Shrinkage and Leakage Model Review Final Report

Joint Distribution Network Publication
March 2024

Cadent Your Gas Network
Northern Gas Networks
SGN Your gas. Our network.
WALES&WEST UTILITIES

WALES&WEST UTILITIES

Contents

Executive Summary

The Shrinkage and Leakage Model Review consultation is an opportunity for Gas Distribution Networks (GDNs) and interested stakeholders to review and feed back on an annual basis, the components and assumptions used within the Shrinkage and Leakage Model (SLM) to ensure that it maintains or improves the accuracy of Shrinkage and Leakage calculations. This year's consultation completed on 15th March 2024.

The purpose of this review is to assess how the SLM can better achieve the objective set out in Special Condition 4.4 Part D of the Transporter Licence.

The condition requires Licensees to:

- keep the SLM under review and propose revisions that maintain or improve the accuracy of its calculation of Shrinkage and Leakage
- review the methodologies for the SLM to verify comparability of the Shrinkage and Leakage volumes produced by each DN Operator.

The GDNs published a joint report on 16th February 2024 and received one response from the consultation. Whilst the annual SLM Review process provides a positive outlet for review and comment from the wider industry, we encourage all stakeholders to raise their views and concerns via the regular Shrinkage Forum meetings facilitated by the Joint Office of Gas Transporters. These meetings offer a valuable opportunity for interested parties to further understand elements of the Shrinkage and Leakage assessment and the areas of Shrinkage of most interest to them, and to allow stakeholders to directly address these points to the GDNs. Forthcoming meetings are scheduled for 23rd September 2024 and 25th November 2024.
We remain committed to improving all aspects of Shrinkage, and consider all feedback to help develop our future works programme relating to the measurement and modelling of Shrinkage, whilst balancing the costs to gas consumers and the benefits to wider society.

Summary of 2024 commitments

Commitment	Description
Digital Platform for Leakage Analytics (DPLA)	To review all elements of fugitive emissions which will help to inform some of the previous year's projects (Pipe Remediation Review, Profiling Shrinkage and AGI Venting) as part of this project aims to trial suitable methane leak detection and quantification technologies. The outputs from this project will be a new modelling tool which combines network data and data collected from the suitable technologies to predict, monitor and report on gas emissions.
Profiling Shrinkage	Conduct analyses to identify the variables that estimates of shrinkage volumes are most closely correlated with and to engage with stakeholders to understand and develop an appropriate methodology.
Independent Shrinkage Expert	To participate in the development of MOD0843 - Establishing the Independent Shrinkage Charge and the Independent Shrinkage Expert.
Own Use Gas Review	Continue investigation into the refresh of the Own Use Gas model and methodology assumptions.

Representation from Centrica plc

Centrica plc submitted a response to the consultation via email on 17th March 2024 regarding shrinkage reductions, additional information to be included in the final report and mainly concerns about the progress and engagement on developing a methodology for profiling shrinkage. We would like to thank Centrica plc for taking the time to respond[1] to this consultation and would like to address the points raised.

Lack of progress and engagement on developing a methodology for profiling shrinkage

We agree that little progress has been made in this area and that this is disappointing given the encouragement to develop and implement a profiling methodology since 2018. From engagement at the Shrinkage Forum and in the consultation response, it is clearly stated that the Proposer's view is that profiling should not be conflated with procurement. However, it is not well understood by the Shrinkage Experts representing the GDNs at the Shrinkage Forum why profiling would not affect Shrinkage procurement processes which has lead to the confusion of how a profiling shrinkage methodology will be used. As such, in addition to committing to conducting analyses to identify the variables that estimates of shrinkage volumes are most closely correlated with, we will engage with internal stakeholders, the Central Data Services Provider (CDSP) and others who can aid with our understanding to drive progress.

We will discuss and share findings from our analyses at bimonthly meetings and at the Shrinkage Forum meetings whilst ensuring that these are collaborative meetings and not just informative.

The Profiling Shrinakge project needs to be progressed independently of the Digital Platform for Leakage Analytics project

The initial view was that the Digital Platform for Leakage Analytics project would deliver real world insights from methane leakage sensing technologies to help inform on which variables are most closely link to Shrinkage volumes but understand the concern that this may delay progress and so we will revert to treating this as a separate project.

