

# Leakage Model Modification No. 02 Report

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## Report on the Proposed Revision to the Low Pressure Service Leakage Calculations

Version 1.0

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### **Overview:**

Gas Distribution Network Operators (DNOs) have an obligation under *Special Condition E9.3* of the 2008-13 GT Licences to “establish a leakage model”. The National Leakage Assessment Model (*leakage model*) comprises a spreadsheet model and methodology documentation. In addition, under *Special Condition E9*, any modifications to the *leakage model*, once established, have to go through the modification process defined within *Special Condition E9.7-13*. Within this modification process is the obligation to consult with relevant shippers and any other interested parties. Following the consultation process, there is a further obligation to produce a report, which is to include an Independent Experts assessment, on the validity of the proposed modifications with respect to leakage measurement.

*Special Condition E9.4(a)* specifies that the *leakage model* shall facilitate the achievement of the accurate calculation of gas leakage from LDZs. Pursuant to this requirement, National Grid proposed and consulted on improvements to the calculation of service leakage within the *leakage model* to facilitate the accurate calculation of gas leakage.

This document fulfils National Grid’s obligation to produce a report on the outcome of the consultation and the implementation of the proposed modifications in the leakage model.

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## Context

The 2008-2013 Gas Distribution Price Control Review introduced new controls around the estimation of emissions from gas distribution systems; these controls being brought in to support the Shrinkage Incentive and the introduction of the new Environmental Emissions Incentive.

Special Condition E9 of the GDN Licences introduced a number of obligations on Distribution Network Operators (DNOs), including:

- establishment of a leakage model;
- annual report of emissions;
- consultation on modifications to the leakage model

## Associated Documents

The GDN Licences can be found on the Ofgem website; all other documents can be found on the Joint Office website.

GDN Licences, Special Condition E9

<a href="#">Leakage Model Modification Consultation No.2 February 2012</a>	- National Grid Consultation
Independent Review of Leakage Model Modification Consultation No.2	- GL Industrial Services UK Ltd
<a href="#">Centrica response NGD leakage model consultation 2</a>	- British Gas Representation
<a href="#">Representation - Scotia Gas Networks LMMCons 2</a>	- Scotia Gas Representation
<a href="#">Leakage Model Modification Draft Consultation</a>	- National Grid Draft Consultation discussed at Shrinkage Forum held 6 January 2012
<a href="#">Minutes of the Shrinkage Forum held 6 January 2012</a>	- Minutes of the meeting prepared by Joint Office
<a href="#">Leakage Model Modification Consultation No.1 March 2009</a>	- Joint Distribution Consultation

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**Summary**

Special Condition E9 of National Grid's Gas Transporter Licence requires National Grid to establish and maintain a leakage model. Part of the obligation to maintain this model is to review the accuracy of the leakage estimation. National Grid has identified an area of inaccuracy within the current leakage model associated with the calculation of Low Pressure Service leakage.

A further obligation of Special Condition E9 is that National Grid consults with Shippers, and any other interested parties, on any proposed modifications to the leakage model. National Grid issued a consultation on the proposed modification to its leakage model on 23 February 2012.

Special Condition E9 also requires National Grid to appoint an Independent Expert to review the Consultation and report on this review. The review is to be published within twenty-eight days of the close of the consultation.

This document provides a report on the Consultation on improvements to the leakage model and includes the review by the Independent Expert.

## 1. Introduction

### 1.1 Background

The 2008-2013 Gas Distribution Price Control Review (GDPCR1) introduced new controls around the estimation of emissions from gas distribution systems, these controls being brought in to support the introduction of the new Environmental Emissions Incentive. The new regime created an incentive for GDNs to reduce leakage.

The establishment of baselines for gas distribution leakage was part of the GDPCR in respect of the Environmental Emissions and Shrinkage Incentives. Ofgem requested GDNs to provide an estimate of leakage for the five-year period covered by the GDPCR. Ofgem used the GDNs' submissions as a basis for setting the Environmental Emissions Leakage baselines for the five years of the GDPCR.

GDN Licence Special Condition E8 & E9 cover the Shrinkage and Environmental Emissions Incentives, respectively. In particular, Special Condition E9 covers leakage estimation and provides a control mechanism on the leakage model to ensure that it accurately calculates leakage and, where reasonably practical, is consistent across DNOs. Furthermore, E9 requires DNOs to review the model to ensure it achieves these objectives, to consult on changes to the leakage model, to ensure that changes preserve incentives, to appoint an independent expert to review the model and to submit a report to the Authority.

