Shrinkage Overview
Joint DN Presentation

25th October 2016

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Shrinkage Overview

1. Background to Shrinkage

2. Components of Shrinkage

3. Proposed Modifications

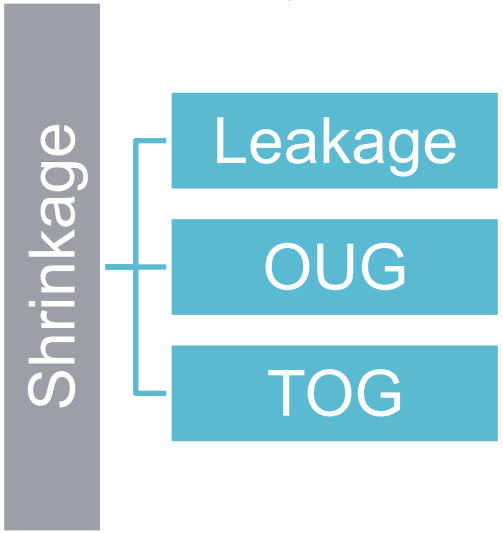
4. Annual lifecycle of Shrinkage

1. Background to Shrinkage

Shrinkage
What is Shrinkage?

- Shrinkage refers to the gas which is lost from the transportation network.
- Under the Uniform Network Code (UNC), gas distribution network companies are responsible for purchasing gas to replace the gas lost through Shrinkage.
- DNs forecast an annual Shrinkage amount and then buy an equal quantity of gas each day of the year.
- Shrinkage is a combination of

Leakage + Own Use Gas + Theft of Gas



Shrinkage
What is Shrinkage?

Shrinkage forms the majority of gas distribution network companies business carbon footprint and accounts for around 1% of Great Britain's total greenhouse gas emissions.

As such reducing losses aligns with:

- Achieving the UK governments emissions targets
- Reducing customer bills

Shrinkage
Management of Shrinkage

- DNs utilise a world leading leakage model to calculate leakage and shrinkage.
- This model was developed by Advantica and approved by Ofgem. It is used to establish Leakage and Shrinkage baselines and also actual annual performance. Any modifications to the model must be consulted on and approved by Ofgem.
- DNs have a licence condition to continuously examine ways of improving the accuracy of this model.
- The model is updated annually with actual asset records and average network pressures based on many 1000's of governor readings taken across the network 365/24/7.
- The model is used to calculate actual shrinkage and leakage annually and reported to Ofgem via Regulatory Returns

Shrinkage
Management of Shrinkage

- Annually, DNs undertake many internal checks and audits on the asset and pressure data used in the model to calculate the annual Shrinkage and Leakage returns – the acquisition and processing of this data is formally documented as part of the Data Acquisition Governance (DAG) procedure.
- DNs have invested significantly in pressure management systems to minimise pressures.
- DNs proactively manage LP network pressures to minimise leakage through close liaison with Operations/Maintenance teams using appropriate management procedures.
- Annual replacement of 1000’s km of metallic mains and services continues to significantly reduce shrinkage.

Shrinkage
Basic Incentive Structure

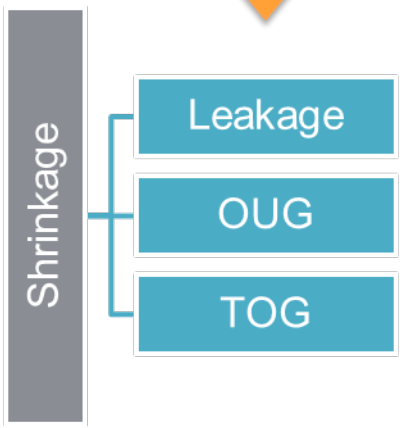
Two mechanisms of incentivisation for DNs

Shrinkage

Relates to total losses from the transportation network.

Uses price of gas and agreed pre-set **shrinkage** baseline to set an annual allowance to purchase gas lost through **shrinkage.**

If a DN experiences **shrinkage** lower than forecast then they keep the remaining allowance which is shared with the customer through IQI.



Environmental Emissions Incentive

Related to gas **leakages** to the environment.

Uses the social cost of carbon to form an incentive value.

For each unit of **leakage** a DN is under or over their baselines the incentive value is applied. Any benefit is shared with the customer through IQI.

