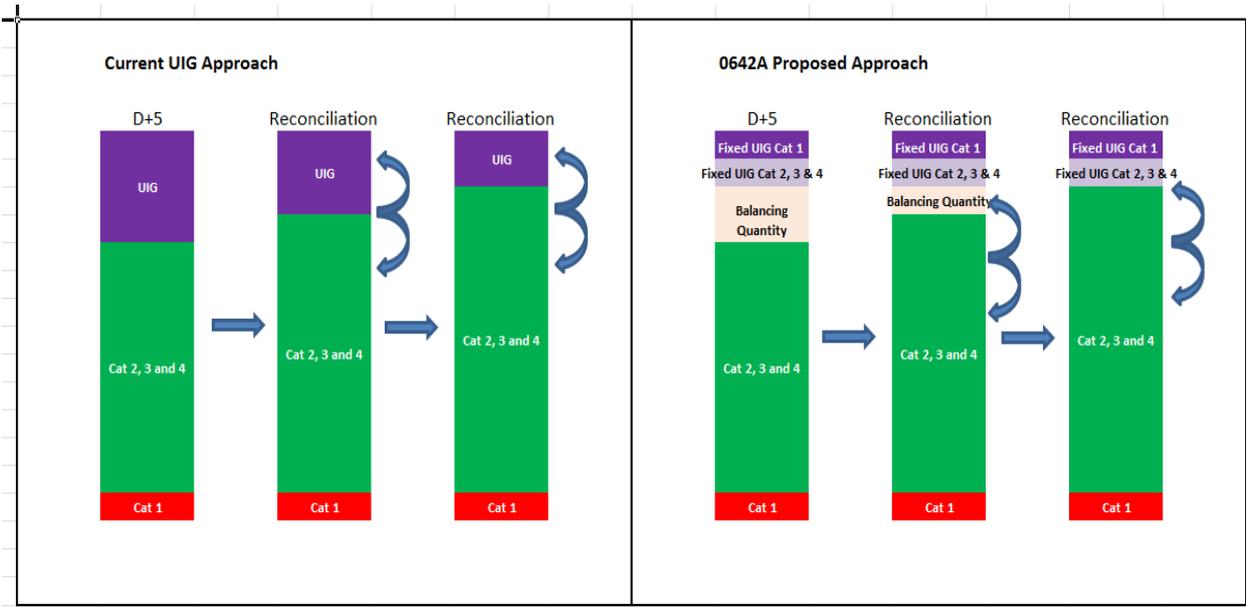
The reassessment activity would reapportion the shares across the categories in a one off activity. It is anticipated the reapportionment activity would mainly be within the first couple of years to allow time for MI and DESC to determine accurate %s; this would then result in increased stabilisation of the fixed UIG and a reduced need for the annual activity. It is not perceived as retrospective activity but an annual reapportionment acting as a safety net so there is not an unfair distribution of UIG for any category.

The design development of the Fixed UIG % for all categories/LDZs and reassessment activity will be completed via the DSC change process.

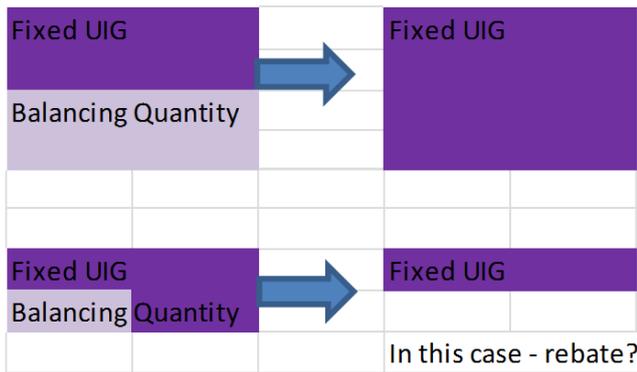
Development of system changes via the DSC can be completed in parallel so that the expedited timescales can be achieved. Although some changes are required for the modification implementation date e.g. implementation of the Fixed UIG /Balancing Quantity it is not anticipated that they will be significant, however, there are likely impacts to Gemini which the DSC Change group will also need to consider for implementation.

