

**LDZ Shrinkage Quantity
Initial Proposals
Formula Year 2016/17**

National Grid LDZ Shrinkage Quantity Initial Proposals - Formula Year 2016/17

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National Grid LDZ Shrinkage Quantity Initial Proposal for Formula Year 2016/17

1. Purpose of Proposal

The purpose of this paper is to present our proposals in respect of National Grid LDZ Shrinkage for the Formula Year 2016/17, as required under Section N of the Uniform Network Code.

Under Section N of the Uniform Network Code, National Grid 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 2016, in which National Grid 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 2016. Responses to this document are encouraged and should be received no later than 1 February 2016. 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 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 2016/17 LDZ Shrinkage Quantities

LDZ	Shrinkage Proposal 2015/16 (GWh)	2015/16 Formula Year Outturn Forecast (GWh)	Proposed Shrinkage Quantities 2016/17 (GWh)
Eastern	204	205	198
East Midlands	247	241	234
North Thames	242	244	236
North West	345	345	333
West Midlands	295	292	282
National Grid	1,334	1,326	1,282

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 44GWh in estimated shrinkage compared to that estimated for the current year end. The main contributing factor to the leakage reduction, approximately 43GWh, is associated with the forecast mains replacement activities in 2016/17.

The system pressures we operate at are reaching optimal performance levels, for the 2016/17 shrinkage proposal we are forecasting system pressures to be those used in the 2015/16 forecast. To maintain current system pressures in future years will become more challenging as both internal pipe remediation and mains insertion techniques become the method of choice for all mains replacement activity and so reduce system capacity.

We continue to focus on improving saturations of monoethylene-glycol (MEG) within our low pressure network. Our shrinkage proposal for 2016/17 is calculated using a 35% saturation level which is 8.5% higher than that used within the 2015/16 proposal and would return an additional 1GWh leakage reduction. The saturations used for the proposals are those used to form our latest projection of 2015/16 outturn and reflect our latest year end forecast. We believe these figures to be reflective of achievable 2016/17 performance levels. 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 2015/16 outturn forecast and 2016/17 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 2016/17 than that forecasted for 2015/16.

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 2016.

The table below demonstrates the historic breakdown of outturn performance against shrinkage proposal forecasts. For reference, the shrinkage outturn performance for 2015/16 is our latest estimated year end position.

Table 2. Shrinkage Proposal Accuracy

	2015/16	2014/15	2013/14	2012/13	2011/12	2010/11	2009/10	2008/09
Proposal (GWh)	1334	1,403	1,505	1,625	1,692	1,734	1,824	1,951
Outturn (GWh)	1326 <i>(Forecast)</i>	1,370	1,451	1,600	1,619	1,756	1,812	1,911
Difference (GWh)	8	33	54	25	74	-22	13	39
Difference (%)	0.6%	2.4%	3.6%	1.5%	4.4%	-1.3%	0.7%	2.0%

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

Table 3. Proposed LDZ Daily Shrinkage Quantity Values for 2016/17 Formula Year

LDZ	Daily Shrinkage Quantity (kWh)
Eastern	543,028
East Midlands	640,896
North Thames	645,773
North West	912,004
West Midlands	771,107
National Grid	3,512,808

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 2016/17 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 13 November 2015.

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's mains replacement policy. These proposals assume an estimated amount of mains replacement applicable for the 2016/17 leakage assessment; equating to approximately 3,990km of iron main from April 2015.

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

Table 4. Estimated LDZ Low Pressure Leakage for 2016/17 Formula Year

LDZ	Low Pressure Leakage	
	Tonnes	GWh
Eastern	8,880	132
East Midlands	8,983	135
North Thames	11,192	168
North West	16,584	250
West Midlands	13,908	208
National Grid	59,546	893

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

² Actual asset data as at 31 March 2015 adjusted for completed and planned iron replacement to 31 March 2017.

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

Table 5. Estimated LDZ Medium Pressure Leakage for 2016/17 Formula Year

LDZ	Medium Pressure Leakage	
	Tonnes	GWh
Eastern	1,043	15
East Midlands	2,807	42
North Thames	1,419	21
North West	1,032	16
West Midlands	1,403	21
National Grid	7,704	116

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 2014/15 final assessment is deemed reflective of future years and so used for the purpose of forecasting 2016/17 estimates.

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

Table 6. Estimated AGI Emissions for 2016/17 Formula Year

LDZ	AGI Emissions ³	
	Tonnes	GWh
Eastern	2,512	37
East Midlands	2,556	38
North Thames	2,003	30
North West	2,982	45
West Midlands	2,531	38
National Grid	12,584	189

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'.

For the purpose of the 2016/17 estimate the quantities used are reflective of those determined in the 2014/15 final assessment.

