

**LDZ Shrinkage Quantity
Initial Proposals
Formula Year 2017/18**

**National Grid Gas Distribution Ltd LDZ Shrinkage Quantity Initial Proposals - Formula
Year 2017/18**

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National Grid Gas Distribution Ltd LDZ Shrinkage Quantity Initial Proposal for Formula Year 2017/18

1. Purpose of Proposal

The purpose of this paper is to present our proposals in respect of National Grid Gas Distribution Ltd (NGGDL) LDZ Shrinkage for the Formula Year 2017/18, as required under Section N of the Uniform Network Code.

Under Section N of the Uniform Network Code, NGGDL has an obligation to estimate the LDZ Shrinkage Quantity values for the coming Formula Year and to present these to Users for consultation.

Following representations from Users, a further paper will be issued, by 1 March 2017, in which NGGDL will set out its final estimate of its LDZ Shrinkage Quantity values.

We appreciate hearing the views of Ofgem and Users; these views will help inform our Final Proposals, which are due to be published on 1 March 2017. Responses to this document are encouraged and should be received no later than 1 February 2017. Communication should be directed to Matt Marshall or via the Joint Office (contact details below).

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For the purposes of this document, 'LDZ' refers to LDZs owned by National Grid Gas Distribution Ltd and as defined by Uniform Network Code.

2. Summary of Proposal

The LDZ Shrinkage Quantity values, which are set out within Table 1 below, reflect the losses associated with Unaccounted for Gas (leakage & theft of gas) and Own Use Gas (gas used in the operation of the system). Details of how these Quantities have been determined are included in this paper. The current shrinkage volumes are shown for comparison purposes.

Table 1. Proposed 2017/18 LDZ Shrinkage Quantities

LDZ	Shrinkage Proposal 2016/17 (GWh)	2016/17 Formula Year Outturn Forecast (GWh)	Proposed Shrinkage Quantities 2017/18 (GWh)
Eastern	198	211	206
East Midlands	234	238	228
North Thames	236	243	232
North West	333	340	326
West Midlands	282	291	282
NGGDL	1,282	1,323	1,273

The calculations that were used to derive the Shrinkage Quantity values and a summary of the underlying information are set out in this proposal.

This year's shrinkage proposal reflects a reduction of 50GWh in estimated shrinkage compared to that estimated for the current year end. The main contributing factor to the reduction, approximately 39.4GWh, is associated with the forecasted low and medium pressure mains replacement activities in 2017/18.

In our Shrinkage Proposals for 2016/17 we described the potential challenges to maintaining system pressures in future years. The usage of internal pipe remediation and mains insertion techniques is becoming more prevalent; this has a positive impact on end user customer experience and reduces disruptive excavation works however it does require a greater system pressures to ensure end user requirements are satisfied. In 2016/17 we have seen pressures increase to a greater level than those initially forecasted, this was in part due to the use of main insertion techniques but also reflects our additional efforts to optimise each of our networks so that all customers receive a consistent gas supply. Optimisation of the network will continue for the remainder of the RIIO GD1 period, we expect to progressively reduce system pressures to achieve the levels of 2015/16. This will be realised through the upgrade of automated pressure management software, training, internal engagement and increased focus on areas where over pressurisation has been identified. For the 2017/18 proposals, we have maintained forecasted 2016/17 year end average system pressure levels.

We continue to focus on improving saturations of Monoethylene Glycol (MEG) within our low pressure network. Our shrinkage proposal for 2017/18 is calculated using a 40% saturation level which is 8.6% higher than that forecasted for end of year 2016/17 and would return an additional 10.1GWh leakage reduction. Although the MEG saturation has improved historically as a result of our continued focus in maintaining and maximising the equipment we have available, the removal of assets with lead yarn joints continues to erode the increased saturation benefit.

The remainder of the difference between 2016/17 outturn forecast and 2017/18 shrinkage proposal is attributable to the shrinkage elements: Own Use Gas and Theft of Gas. These components are calculated as a factor of consumption of which we are forecasting will be lower in 2017/18 than that forecasted for 2016/17.

The impact of any variation between the actual and assumed factors underpinning these Shrinkage Proposals will be picked up in the post year Shrinkage Assessment and Adjustment process in July 2018.