### 1.2 Purpose of this Document

This Report fulfils National Grid's obligation, under the GT Licence Special Condition E9 paragraph 9(b), to "...make publicly available and submit to the Authority<sup>1</sup> a report setting out:

- (i) the modifications originally proposed;
- (ii) the revised allowed leakage volumes ( $LB_{t,i}$ ) proposed pursuant to paragraph 8;
- (iii) the representations made by relevant shippers or other interested parties (if any) to the licensee and not withdrawn;
- (iv) any changes to the modifications and allowed leakage volumes ( $LB_{t,i}$ ) proposed as a result of such representations;
- (v) the independent expert's report referred to in paragraph 11;
- (vi) how the proposed modifications would better facilitate the objectives set out in paragraph 4 above; and
- (vii) a timetable, developed in accordance with paragraph 10, for the implementation of the modification originally proposed or any alternative modification developed in the light of any representations made by relevant shippers or other interested parties, including the date with effect from which such modification (if made) is to take effect..."

### 1.3 Independent Review

National Grid have an obligation, in line with Special Condition E9 paragraph 11 – 13, to appoint an Independent Expert to review the Leakage Model and provide a report of that review, including the implications of the proposed changes, within 28 days of the close of the consultation.

### 1.4 Baselines

The baselines applicable for these two incentives, for each year from 2008/09 to 2012/13 and for each LDZ, are set out in National Grid's Licence. Proposed revisions to these baselines are included in Appendix A.

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<sup>1</sup> Special Condition E9 9(b) specifies that the report should be issued within 28 days of the close of the consultation.

## 2. Outcome of the Consultation

### 2.1 Representations

The Consultation sought respondents' views on three specific areas, the proposed use of mains replacement data to establish a new estimate of current service populations, the proposed change to the Low Pressure Service leakage calculation to reflect the impact of transferred services and the selection of GL Noble Denton as Independent Expert.

Two responses to the consultation were received, from [British Gas](#) and [Scotia Gas Networks](#), the details of which are outlined below.

### 2.2 Representations in respect of the specific consultation questions

This section presents the respondents', British Gas (BG) and Scotia Gas Networks (SGN), comments in respect of the specific questions presented in the consultation and National Grid's (NGGD) response:

- i. Should data from the latest three years of mains replacement be used to determine the mix of service populations for a new base year?

BG: Yes, all GDNs must use the same data and source report.

SGN: Yes, it is believed this will provide a more informed picture of remaining service population, and therefore more accurate representation moving forward.

NGGD: Both respondents agree that the proposed methodology for determining the current service populations is appropriate and should be used. This view is also supported by the Independent Expert's report.
- ii. Should the Low Pressure Service Leakage model reflect the impact of service transfers to improve the accuracy of the leakage calculation?

BG: Yes as long as this figure is measureable and robust and not an assumed proportion of all services.

SGN: Yes, it is believed capturing details relating to service transfers will provide a more informed leakage calculation, reflecting the benefit gained from service transfers, which is not considered at present. The net result will be a more accurate estimation of leakage.

NGGD: Both respondents agree that the leakage model should reflect the impact of service transfers and that this will improve the accuracy of the leakage model. This view is also supported by the Independent Expert's report. The actual number of service transfers and re-lays is recorded and submitted to Ofgem annually.
- iii. Are the revised allowed leakage volumes appropriate to maintain the incentive properties of the environmental emissions incentive at current levels?

BG: The movement in the incentive target must be equivalent to the movement in leakage volume assessed in the assumption changes.

SGN: It is believed that the principles applied to the revised allowed leakage volumes are appropriate, but would obviously be subject to assessment by the appointed Independent Expert.

NGGD: In its consultation, National Grid has proposed revisions to the Leakage Baselines ( $LB_{t,i}$ ) in its Licence that are commensurate with the impact of establishing a service population in line with the proposed methodology and that take account of the likely impact of reflecting service transfers<sup>2</sup> in its leakage

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<sup>2</sup> The actual impact of including service transfers is dependent on the actual service transfer activity, which is not known prior to the work being completed. National Grid has proposed adjustments based on an average transfer workload over the last three years, i.e. from the data used to determine the service populations in 2010/11.

model. The proposed values have been validated by the Independent Expert in its report and have been confirmed as being appropriate.