Other elements e.g. reports for DESC / governance documents can be developed post modification implementation, the development and implementation of those changes would be required before the end of the 1st Gas Year to enable the activities required for the subsequent gas years.

Below are illustrations to accompany the creation of the Fixed UIG / Balancing Quantity and the annual reassessment process.



Annual reassessment



Based on average figures across the year, evidence based numerical calculation

UNC 0643 - The following Business Rules are proposed in addition to those for UNC 0642:

The second reconciliation period will result in a further adjustment. All of these subsequent reconciliations are for supply meter points that were not reconciled in the previous calendar month. The revised status for the settlement day is as follows:

Shipper	Meter points	Meter Points reconciled	Revised volume (nominal values), kWh
A	10	10	1,500
B	40	30	4,000

C	30	20	2,000
D	20	20	4,500

The revised reconciliation volume for this day is now 500 (as 1,000 kWh has been reallocated to site).
 The revised settlement error allocation for this nominal day is therefore:

Shipper	% Meter Points unreconciled	Adjusted User NDM allocation (Settlement Error)	Settlement Error Allocation
A	0	0	0
B	25	111940	300
C	33	74627	200
D	0	0	0
Total		186,567	

Transition

There will be a requirement for Xoserve to undertake a transition process for any reconciliations back beyond the reconciliation deadline. To aid implementation Xoserve will only process reconciliations up to the cut-off date; the retrospection process will take account of these volumes (see below).

Retrospection

Retrospection as outlined below will ensure that customers are not unfairly allocated gas which they have not used and therefore prevent an incorrect redistribution of cost between customers.

A corrective exercise will be undertaken for the period between 01 June 2017 and the implementation date of this modification (“Correction Period”). The CDSP will be required to undertake a one-off exercise for this Correction Period, using the revised settlement rules set out in this modification to adjust the shipper gas imbalance positions and cashing out shippers on the basis of those positions. When undertaking the retrospective adjustment the following steps will be undertaken.

- For historic billing period (i.e. month) in the Correction Period, Xoserve will re-calculate UIG, using the 1.1% of LDZ throughput to set UIG. The resulting Settlement Error will be allocated to read or unread meters in accordance with the new process above. This will result in Shippers either increasing or decreasing their NDM allocation. The allocation of Settlement Error will use the UIG weighting factors in force during the time.
- As this calculation will simply move energy between shippers, system settlement prices will remain the same.
- Xoserve will then sum the resulting credit and debits for each shipper over the period and issue a corrective invoice to each shipper.
- To take account of any reconciliations that would have straddled the implementation date of the new regime, Xoserve will undertake a second retrospective correction activity 12 months after the implementation date.

6 Impacts & Other Considerations

Does this modification impact a Significant Code Review (SCR) or other significant industry change projects, if so, how?

None identified.

Consumer Impacts

UNC 0642 and UNC 0643

Some participants note that these modifications have been raised owing to the large and unexpected levels of volatility in the market, resulting in significant costs to all Shippers, which are being translated into either higher costs in fixed term domestic contracts (which are expected to become the default market tariff offering) or higher costs being passed through to non-domestic customers in line with their contracts. As indicated above, around £160m of cost is being smeared across the industry owing to these errors. These modifications, by removing this volatility and ensuring correct apportionment of costs, will address this negative issue to the benefit of customers.

However, others felt that the levels of volatility were understood and that the associated rebalancing of costs were known at Nexus implementation.

Some consider that UNC 0642 fundamentally rebalances UIG sharing across different Customer Classes by moving UIG from larger Customers to smaller/medium Customers.

It was noted that UNC 0643 seeks to backdate the proposals in UNC 0642 to 01 June 2017 to remove any residual risk to non domestic Customers. In addition, UNC 0643 seeks to apply reconciliation volumes to DM/NDM sites if they are unreconciled and so the shift UIG should mean settlement error will be less pronounced than UNC 0642.