Shrinkage reductions

The below is NGN's response to the query raised regarding shrinkage reductions:

"NGN can confirm that figures reported for 2021-22 and 2022-23 are accurate, and the reasons for the differences between these years can be attributed to the Average System Pressure and MEG – Gas Conditioning. A drop in overall throughput of both LDZs is also a contributing factor due to the gas price and cost of living crisis. The details of the Average System Pressure and MEG factors are detailed below:

- Average System Pressure

NGN as with other GDNs rely on pressure control equipment fitted to district governors to ensure pressure across the networks are only as high as they need to be. In the year in question and to, some degree, in the months leading up-to Gas year 22/23, we suffered a

[1] https://www.gasgovernance.co.uk/sites/default/files/ggf/book/2024-03/Shrinkage%20and%20Leakage%20Model%20Review%20Consultation%20Response%20-%20Centrica%20%2818%20March%202024%29.pdf

lot of pressure control failures which, combined with slowness in the supply chain, meant we were unable to get the parts required to repair faults as fast as the failures.

The supply chain issues affected all GDNs and were not limited to our industry and were the result of international lockdowns during the COVID pandemic affecting factory production across the world. Later in 2022, through 2023 until the present day, NGN have increased focus in this area to minimise the impact of faulty equipment and have partnered with an alternative supplier introducing competition to a market which was highly monopolised at the time. The introduction of an additional, competitive supplier, will result in the reduction in likelihood of this type of supply / demand issue in the future.

- MEG – Gas Conditioning

A major review of the MEG gas conditioning programme has been undertaken to understand where the performance could be further improved, with director level backing, this has led to much improved visibility and accessibility of saturation management information, enabling intervention into low-performing foggers at an earlier stage.

Due to aging equipment and an ever changing network due to the mains replacement programme, a major maintenance programme of all existing foggers, refurbishment, installation of additional foggers, ensuring the sample points are in the optimal locations."

Additional information

The additionial information requested has been included for this Final Report.

2024 Commitments Summary

Digital Platform for Leakage Analytics – SIF Beta

Project Team: Cadent, SGN, WWU, NGN, National Gas, Guidehouse

Shrinkage Components: Pipe Leakage, AGI Leakage

Selection Reason: The solution applies a combination of physics based hydraulic models and machine learning based models that leverage existing and new data to detect and locate gas leaks more accurately than the SLM. This ensures that shrinkage calculations will remain relevant into the future and enhance the GDNs' abilities to proactively reduce emissions due to leaks from the gas networks.

Expected Materiality: Success will see a step change in the methods used to inform on gas network emissions, allowing asset by asset identification and quantification of emission sources that enable targeted replacement or refurbishment of the highest emitters. Assuming all GDNs implement the DPLA, the project anticipates 12,435 GWh of avoided natural gas and/or hydrogen loss volumes and 14,856 $ktCO_2e$ of avoided greenhouse gas emissions from distribution network shrinkage and leakage by 2050.

Costs: Approximately £12m for Beta Phase.

Expected Timelines: The Beta Phase is to be completed by March 2026. The aims for the next 12 months will be for Cadent to field test a selection of methane detection technologies on their network. Some examples include sensors mounted on vehicles which assess leakage rates at an asset level and fixed methane detection sensors continuously surveying for leaks at above ground installations (AGIs). Further information will be disseminated at the Shrinkage Forum and other industry sessions.

As the platform relies heavily on data to deliver meaningful results, the GDNs will focus on data preparation to ensure interoperability following the learnings from Cadent. This would support the roll out of the analytics platform and aligns with GDN digitalisation strategies. There is also another separate SIF project called 'Intelligent Gas Grid' led by SGN with WWU and NGN as collaborating partners. Part of this project looks at the use of machine learning to detect anomalies on the network based on pressure data. The knowledge gained from this project will be shared with DPLA.

Stakeholder Engagement: Engagement will continue through the Shrinkage Forum and separate sessions will continue to be held with interested stakeholders to enable a collaborative approach by allowing for timely input from stakeholders throughout the project.

Profiling Shrinkage

Project Team: Cadent, SGN, WWU, NGN, Centrica

Shrinkage Components: All

Selection Reason: Stakeholder Representation

Expected Materiality: Not established.