Table 7 below shows the amount of gas lost because of other losses on a LDZ basis, which is proposed as the estimate for 2016/17:

³ Includes leakage and routine equipment venting

Table 7. Estimated 2016/17 Other Losses

LDZ	Other Losses	
	Tonnes	GWh
Eastern	42	0.6
East Midlands	66	1.0
North Thames	35	0.5
North West	65	1.0
West Midlands	42	0.6
National Grid	250	3.7

3.1.4 Leakage Reduction Initiatives

Natural Gas is composed primarily of Methane, which as a Greenhouse Gas is twenty-one times worse than carbon dioxide. National Grid has a climate change strategy that targets an 80% reduction in greenhouse gas emissions by 2050.

There are a number of initiatives being employed across the Company to achieve this aim, one of which has had a direct impact on the leakage from low pressure gas distribution systems. 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. Replacing old metallic pipe with plastic pipe will help reduce emissions; however, in order to achieve this in the most economic way, mains insertion techniques are used where possible and the impact of this is to drive operating pressures upwards. National Grid are also investigating the use of low impact pipe lining robotic equipment, which if deployed widely, would also reduce infrastructure capacity and so require an increase in operating pressures. National Grid embarked upon a programme of installing pressure profiling equipment, with the aim of lowering average system operating pressures. In addition to installing additional pressure management equipment, National Grid has also upgraded its pressure control management system, which will enable improved monitoring, recording and reporting of system pressures.

Historically average System Pressures (ASP) from year-to-year had typically been in the order of 30mbarg. However, with the increased focus on pressure management, the installation of profiling equipment and system upgrade there has been a significant reduction in average system pressure in National Grid's mixed material networks. The calculated ASP in 2008/09 was 29.9mbarg and the forecast ASP for 2016/17, and that used for these proposals, is 27.7mbarg. This represents a 7.5% reduction in ASP resulting in a significant reduction in leakage, applying the 2008/09 ASP to the 2016/17 predicted mains asset profile would result in an additional 70GWh in leakage.

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

- Collaboration with "The Technology Partnership" in Cambridge to trial an innovative diaphragm device that produces a fine mist of MEG. This increases the effectiveness of MEG take up by gas and therefore the achieved saturation level. Next year will see the installation of fogging units at 4 sites to trial the effectiveness outside of the laboratory. If successful, this innovation could be implemented in future years to around 350 sites and could see MEG saturation increase. (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.)
- Undertaking a network innovation project to investigate the correlation between pressure and leakage on medium pressure systems. If such a correlation is established, to the extent that Stakeholders accept modification of the Shrinkage model, we will consider the implementation of pressure profiling equipment to MP mains. Roll out might be able to commence as early as 2017/18.

- Studying the equipment we operate at our Above Ground Installations that vents routinely as part of its operation. This would allow the benefit replacement by 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 2016/17 on an LDZ basis with the leakage expressed in GWh.

Table 8. Estimated 2016/17 Formula Year LDZ Leakage Summary

LDZ	Leakage (GWh per annum)
Eastern	185
East Midlands	217
North Thames	219
North West	312
West Midlands	268
National Grid	1,201

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 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 2016/17 Own Use Gas quantity values are shown in Table 9 below.

Table 9. Estimated 2016/17 LDZ OUG Quantity Values

LDZ	Forecast LDZ Consumption GWh/annum	OUG GWh/annum	OUG kWh/day
Eastern	42,171	5	13,056
East Midlands	54,549	6	16,888
North Thames	51,933	6	16,078
North West	66,818	8	20,686
West Midlands	43,603	5	13,499
National Grid	259,074	29	80,207

3.3 Theft of Gas

UNC Section N 1.3.2 states that LDZ Shrinkage shall include, and National Grid 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 2016/17 Theft of Gas Quantity Values:

Table 10. Estimated 2016/17 LDZ Theft of Gas Quantity Values

LDZ	Forecast LDZ Consumption GWh/annum	ToG GWh/annum	ToG kWh/day
Eastern	42,171	8	23,107
East Midlands	54,549	11	29,890
North Thames	51,933	10	28,456
North West	66,818	13	36,613
West Midlands	43,603	9	23,892
National Grid	259,074	52	141,959

3.4 LDZ Shrinkage Quantity Summary

Table 11 below shows the proposed LDZ Shrinkage Quantity Values for the Formula Year 2016/17 in GWh per annum:

Table 11. Estimated 2016/17 LDZ Shrinkage Quantity Values

LDZ	Leakage (GWh)	OUG (GWh)	Theft (GWh)	Total (GWh)
Eastern	185	5	8	198
East Midlands	217	6	11	234
North Thames	219	6	10	236
North West	312	8	13	333
West Midlands	268	5	9	281
National Grid	1201	29	52	1282

Table 12 below shows the estimated Daily Shrinkage Quantity values applicable for the 2016/17 Formula Year in kWh per day:

Table 12. Estimated 2016/17 LDZ Daily Shrinkage Quantity Values

LDZ	Total (kWh)
Eastern	543,028
East Midlands	640,896
North Thames	645,773
North West	912,004
West Midlands	771,107
National Grid	3,512,808

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 2016/17. 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 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 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 to recover the costs, and proposal for the most appropriate way for National Grid 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 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 2016. Responses to this document are encouraged and should be received no later than 1 February 2016. 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 2016 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 06:00 hrs on 1 April 2016.