UNC 0642A

Some participants noted that there were no direct impacts on Customers – although improved allocation will ensure a closer match between Transporters invoiced charges and Customers actual usage, minimising reconciliation flows and improving/reducing volatility in the energy purchasing area.

Some consider that this modification fundamentally rebalances UIG sharing across different Customer Classes by moving UIG from smaller Customers to medium/larger Customers.

Consumer Impact Assessment	
Criteria	Extent of Impact
Which Consumer groups are affected?	<ul style="list-style-type: none"> • Domestic Consumers • Small non-domestic Consumers • Large non-domestic Consumers • Very Large Consumers

<p>What costs or benefits will pass through to them?</p>	<p>UNC 0642 and UNC 0643</p> <ul style="list-style-type: none"> • Some consider implementation would reduce the risk of direct additional costs being passed on to non-domestic customers due to alleged misallocations of energy and costs. • Others felt these modifications are likely to increase tariff risk premiums for domestic customers, subject to meter reading frequency factors. • Some believe UNC 0642/UNC 0643 will reduce volatility in the wholesale market and reduce Shipper balancing costs, which should reduce cost pressures on Customer pricing. • Some consider that volatility is impacted by the timing of the UIG run which is not amended or addressed by these modifications and therefore they will not significantly impact pricing.
<p>When will these costs/benefits impact upon consumers?</p>	<p>Following implementation.</p>
<p>Are there any other Consumer Impacts?</p>	<p>No other impacts identified.</p>

Cross Code Impacts

None identified – it is not believed any SPAA or iGT UNC changes are required to complement these modifications.

EU Code Impacts

None identified.

Central Systems Impacts

It is likely that if one of these modifications were implemented, it would have significant impacts on Central Systems and processes. Xoserve have undertaken a very high level assessment of each modification, which is in sufficient detail to be considered a ROM.

The Workgroup noted that as these modifications have been directed to follow Urgent procedures, they may have significant impacts on the existing change programme if one of them were directed for implementation.

Workgroup Impact Assessment

Workgroup participants were concerned at the condensed timescales available to assess these modifications and to fully understand their potential impacts. However, they agreed that due to the significance of UIG issues that Urgency was appropriate.

The Workgroup recommends that respondents consider Ofgems criteria for Urgency and the guidance on retrospection.

Some participants note that these modifications have significant implementation costs associated to each and would if implemented, move UIG and associated costs around the industry and might address volatility but none of the proposals seek to resolve core UIG issues.

UNC 0642

The Workgroup notes that this modification would have the following impacts:

- The Workgroup notes that Xoserve would be required to review the AUG arrangements to identify the impacts of the proposed changes and if these would fall within the current work scope or possibly require a re-tendering process to be undertaken.
- Some Workgroup participants were concerned that if implemented, UNC 0642 might require further modifications to put in place transitional rules due to potential impacts of an implementation date being ahead of the Systems availability date.

UNC 0642A

The Workgroup notes that this modification would have the following impacts:

- This modification would require a review of the AUG arrangements and a process for transition from these arrangements and AUGE termination. This might require the payment of AUGE contract termination costs.
- That DESC and PAC would need to review their scope of works to ensure that the task allocated by the modification can be managed.
- It was noted that that DESC would be required to describe the methodology for establishing base UIG factors.

UNC 0643

The Workgroup notes that in addition to the impacts identified for UNC 0642, UNC 0643 would have the following impacts:

- Xoserve will be required to undertake a retrospective adjustment for the Correction Period to correct for the current inequitable settlement regime, with quarterly reconciliations run as meter reads are received.
- A new mechanism will need to be developed to handle any Central System activities that straddle the implementation date of this modification and proposed retrospective implementation date.
- Additional business rules are needed to clarify the process of retrospective implementation and how Shipper positions are maintained.