The table below demonstrates the historic breakdown of outturn performance against shrinkage proposal forecasts. For reference, the shrinkage outturn performance for 2016/17 is our latest estimated year end position. During 2016/17 we have elevated the system pressures in selected networks which has resulted in increases in fugitive emissions against those previously forecasted. This has had a beneficial impact on the end consumer, ensuring those at the extremities of the network are receiving a consistent gas supply.

Table 2. Shrinkage Proposal Accuracy

	2016/17	2015/16	2014/15	2013/14
Proposal (GWh)	1,282	1,334	1,403	1,505
Outturn (GWh)	1,323 <i>(Forecast)</i>	1,329	1,370	1,451
Difference (GWh)	41	5	33	54
Difference (%)	-3.2%	0.4%	2.4%	3.6%

The Daily Shrinkage Quantity values, shown in Table 3 below, will be used as the basis for National Grid Gas Distribution Ltd's LDZ Shrinkage gas procurement during the Formula Year in question.

Table 3. Proposed LDZ Daily Shrinkage Quantity Values for 2017/18 Formula Year

LDZ	Daily Shrinkage Quantity (kWh)
Eastern	563,964
East Midlands	623,721
North Thames	634,323
North West	894,408
West Midlands	771,510
NGGDL	3,487,926

3. Component Analysis

This section of the document presents an analysis of the components of LDZ Shrinkage that make up the estimates for the Formula Year 2017/18 proposal. Gas Distribution Networks (GDNs) have an obligation under Special Condition 1F Part E of the Licence to review the Shrinkage and Leakage Model on an annual basis and to consult on the outcome of that review with other DN Operators, gas shippers and other interested parties. The Shrinkage Quantity Proposals are calculated using the methodology contained within the Shrinkage and Leakage Model. The Shrinkage and Leakage Model Review was published on the Joint Office website on 18 November 2016.

3.1 Leakage

Leakage represents the largest component of the LDZ Shrinkage Quantity. Leakage is estimated using the agreed leakage model, which is controlled under Special Condition 1F of the GDN Licences. Under paragraph 1F.17 Distribution Networks have the obligation to annually review the leakage model to ensure that it meets the obligation, specified under paragraph 1F.13, of:

- (a) the accurate calculation and reporting of gas shrinkage and leakage from each of the LDZs operated by the licensee; and

Any proposed modifications to the leakage model would be subject to consultation with the industry, be independently assessed and submitted to Ofgem for approval.

DNs also have an obligation by 31 July each year to assess and publish the leakage volume for the previous financial year; the latest approved model is used for this assessment.

For the purpose of analysis, leakage may be split into three categories:

- Distribution Mains (including service pipes),
- Above Ground Installations (AGIs) and
- Other losses

Distribution mains and services leakage is a feature of normal system operation.

AGI leakage includes the routine venting of control equipment.

Other losses include gas lost as a result of interference damage and broken mains. These losses are caused by specific events and are not continuous.

3.1.1 Distribution Mains (and Services) Leakage

The leakage of gas from the Distribution Mains system, which includes service pipe leakage, is calculated by combining the results of the 2002/03 National Leakage Test programme with the following network¹ specific information:

- Pipe asset data²
- Annual average system pressure (ASP) in each network
- Measured concentration of Monoethylene Glycol (MEG) joint treatment chemical in the gas
- Annual metallic service replacement

Leakage is calculated by multiplying the annual average mains pressure in each network by the Main and Service Pipe Leakage Factors determined by the 2002/03 National Leakage Test programme and the relative lengths of mains / numbers of services in each network. Where applicable, i.e. cast iron mains only, the Pipe Leakage Factors are adjusted to take into account the measured concentration of MEG.

A detailed comparison of changes in low-pressure leakage from last year's proposal is included in Appendix 1.

There has been, and will continue to be, significant replacement of iron mains, in line with National Grid Gas Distribution Ltd's mains replacement policy. These proposals assume an estimated amount of mains replacement applicable for the 2017/18 leakage assessment; equating to approximately 3,794km of iron main from April 2016.

¹ Network in this context relates to physically interconnected pipe systems, not National Grid Gas Distribution Ltd.'s regionally based structure.