Shrinkage
Basic Incentive Structure

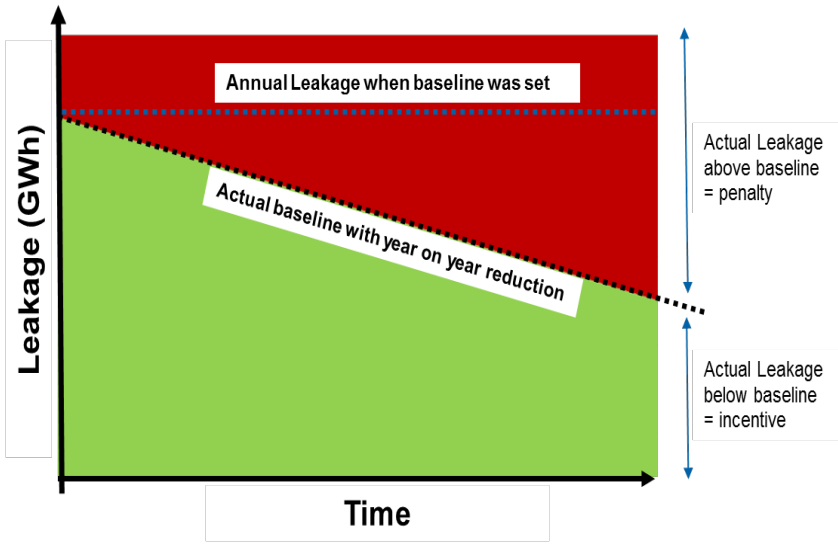
8 Year Incentive Mechanism

Allows DNs to receive an eight year incentive benefit irrespective of the timing of the investment.

Stimulates the DNs to continue to improve year on year, and removes the demotivation to undertake investment near the end of the control.

Baselines set by forward projecting the benefits of Mains Replacement activities.

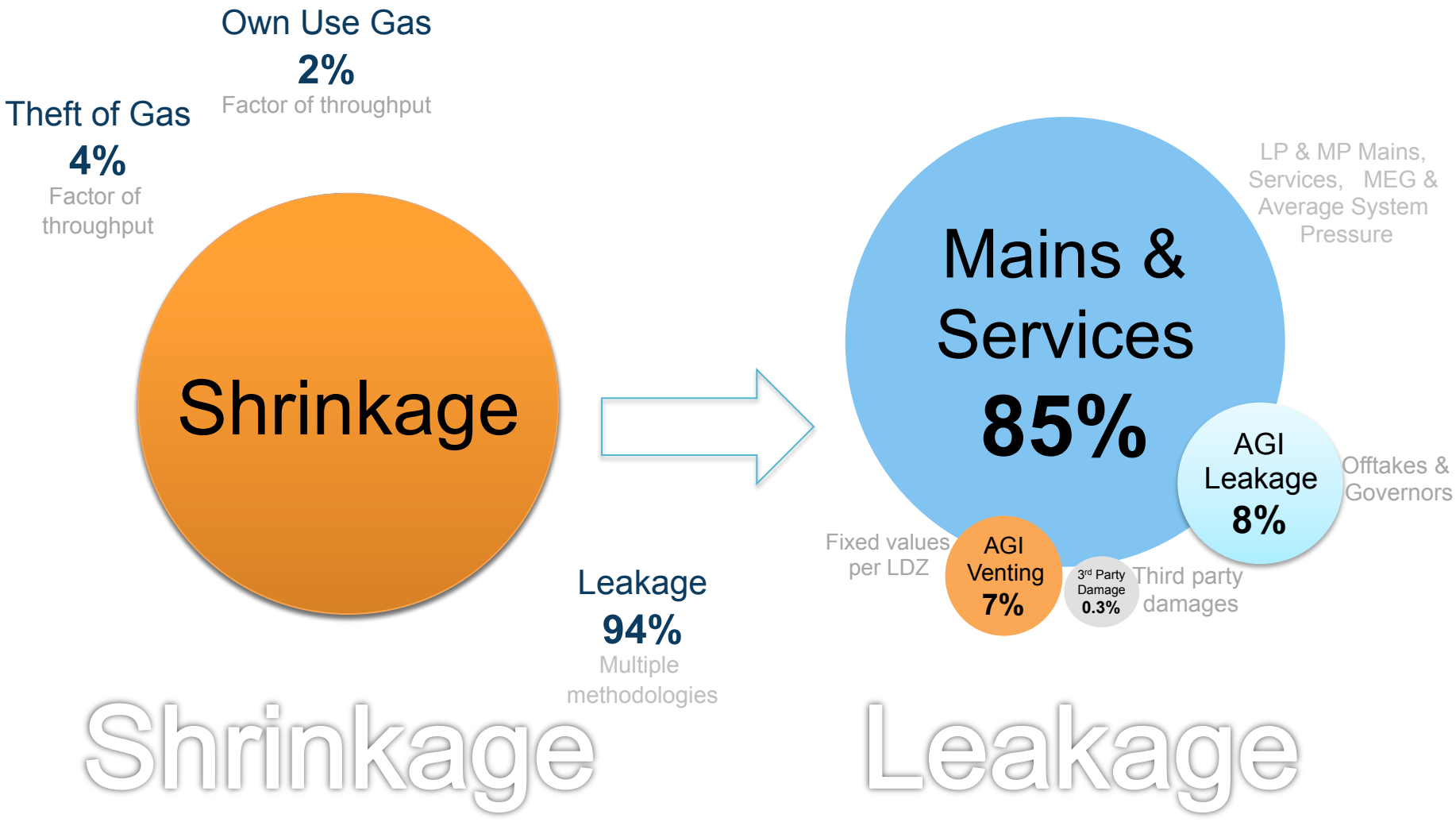
The assessment of baselines and actual Leakage and Shrinkage are undertaken using the same model.