- iv. Should the above changes be made so to apply for the 2011/12 leakage assessment and for future years for National Grid Distribution networks?

BG: No, consistency needs to be kept with the other GDNs and the incentive targets need to be adjusted so consumers are not over charged through increased incentive payments from no real decrease in leakage. British Gas would prefer a wholesale review of all the assumptions within the leakage model and all national averages to be converted to updated regional figures.

SGN: We support the principle that changes which will result in a more accurate calculation of leakage by the model should be supported and any such change accommodated at the earliest opportunity.

NGGD: National Grid considers that improvements to the leakage model that have been identified should be implemented as soon as is practical. Whilst ideally for Shippers such improvements would be made to all networks' models at the same time, we consider that it is still better to implement the change to National Grid's networks alone than not to implement the change at all. We understand that other DNs are considering implementing a similar change for their networks and that SGN has already raised such a consultation.

- v. Is it appropriate to engage GL Noble Denton as an Independent Expert to review the Leakage Model and proposed allowed leakage volumes and then provide a report of that review?

BG: No, we believe GL Noble Denton is not independent as they wrote the original leakage model and therefore not suitable. We would expect an independent expert to be able to give an unconflicted evaluation.

SGN: It is appropriate that a suitable independent expert be appointed to review the Leakage Model for the purpose described. It is suggested that any such independent expert be appointed on the basis of carrying out said assessment for all DNs supportive of the proposal and who would also wish to adopt this same change within a similar timescale to that recommended within this proposal.

NGGD: National Grid believes that GL Noble Denton having produced the original leakage model qualifies them to be best placed to assess any improvements to the model. In addition, GL Noble Denton was appointed, via a tendering process, to act as Independent Expert for the previous leakage model modification. The intention to appoint GL Noble Denton as Independent Expert was raised at the Shrinkage Forum in January 2012 at which Shipper agreement to this was recorded in the minutes:

*"RMA [Roy Malin, National Grid] then drew attention to the fact that National Grid Distribution were not likely to go out to tender again for independent assessment but would use GL Noble Denton as they had constructed the original model. Shippers were asked their views on this approach, and both BD [Brian Durber, E.ON UK] and RH [Rochelle Hudson, British Gas] were happy with this always assuming the GL Noble Denton quote was reasonable."*

## 2.3 General Comments from Representations

In addition to comments on the specific questions in the consultation, the following general comments were made:

### 2.3.1 Representation from British Gas

BG: 2. British Gas believes that the shrinkage calculations and incentive targets are too low, as the amount of unaccounted for gas is considerable and the gas networks need to pay their share of this cost and be incentivised to help the industry improve.



- NGGD: The network owners have an obligation to keep the leakage model under review. This consultation is on an identified improvement to the leakage model that should improve its accuracy and thus result in a better estimate of leakage. This should ultimately lead to a more cost-reflective allocation of shrinkage costs. National Grid, along with the other DNs, has an incentive to reduce shrinkage and has, over the past four years, implemented improvements to the operation of its networks that has contributed to the reduced leakage (and thus shrinkage) levels that have been achieved over that time.
- BG: 3. British Gas also feels the leakage model is not fit for purpose given the age of the assumptions (all linking back to at least the leakage survey of 2002/03, if not 1992, when the model was created or older) and the use of national averages which are no longer relevant following DN sales. We urge a wholesale review of shrinkage, including the leakage model and incentives on theft.
- NGGD: National Grid has an obligation to ensure that the leakage model is as accurate as it can be. The National Leakage Tests carried out in 2002/03 cost in the order of £10m and the pressure-decay method used is recognised as being the most accurate methodology for determining leakage from gas supply systems. Approximately 850 mains of differing diameter and material categories were tested in order to establish a statistically robust estimate of the leakage in the population as a whole. As part of our stakeholder engagement for the forthcoming Price Control, National Grid reviewed stakeholder proposals for a new leakage-rate test programme. Given the likely cost of implementation, we do not consider it justifiable to take it forward at this time; it would significantly increase the number of tests required and, therefore, the cost to achieve statistically robust leakage rates on a regional basis.
- The major assumptions in the leakage model that date back to 1992 are those regarding service populations, and it is these assumptions that this proposal is seeking to update. The proposed solution will provide a regional estimate of service populations rather than the national assumptions that currently apply.
- BG: 4. Whilst British Gas welcomes improvements to the leakage model we cannot support an asymmetric change to the leakage calculations, which will only reduce the shrinkage measured by the GDNs, effectively transferring cost from the networks to shippers. Particularly knowing that the AGI venting assumptions are much older (dating back to the 1970's) and should increase the leakage calculated.
- NGGD: National Grid issued a draft consultation covering both the change to the low pressure service calculation and that for venting at above ground installations (AGIs). Both of these proposals were discussed at a Shrinkage Forum on 6 January 2012. The conclusion at the Shrinkage Forum was that the proposal to update the AGI Venting calculation required further empirical evidence to support the proposed venting estimate. In response to this requirement for additional verification, the proposal to amend the AGI Venting estimation was removed for the final Leakage Model Modification Consultation.
- Following on from the Shrinkage Forum, National Grid has engaged with GL Noble Denton in order to develop a methodology for testing and measuring venting rates at AGIs. Once they are confirmed, the details of the research to be carried out in respect of AGI venting will be shared with the Shipper community at a Shrinkage Forum.
- BG: 5. British Gas also wants to ensure consistency with the other GDNs and the incentive regime is aligned with any methodology or model changes. With this in mind, we expect any changes to the leakage model will not commence before all GDNs have carried out their regional analysis, discussed with Shippers at the Shrinkage Forum and updated the incentives. Just to clarify, the incentive targets must move on a consistent basis with the changed model output to ensure consumers are not overcharged, i.e. from windfall gains by the GDNs in the allowed revenue.