10. Recommendation concerning the implementation of the Proposal

We recommend the proposed LDZ Daily Shrinkage Quantity values be implemented with effect from 06:00 hrs on 1 April 2016.

11. National Grid's Proposal

This report contains our Initial Proposals for the LDZ Daily Shrinkage Quantity values for the Formula Year 2016/17.

Appendix 1: LP Leakage Analysis 2015 to 2016 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 2016/17 with 2015/16 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

	2015 Proposal	2015 Latest Outturn Forecast	2016 Proposal
Leakage (GWh)	138	138	132
Annual Average System Pressure (mbar)	29.2	28.8	28.8
ASP (All-PE systems excluded) (mbar)	27.5	27.3	27.3
MEG Saturation Level	0%	0%	0%

In comparison to last year's anticipated leakage performance, there is an anticipated decrease of 0.4mbar in overall ASP for Eastern LDZ and a 0.2mbar decrease in ASP for mixed material networks. Our latest estimate of 2015/16 LP replacement is 333km, and we expect to replace a further 311km of metallic main in 2016/17. The combination of mains replacement and average system pressure is expected to deliver a comparative leakage reduction of 6.5GWh in 2016/17.

A1.2 East Midlands LDZ

Table A1.2 East Midlands LDZ

	2015 Proposal	2015 Latest Outturn Forecast	2016 Proposal
Leakage (GWh)	150	142	135
Annual Average System Pressure (mbar)	29.9	28.6	28.7
ASP (All-PE systems excluded) (mbar)	28.3	27.1	27.1
MEG Saturation Level	24%	34%	34%

In comparison to last years anticipated leakage performance, there is an anticipated decrease of 0.2mbar in overall ASP for East Midlands LDZ, a 0.8mbar decrease in ASP for mixed material networks and 10% increase in MEG Saturations. Our latest estimate of 2015/16 LP replacement is 323km, and we expect to replace a further 304km of metallic main in 2016/17. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 15GWh in 2016/17.

A1.3 North Thames LDZ

Table A1.3 North Thames LDZ

	2015 Proposal	2015 Latest Outturn Forecast	2016 Proposal
Leakage (GWh)	174	175	168
Annual Average System Pressure (mbar)	25.0	25.3	25.3
ASP (All-PE systems excluded) (mbar)	25.0	25.3	25.3
MEG Saturation Level	17%	25%	25%

In comparison to last years anticipated leakage performance, there is an anticipated increase of 0.3mbar in ASP for North Thames LDZ, 0.3mbar increase in ASP for mixed material networks and 8% increase in MEG Saturations. Our latest estimate of 2015/16 LP replacement is 374km, and we expect to replace a further 360km of metallic main in 2016/17. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 6GWh in 2016/17.

A1.4 North West LDZ

Table A1.4 North West LDZ

	2015 Proposal	2015 Latest Outturn Forecast	2016 Proposal
Leakage (GWh)	263	262	250
Annual Average System Pressure (mbar)	27.8	27.2	27.2
ASP (All-PE systems excluded) (mbar)	27.4	26.8	26.8
MEG Saturation Level	35%	44%	44%

In comparison to last years anticipated leakage performance, there is an anticipated decrease of 0.6mbar in overall ASP for North West LDZ and a 0.6mbar decrease in ASP for mixed material networks along with an estimated 9% increase in MEG saturation. Our latest estimate of 2015/16 LP replacement is 566km, and we expect to replace a further 480km of metallic main in 2016/17. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 13GWh in 2016/17.

A1.5 West Midlands LDZ

Table A1.5 West Midlands LDZ

	2015 Proposal	2015 Latest Outturn Forecast	2016 Proposal
Leakage (GWh)	221	218	208
Annual Average System Pressure (mbar)	26.6	26.4	26.4
ASP (All-PE systems excluded) (mbar)	26.0	26.0	26.0
MEG Saturation Level	28%	37%	38%

In comparison to last years anticipated leakage performance, there is an anticipated decrease of 0.2mbar in overall ASP for West Midlands LDZ along with an anticipated 10% increase in MEG saturation. Our latest estimate of 2015/16 LP replacement is 498km, and we expect to replace a further 440km of metallic main in 2016/17. The combination of mains replacement, average system pressure, and MEG treatment is expected to deliver a comparative leakage reduction of 13GWh in 2016/17.

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 2016/17 Formula Year:

Table A2.1 Assumed Calorific Values

LDZ	Average Calorific Values (MJ/m³)
Eastern	38.97
East Midlands	39.54
North Thames	39.37
North West	39.68
West Midlands	39.36

The Calorific Value assumptions are used to calculate expected energy loss as part of the shrinkage calculation and specifically used to convert 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.