Costs: Internal resourcing only.

Expected Timelines: To be determined pending discussions from collaborative meetings and engagement with stakeholders.

Stakeholder Engagement: Bimonthly collaborative meetings with stakeholder and updates at the Shrinkage Forum.

Own Use Gas Review

Project Team: Cadent, SGN, WWU, NGN, DNV, Newcastle University

Shrinkage Components: Own Use Gas

Selection Reason: Stakeholder Representation

Expected Materiality: Not established.

Costs: Approximately £200k

Expected Timelines: To be complete mid-2024. Newcastle University are currently reviewing the work undertaken by DNV. DNV are now developing an updated Own Use Gas model with modern technology and the latest assumptions based on recent data.

Stakeholder Engagement: Engagement will continue through the Shrinkage Forum.

Establishing the Independent Shrinkage Charge and the Independent Shrinkage Expert (UNC Modification 0843)

Modification Owner: OVO Energy

Shrinkage Components: All

Selection Reason: Stakeholder Modification

Expected Materiality: Unknown as this would be dependent on the activities undertaken by the Independent Shrinkage Expert.

Costs: Not yet applicable, internal resourcing only. Should this modification be approved, the costs will be for the implementation and instatement of an Independent Shrinkage Expert and their proposed activities.

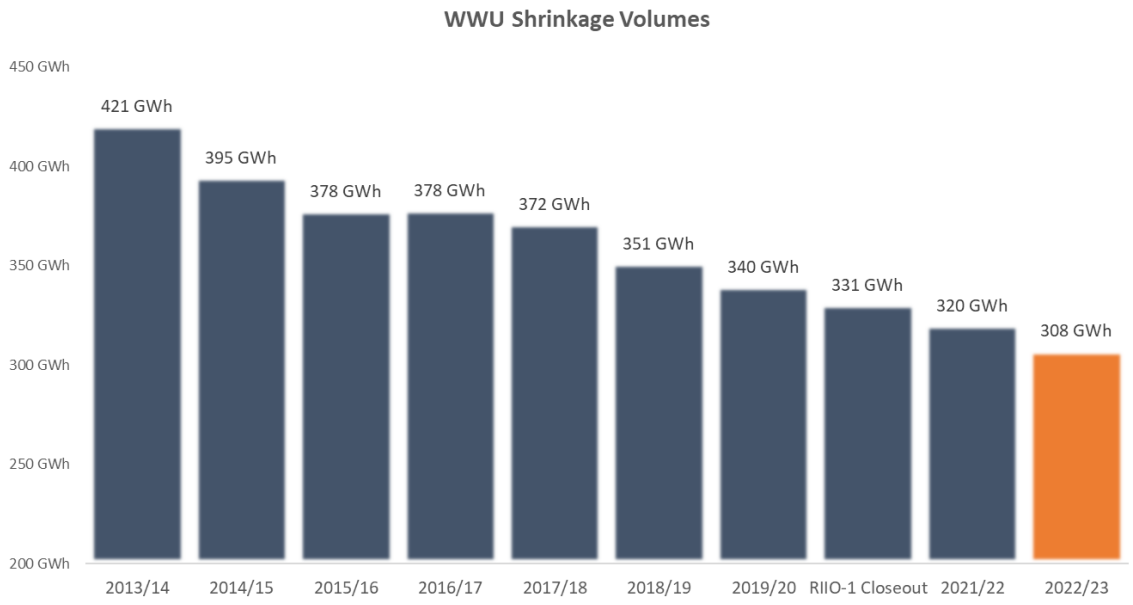
Expected Timelines: Unknown as modification framework and methodology continues to be discussed.