- NGGD: Each DN has a licence obligation to ensure the accuracy of its leakage assessment. Ideally, modifications will be made by all DNs. However, in respect of these proposals, National Grid was unable to achieve agreement with the other DNs on the timing of the changes. National Grid believes that the implementation of the proposed modifications to the leakage model would improve the accuracy of its leakage assessment and, therefore, believe that our licence obligations in this respect require us to progress the modification proposal. Scotia Gas Networks have subsequently issued a consultation proposing to adopt the same modification to its leakage model.
- BG: 6. We thank the GDNs for the improved visibility of the leakage model over the past year and consider the processes outside of the leakage model to be robust. However there are significant assumptions within the leakage model that are at least ten years old and based on national averages, which are no longer appropriate following DN sales in 2005 as they do not enable benchmarking or challenge the GDNs to improve.
- NGGD: National Grid is committed to improving the accuracy of its leakage and shrinkage estimation where such improvements can be demonstrated to be both robust and cost effective.
- BG: 7. Whilst we understand NGGD wanting to update the service pipe material mix assumptions, it is just one of many assumptions within the leakage model that is based on the national leakage tests carried out in 2002/03. If any assumptions are changed to regional characteristics we would expect all national assumptions to be regionally set, thereby giving each GDN and their individual LDZs the most accurate picture of leakage.
- NGGD: National Grid acknowledges that, ideally, revisions to the leakage model would be adopted by all DNs and have engaged with the other DNs in both this and the previous leakage model modification. We understand that other DNs are considering similar changes.
- BG: 8. We consider using the last three years of mains replacement data to calculate the proportion of metallic services as reasonable and expect all GDNs to use the same years, namely 2008/09, 2009/10 and 2010/11 and the equivalent source of data.
- NGGD: National Grid welcomes the support for the proposed methodology.
- BG: 9. British Gas welcomes the updating of assumptions of the Above Ground Installations venting methodologies and urges all the GDNs to investigate their portfolios and present their findings at the next Shrinkage Forum. This is another example where the national averages (and significant assumptions) from the 2002/03 shrinkage survey are now inappropriate. We expect significant improvements in leakage measurement could be made in the next price control, GD1, from decommissioning the beyond use AGIs which still vent and leak gas.
- NGGD: The AGI venting estimate currently being used is based on a national figure quoted in a Watt Committee report from 1994. The derivation of this estimate is unknown.

National Grid put forward a proposal for AGI venting to be estimated from manufacturers' data; however, this proposal still relied on two further assumptions that the venting rate was linearly proportional to the operating pressure of the control system and that there is an additional amount of venting<sup>3</sup> associated with physical control actions.

As mentioned above, we are in the process of establishing a testing methodology that will enable these assumptions to be verified and/or quantified. Adopting a revised approach to AGI Venting that is 'activity based' should facilitate the replacement of the existing equipment with more environmentally friendly alternatives.

