LDZ Shrinkage Factors
Initial Proposals
Gas Year 2006/07

National Grid
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Contents

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1. Purpose of Proposal

The purpose of this paper is to present our proposals in respect of the National Grid LDZ Shrinkage Factors for the Gas Year 2006/07 as required under Section N of the Uniform Network Code.

In Section N of the Uniform Network Code, National Grid has an obligation to set LDZ Shrinkage Factors to provide for the gas that is used by National Grid LDZs or lost from its LDZ systems.

Following representations from Users, a further paper will be issued, by 1st September 2006, in which National Grid will set out its final estimate of its LDZ Shrinkage Factors.

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

2. Summary of Proposal

The LDZ Shrinkage Factors, which are set out within the table below, reflect the losses associated with leakage, theft of gas and gas used in the operation of the system. Details of how these factors have been determined are included in this paper. The structure of the paper follows the format of a Network Code Modification report.

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

The Shrinkage Factors, in the table below, will be used as the basis for National Grid's LDZ shrinkage gas procurement during the Gas Year in question.

LDZ	Existing Shrinkage Factors 2005/06[1]	Proposed Shrinkage Factor 2006/07[2]
Eastern	0.60%	0.593%
East Midlands	0.54%	0.519%
North Thames	0.62%	0.622%
North West	0.62%	0.656%
West Midlands	0.76%	0.729%
Flow Weighted Average	**0.62%**	**0.621%**

[1] The factors shown in the table are as a percentage of LDZ consumption, i.e. 0.60% (as shown in the table) is 0.60% of the appropriate LDZ's consumption.

[2] We propose to use three decimal places in respect of Gas Year 2006/07 Shrinkage Factors because the additional place enhances accuracy and is supported by GEMINI.

3. Component Analysis

This section of the document presents an analysis of the components of LDZ shrinkage that make up the estimates for the Gas Year 2006/07 proposal.

3.1 Leakage

Leakage represents the largest component of the LDZ Shrinkage Factor.

For the purpose of analysis, leakage may be conveniently 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. (Routine equipment venting at AGI installations could be said to be Own Use Gas, however for the purpose of this proposal it is included in the AGI leakage category.)

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 Testing programme with the following network[3] specific information:

- Pipe asset data[4]
- Annual average system pressure in each network
- Measured concentration of Monoethylene Glycol (MEG) joint treatment chemical in the gas.

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.

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

[4] Actual asset data @ 31/03/06 adjusted for completed and planned iron replacement @ 31/03/07 thus giving a mid gas year indication.

Information relating to the National Leakage Test programme, the application of the results to calculate leakage and the external validation of the results has already been shared with Users and Ofgem; consequently it is not proposed to include additional details in this paper.

The table below shows the Low Pressure leakage on an LDZ basis.

LDZ	Low Pressure Leakage	
	Tonnes[5]	GWh
Eastern	14,602	218
East Midlands	19,503	293
North Thames	20,957	313
North West	29,726	446
West Midlands	22,071	330
Total	**106,859**	**1,600**

The table below shows the Medium Pressure leakage on an LDZ basis.

LDZ	Medium Pressure Leakage	
	Tonnes	GWh
Eastern	1,352	20
East Midlands	2,992	45
North Thames	2,036	30
North West	1,672	25
West Midlands	1,928	29
Total	**9,979**	**149**

3.1.2 AGI Leakage

The figures for leakage from Above Ground Installations have been taken from the findings of the 2003 Above Ground Installation Leakage Test programme.

Information relating to the programme has already been shared with Users and Ofgem; consequently, it is not proposed to include significant detail in this paper.

[5] The tonnes figure is provided for information (it has no purpose in respect of calculating the Shrinkage Factors). The conversion to tonnes is based on a gas density of 0.73kg/m^3.

The table below shows AGI leakage on an LDZ basis.

LDZ	AGI Emissions[6]	
	Tonnes	GWh
Eastern	2,866	43
East Midlands	2,562	38
North Thames	2,569	38
North West	3,487	52
West Midlands	2,855	43
Total	**14,338**	**215**

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'.

Statistics in respect of the number of routine broken mains and damages are used in conjunction with calculations of the amount of gas lost through each type of incident to derive the total amount of gas lost as a result of these events. (For the purpose of this paper the number of events in 2005 has been used for the analysis together with emergency personnel response times.)

In addition to the routine events in 2005 there were 44 gas release events where the total gas released was greater than 500kg. For these the actual volume released was used. In total for National Grid the energy lost as a result of these events was 0.67 GWh.