2. Components of Shrinkage

Shrinkage

Components of Shrinkage



Shrinkage
Calculating Shrinkage

- We estimate Shrinkage using an industry approved methodology and engineering model. All DNs use the same methodology.
- Distribution Networks regularly meet to ensure consistency in the application of modelling methodology.
- Continually review the methodology with a view to enhancing the calculation methods and improving the accuracy of the Shrinkage assessment.
- Model uses pre-determined leakage rates along with data accurately reflecting asset configuration and actual performance during the year in question.

Did you know...

Shrinkage accounts for around 1% of all GB greenhouse gas emissions

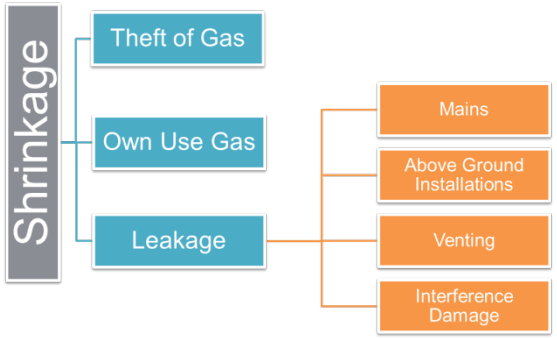
Shrinkage
Components of Shrinkage

Measure: Theft of Gas

Proportion*: 4% of total Shrinkage

General Calculation:

0.02% of Consumption



Additional Information:

Theft of Gas is defined as gas lost upstream of the meter, with a single factor being applied across all LDZs.

*As per output from 2014/15 RRP – Will vary year on year and by Distribution Network

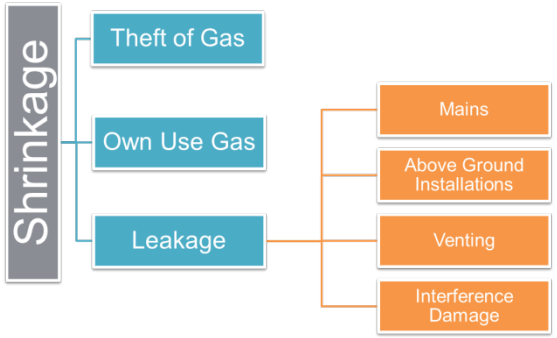
Shrinkage
Components of Shrinkage

Measure: Own Use Gas

Proportion*: 2 % of total Shrinkage

General Calculation:

0.0113% of Consumption



Additional Information:

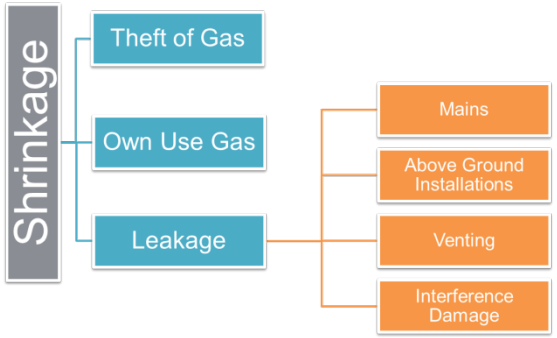
Own Use Gas is gas that is used as part of the operational requirements of the distribution network at pressure reduction stations. This is gas that is used (for example) for pre-heating prior to pressure reduction to ensure the gas doesn't freeze.

