Final Proposals of LDZ Shrinkage Factors
North East and Northern LDZ
Gas Year 2007/08

NGN
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LDZ Shrinkage Factors Final Proposals - Gas Year 2007/08

Contents

Section **Page**

1. Purpose of Proposal 1
2. Summary of Proposal 1
3. Component Analysis 2
   - 3.1 Leakage 2
     - 3.1.1 Distribution Mains (and Services) Leakage 2
     - 3.1.2 AGI Leakage 3
     - 3.1.3 Other Losses 3
     - 3.1.4 Total Leakage 4
   - 3.2 Own Use Gas 4
   - 3.3 Theft of Gas 5
   - 3.4 LDZ Shrinkage Factor Summary 6
4. Detailed Analysis 7
   - 4.1 Leakage 7
   - 4.2 Own Use Gas 8
   - 4.3 Theft of Gas 8
5. Extent to which the Proposal would better facilitate the relevant objectives 9
6. The implications for Northern Gas Networks of implementing the Proposal 9
7. The implications of implementing the Proposal for Users 9
8. Analysis of any advantages or disadvantages of implementation of the Proposal 10
9. Summary of the representations (to the extent that the import of those representations are not reflected elsewhere in the Proposal) 10
10. Programme of works required as a consequence of implementing the Proposal 10
11. Proposed implementation timetable (inc timetable for any necessary information system changes) 10
12. Recommendation concerning the implementation of the Proposal 10
13. Northern Gas Networks's Proposal 10

Appendix 1. Pipe and Service Leakage Analysis 2005 to 2006 by LDZ 11

Appendix 2. Flow-Weighted Average Calorific Values (CVs) for each LDZ for 2005 and 2006 12

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LDZ Shrinkage Factors Final Proposals for Gas Year 2007/08

1. Purpose of Proposal

The purpose of this paper is to present NGN's proposals in respect of LDZ Shrinkage Factors for the North East and Northern LDZ for the Gas Year 2007/2008 as required under Section N of the Network Code.

In Section N of Network Code, Northern Gas Networks has an obligation to set an LDZ Shrinkage Factor to provide for the gas that is used by Northern Gas Networks LDZs or lost from its LDZ systems.

2. Summary of Proposal

The LDZ Shrinkage Factors, 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 provided later in this paper. The structure of the paper follows the format of a Network Code Modification report.

Fugitive emissions of gas have been calculated on an LDZ basis using a mains population as at 31st March 2007, omitting NG Metering sites. NGN have used a figure for OUG supported by a review carried out by Advantica. NGN has considered Theft of Gas and propose using the same factor as last year. 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 set out in these proposals do not include pressure or temperature correction, in line with the agreed methodology. The factors are based on 17 year weather corrected demand data from calendar year 2006.

Since the publication of the initial proposals, an error in the shrinkage model provided by National Grid to NGN at the point of sale has been identified. The medium pressure Pit Cast Iron mains incorrectly referenced the low pressure Pit Cast mains leakage rates. MP Pit Cast should refer to Spun Cast leakage rates. MP pit cast, unlike LP, tends not to be lead yarn jointed and, therefore, Spun Cast rates are more appropriate. In terms of MP leakage for NGN, correction of this error represents a 5.2% reduction in Medium Pressure leakage, which results in a reduction of 0.001% in overall Shrinkage.

This leakage error has been corrected in the NGN Shrinkage model and this action explains the variance in shrinkage factors between our initial and final proposals.
The factors below are the final proposals for the gas year commencing 1st Oct. 2007.

LDZ	Proposed Shrinkage Factor 2007/08
North East	0.638
Northern	0.584

Note: the factors shown in the table are as a percentage of LDZ throughput – i.e. 0.638 (as shown in the table) is 0.638% of the appropriate LDZ's throughput.

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 2007/08 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 the following 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 not continuous; they are caused by specific events.

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[1] specific information:

- current records of the pipe asset as at 31st March 2007
- the annual average system pressure in each network; and
- the 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.

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.

[1] Network in this context relates to physical interconnected pipe systems.

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

LDZ	Low Pressure Leakage	
	Tonnes[2]	GWh
North East	13638	238
Northern	10374	181
Total	**24012**	**419**

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

LDZ	Medium Pressure Leakage	
	Tonnes	GWh
North East	1003	18
Northern	623	11
Total	**1626**	**29**

3.1.2 AGI Leakage

The figures for leakage from Above Ground Installations have been taken from the findings of the Transco 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.

The table below shows AGI leakage on an LDZ basis.

LDZ	AGI Emissions[3]	
	Tonnes	GWh
North East	1253	22
Northern	1564	27
Total	**2817**	**49**

3.1.3 Other Losses

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

Statistics in respect of the number of 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. The table below shows the amount of gas lost as a result of interference.