The table below shows the amount of gas lost because of other losses on a LDZ basis.

LDZ	Interference Damage	
	Tonnes	GWh
Eastern	61.8	0.9
East Midlands	124.7	1.9
North Thames	66.9	1.0
North West	137.3	2.1
West Midlands	78.5	1.2
Total	**469.4**	**7.0**

[6] Includes leakage and routine equipment venting

3.1.4 Total Leakage

The table below shows the total amount of predicted leakage for Gas Year 2006/07 on an LDZ basis with the leakage expressed in tonnes, GWh and as a percentage of LDZ consumption.

LDZ	Leakage		
	Tonnes	GWh	Leakage % Consumption
Eastern	18,881	282	0.561%
East Midlands	25,192	378	0.487%
North Thames	25,630	383	0.590%
North West	35,022	525	0.624%
West Midlands	26,932	403	0.697%

3.2 Own Use Gas

We intend to apply the more accurate Own Use Gas model that has been developed by Advantica in respect of these proposals.

The reason why the Advantica model is better than the model that has been used previously is that it makes extensive use of real flow, pressure and temperature data whereas the older model makes much more use of assumed values.

In spite of the Advantica model producing Own Use Gas factors that are lower than the model previously applied there is evidence that it still overstates the amount of Own Use Gas.

The reason for this is that a heater efficiency of 50% is assumed in the model whereas there is evidence that the true level of efficiency is greater than this; and therefore the amount of gas actually used is correspondingly less.

Our waterbath heaters have been measured to have efficiencies in the range 53-69%, and 17% of our heating plant (by capacity) is made up of modular boilers, which are more efficient than waterbath heaters.

The Own Use Gas Factors calculated by the Advantica model in respect of our LDZs have been given in the table below.

LDZ	OUG Factor
Eastern	0.0261%
East Midlands	0.0073%
North Thames	0.0028%
North West	0.0173%
West Midlands	0.0076%

National Grid proposes to apply a flow weighted OUG factor for its LDZ's of 0.012%.

3.3 Theft of Gas

The Uniform Network Code 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.

Historically, unidentified theft has been assumed to be 0.3% of LDZ Consumption.

The responsibility for Theft of Gas is split between Gas Transporters and Shippers.

The statistics for confirmed Theft of Gas for 2005 are detailed in the table below.

	2005	
	Total	**Transporter Responsible**
Reported incidents of Theft	916	28

The statistics for 2005 indicate that, of the cases of confirmed theft made known to National Grid, 3.1% was identified as being the responsibility of the Transporter.

However, we do not propose at this time to recommend a change to last year's agreement; consequently, we believe that it is appropriate for National Grid to assume responsibility for Theft of Gas equal to 0.02% of LDZ Consumption.

3.4 LDZ Shrinkage Factor Summary

The proposed LDZ Shrinkage Factors for the Gas Year 2006/07 are presented in the table below[7].

LDZ	Leakage %	Own Use Gas %	Theft of Gas %	Proposed Shrinkage Factor 2006/07 %
Eastern	0.561	0.012	0.02	0.593
East Midlands	0.487	0.012	0.02	0.519
North Thames	0.590	0.012	0.02	0.622
North West	0.624	0.012	0.02	0.656
West Midlands	0.697	0.012	0.02	0.729

[7] All factors are expressed as percentages of LDZ consumption.

4. Detailed Analysis

4.1 Leakage

In May 2003, Advantica – on behalf of National Grid – completed an extensive programme of Leakage Tests.

These tests were undertaken at the request of Users.

Before commencing the testing programme, Users were invited to help National Grid scope the project. Subsequently Users were updated in respect of progress and had the opportunity to witness one of the tests.

Altogether 849 sets of test results were obtained. The full test results were presented to Users on the 10th of June 2003. Users have subsequently received a report, written by Advantica, detailing the programme and its findings.

To ensure that the testing programme was effective, Stone and Websters (a firm of consulting engineers) were asked to investigate the planned methodology. They found that both the proposed testing process and the equipment were fit for purpose. A copy of their report has been circulated.

In addition, Dr Shirley Coleman from the Industrial Statistics Research Unit of Newcastle University was invited to comment upon and discuss with Users the proposed sample plan. It was concluded that the proposed sample was likely to produce the results that were required.

To ensure that the tests were conducted properly, Haswells (a firm of consulting engineers) were invited to observe the training given to test teams and to carry out random audits of the tests as they occurred. Altogether, Haswells audited 77 tests finding that high professional standards were maintained throughout the programme. Haswells produced interim and final reports that have been passed to Users. In addition, Users were given the opportunity to question Haswells during a meeting.