*As per output from 2014/15 RRP – Will vary year on year and by Distribution Network

Shrinkage
Components of Shrinkage

Measure: Interference Damage

Proportion*: 0.3% of total Shrinkage



General Calculation:

Large scale (defined as >500kg gas released): An assessment is made on quantity using various analysis tools

Small scale (<500kg gas released) Mains or Service damage:

No. incidents x leakage rate x average predetermined response/fix time

Additional Information:

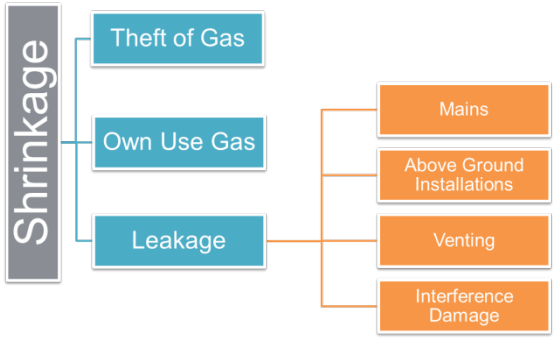
Interference Damage is a combination of large scale and small scale unplanned gas escapes into the atmosphere, usually caused by a third party damage.

*As per output from 2014/15 RRP – Will vary year on year and by Distribution Network

Shrinkage
Components of Shrinkage

Measure: Venting

Proportion*: 7% of total Shrinkage



General Calculation:

Annual leakage value per LDZ (There is currently no correlation to improvement works or asset replacement)

Additional Information:

Venting equipment routinely releases gas into the atmosphere as part of day to day operation.

Venting rates were determined as part of a 1994 Watt Committee Report. This report is no longer available in the public domain.

DNs are developing a proposed modification to change this measure into an activity based calculation.

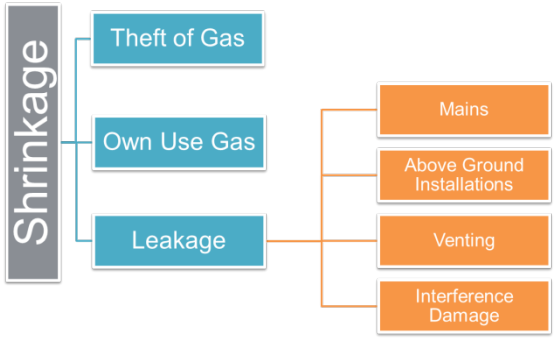
Shrinkage
Components of Shrinkage

Measure: Above Ground Installation

Proportion*: 8% of total Shrinkage

General Calculation:

Number of assets x leakage rate



Additional Information:

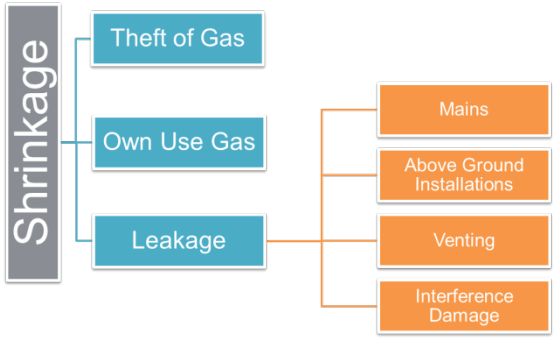
5 different leakage rates for AGI asset types, based on a national survey carried out in 2002/03.

Categories: Gas Holders, NTS Offtakes, LTS Offtakes, District Governors, Service Governors.

Shrinkage
Components of Shrinkage

Measure: Mains and Services

Proportion: 85% of total Shrinkage



General Calculation for Mains:

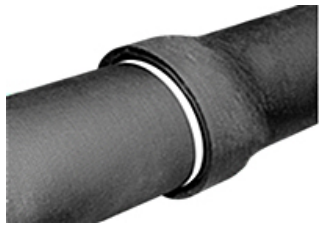
LP Asset length x leakage rate x average system pressure correction x MEG treatment

MP Asset length x leakage rate

Additional Information: Material and diameter of asset determine the rate of Leakage as per the National Leakage Test results from 2002. The NLT used the pressure decay method to determine leakage on a random sample of pipes (different diameter and materials).