Rough Order of Magnitude (ROM) Assessment

ROMs were not available for consideration. However, Xoserve provided high level impacts assessments which included a number of assumptions for each modification and these are provided in a presentation published alongside this Report and a summary is set out below.

It was noted that the assessment for **UNC 0642A** did not take account of the recent changes to the solution.

Rough Order of Magnitude (ROM) Assessment

UNC 0642	42 Weeks build time, Delivery Cost Estimate £2m
UNC 0642A	35 Weeks build time, Delivery Cost Estimate £1m
UNC 0643	50 Weeks build time, Delivery Cost Estimate £2.2m

7 Relevant Objectives

Impact of the modification on the Relevant Objectives:

Relevant Objective	Identified impact
a) Efficient and economic operation of the pipe-line system.	None
b) Coordinated, efficient and economic operation of (i) the combined pipe-line system, and/ or (ii) the pipe-line system of one or more other relevant gas transporters.	None
c) Efficient discharge of the licensee's obligations.	None
d) Securing of effective competition: (i) between relevant shippers; (ii) between relevant suppliers; and/or (iii) between DN operators (who have entered into transportation arrangements with other relevant gas transporters) and relevant shippers.	0642 – Positive 0642A - Positive 0643 – Positive
e) Provision of reasonable economic incentives for relevant suppliers to secure that the domestic customer supply security standards... are satisfied as respects the availability of gas to their domestic customers.	None
f) Promotion of efficiency in the implementation and administration of the Code.	None
g) Compliance with the Regulation and any relevant legally binding decisions of the European Commission and/or the Agency for the Co-operation of Energy Regulators.	None

Given the difference of opinions these views on the Relevant Objectives were extracted from the modifications and some participants did not agree with these comments:

UNC 0642

The current levels of volatility are having a detrimental impact on the market, creating significant levels of uncertainty. This is having the greatest impact on the smallest shipper organisations in the market who do not have the benefit of a large domestic portfolio to absorb the effects of this volatility. Returning the

market volatility to pre-Nexus levels will reduce the inefficient costs that shippers are incurring and so further competition between relevant shippers.

A benefit of this option is that the NDM within month shape will be more accurate. As there are products in the market that rely on the customer having good within-month shape to give accurate pricing this will be a market benefit.

UNC 0642A

This Modification delivers positive impacts to Relevant Objective (d) as it delivers enhancements to already existing processes to give transparency in how UIG is calculated and divided across parties, which assists with simplifying understanding of UIG whilst actively introducing stability through reduced volatility.

UNC 0643

The current levels of volatility are having a detrimental impact on the market, creating significant levels of uncertainty. This is having the greatest impact on the smallest shipper organisations in the market who do not have the benefit of a large domestic portfolio to absorb the effects of this volatility. Returning the market volatility to pre-Nexus levels will reduce the inefficient costs that shippers are incurring and so further competition between relevant shippers.

A benefit of this option is that the NDM within month shape will be more accurate. As there are products in the market that rely on the customer having good within-month shape to give accurate pricing this will be a market benefit.

The market is currently pricing risk and uncertainty in accordance with the pre-nexus settlement regime (we certainly have seen no substantial shift in either domestic tariffs or non-domestic prices since 01 June 2017). A retrospective adjustment to reinstate the pre-nexus allocation and nomination regime will simply therefore realign settlement with the market pricing that was operated, so avoiding windfall gains or losses.

8 Implementation

UNC 0642:

The following implementation dates are proposed:

- Implementation date of 01 April 2018 if a decision to implement is issued by 01 March 2018;
- 01 May 2018 if a decision to implement is received by 1 April 2018;
- If a decision to implement is received after 1 April 2018, implementation is 10 business days following the decision to implement.

The proposer is of the view that this issue represents a critical problem to the market and the current inequitable regime needs a clear end date, so that Shippers can align their business processes to the new settlement processes. They are mindful of the uncertainty caused by the changes in the Project Nexus implementation date and so believe a clear implementation timeline is necessary in this case.