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<sup>3</sup> Estimated to be 25%

BG: 10. We are disappointed that the AGI changes have not progressed further within this consultation as we would expect all assumption changes to occur simultaneously with the impact of each assumption made clear.

NGGD: As mentioned above, we have responded to the Shrinkage Forum request to obtain additional empirical data on which to base the revised AGI venting calculation. It is not possible to achieve this within the timescales necessary to implement improvements in time for the next leakage assessment.

### **2.3.2. Representation from Scotia Gas Networks**

SGN can confirm that they have no objections to the formal Leakage Model Modification Consultation, published on 23rd February 2012 by NGGD.

SGN can confirm they remain supportive of, and committed to, the ongoing review and improvement in accuracy of the model and estimation of leakage generally.

### **3. The Modifications**

#### **3.1 Low Pressure Service Leakage**

National Grid proposed this modification because the current leakage model does not correctly account for the impact of service replacement that has taken place since the original model assumptions were established.

The proposal is to use recent mains and service replacement data to estimate the current service populations. In 2009, the leakage model was updated to reflect the impact of re-laying steel services. This proposal recommends that the impact of transferring plastic services to be taken into account in the leakage estimation.

A full description of the proposed change and a hypothetical worked example can be found in Appendix B. This is an extract from the consultation document that has been amended to reflect a number of observations made by the Independent Expert<sup>4</sup>.

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<sup>4</sup> These observations are restricted to comments in three instances on wording and do not affect the methodology or any calculations.

#### 4. Independent Expert Review

GL Industrial Services UK Ltd was appointed as Independent Expert for the Leakage Model Modification consultation. Alan Brown from GL, who carried out the review, has a long history of leakage estimation within the Gas Industry, having worked in this area for British Gas West Midlands, Transco and Advantica. Alan also carried out the review of the previous model modification proposal in June 2009.

The Independent Expert's review can be found on the [Joint Office Website](#), along with this document.

The review was supportive of the National Grid's proposal to establish current service populations based on the last three years mains and service replacement data and confirmed that this had been correctly implemented within the revised leakage model.

The review confirmed that the proposed inclusion of the impact on leakage of service transfers would improve the accuracy of the leakage modelling and that this had been correctly implemented within the revised leakage model.

The review confirmed National Grid's proposal that it is appropriate for the environmental emissions baselines to be revised in the event that the proposed modifications are to be implemented and confirmed that the proposed revision to the baselines outlined in the consultation have been estimated correctly in accordance with the proposed methodology.

##### 4.1 Specific Observations in the Independent Expert's Report

The Independent Expert's report focused on three main areas:

- i) The proposed modifications to the leakage model outlined in the consultation;
  - Observation: Section 9.1 of the Independent Expert's report noted three typographical errors in the consultation document.
  - Response: These have been amended in the supporting analysis in Appendix B of this document.
- ii) The implementation of the proposed modifications within the leakage spreadsheet model [LDZ Leakage Model 1.4]
  - Observation: Section 7 [D] of the Independent Expert's report noted an inconsistency in the definition of ALL PE networks; EA uses <5% metallic and the other LDZS use <3%
  - Response: The definition of ALL-PE networks does not have an impact on the leakage calculations; it is used purely for identifying those networks that do not contain a significant length of metallic main. Its purpose within the leakage model is to facilitate the calculation of an LDZ-level average system pressure for mixed material networks, which is used for reporting purposes only. We will make this definition consistent across the LDZs.
  - Observation: Section 7 [E] of the Independent Expert's report noted that rounding service numbers to whole values was causing slight discrepancies between service numbers in the revised model and those calculated by application of the proposed methodology.
  - Response: The rounding of service numbers in the calculations has been removed in the final model to eliminate the discrepancies. The revised model has been checked by the Independent Expert for validity.
- iii) The update of the leakage model specification document to reflect the proposed modifications
  - Observation: Section 6.3 [A] of the Independent Expert's report noted that definition of the calculations for both Steel and PE service connections to metallic mains would benefit from expansion.