[2] 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 specific gravity of 0.64.
[3] Includes leakage and routine equipment venting

Interference	Tonnes	GWh
North East	2	0.040
Northern	5	0.080
Total	**7**	**0.120**

The table below shows the amount of gas lost as a result of AGI working losses.

AGI Working Losses	Tonnes	GWh
North East	415	7.24
Northern	477	8.34
Total	**892**	**15.58**

3.1.4 Total Leakage

The table below shows the total amount of leakage for calendar year 2006 using the 17 year weather corrected demand figures, with the leakage expressed in tonnes, GWh and as a percentage of LDZ throughput.

LDZ	Leakage		
	Tonnes	**GWh**	**Leakage % Throughput**
North East	16314	285	0.607
Northern	13040	228	0.552

3.2 Own Use Gas

Natural gas is a compressible fluid; as a direct result of this property, it experiences a drop in temperature when it undergoes an isenthalpic expansion. This means that when gas has its pressure reduced (at an NTS offtake or Local Transmission System regulator site) the gas on the downstream side of the pressure reduction apparatus is colder than the gas on the upstream side.

To avoid the gas leaving a site at below the freezing point of water pre-heating may be applied. (Pre-heating is only needed to maintain gas above 0 deg C and if the gas enters the site at a sufficiently high temperature – e.g. during the summer, or the pressure reduction is small then pre-heating may not be required.)

Pre-heating requires a small proportion of the gas passing through the site to fuel the pre-heating equipment[4].

The model used to assess the Own Use Gas component applies thermodynamic principles with a range of conservative assumptions. These include the supposition that all gas into an LDZ passes through one offtake, and is subject to a two stage pressure reduction process with a plant efficiency assumed to be 50%.

[4] A minority of the smaller pre-heaters use electricity instead of gas as the fuel.

NGN believes that the assumptions used in the calculations, particularly concerning the plant efficiency of the equipment, are pessimistic. That is to say that the calculations overstate the amount of own use gas that is consumed.

NGN recognises that any method to estimate OUG will have limitations but it is a clear Code obligation on all Transporters to use the best information available to estimate OUG in the LDZ.

Advantica is well respected within the gas industry with many years' experience in scientific and engineering development. A report published in 2002 proposed OUG figures of 0.0113% nationally. Following the outcome of last year's Shrinkage Forum discussions, Advantica has carried out further work to substantiate this figure and addressed the Shrinkage Forum on 22nd June 2006.

The conclusions from Advantica were that pre-heater efficiencies fell between 53% and 69%. Nevertheless, NGN proposes the conservative figure of 50% efficiency resulting in an OUG of 0.0113% for gas year 2006/7.

3.3 Theft of Gas

Network Code Section N 1.4.2 states that LDZ Shrinkage shall include, and Northern Gas Networks 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. The statistics for confirmed Theft of Gas from 2003 are detailed in the tables below.

Cases Of Confirmed Theft Made Known To Transco	**Total**	**Transporter Responsible**
2004	1316	53 (4.0%)
2003	419	5 (1.2%)

Cases Of Confirmed Theft Made Known To Northern Gas Networks	**Total**	**Transporter Responsible**
June 05 - May 06	268	10 (3.7%)

The statistics indicate that of the cases of confirmed theft made known to NGN, 3.7% were identified as being transporters' responsibility, 4% in 2004 and just 1.2% in 2003.

Historically, unidentified theft has been assumed to be 0.3% of LDZ throughput, of which 10% is deemed to be Transporter responsibility, resulting in a theft of gas factor of 0.03%. The basis for these assumptions is uncertain. NGN does not accept that the proportion of Transporter theft is as high as 10%. The most recent statistics support this view.

The available statistics imply that transporters are responsible for between 1% and 4% of theft. However NGN recognising the limitations of the current methodology and the concerns of shippers, considers that the proportion of theft attributed to the Transporter should remain at 6.67%, resulting in a theft of gas factor of 0.02% in line with last year's figure.

3.4 LDZ Shrinkage Factor Summary

The proposed LDZ Shrinkage Factors for the Gas Year 2007/08 are presented in table below.

LDZ	Leakage	Own Use Gas	Theft of Gas	Proposed Shrinkage Factor 2007/08
North East	0.607	0.0113	0.02	0.638
Northern	0.552	0.0113	0.02	0.584

Note: All factors are expressed as percentages of LDZ throughput.

4. Detailed Analysis

4.1 Leakage

In May 2003, Advantica on behalf of Transco 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 Transco 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) was 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. She presented her findings to the Users on the 10th of June 2003 when she also 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, Northern Gas Networks 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, which have undergone a rigorous re-assessment this year, measurements of MEG concentration and average system pressures to derive total leakage by LDZ.