Some Workgroup Participants were concerned that the dates proposed would cause difficulty in operating to a balancing regime where the rules are implemented but the systems may not be available for some time.

Some consider there is a risk that as industry participants are balancing to a different regime, this may cause the system to be out of balance. Some participants felt that Shippers have a clear understanding of

what is required of them as they have historical information they can use to base future activities on. However, others felt that only DM Shippers would have this information available.

There is a risk that Shippers who use nomination information from Gemini could be impacted as they would potentially be using information that would put them out of balance.

Some were concerned that Shippers would be operating to different rules as there would be no common understanding of the requirements for balancing as the Code and systems would not be aligned.

Some were concerned that there might be energy balancing risks.

UNC 0642A:

No implementation timescales are proposed. However, the proposer suggests it would be beneficial if the Modification were approved sufficiently ahead of 30 September 2018 to allow effective system implementation by the start of the 2018 Gas Year on 01 October 2018.

Should an adhoc date be selected; implementation should be on the 1st of the month.

UNC 0643:

No specific timeline is proposed. However, owing to the excessive costs being incurred in the market by the current levels of volatility this modification needs to be implemented as soon as possible.

9 Legal Text

Legal Text has been provided by Cadent on behalf of Transporters and is published alongside this report. The Workgroup has considered the Legal Text and is satisfied that it meets the intent of the Solutions for each modification in this report.

10 Recommendations

Workgroup's Recommendation to Panel

The Workgroup agrees these modifications should proceed to consultation.

11 Annex 1 – DNV GL Paper

See separate document attached below.

UIG Calculation Issue - Analysis

This document is from the AUG Expert in response to an industry request for support in understanding the high levels in UIG and the day to day volatility.

Overview

Mod 432 introduced several changes to the balancing regime, in particular the introduction of reconciliation for all meter points and the calculation of daily UIG – a balancing figure which is then allocated to shippers based on a table of weighting factors provided by the AUG Expert.

The current approach to the calculation of daily UIG contains a key weakness that results in very high levels of variation in the day to day estimate, in addition to UIG with an unrealistically high order of magnitude.

- The central issue is the fact that up until all meter reads have been received and reconciled, the UIG calculation mixes actual load data (LDZ intake and daily metered load) with estimated load data (using the NDM allocation algorithm). UIG is then calculated as the difference between the actual LDZ intake and the DM (metered) and NDM (estimated) loads.

As a result of this, the difference figure labelled as UIG actually contains error due to the inaccuracy of the NDM algorithm. This error is the cause of the large magnitude and the volatility of the values that are being returned. This is shown in Figure 1. The left side of the diagram shows the pre-Nexus situation where the Scaling Factor (SF) accounted for both the Unidentified Gas (UG) and the error in the allocation algorithm as SF has now been removed.

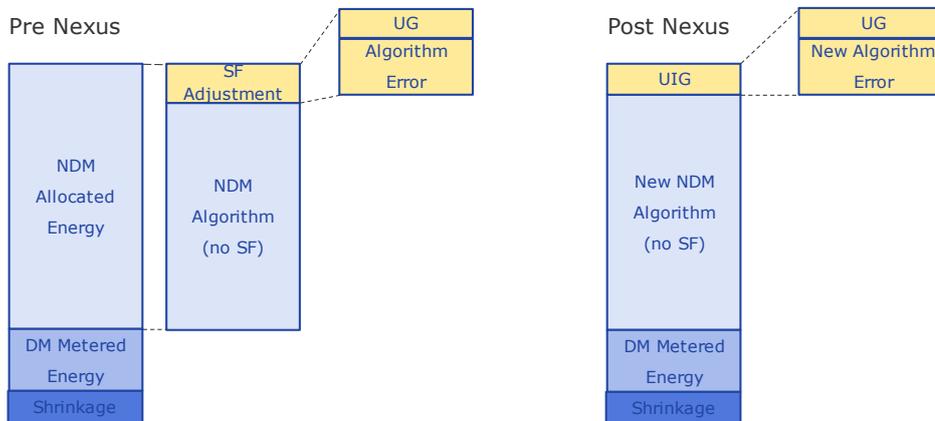


Figure 1: Explanation of 'Algorithm Error'