Did you know...

The NLT in 2002 consisted of tests on 849 mains assets and 536 AGIs to achieve a 90% confidence interval



Mains Leakage – LP Calculations

Low Pressure: 5 material types x 5 diameters = 25 different leakage rates (applicable at 30mbar pressure – adjusted for actual pressure in the SLM).

The higher the system pressure the more an asset will leak.

Lead yarn joints leak less if MEG is saturated in the gas. More MEG = Less Leakage.

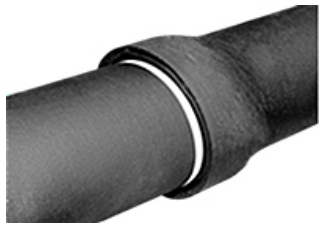
88.5% of Pit Cast and 18.5% of Spun Cast LP mains have Lead Joints.

Leakage rates in Cu.m/Annum/Km at 30mb Standard System Pressure

MATERIAL	D1 <=3"	D2 4"-5"	D3 6"-7"	D4 8"-11"	D5 >=12"
PE	63.509	63.509	63.509	63.509	63.509
Steel	3416.345	3854.337	3854.337	3854.337	3854.337
Ductile	719.184	719.184	576.399	576.399	576.399
Pit Cast	2407.209	1639.845	2525.467	2203.980	7463.399
Spun Cast	1075.711	1075.711	1075.711	1075.711	1075.711

Did you know...

The lower the ASP the less influence MEG has on Leakage



Service Leakage

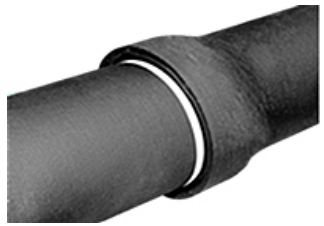
4 service types each with their own leakage rate(applicable at 30mbar pressure - adjusted for actual pressure in the SLM) determined as part of the 2002/03 NLT.

TYPE	Rate
Metal - Metal	10.592
Metal - PE	0
PE - Metal	2.194
PE - PE	0

General Calculation for Services:

No. of services in each category x leakage rate x average system pressure correction

Modification made to service calculation in 2014 after consultation



Mains Leakage – MP Calculations

Medium Pressure: 11 different leakage rates.

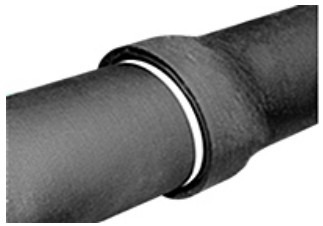
Leakage rates used are those of LP leakage and unlike LP are **not** corrected for average system pressure. Public Reported Escapes were of similar volume to that of LP pipelines so an assumption was made that MP leaks at a similar rate to LP

Future modification to Leakage model is being investigated to determine if average system pressure impacts on medium pressure leakage.

This could potentially justify investment in pressure profile MP networks in a similar way to some LP systems.

Did you know...

Polyethylene pipes have a leakage factor in the SLM



Shrinkage

Comparison to Energy UK findings

Mechanism	NLT	USA	NETHERLANDS	SPAIN
Test Year	2002/03	1996	2005	2009
Sample Size	849 Mains + 536 AGIs	44	20	21
Method	Pressure Decay	Pressure Variation	Leakage Survey	Pressure Variation
Findings	Questions length of time since refreshed, previous NLT conducted in 1992 had significantly higher leakage rates. Good sample size.	Accuracy of 0.5% of consumption with Shrinkage assumed to be 2% of consumption, suggesting an accepted error of +/- 25%.	Survey of mains asset base every 5 years, but based on above ground surveys and then apply leakage rates. Short system length, predominantly plastic.	Tests only covered MP PE mains

3. Proposed Modifications

Review of Own Use Gas Assessment

Scope: Comparing alternative pre heating technologies and system efficiencies then publish results for comparisons.

How: Installation of two alternative Pre Heating technologies across 6 NGN sites of differing scales – three Thermo Catalytic Systems (Hotcats) and three Low Pressure Steam Systems (LP Steam). Smart Metering technology will be installed on each site and used to calculate system efficiency's for each site and the smart metering technology will also be installed on six sites using the existing technology.

Rationale: The current shrinkage arrangements provide no incentive to target reductions in the Business Carbon Footprint (BCF) associated with gas pre heating and there has been limited research or development in this area resulting in no viable alternatives to target reductions in the BCF

Interference Damage Consultation

Proposal: Change to the large scale interference damage methodology to remove opportunity for windfall gains or losses in respect of the Shrinkage incentive.