- Response: These have been amended in the specification document. The wording defining 'the number of steel service connections to metallic mains in an individual network' has been changed to:
- "The number of steel service connections to metallic mains in an individual low-pressure network is calculated as a movement away from the number of connections of this type in the baseline year, 2010/11. The cumulative annual service replacement in the LDZ is apportioned between the individual networks based on the network's proportion of the LDZ total for the specific service category in the baseline year. This is calculated as:
- [Baseline No.] – [No. of services replaced in LDZ since 2010/11] x [% of total steel service connections to metallic mains in LDZ in 2010/11]"
- Similar wording has been adopted for PE service connections to metallic mains.
- Observation: Section 6.3 [B] of the Independent Expert's report noted that the percentage split of Steel and PE service connections to PE mains had been incorrectly reflected in the specification document.
- Response: These have been amended in the specification document to reflect the correct percentages.
- Observation: Section 7 [A] of the Independent Expert's report noted that the definition of the MEG benefit in the specification differed from its implementation in the leakage model, but confirmed that the two approaches were consistent.
- Response: No amendments have been made to either the specification document or the spreadsheet model. We will consider updating the spreadsheet model to match the specification document in a future release of the model.
- Observation: Section 7 [C] of the Independent Expert's report noted that specification document contained a reference to an assumption that all services on ALL-PE networks are assumed to be PE and that the ALL-PE definition was 99.5% PE.
- Response: This definition is no longer relevant with the revision to the service leakage methodology and, therefore, has been removed from the final document.

## 5. Facilitation of the Objectives in Special Condition E9 Paragraph 4

Extent to which implementation of this Modification Proposal would better facilitate the achievement (for the purposes of each Transporters' Licence) of the Relevant Objectives:

*Special Condition E9.4: The Leakage Model shall facilitate the achievement of the following objectives –*

- (a) the accurate calculation and reporting of gas leakage from each of the LDZs operated by the licensee; and*
- (b) being consistent with, and where reasonably practicable, identical to Leakage Models used by other DN Operators.*

The modification proposal facilitates the objectives of Special Condition E9 paragraph 4(a). The independent Expert's review of the modification proposal supported National Grid's assertion that the implementation of the revised Low Pressure Service methodology would provide a better assessment of leakage and the impact of service transfer activity on the leakage calculation.

## 6. Proposed Implementation Timetable

Subject to Ofgem approval, National Grid proposes to implement the revision to the leakage model as follows:

<b>Purpose</b>	<b>Applicable Period</b>	<b>Application Date</b>
Environmental Emissions Incentive	1 April 2011 to 31 March 2012 and subsequent years	From July 2012
Shrinkage Assessment and Adjustment	1 April 2011 to 31 March 2012 and subsequent years	From July 2012
Greenhouse Gas Reporting	1 April 2011 to 31 March 2012 and subsequent years	From July 2012
2013/14 Shrinkage Quantity Proposal	1 April 2013 to 31 March 2014 and subsequent years	From Jan-Mar 2013



## 7. Summary of Consultation

Having considered the representations to the consultation, as outlined in Section 2, National Grid continues to believe that, as the proposed modifications to the Low Pressure Service methodology provide a better assessment of leakage, it is appropriate for the leakage model to be amended to reflect the proposed modifications outlined in the consultation document. National Grid believes that implementation of this modification would facilitate the objectives set out in Special Condition E9 paragraph 4(a).

In summary, implementation of this proposal would:

- i) Establish an estimate of current service populations using mains and service replacement data from the 2008/09, 2009/10 and 2010/11 formula years;
- ii) Amend the leakage model calculations to facilitate the inclusion of the impact of service transfer activity; and
- iii) Amend the Environmental Emissions Incentive baseline values, as proposed in Appendix A.

It is proposed that, subject to Ofgem approval, National Grid will implement the revised Low Pressure service methodology from July 2012 in respect of calculating leakage for the 2011/12, and subsequent, formula years.

## Appendix A Proposed Revision to Baselines

This section includes any revision to the Environmental Emissions Incentive baselines ( $LB_{t,i}$ ) as result of the proposed modification.

### A.1 Revised Baselines Values

National Grid believes that if the proposed modifications to the leakage model were to be implemented, it would be appropriate for the Environmental Emissions baselines to be revised; this view was supported by the Independent Expert.

Accordingly, in its consultation document National Grid proposed revised baseline values for each of its LDZs. The derivation of these values can be found in Appendix B.3 of this document. The revised values reflect the actual impact of updating the current service population assumptions and an estimated impact of reflecting service transfer activity within the leakage model, as outlined in the modification consultation. The Independent Expert's report confirmed that these values have been calculated correctly and in accordance with the proposed methodology.

The table below shows the original and proposed revisions to the Environmental Emissions Incentive baseline values for the remaining years of the current price control period.