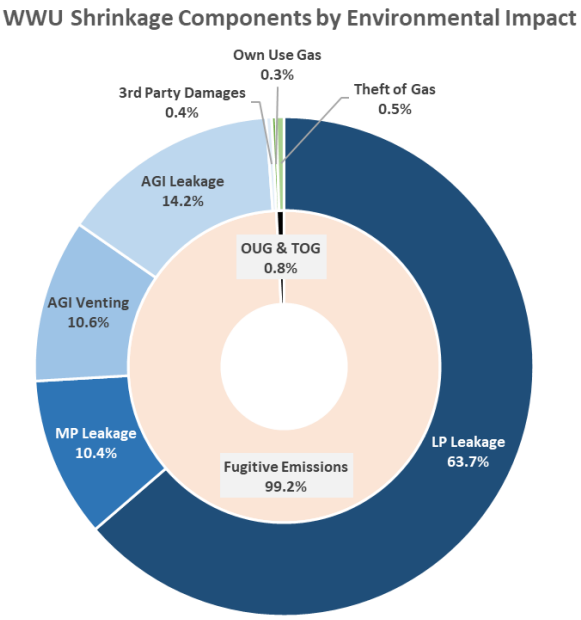
Stakeholder Engagement: GDNs will continue to participate in the workgroup sessions, however, maintain that with the ongoing progress of the DPLA project, there is no cost benefit to gas consumers or emissions reductions possible unless the Independent Shrinkage Expert provides suitable granularity in their work to deliver actionable insights. In this context, an example of an actionable insight is the location of leaks which would enable GDNs to monitor, prioritise and remediate them.

Shrinkage Performance

This section shows a breakdown of shrinkage volumes by GDN since 2013/14.

WWU Performance





Wales & West Utilities Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	197.3 GWh 62%	System pressures increased by 0.07mb causing increased emissions. Low Pressure metallic mains length decreased by 397.9km. MEG is not used within this Distribution Network. Demand decreased by -12.3% impacting OUG and TOG by the same amount.	187.4 GWh 61%	-9.9 GWh -5.0%
MP Leakage	30.9 GWh 10%		30.6 GWh 10%	-0.3 GWh -1.0%
Other (AGI's, OUG, Theft & Interference)	92.1 GWh 29%		89.7 GWh 29%	-2.4 GWh -2.6%
Total	320.3 GWh 100%		307.7 GWh 100%	-12.6 GWh -3.9%

Wales North LDZ (WN) Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	16 GWh 38%	System pressures increased by 0.631mb causing increased emissions. Low Pressure metallic mains length decreased by 32.5km. MEG is not used within this LDZ Demand decreased by -12.6% impacting OUG and TOG by the same amount.	15.7 GWh 38%	-0.3 GWh -2.2%
MP Leakage	3.2 GWh 8%		2.7 GWh 7%	-0.6 GWh -17.0%
Other (AGI's, OUG, Theft & Interference)	22.9 GWh 54%		22.6 GWh 55%	-0.4 GWh -1.6%
Total	42.2 GWh 100%		40.9 GWh 100%	-1.3 GWh -3.0%

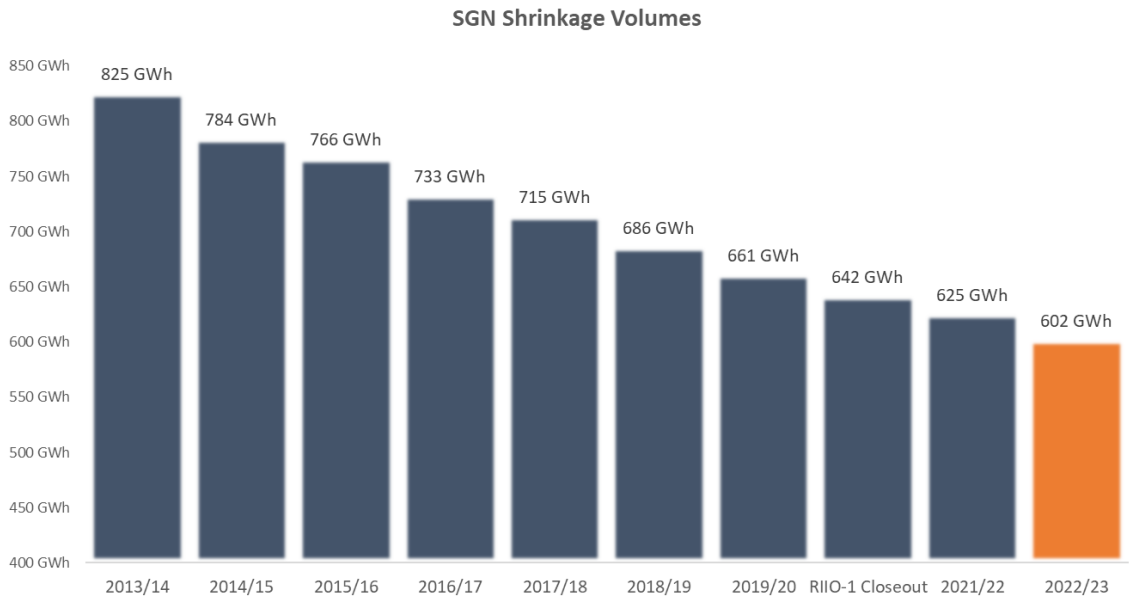
Wales South LDZ (WS) Network Performance