All the data produced by the tests was sent to Dr Coleman for independent analysis. Dr Coleman presented her findings to the Users on the 10th of June 2003 and provided them with copies of her report.

Further detail relating to the testing programme and the results that it produced may be found in the Advantica report that has been circulated to Ofgem and Users.

In addition to testing distribution mains, we have also tested our above ground LDZ assets.

The AGI testing programme was introduced during the March 2003 Shrinkage Forum. Subsequently Users had the opportunity to question Dr Peter Russell - who led the work - and to visit a test in progress. To ensure the integrity of the

testing programme Nottingham University (Environment Science Department) examined the testing procedure and Dr Coleman commented upon the results prior to their being used in the Final Proposals in respect of the 2003/04 Gas Year.

We believe that the recent test programmes provide a firm basis for assessing the leakage from both the distribution mains and AGIs; consequently, National Grid has utilised the information as the basis for these proposals.

The results of the leakage testing programmes have been used in conjunction with our mains and other plant records, measurements of MEG concentration and system pressures to derive total leakage by LDZ.

In the twelve months since we published our proposals for the 2005/06 Gas Year, we have seen the replacement of around 1,800km with a plan to replace an additional 1820km by 31/03/07 of metallic gas mains and associated metal gas services and seen a decrease in low pressure metallic mains pressures of 0.43mbar.

The net effect of these significant initiatives has been to reduce the amount of leakage that has been occurring.

Set against these positive steps (from a leakage reduction perspective) a reduction in measured MEG concentration[8] has been recorded. This has tended to increase leakage slightly.

4.2 Own Use Gas

We have presented details of the method whereby Own Use Gas is calculated. The 2006/07 proposals utilise this methodology. In the past, a flow weighted OUG factor has been determined and applied to each LDZ, and we propose that this methodology should remain unchanged.

4.3 Theft of Gas

It was agreed last year that a ToG factor of 0.02% should be used and as no credible information has become available to dispute this we will retain this for ToG.

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

This proposal provides an accurate estimate of LDZ Shrinkage Factors for the Gas Year 2006/07. As a result, the gas usage and loss in transportation within

[8] It should be expected that MEG concentration would reduce year on year as gas treatment becomes less economic because the length of cast iron main to treat reduces as it is replaced by PE mains.

the LDZs will be reflective of actual conditions. This in turn facilitates the achievement of efficient and economic operation of the system through effective targeting of costs.

It will also lead to better targeting of costs to Users through the RbD process and this is consistent with securing effective competition.

6. The implications for National Grid of implementing the Proposal

a) Implications for the operation of the System:
We are not aware of any such implications that would result from implementing this proposal.

b) Development and capital cost and operating cost implications:
The proposed LDZ Shrinkage Factors (which do not include Pressure and Temperature correction) 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 introduction of LDZ Specific Own use gas factors should enhance comparative regulation by increasing cost reflectivity

7. The implications of implementing the Proposal for Users

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

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

- **Advantages:** Better reflective of the actual system usage and losses with improved cost targeting.
- **Disadvantages:** National Grid is not aware of any disadvantages.

9. Summary of the representations (to the extent that the import of those representations are not reflected elsewhere in the Proposal)

This paper outlines our initial proposals. We appreciate hearing the views of Ofgem and Users; these views will help inform our final proposals (that are due to be published on the 1st of September.)

Users wishing to discuss any matter can do so in private or at the proposed Shrinkage Forum in July.

It would be appreciated if Users could let us have any feed-back that they would like to share with us before the 1st of August as in that way we will be able to better respond to any concerns.

Note: Due to the pressure of time it will be difficult to respond to any points that might be raised during August because the Uniform Network Code requires National Grid to publish its proposals on the 1st of September.

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

The only required modification is to the LDZ Shrinkage Factor values entered into the UK LINK.

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

Following publication of our final proposals, Users have until the 15th of September 2006 to request that Ofgem issue a Condition 7(4) 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 Shrinkage Factors from 06:00 hrs on the 1st of October 2006.

12. Recommendation concerning the implementation of the Proposal

We recommend the proposed LDZ Shrinkage Factors be implemented with effect from 06:00 hrs on the 1st October 2006.

13. National Grid's Proposal

This report contains our initial proposal for the LDZ Shrinkage Factors for the Gas Year 2006/07.