GDN	LDZ	Original Baselines		Revised Baselines	
		2011/12	2012/13	2011/12	2012/13
National Grid Gas Distribution	EA	268	267	256	254
	EM	380	378	355	353
	NT	368	364	336	332
	NW	455	450	437	432
	WM	371	367	367	363

## Appendix B Supporting Analysis

### B.1 Determination of service populations for new base year (2010/11)

#### B.1.1 Proposed methodology for application within the Leakage Model

Each year, NNGD replace in the order of 1800-2000km of metallic main. When replacing a main, it is policy to not reconnect steel services, i.e. any steel service connections to the original main are replaced, or 're-laid', with PE services. Any PE services that were connected to the original main are transferred to the new main. Data regarding the level of mains replacement and any associated service 're-lays' or 'transfers' is included within the regulatory reporting to Ofgem. It is proposed to use this data to estimate the relative service populations over the past three years, thereby setting a new baseline from which the forward replacement and transfer of services can be taken into account in the same way as that in the current methodology.

The table below shows a summary the mains replacement data for the last three years:

GDN	Length of main replaced (km)	Number of Relays	Number of Transfers	Relays /km	Transfers /km
East of England	2,156	90,053	95,468	42	44
London	1,071	44,180	33,615	41	31
North West	1,783	79,465	55,842	45	31
West Midlands	1,199	60,801	41,609	51	35

To determine the relative populations of service connections to PE mains, we propose to use data relating to PE mains from the 2002/03 National Leakage Tests:

Number of Tests	Length of Main Tested (km)	Number PE Services	Number Steel Services	Total number Services	PE Service %	Steel Service %
81	7,039	770	14	784	98.20%	1.80%

To determine the baselines:

- i) the number of steel services per km of metallic main = service 're-lays' / length of main replaced
- ii) the number of PE services per km of metallic main = service 'transfers' / length of main replaced
- iii) the number of steel services connected to metallic mains<sup>5</sup> = the number of steel services per km of metallic main x the length of metallic main in the network
- iv) the number of PE services connected to metallic mains<sup>6</sup> = the number of PE services per km of metallic main x the length of metallic main in the network
- v) the number of service connections to PE mains<sup>7</sup> in each low pressure network = total number of services – number of steel services
- vi) the number of PE service connections to PE mains = the number of service connections to PE mains x PE Services %
- vii) the number of steel service connections to PE mains = the number of service connections to PE mains x steel services %

#### B.1.2 Worked Example

For Cambridge network in Eastern (EA) LDZ, which is part of East of England Network:

Metallic Length = 256km; Total Number Services = 59,321

<sup>5</sup> Text updated as per observation in Independent Expert's report

<sup>6</sup> Text updated as per observation in Independent Expert's report

<sup>7</sup> The current leakage model identifies the leakage associated with service connections to both metallic and PE mains. However, the 2002/03 National Leakage Tests determined the leakage from service connections to PE mains to be zero. For completeness, it is proposed to maintain the service connections to PE mains within the current leakage model, albeit that this will return zero leakage.

Number Steel Service Connections to Metallic Mains	= Relays/km x Metallic Length
	= 42 x 256
	= 10,752
Number PE Service Connections to Metallic Mains	= Transfers/km x Metallic Length
	= 44 x 256
	= 11,264
Total no. service connections to metallic mains	= 10,752 + 11,264
	= 22,016
Total no. service connection to PE mains	= 59,321 – 22,016
	= 37,305
Number PE service connections to PE mains	= 37,305 x 98.2%
	= 36,634
Number steel service connections to PE mains	= 37,305 x 1.8%
	= 671

In summary:

No. steel service connections to metallic mains	No. PE service connections to metallic mains	No. PE service connections to PE mains	No. steel service connections to PE mains	Total No. of service connections <sup>8</sup>
10,752	11,264	36,634	671	59,321

## B.2 Calculating the Impact of Service Population Movement

The annual service workload activity is recorded, on an LDZ basis, and reported to Ofgem through the regulatory reporting process. The leakage model currently uses this information to estimate the impact of replacement of steel services with PE. It achieves this by apportioning the total LDZ service replacement workload by the proportion of steel services within each constituent network within the LDZ. It is proposed to extend this methodology to take account of the impact of the service transfer activity. The proposed revised methodology to capture the leakage reduction for both service transfers and replacement activity is shown in the worked example below.