² Actual asset data as at 31 March 2016 adjusted for completed and planned iron replacement to 31 March 2018.

Table 4, below, shows the Low Pressure leakage on an LDZ basis:

Table 4. Estimated LDZ Low Pressure Leakage for 2017/18 Formula Year

LDZ	Low Pressure Leakage	
	Tonnes	GWh
Eastern	9,276	139
East Midlands	8,527	128
North Thames	10,917	164
North West	16,214	245
West Midlands	13,969	209
NGGDL	58,902	885

Table 5, below, shows the estimated Medium Pressure leakage on an LDZ basis:

Table 5. Estimated LDZ Medium Pressure Leakage for 2017/18 Formula Year

LDZ	Medium Pressure Leakage	
	Tonnes	GWh
Eastern	1,008	15
East Midlands	2,761	42
North Thames	1,383	21
North West	986	15
West Midlands	1,325	20
NGGDL	7,463	112

3.1.2 AGI Leakage and Venting

The figures for leakage from Above Ground Installations have been taken from the findings of the 2003 Above Ground Installation Leakage Test programme. The asset profile determined as part of the 2015/16 final assessment is deemed reflective of future years and so used for the purpose of forecasting 2017/18 estimates.

Table 6, below, shows the estimated AGI leakage and venting on an LDZ basis:

Table 6. Estimated AGI Emissions for 2017/18 Formula Year

LDZ	AGI Emissions ³	
	Tonnes	GWh
Eastern	2,537	38
East Midlands	2,589	39
North Thames	2,004	30
North West	2,987	45
West Midlands	2,533	38
NGGDL	12,649	190

³ Includes leakage and routine equipment venting

3.1.3 Other Losses

Gas may be lost from LDZ equipment as a result of specific events, namely broken mains and interference damage to plant, in addition to ongoing leakage. These losses are known collectively as 'other losses'.

To forecast the impact of this component is difficult due to the uncertain nature and the uncontrolled external influences, for the purposes of the 2017/18 estimate the quantities used are an average of those recorded in 2013/14 – 2015/16.

Table 7 below shows the amount of gas lost because of other losses on a LDZ basis, which is proposed as the estimate for 2017/18:

Table 7. Estimated 2017/18 Other Losses

LDZ	Other Losses	
	Tonnes	GWh
Eastern	42	0.6
East Midlands	66	1.0
North Thames	52	0.8
North West	68	1.0
West Midlands	47	0.7
NGGDL	274	4

3.1.4 Leakage Reduction Initiatives

We are proud of our achievements in reducing harmful emissions, in RIIO-GD1 so far, shrinkage reduction volumes of 239 GWh (16%) against opening baselines are forecasted to be achieved. All our networks are on track to surpass the emissions reduction targets prescribed by OFGEM in the Final Proposals document.

In the first five years our forecast predicts that East of England will surpass targets (16% reduction versus eight year 15% reduction target), We are also making significant progress in the other networks, with North Thames (15% against 17.5% target), North West (17% against 19.8%) and West Midlands (14% against 15.5%) all on track to surpass emission reduction targets before the end of RIIO-GD1. This reduction reflects our commitment to reducing emissions and the investment and focus placed predominantly in system pressure optimisation and our commitment to improving MEG saturations.

Leakage from low pressure gas distribution systems contributes approximately 80% of all gas distribution leakage and the major controllable influence on this is the pressure at which the systems operate. We have described in this document our customer focussed approach to optimising the networks we operate in, both with the use of unintrusive mains insertion techniques and also the elevation of system pressures to ensure customers in the extremities of the networks are receiving a consistent gas supply.

In future, we anticipate the delivery of a number of initiatives that should further reduce overall shrinkage quantities, these include:

- Upgrade of automated pressure management software which will enable improved monitoring, recording and control of system pressures.
- Field trials of Norgren head fogging nozzles in North West and West Midlands LDZs. We would expect increased effectiveness of MEG take up by gas and

therefore an increased saturation level. (Note that as the amount of lead/yarn jointed cast iron pipe reduces as a result of mains replacement the impact of MEG also reduces.)