In the twelve months since we published our proposals for the 2006/07 Gas Year we have also:

- replaced 558 km of metallic low pressure gas mains and associated metal gas services,
- replaced around 7km of metallic medium pressure gas mains and services.

We have installed additional Pressure Reduction Installations to enable the connection of new customers, have seen a small reduction in measured MEG concentration[5] and average system pressure has remained very similar to that of 2006, in both LDZ's.

The overall effect of these influences has led to a slight decrease in leakage.

4.2 Own Use Gas

In the past, Transco has presented details of the method whereby Own Use Gas is calculated. NGN support the opinion, expressed at last year's proposal meeting, that the OUG methodology overestimates the figure for OUG due to pessimistic assumptions in the current model, particularly with regard to plant efficiency and the supposition that all gas enters the LDZ via one offtake. The report carried out by Advantica for Transco and published in 2002 concluded that the OUG for calendar year 2000 was 0.0113% based on pre-heater efficiency of 50%. NGN, along with other Networks, engaged Advantica in 2006, to carry out work to consider the sensitivities of the original report. Their work concluded that pre-heater efficiencies range between 53% and 69% and NGN therefore proposes to retain 0.0113% as the OUG figure for gas year 2007/08.

4.3 Theft of Gas

Historically Transco figures suggested that the proportion of theft for which Transco was responsible for managing was significantly less than 10%, (see table in Section 3.3).

NGN figures for the period June 2006 to May 2007 support the position highlighted last year that transporter responsibility is substantially less than 10%. In the light of these figures and the most recent NGN figures, NGN consider that theft, which is the transporter's responsibility, continues to be close to 4%. However, NGN considers the issue remains unresolved and therefore proposes that the NGN Theft of Gas factor

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

should remain at 0.02% for the Gas Year 2007/08 based on the transporter being responsible for 6.67% of thefts.

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

This proposal provides an accurate estimate of LDZ leakage and a conservative estimate of LDZ theft of gas and own use gas for the Gas Year 2007/08. As a result, the gas usage and loss in transportation within the LDZs will be reflective of actual conditions. This facilitates the achievement of efficient and economic operation of the system, as NGN 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.

6. The implications for Northern Gas Networks of implementing the proposal including:

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 Northern Gas Networks to recover the costs, and proposal for the most appropriate way for Northern Gas Networks 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 continued removal of Temperature and Pressure correction greatly facilitates the establishment and operation of Distribution Network specific transportation charging formula (which is an Ofgem objective). For this reason NGN propose to continue the regime that does not include Temperature and Pressure Correction.
In the longer term this proposal offers the prospect of real savings for consumers through the operation of the principle of comparative regulation.

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:** Improved allocation of the actual system usage and losses with improved cost targeting and appropriate incentivisation for future shrinkage reduction.
- **Disadvantages:** Northern Gas Networks 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)

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)

When we publish our final proposals, Users have until the 16th of September 2007 to request that Ofgem issue a Condition 7(4) disapproval of this proposal. (This provision is in the Network Code Section N 3.1.8.)

If no disapproval notice is issued, it is our intention to implement revised LDZ Shrinkage Factors from 06:00 hrs on the 1st of October 2007.

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 2007.

13. Northern Gas Networks Proposal

This report contains our proposal for the LDZ Shrinkage Factors for the Gas Year 2007/08.

Appendix 1 – Pipe and Service Leakage Analysis 2005 to 2006 by LDZ

This section of the document provides a comparison of the assessed levels of LP pipe and service leakage by LDZ.

Details of leakage quantities in tonnes and 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.

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.

North East LDZ

	2005	**2006**
Leakage (GWh)	299	286
Annual Average System Pressure	31.92	32.00
ASP (All-PE systems excluded)	31.52	31.24
MEG Saturation Level	26.11	15.75

There was an increase of 0.08mbar in overall Average System Pressure for North East LDZ between 2005 and 2006. There was a decrease of 10.36% in MEG saturation levels.

Northern LDZ

	2005	**2006**
Leakage (GWh)	225	229
Annual Average System Pressure	32.9	33.04
ASP (All-PE systems excluded)	32.3	32.19
MEG Saturation Level	21.16	17.61

There was an increase of 0.14mbar in overall Average System Pressure for Northern LDZ between 2005 and 2006 and a decrease of 3.55% in MEG Saturation levels.

Appendix 2 – Flow-Weighted Average Calorific Values (CVs) for each LDZ for 2005 and 2006

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 2006. These values have then been applied to convert leakage estimates in volume terms to energy quantities for each LDZ. The values are presented in the table below with 2005 for comparison purposes.

LDZ	**Average Calorific Values (MJ/m^3)**	
	2005	**2006**
North East	40.38	40.2
Northern	40.37	40.3