### B.2.1 Worked Example

Assume that:

- the total number of steel and PE services connections to metallic mains in the LDZ for the baseline year (2010/11) is 255,000 & 270,000, respectively, calculated using the methodology above for each network within the LDZ;
- 20,000 steel services are replaced in 2011/12 and 25,000 in 2012/13, i.e. 45,000 in total by 2012/13;
- 25,000 PE services are transferred in 2011/12 and 30,000 in 2012/13, i.e. 55,000 in total by 2012/13; and
- there are now 60,000 consumers attached to the network

The number of services in 2012/13 for the Cambridge network, using the service populations calculated in B.1.2 above, would be calculated as:

- Number of steel services connections to metallic mains
  - = Baseline No. – No. Replaced in LDZ x % of Service Category
  - = 10,752 – 45,000 x 10,752 / 255,000
  - = 10,752 – 45,000 x 4.2%
  - = 10,752 – 1,897
  - = 8,855
- Number of PE service connections to metallic mains
  - = Baseline No. – No. Transferred in LDZ x % of Service Category
  - = 11,264 – 55,000 x 11,264 / 270,000

<sup>8</sup> Text updated as per observation in Independent Expert's report

$$\begin{aligned}
 &= 11,264 - 55,000 \times 4.2\% \\
 &= 11,264 - 2,295 \\
 &= 8,969
 \end{aligned}$$

3. Number of steel service connections to PE mains

$$\begin{aligned}
 &= \text{Base year number} \\
 &= 671
 \end{aligned}$$

4. Number of PE service connections to PE mains

$$\begin{aligned}
 &= \text{Total no. connections} - \text{All other service connections} \\
 &= 60,000 - (8,855 + 8,969 + 671) \\
 &= 41,505
 \end{aligned}$$

### B.3 Determination of revised Allowed Leakage Volumes consistent with proposals

The GDN Licence<sup>9</sup> states 'If the licensee proposes a modification to the Leakage Model pursuant to paragraph 7, the licensee shall together with all other DN Operators propose revised allowed leakage volumes ( $LB_{i,i}$ ) for each LDZ operated by the licensee that would retain the incentive properties of the environmental emissions incentive at the same level as those applicable prior to the proposed change to the Leakage Model.'

To determine revised allowed leakage volumes for the environmental emissions incentive consistent with the proposed modifications such that the incentive properties 'remain at the same level as those applicable prior to the proposed change', the output of the proposed revised model has been compared to that of the current leakage model, v1.3.

#### B.3.1 Impact of Changes to the Low Pressure Service Calculation

The impact of reflecting the new service populations has been estimated by comparing the revised leakage model output with that of the current model using 2010/11 data.

The impact of reflecting the leakage reduction associated with the movement in the service population has been estimated using the lengths of planned mains replacement and the relative proportions of service connections to metallic mains (shown Appendix B.1).

- The impact of service transfers is calculated as:
  - Mains Replacement Length x 'Transfers/km' x Leakage Rate x Average System Pressure (ASP)<sup>10</sup>
- The impact of service re-lays are already included in the current model.
- For estimating the impact in 2012/13, the total length of replacement from 2010/11 is taken into account, as it is a cumulative impact in the model.

GDN	LDZ	2010/11 – Service Leakage (GWh)			Impact of taking account of service transfers (GWh)		Combined Impact (GWh)	
		Current Model	Revised Model	Change	2011/12	2012/13	2011/12	2012/13
National Grid Gas Distribution	EA	47.2	35.2	12.0	0.3	0.6	12.3	12.6
	EM	69.7	45.3	24.4	0.4	0.8	24.8	25.2
	NT	75.1	43.8	31.4	0.2	0.4	31.6	31.8
	NW	78.1	60.8	17.3	0.4	0.8	17.7	18.1
	WM	57.2	53.6	3.6	0.3	0.6	12.3	12.6

GDN	LDZ	Original Baselines		Revised Baselines	
		2011/12	2012/13	2011/12	2012/13
National Grid Gas Distribution	EA	268	267	256	254
	EM	380	378	355	353
	NT	368	364	336	332

<sup>9</sup> Special Condition E9 paragraph 8

<sup>10</sup> ASP was omitted in error from the consultation document, but was included in the calculation of the impact of service transfers.

GDN	LDZ	Original Baselines		Revised Baselines	
		2011/12	2012/13	2011/12	2012/13
	NW	455	450	437	432
	WM	371	367	367	363