- The correlation between leakage on medium pressure systems and system pressure was determined as part of a network innovation project in 2016/17. We are reviewing the findings with a view to proposing a modification to the leakage calculation methodology, if Stakeholders were to accept such a modification we will consider the implementation of pressure profiling equipment to MP mains, roll out might be able to commence as early as 2018/19.
- Studying the equipment we operate at our Above Ground Installations that vents routinely as part of its operation with the intention to raise a modification to the leakage calculation methodology. This would allow the benefit of replacement of non-venting equipment to be predicted, which could stimulate an investment programme, depending on whether such investment was cost justified.

3.1.5 Total Leakage

Table 8 below shows the total amount of estimated leakage for Formula Year 2017/18 on an LDZ basis with the leakage expressed in GWh.

Table 8. Estimated 2017/18 Formula Year LDZ Leakage Summary

LDZ	Leakage (GWh per annum)
Eastern	192
East Midlands	210
North Thames	215
North West	306
West Midlands	268
NGGDL	1,191

3.2 Own Use Gas

Own Use Gas is treated as a consolidated quantity, calculated as a factor of annual LDZ consumption, to be procured on a flat daily basis.

In line with this methodology, National Grid Gas Distribution Ltd proposes to apply a fixed LDZ Specific daily quantity for OUG equivalent to 0.0113% of annual LDZ consumption. This factor represents the estimated national average that was determined by Advantica in 2002.

The estimated 2017/18 Own Use Gas quantity values are shown in Table 9 below.

Table 9. Estimated 2017/18 LDZ OUG Quantity Values

LDZ	Forecast LDZ Consumption GWh/annum	OUG GWh/annum	OUG kWh/day
Eastern	42,802	5	13,251
East Midlands	56,475	6	17,484
North Thames	51,933	6	16,078
North West	65,855	7	20,388
West Midlands	44,986	5	13,927
NGGDL	262,050	30	81,128

3.3 Theft of Gas

UNC Section N 1.3.2 states that LDZ Shrinkage shall include, and National Grid Gas Distribution Ltd is therefore responsible for, gas illegally taken upstream of the customer control valve and downstream where there is no shipper contract with the end-user.

As with Own Use Gas, Theft of Gas is treated as a consolidated quantity calculated as a factor of annual LDZ consumption to be procured on a flat daily basis.

The responsibility for Theft of Gas is split between Gas Transporters and Shippers. Transporter Responsible Theft has been deemed 0.02% of LDZ Consumption. Table 10 below shows the estimated 2017/18 Theft of Gas Quantity Values:

Table 10. Estimated 2017/18 LDZ Theft of Gas Quantity Values

LDZ	Forecast LDZ Consumption GWh/annum	ToG GWh/annum	ToG kWh/day
Eastern	42,802	9	23,453
East Midlands	56,475	11	30,945
North Thames	51,933	10	28,456
North West	65,855	13	36,085
West Midlands	44,986	9	24,650
NGGDL	262,050	52	143,589

3.4 LDZ Shrinkage Quantity Summary

Table 11 below shows the proposed LDZ Shrinkage Quantity Values for the Formula Year 2017/18 in GWh per annum:

Table 11. Estimated 2017/18 LDZ Shrinkage Quantity Values

LDZ	Leakage (GWh)	OUG (GWh)	Theft (GWh)	Total (GWh)
Eastern	192	5	9	206
East Midlands	210	6	11	228
North Thames	215	6	10	232
North West	306	7	13	326
West Midlands	268	5	9	282
NGGDL	1,191	30	52	1,273

Table 12 below shows the estimated Daily Shrinkage Quantity values applicable for the 2017/18 Formula Year in kWh per day:

Table 12. Estimated 2017/18 LDZ Daily Shrinkage Quantity Values

LDZ	Total (kWh)
Eastern	563,964
East Midlands	623,721
North Thames	634,323
North West	894,408
West Midlands	771,510
NGGDL	3,487,926

4. Extent to which the Proposal would better facilitate the relevant objectives

This proposal provides a robust estimate of LDZ Shrinkage Quantity values for the Formula Year 2017/18. As a result, the gas usage and loss in transportation within the LDZs will be reflective of actual conditions. This in turn facilitates the achievement of efficient and economic operation of the system, as National Grid Gas Distribution Ltd will be incentivised to identify opportunities to reduce Shrinkage in future years. It will also lead to better targeting of costs to Users through the RbD process and this is consistent with securing effective competition.