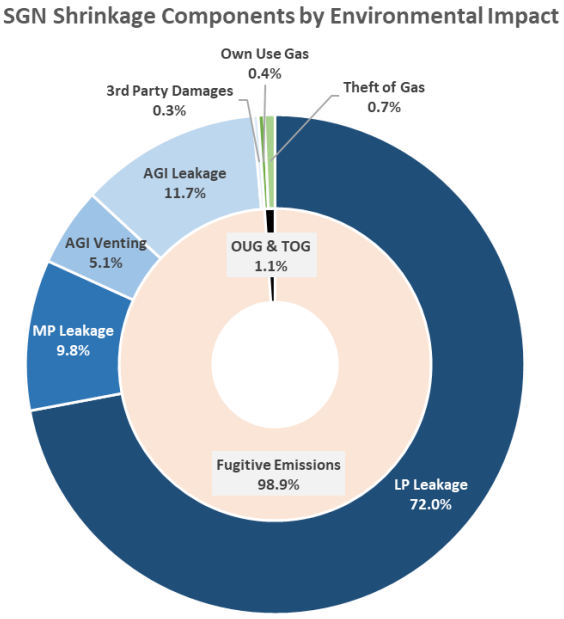
Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	50.7 GWh 57%	System pressures increased by 0.011mb causing increased emissions. Low Pressure metallic mains length decreased by 88.8km. MEG is not used within this LDZ Demand decreased by -11.7% impacting OUG and TOG by the same amount.	48.7 GWh 56%	-1.9 GWh -3.8%
MP Leakage	9.2 GWh 10%		9.3 GWh 11%	0.1 GWh 1.0%
Other (AGI's, OUG, Theft & Interference)	29.4 GWh 33%		28.6 GWh 33%	-0.8 GWh -2.8%
Total	89.3 GWh 100%		86.6 GWh 100%	-2.6 GWh -3.0%

South West England LDZ (SW) Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	130.6 GWh 69%	System pressures increased by 0.003mb causing increased emissions. Low Pressure metallic mains length decreased by 276.5km. MEG is not used within this LDZ Demand decreased by -12.3% impacting OUG and TOG by the same amount.	123 GWh 68%	-7.6 GWh -5.8%
MP Leakage	18.5 GWh 10%		18.6 GWh 10%	0.1 GWh 0.5%
Other (AGI's, OUG, Theft & Interference)	39.7 GWh 21%		38.5 GWh 21%	-1.2 GWh -3.1%
Total	188.9 GWh 100%		180.1 GWh 100%	-8.7 GWh -4.6%

SGN Performance





SGN Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	428.3 GWh 69%	System pressures decreased by 0.04mb causing decreased emissions. Low Pressure metallic mains length decreased by 772.2km. MEG saturations increased 8.2% Demand decreased by -5.3% impacting OUG and TOG by the same amount.	408.5 GWh 68%	-19.8 GWh -4.6%
MP Leakage	55.7 GWh 9%		55.4 GWh 9%	-0.3 GWh -0.5%
Other (AGI's, OUG, Theft & Interference)	139.4 GWh 22%		138.3 GWh 23%	-1.1 GWh -0.8%
Total	623.4 GWh 100%		602.2 GWh 100%	-21.2 GWh -3.4%

South East LDZ (SE) Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	205.7 GWh 77%	System pressures decreased by 0.139mb causing decreased emissions. Low Pressure metallic mains length decreased by 334.1km. MEG saturations decreased 1.1% Demand decreased by -6.2% impacting OUG and TOG by the same amount.	196.8 GWh 76%	-8.9 GWh -4.3%
MP Leakage	13.8 GWh 5%		13.7 GWh 5%	-0.1 GWh -0.8%
Other (AGI's, OUG, Theft & Interference)	48.3 GWh 18%		47.3 GWh 18%	-1 GWh -2.0%
Total	267.8 GWh 100%		257.8 GWh 100%	-10 GWh -3.7%