How: For large scale losses of gas used for the calculation of incentives, even if the quantity of gas released is known/estimated, the quantity used is 500kg. (Quantity x leakage rate as per other Leakage model components).

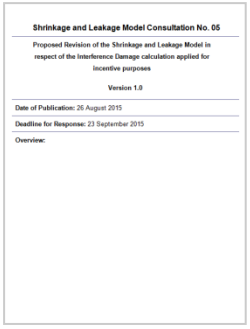
Rationale: Whilst it is reasonable to have an incentive to reduce the overall number of incidents occurring, the introduction of the rolling incentive mechanism for the RIIO-GD1 price control period increases the impact of a large gas release incident, especially if it were to occur in the final year of the price control period.

Interference Damage Consultation

1. Interference Damage calculation impact on the Shrinkage and Environmental Emissions incentives raised with Ofgem during the RIIO-GD1 price control review.

   Ofgem made reference to this in the Final Proposals Supporting Document.

2. 2015 DNs raised modification proposal


Shrinkage and Leakage Model Consultation No. 05

Proposed Revision of the Shrinkage and Leakage Model in respect of the Interference Damage calculation applied for incentive purposes

Version 1.0

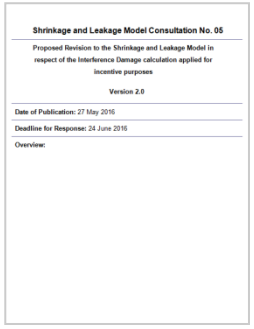
Date of Publication: 26 August 2015

Deadline for Response: 23 September 2015

Overview:

3. Stakeholder feedback received during consultation period

4. 2016 DNs published a secondary proposal for consultation


Shrinkage and Leakage Model Consultation No. 05

Proposed Revision to the Shrinkage and Leakage Model in respect of the Interference Damage calculation applied for incentive purposes

Version 2.0

Date of Publication: 27 May 2016

Deadline for Response: 24 June 2016

Overview:

5. Stakeholder feedback received during consultation period

6. Currently in the process of formulating response and considering Stakeholder feedback

AGI Venting Proposal

Current Calculation: Single value by LDZ for the entirety of the Venting emissions derived from 1994 Watt Committee Report

Proposal: Move to activity based calculation

How: Asset collection activities undertaken by all Distribution Networks to determine the quantity of venting equipment at all above ground installations.

Use captured and/or manufacturer information to determine actual venting from each asset.

Increased accuracy in calculations. Investment in innovative non-venting equipment can be reflected in Shrinkage calculations, with reduction in Shrinkage costs passed to customer.

Medium Pressure Leakage Proposal

Current Calculation: Leakage rate x asset length

Consideration: Would including an ‘average system pressure’ adjustment improve accuracy of calculation ?

How: Need to confirm that is the case, then develop a rationale to reflect accurately in the leakage model

Potential Outcome: A methodology change for MP leakage could be developed to include a pressure correction calculation if appropriate. Where economic, this may justify variable pressure control system to be introduced to some MP systems

Mains Leakage – LP Pressure Profiling

Seasonal Clocking (before)

Governors set manually twice per year, 1 winter setting and 1 summer setting which must supply enough gas to combat a worst case scenario (e.g. set at a deliberately high pressure)

Pressure Profiling (after)

Governors automatically controlled by a sophisticated computer system that profiles historic pressures at extremity points and acts accordingly. This allows system to run at close to optimum pressure whilst still balancing requirements of customer at ECV.

4. Annual lifecycle of Shrinkage

Shrinkage
Annual Lifecycle

January:

· **1st:** Shrinkage proposals issued for next formula year.