Over time, as meter reads are received, the reconciliation process will remove the algorithm error as estimated consumption values are replaced with actuals. However, given current meter read frequencies, an accurate estimate of UG will not be obtained until at least a year after initial UIG calculation.



Page 2 of 5

The Problem

The name UIG suggests that the balancing figure represents Unidentified Gas, i.e. the total figure estimated by the AUG Expert. This is **not** the case, however, as the two represent different things. UIG is a daily figure rather than an annual one, and is calculated by subtracting shrinkage, metered DM demand and NDM allocations from the total LDZ intake. The issue here is that the NDM allocations are essentially forecasts of NDM demand based on a version of the NDM profiling algorithm. These forecasts are subject to error, as with any other forecasting model.

It is known from DNV GL’s work as the AUGE that UG is a stable figure of approximately 1% of throughput, a figure that has remained relatively stable throughout the AUGE period. The most recent estimate available, from the AUG Statement for 2017/18, put the overall level of Unidentified Gas at 1.1% of throughput.

It should be borne in mind that these Unidentified Gas figures are calculated independently at an annual rather than a daily level, using far more sophisticated data and methods than the daily UIG calculation. These methods are described in detail in the AUG Statement. UIG, which is intended to be a daily estimate of the level of Unidentified Gas, is calculated using methods defined in Mod 432, and has been shown since Nexus go-live to return very different and unreliable results.

The most recent figures we have seen show that the daily Mod 432 calculation returned an average UIG figure of approximately 7% of throughput for September, with a peak of nearly 15% for the national UIG total. UIG for individual LDZs is even more variable and ranged between -16.9% and 23.9% of throughput.

These figures are clearly not credible: negative UG of this magnitude is not physically possible, whilst it is equally implausible that 24% of throughput on a given day is lost to Unidentified Gas. It is clear, therefore, that the current UIG calculation is not fit for purpose, and a solution must be found to ensure that it returns accurate and consistent values that reflect the true level of Unidentified Gas.

As stated above, the large amount of variation in the UIG estimates calculated using Mod 432 techniques is a result of the formula mixing actual values (LDZ intake and daily metered load) with allocations (Product Class 3 and 4 load) in the UIG equation:

$$UIG = LDZ\ Throughput - Shrinkage - Metered\ Demand\ (Products\ 1\ \&\ 2) - Allocated\ Demand\ (Products\ 3\ \&\ 4)$$

This calculated difference figure is **not** Unidentified Gas: it is Unidentified Gas *plus* allocation algorithm error.

Pre-Nexus, the NDM profiling algorithm (see equation below) was used on an LDZ by LDZ basis to calculate an allocation for each EUC. The algorithm included a Scaling Factor (SF) which scaled all allocations to ensure that the total LDZ allocation matched the total LDZ demand.

Used in this manner, the profiling algorithm was splitting the total LDZ demand between EUCs. This is the purpose for which the algorithm was intended. Used in this way, there is no real requirement for the algorithm to give an accurate forecast by EUC, merely to get the relative proportions of demand from each EUC correct.

$$Alloc^{EUC} = A^{EUC} * ALP^{EUC} / 365 * (1 + DAF^{EUC} * WCF^{LDZ}) * SF^{LDZ}$$

The profiling algorithm excluding the SF can be thought of as a bottom-up forecast of the NDM demand as shown in Figure 1 (the diagram shows the algorithm under-forecasting so SF in

31st October 2017

this case is greater than 1, but the algorithm could also over-forecast resulting in $SF < 1$). This bottom-up forecast has an inherent 'algorithm error' associated with it. The SF can be thought of as a correction to allow for this algorithm error and UG.