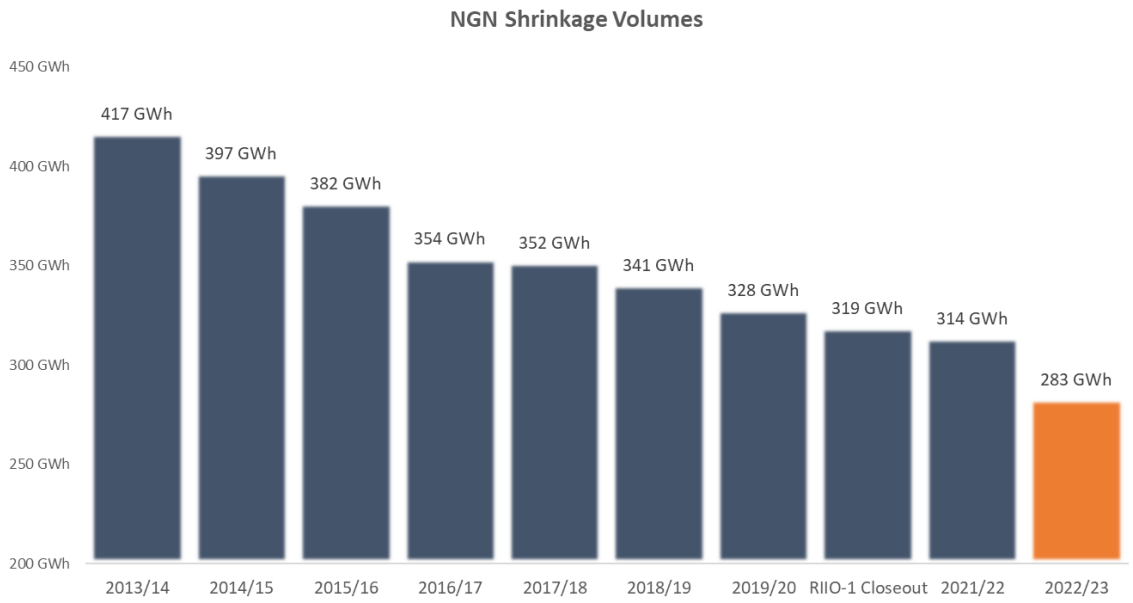
South LDZ (SO) Network Performance

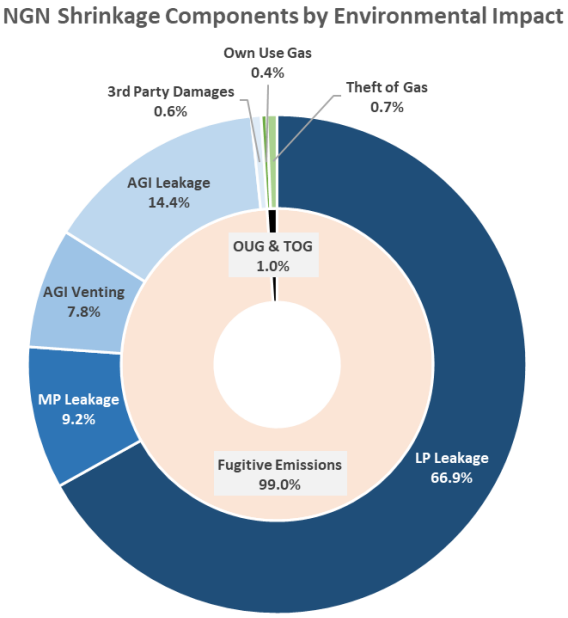
Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	119.5 GWh 64%	System pressures increased by 0.043mb causing increased emissions. Low Pressure metallic mains length decreased by 191.4km. MEG saturations increased 0% Demand decreased by -8.3% impacting OUG and TOG by the same amount.	115.5 GWh 63%	-4.1 GWh -3.4%
MP Leakage	26.6 GWh 14%		26.5 GWh 14%	-0.1 GWh -0.3%
Other (AGI's, OUG, Theft & Interference)	42.1 GWh 22%		42.1 GWh 23%	0 GWh 0.0%
Total	188.2 GWh 100%		184.1 GWh 100%	-4.1 GWh -2.2%