5. The implications for National Grid Gas Distribution Ltd of implementing the Proposal

a) Implications for the operation of the System:

We are not aware of any implications for system operation resulting from implementation of this proposal.

b) Development and capital cost and operating cost implications:

The proposed LDZ Shrinkage Quantity values lead to a fair allocation of operating costs between LDZ systems.

c) Extent to which it is appropriate for National Grid Gas Distribution Ltd to recover the costs, and proposal for the most appropriate way for National Grid Gas Distribution Ltd to recover the costs:

It is appropriate for each LDZ to incur a share of the overall Shrinkage Energy dependent upon the actual shrinkage in that LDZ.

d) Analysis of the consequences (if any) this proposal would have on price regulation

The proposal is consistent with the establishment and operation of Distribution Network specific transportation charging formula.

6. The implications of implementing the Proposal for Users

This proposal improves the equability and accuracy of cost targeting across all Users.

7. Analysis of any advantages or disadvantages of implementation of the Proposal

- **Advantages:** Good representation of the actual system usage and losses leading to improved cost targeting.
- **Disadvantages:** National Grid Gas Distribution Ltd is not aware of any disadvantages.

This paper outlines our Initial Proposals. We appreciate hearing the views of Ofgem and Users; these views will help inform our Final Proposals, which are due to be published on 1 March 2017. Responses to this document are encouraged and should be received no later than 1 February 2017. Communication should be directed to Matt Marshall or via the Joint Office (contact details below).

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8. Programme of works required as a consequence of implementing the Proposal

The only required modification is the input of LDZ Daily Shrinkage Quantity values into GEMINI.

9. Proposed implementation timetable (inc timetable for any necessary information system changes)

Following publication of our Final Proposals, Users will have until 15 March 2017 to request that Ofgem issue a Standard Special Condition A11 (18) disapproval of this proposal; this provision is in the Uniform Network Code Section N 3.1.8.

If no disapproval notice is issued beforehand, it will be our intention to implement revised LDZ Daily Shrinkage Quantity values from 05:00 hrs on 1 April 2017.

10. Recommendation concerning the implementation of the Proposal

We recommend the proposed LDZ Daily Shrinkage Quantity values be implemented with effect from 05:00 hrs on 1 April 2017.

11. National Grid Gas Distribution Ltd's Proposal

This report contains our Initial Proposals for the LDZ Daily Shrinkage Quantity values for the Formula Year 2017/18.

Appendix 1: LP Leakage Analysis 2016 to 2017 proposals by LDZ

This section of the document provides a comparison of the estimated levels of LP pipe and service leakage by LDZ; LP Leakage accounts for approximately 80% of total leakage.

Details of leakage in energy quantity, annual Average System Pressures (ASP) and Monoethylene Glycol (MEG) levels are presented for 2017/18 with 2016/17 estimates for comparison purposes. The levels quoted are only those attributable to low pressure mains and service leakage; MEG Levels relate to the length weighted average saturation in low pressure networks where MEG is used. The metallic mains lengths quoted are latest estimations of mains replacement quantities at time of publication and are subject to change.

We have supplied specific information relating to the average pressure experienced by networks that contain metallic pipes, which excludes the all-PE networks that often operate at higher pressures but have very low leakage because of their superior performance. This should enable Users to better compare the effective operating pressures of the different LDZs.

A1.1 Eastern LDZ

Table A1.1 Eastern LDZ

	2016 Proposal	2016 Latest Outturn Forecast	2017 Proposal
LP Leakage (GWh)	132	144	139
Annual Average System Pressure (mbar)	28.8	30.0	30.0
ASP (All-PE systems excluded) (mbar)	27.3	28.3	28.3
MEG Saturation Level	0%	35%	40%

In comparison to last year's anticipated leakage performance, there is an anticipated increase of 0.2mbar in overall ASP for Eastern LDZ and a 1.0mbar increase in ASP for mixed material networks. Our latest estimate of 2016/17 LP replacement is 273km, and we expect to replace a further 282km of metallic main in 2017/18. We expect to achieve a 40% MEG saturation in East Anglia, treating 1.2km of metallic pipe. The combination of mains replacement, average system pressure and MEG treatment is expected to deliver a comparative leakage reduction of 5GWh in 2017/18 against 2016/17 expected performance.