Post-Nexus, the SF has been removed from the NDM algorithm altogether. There are also some other, more minor changes to the algorithm in the way it uses CWV, but essentially it operates in the same way. As a result, the UIG amount calculated under Nexus includes both UG and the algorithm error.

Algorithm Error Analysis

The key to this issue is the magnitude of the algorithm error. Based on the AUG Expert's experience in the gas demand forecasting domain, we believe that the algorithm forecast will have an average daily error of at least 5% and maybe significantly more.

The GDNs generate daily aggregate forecasts of gas demand on an LDZ basis. The AUG Expert has taken actual demand and 13:00 day ahead forecast data from the National Grid website for EA LDZ as an example. Figure 2 below shows the forecast error from October 2016 to present.

Over this period, the average daily error is $\approx 4\%$. The error varies randomly from day to day and can be as high as 20%. The errors are generally more volatile in the "shoulder months" i.e. when the weather is changing from winter to summer and customers switch their heating on/off at different times. This pattern of errors is entirely consistent with what is being observed in UIG.

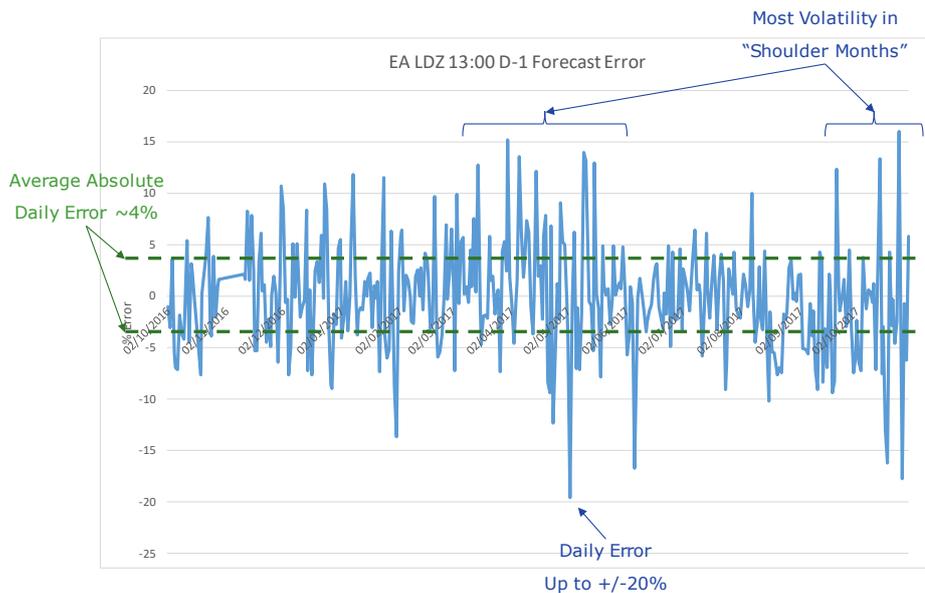


Figure 2: EA LDZ 13:00 D-1 Forecast Error over 1 year

31st October 2017

Page 4 of 5

The above analysis is based on LDZ level forecasting. These forecasts are generated using accurate LDZ level data and an ensemble of sophisticated models (regression, ARIMA, Neural Network etc.) which have been tuned over many years.

The allocation algorithm works using a broad-brush approach based on End User Categories: in effect, any load in the same EUC is assumed to follow the same pattern of consumption because ALPs, DAFs and WCFs are all defined on an EUC by EUC basis (with an additional split by WAR band in some cases). In reality, however, loads within any given EUC can vary widely in nature despite having similar AQs, and in particular, can show different levels of temperature dependency that is only partially reflected in the WAR bands.