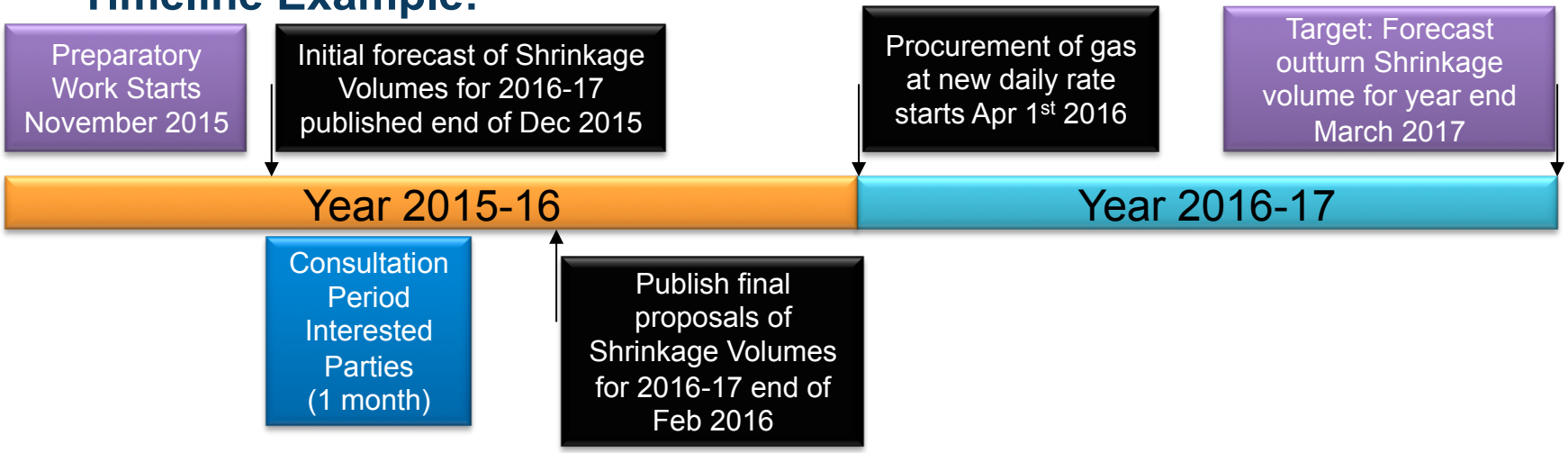
Shrinkage
Annual Shrinkage Proposals

Task: Projection of expected Shrinkage volumes at future year end.

Responsibility: Individual DNs

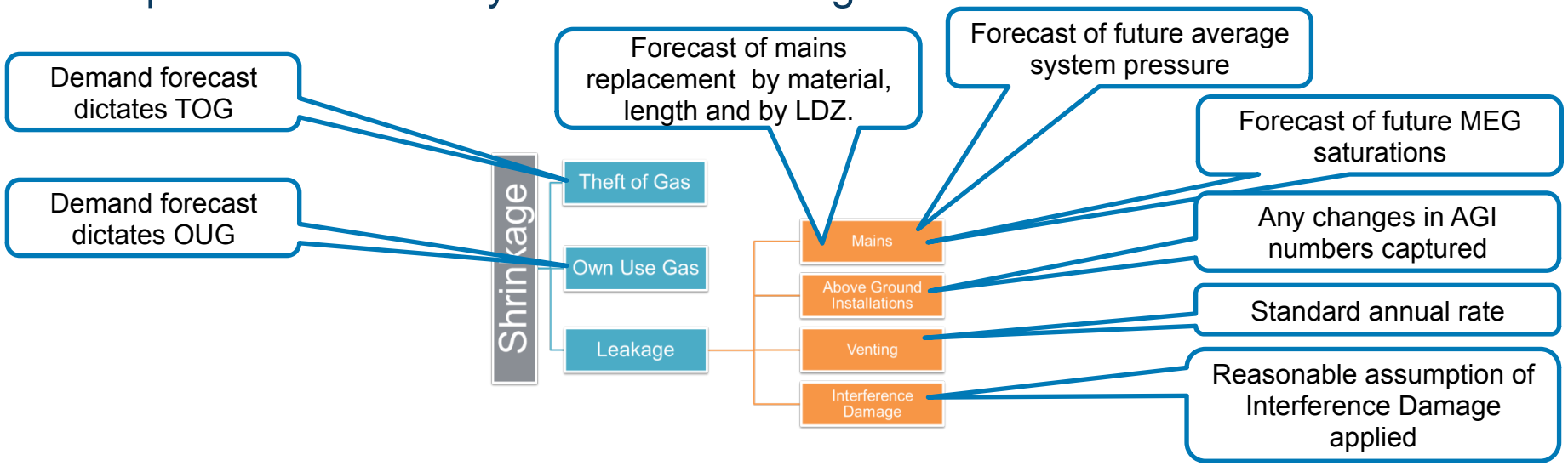
Obligations: Publish initial forecast before 31 December and final forecast end of February on Joint Office website.