A1.2 East Midlands LDZ

Table A1.2 East Midlands LDZ

	2016 Proposal	2016 Latest Outturn Forecast	2017 Proposal
LP Leakage (GWh)	135	138	128
Annual Average System Pressure (mbar)	28.7	29.9	29.9
ASP (All-PE systems excluded) (mbar)	27.1	28.4	28.3
MEG Saturation Level	34%	29%	39%

In comparison to last years anticipated leakage performance, there is an anticipated increase of 1.2mbar in overall ASP for East Midlands LDZ and a 1.2mbar increase in ASP for mixed material networks. Our latest estimate of 2016/17 LP replacement is 362km, and we expect to replace a further 374km of metallic main in 2017/18. We expect to achieve a MEG saturation of 39% in East Midlands, treating 149km of metallic pipe. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 10GWh in 2017/18 against 2016/17 expected performance.

A1.3 North Thames LDZ

Table A1.3 North Thames LDZ

	2016 Proposal	2016 Latest Outturn Forecast	2017 Proposal
LP Leakage (GWh)	168	175	164
Annual Average System Pressure (mbar)	25.3	26.1	26.1
ASP (All-PE systems excluded) (mbar)	25.3	26.1	26.1
MEG Saturation Level	25%	20%	35%

In comparison to last years anticipated leakage performance, there is an anticipated increase of 0.8mbar in ASP for North Thames LDZ and a 0.8mbar increase in ASP for mixed material networks. Our latest estimate of 2016/17 LP replacement is 376km, and we expect to replace a further 404km of metallic main in 2017/18. We expect to achieve a MEG saturation of 35% in North Thames, treating 205km of metallic pipe. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 11GWh in 2017/18 against 2016/17 expected performance.

A1.4 North West LDZ

Table A1.4 North West LDZ

	2016 Proposal	2016 Latest Outturn Forecast	2017 Proposal
LP Leakage (GWh)	250	258	245
Annual Average System Pressure (mbar)	27.2	27.8	27.8
ASP (All-PE systems excluded) (mbar)	26.8	27.5	27.5
MEG Saturation Level	44%	35%	43%

In comparison to last years anticipated leakage performance, there is an anticipated increase of 0.6mbar in overall ASP for North West LDZ and a 0.7mbar increase in ASP for mixed material networks. Our latest estimate of 2016/17 LP replacement is 474km, and we expect to replace a further 502km of metallic main in 2017/18. We expect to achieve a MEG saturation of 43% in North West, treating 282km of metallic pipe. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 13GWh in 2017/18 against 2016/17 expected performance.

A1.5 West Midlands LDZ

Table A1.5 West Midlands LDZ

	2016 Proposal	2016 Latest Outturn Forecast	2017 Proposal
LP Leakage (GWh)	208	218	209
Annual Average System Pressure (mbar)	26.4	27.2	27.2
ASP (All-PE systems excluded) (mbar)	26.0	26.8	26.8
MEG Saturation Level	38%	39%	44%

In comparison to last years anticipated leakage performance, there is an anticipated increase of 0.8mbar in overall ASP for West Midlands LDZ and a 0.8mbar increase in ASP for mixed material networks. Our latest estimate of 2016/17 LP replacement is 392km, and we expect to replace a further 356km of metallic main in 2017/18. We expect to achieve a MEG saturation of 44% in West Midlands, treating 582km of metallic pipe. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 9GWh in 2017/18 against 2016/17 expected performance.

Appendix 2: Assumed Daily Weighted Average Calorific Values (CVs)

The table below shows the Calorific Values applied for these proposals; however, the actual daily average CV values over the period will be used for the assessment of the 2017/18 Formula Year:

Table A2.1 Assumed Calorific Values

LDZ	Average Calorific Values (MJ/m³)
Eastern	39.32
East Midlands	39.58
North Thames	39.41
North West	39.68
West Midlands	39.33

The Calorific Value assumptions are used to calculate expected energy loss as part of the shrinkage calculation and specifically used to convert forecast outputs into GWh volumes. We use the latest annual time weighted average view of Calorific Values which are deemed reflective for the purpose of the shrinkage proposal.