Appendix 1. LP Pipe and Service Leakage Analysis 2005 to 2006 proposals by LDZ

This section of the document provides a comparison of the assessed levels of LP pipe and service leakage by LDZ. Users have requested more detail with regard to leakage assessment to be presented within National Grid LDZ Shrinkage Factor proposals.

Details of leakage quantities in energy quantities, annual average system pressures (ASP) and Monoethylene Glycol (MEG) levels are presented for 2006 with 2005 for comparison purposes. The levels quoted are only those attributable to low pressure mains and service leakage.

For the first time we have supplied specific information relating to the average pressure that is experienced by networks that contain metallic pipes and which excludes the all PE networks that often operate at higher pressures but which have very low leakage as a result of their superior performance. This should enable Users to better compare the effective operating pressures of the different LDZs.

A1.1 Eastern LDZ

	2005 Proposal	2006 Proposal
Leakage (GWh)	225	218
Annual Average System Pressure (mbar)	36.0	35.6
ASP (All-PE systems excluded) (mbar)	35.5	33.9
MEG Saturation Level	0%	0%

Table 1 Eastern LDZ

There was a decrease of 0.4bar in overall ASP for East Midlands LDZ, but more significantly, a decrease in ASP of 1.4mbar for mixed material networks This LDZ does not treat lead yarn jointed cast iron mains with MEG. It should be noted that mains replacement has also affected leakage by substituting new, better performing PE pipes for older metallic ones.

A1.2 East Midlands LDZ

	2005 Proposal	2006 Proposal
Leakage (GWh)	307	293
Annual Average System Pressure (mbar)	34.2	35.3
ASP (All-PE systems excluded) (mbar)	34.4	33.2
MEG Saturation Level	30%	28%

Table 2 East Midlands LDZ

There was an increase of 1.1mbar in overall ASP for East Midlands LDZ, but more significantly, a decrease in ASP of 1.2mbar for mixed material networks. There was a decrease of 2% in MEG Saturation levels. It should be noted that mains replacement has also affected leakage by substituting new, better performing PE pipes for older metallic ones.

A1.3 North Thames LDZ

	2005 Proposal	2006 Proposal
Leakage (GWh)	339	313
Annual Average System Pressure (mbar)	26.8	26.3
ASP (All-PE systems excluded) (mbar)	26.8	26.3
MEG Saturation Level	10%	17%

Table 3 North Thames LDZ

There was a decrease of 0.5mbar in both overall and mixed material system Average System Pressure for North Thames LDZ, and an increase of 7% in MEG Saturation levels. It should be noted that mains replacement has also affected leakage by substituting new, better performing PE pipes for older metallic ones.

A1.4 North West LDZ

	2005 Proposal	2006 Proposal
Leakage (GWh)	442	446
Annual Average System Pressure (mbar)	28.3	29.8
ASP (All-PE systems excluded) (mbar)	28.1	29.2
MEG Saturation Level	11%	9%

Table 4 North West LDZ

There was an increase of 1.5mbar in overall Average System Pressure for North West LDZ, more significantly, a 1.1mbar increase in ASP for mixed material systems. There was decrease of 2% in MEG Saturation levels. It should be noted that mains replacement has also affected leakage by substituting new, better performing PE pipes for older metallic ones.

A1.5 West Midlands LDZ

	2005 Proposal	2006 Proposal
Leakage (GWh)	355	330
Annual Average System Pressure (mbar)	30.0	29.8
ASP (All-PE systems excluded) (mbar)	29.0	28.1
MEG Saturation Level	21%	20%

Table 5 West Midlands LDZ

There was a decrease of 0.2mbar in overall Average System Pressure for West Midlands and a 0.9mbar decrease in ASP for mixed material networks. There was a decrease of 1% in MEG Saturation levels. It should be noted that mains replacement has also affected leakage by substituting new, better performing PE pipes for older metallic ones.

Appendix 2. Flow-Weighted Average Calorific Values (CVs) for each LDZ for 2004 and 2005

The daily flow weighted average Calorific Values for each LDZ, determined in accordance with the Gas (Calculation of Thermal Energy) Regulations, have been used to determine flow-weighted averages for 2005. These values have been applied to convert leakage estimates in volume terms to energy quantities for each LDZ. The values are presented in the table below with 2004 for comparison purposes.

LDZ	Average Calorific Values (MJ/m^3)	
	2004	2005
Eastern	39.3	39.3
East Midlands	39.3	39.4
North Thames	39.4	39.3
North West	39.1	39.4
West Midlands	39.1	39.3