For example, a school, shop, pub and dentist could all share the same AQ, and if they did, they would all be allocated the same value by the algorithm. In reality, they will all have different load profiles, resulting in them having different daily loads even under the same weather conditions. All will have different day-of-week profiles that the current form of the algorithm only partially picks up; all will have different temperature sensitivities, which dependent on EUC may not be picked up at all; and all will have different within-day load profiles, which will lead to them having different daily load totals.

The allocation algorithm is not capable of picking up any of these effects, and so they appear as noise (i.e. additional variation) around the model output and hence increase model error. In addition, any statistical model is subject to what is known as "common cause variation", which is the additional day-to-day fluctuations in demand that are random in nature and cannot be modelled. The overall error in the daily allocation algorithm figures is a combination of the noise due to known effects that it does not fully pick up through its calculation method, plus the genuinely random common cause variation. The combination of these two effects is the source of the highly variable UIG values that have been observed because the Mod 432 method bundles all model error in with the UIG figure.

Analysis carried out by DNV GL, based on simulated UIG error information provided by Xoserve to DESC, shows that errors from the new allocation formula are likely to lie in the range $\pm 14\%$ (95% Confidence Interval). Therefore, given that the current best estimate of Unidentified Gas is 1.1% of throughput, the "UIG plus model error" output produced by the Mod 432 formula is dominated by model error. The large variations observed in the day to day UIG values and their unpredictable nature are both consequences of this.

This problem is compounded by the removal of SF from the allocation algorithm. The actual (known) daily LDZ load is a valuable piece of data, which when used in the algorithm has the ability to remove a great deal of the error described above. In other words, SF was a major factor contributing to the accuracy of the old version of the algorithm. The removal of this factor was intended to leave the difference between the LDZ intake and the allocation as a "balancing factor" representing UIG, but for the reasons described above it does not do this. Removing SF in fact increases the error in the allocation process and adds to the observed variability in the daily Mod 432 UIG figure.

The Solution

It should be noted that the problem as described above cannot be solved by attempting to improve the accuracy of the allocation algorithm. The fundamental issue is that the Mod 432 calculation produces output that is UIG plus model error rather than just UIG, and that as things stand this combination is dominated by the model error. Given that Unidentified Gas is approximately 1% of throughput, in order for UIG to become the dominant factor in the combination, this would require model error to fall to an average level of below 0.5%. The DNV GL simulation returned a current MAPE of around 5.2% for the allocations, which as demonstrated above is typical for a forecasting model of this type. It is not a realistic

31st October 2017

Page 5 of 5

aspiration for this to drop to a MAPE of 0.5%, and it is certainly not possible to achieve this with the allocation algorithm.

An alternative approach is therefore needed that avoids combining UIG with model error and is capable of reporting UIG in isolation. The AUG Expert's recommended solution is therefore to abandon the Mod 432 UIG calculation and use a completely different method that does not involve allocations. This will have the additional benefit of allowing SF to be reintroduced to the allocation algorithm, increasing its accuracy – this will also have a knock-on beneficial effect on other processes such as energy balancing.

1. Calculate daily UIG as a fixed percentage of throughput, based on the most recent figure available. This is 1.1%, which comes from the 2017/18 AUG Statement.
2. Put SF back into the allocation algorithm. SF should scale the allocations to "LDZ total - metered load - shrinkage - UIG", with UIG calculated as per step #1.
3. Create a threshold point for the percentage of meter reads have been received, at which point UIG will be recalculated using Mod 432 principles and reconciliation carried out. This threshold will have to be very high (e.g. 98%) and be in terms of both number of meters and AQ. Only when both conditions are satisfied should UIG be recalculated. Reconciliation will therefore only occur a considerable time after Day D, but the initial UIG figure will be more accurate meaning this delay will not cause any issues – reconciliation will only involve minor changes to the final value.

It is recognised that this approach will require a change to the UNC because it fundamentally alters the way that UIG is calculated, as well as changing the allocation algorithm. This can be done via a Modification, and should be done as quickly as possible in order to allow the new calculation to be put into place at the earliest opportunity.

31st October 2017