Timeline Example:



Shrinkage
Annual Shrinkage Proposals

Projecting Shrinkage Volumes: Each of the following measures are required to accurately forecast Shrinkage volumes.



Consultation period: Interested parties have opportunity to challenge or comment on the proposals, to which the DNs will individually respond to.

OFGEM Representation: OFGEM are able to refuse the proposals (standard special condition A11), in which case the previous years proposal figure would be used.

Shrinkage
Annual Regulatory Reporting Process

Task: End of formula year regulatory reporting process.

Table 3.12: Shows current year outturn performance.

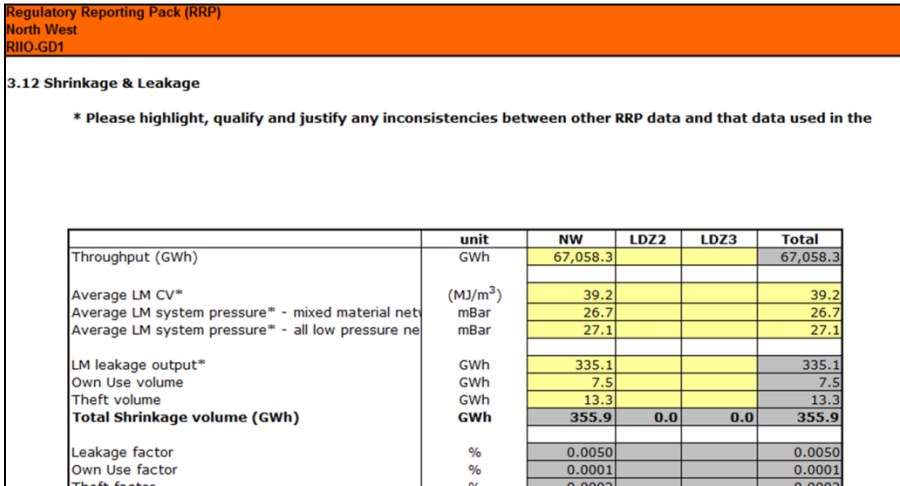
Table 2.6: Forward forecasting of Shrinkage volumes.

Responsibility: Individual DNs.

Obligations: Completed tables submitted to OFGEM by July 31st.

Additional Information:

Workload to complete tables takes about 12 weeks due to complexity.



Regulatory Reporting Pack (RRP)
North West
RIIO-GD1

3.12 Shrinkage & Leakage

* Please highlight, qualify and justify any inconsistencies between other RRP data and that data used in the

	unit	NW	LDZ2	LDZ3	Total
Throughput (GWh)	GWh	67,058.3			67,058.3
Average LM CV*	(MJ/m^3)	39.2			39.2
Average LM system pressure* - mixed material net	mBar	26.7			26.7
Average LM system pressure* - all low pressure ne	mBar	27.1			27.1
LM leakage output*	GWh	335.1			335.1
Own Use volume	GWh	7.5			7.5
Theft volume	GWh	13.3			13.3
Total Shrinkage volume (GWh)	**GWh**	**355.9**	**0.0**	**0.0**	**355.9**
Leakage factor	%	0.0050			0.0050
Own Use factor	%	0.0001			0.0001

Shrinkage
Annual review of Shrinkage Leakage Model

Task: Consult on an annual review of the Shrinkage and Leakage Model with other DN Operators, gas shippers and other interested parties.

Responsibility: Joint DN publication.

Obligation: Final publication 31st December.

Historically:

In 2015/16 a new approach was taken to producing this publication with a concerted effort made to attain stakeholder feedback prior to initial publication and consultation.

We are starting work now on the 2016/17 publication, and wish to encourage the involvement of all parties.

Shrinkage
Annual review of Shrinkage Leakage Model

Proposed Contents of 2016/17 document:

Stakeholder engagement review

Overview of shrinkage

Shrinkage calculation overview

Shrinkage reduction successes

2015/16 SLMR commitments review **New 16/17**

Energy UK Gas Retail Group study review **New 16/17**

Shrinkage Forum review **New for 16/17**

Joint Distribution collaboration session review **New for 16/17**

Our Commitments for 2017/18

LDZ performance **New for 16/17**

Shrinkage
Assessment and Adjustment Process

Task: The process of assessing actual Shrinkage vs. procured volumes

Responsibility: Individual DNs.

Obligation: Published 31st July for previous year.