Scotland LDZ (SC) Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	103 GWh 62%	System pressures decreased by 0.007mb causing decreased emissions. Low Pressure metallic mains length decreased by 246.7km. MEG saturations increased 9.8% Demand decreased by -2.3% impacting OUG and TOG by the same amount.	96.2 GWh 60%	-6.8 GWh -6.6%
MP Leakage	15.2 GWh 9%		15.1 GWh 9%	-0.1 GWh -0.7%
Other (AGI's, OUG, Theft & Interference)	49.1 GWh 29%		48.8 GWh 30%	-0.3 GWh -0.7%
Total	167.3 GWh 100%		160.1 GWh 100%	-7.2 GWh -4.3%

NGN Performance





Northern Gas Networks Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	207.3 GWh 66%	System pressures decreased by 1.82mb causing decreased emissions. Low Pressure metallic mains length decreased by 464km. MEG saturations increased 22.3% Demand decreased by -11.9% impacting OUG and TOG by the same amount.	179.1 GWh 63%	-28.2 GWh -13.6%
MP Leakage	25 GWh 8%		24.7 GWh 9%	-0.3 GWh -1.2%
Other (AGI's, OUG, Theft & Interference)	81.7 GWh 26%		79.6 GWh 28%	-2.1 GWh -2.6%
Total	314 GWh 100%		283.4 GWh 100%	-30.6 GWh -9.7%

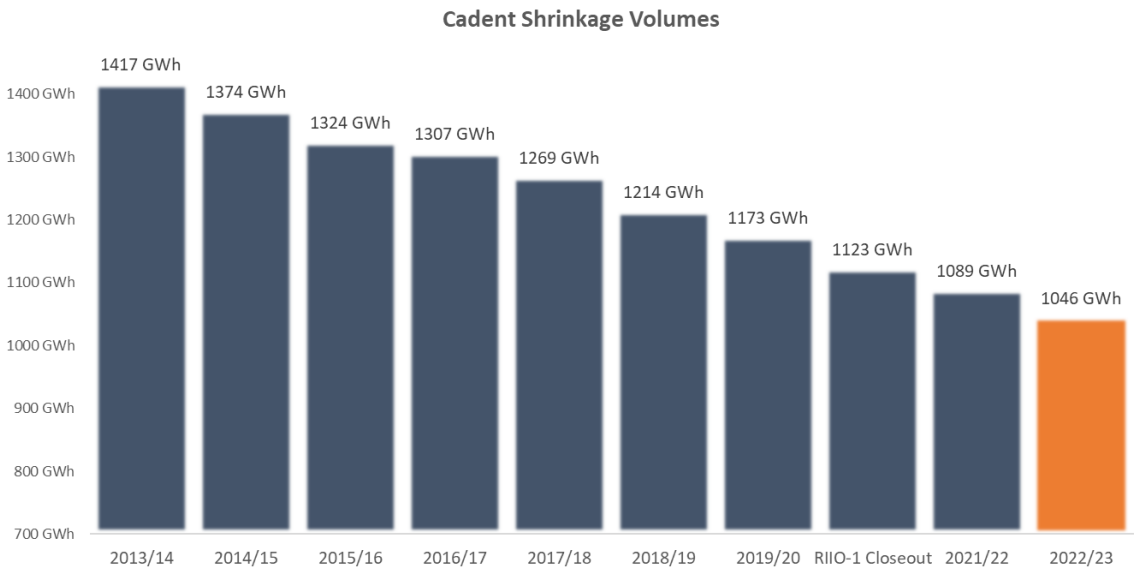
North East (Yorkshire) LDZ Network Performance

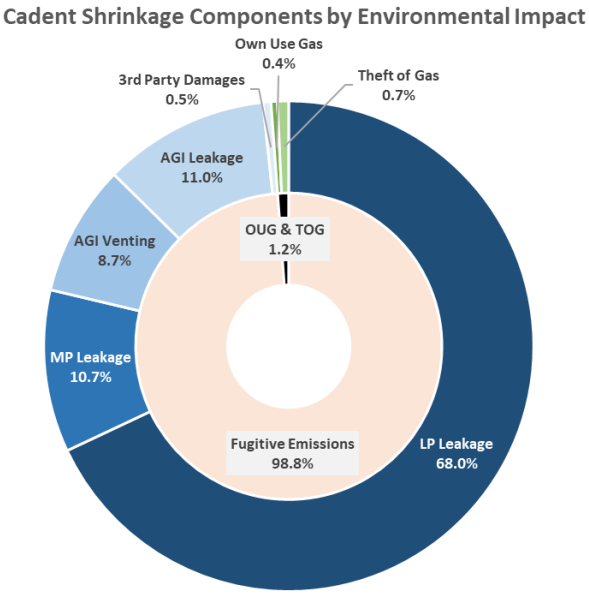
Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	112.6 GWh 66%	System pressures decreased by 2.335mb causing decreased emissions. Low Pressure metallic mains length decreased by 245.5km. MEG saturations increased 13.2% Demand decreased by -12.1% impacting OUG and TOG by the same amount.	96.3 GWh 63%	-16.4 GWh -14.5%
MP Leakage	16.1 GWh 9%		16 GWh 10%	-0.1 GWh -0.7%
Other (AGI's, OUG, Theft & Interference)	41.2 GWh 24%		40.1 GWh 26%	-1.1 GWh -2.7%
Total	169.9 GWh 100%		152.4 GWh 100%	-17.6 GWh -10.4%

North LDZ Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	94.7 GWh 66%	System pressures decreased by 1.211mb causing decreased emissions. Low Pressure metallic mains length decreased by 218.5km. MEG saturations increased 30.2% Demand decreased by -11.7% impacting OUG and TOG by the same amount.	82.8 GWh 63%	-11.9 GWh -12.6%
MP Leakage	8.9 GWh 6%		8.7 GWh 7%	-0.2 GWh -1.9%
Other (AGI's, OUG, Theft & Interference)	40.5 GWh 28%		39.5 GWh 30%	-1 GWh -2.4%
Total	144.1 GWh 100%		131 GWh 100%	-13 GWh -9.0%

Cadent Performance





Cadent Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	705.4 GWh 65%	System pressures increased by 0.11mb causing increased emissions. Low Pressure metallic mains length decreased by 1593.1km. MEG saturations increased 4.8% Demand decreased by -6.5% impacting OUG and TOG by the same amount.	666.9 GWh 64%	-38.5 GWh -5.5%
MP Leakage	106.6 GWh 10%		104.9 GWh 10%	-1.7 GWh -1.6%
Other (AGI's, OUG, Theft & Interference)	276.8 GWh 25%		273.9 GWh 26%	-2.9 GWh -1.0%
Total	1088.8 GWh 100%		1045.7 GWh 100%	-43.1 GWh -4.0%

East Anglia LDZ Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	115.6 GWh 63%	System pressures increased by 0.53mb causing increased emissions. Low Pressure metallic mains length decreased by 302.5km. MEG is not used within this LDZ Demand decreased by -6.6% impacting OUG and TOG by the same amount.	111.1 GWh 62%	-4.5 GWh -3.9%
MP Leakage	14.6 GWh 8%		14.5 GWh 8%	-0.1 GWh -0.5%
Other (AGI's, OUG, Theft & Interference)	53.2 GWh 29%		53.8 GWh 30%	0.6 GWh 1.2%
Total	183.4 GWh 100%		179.5 GWh 100%	-3.9 GWh -2.1%

East Midlands LDZ Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	99.6 GWh 51%	System pressures increased by 0.306mb causing increased emissions. Low Pressure metallic mains length decreased by 280.2km. MEG saturations increased 7.5% Demand decreased by -7% impacting OUG and TOG by the same amount.	94.5 GWh 50%	-5.1 GWh -5.1%
MP Leakage	39.3 GWh 20%		39.4 GWh 21%	0.1 GWh 0.4%
Other (AGI's, OUG, Theft & Interference)	58.3 GWh 30%		56.9 GWh 30%	-1.4 GWh -2.3%
Total	197.2 GWh 100%		.926634240547 G 100%	-6.3 GWh -3.2%

North London LDZ Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	131.1 GWh 67%	System pressures decreased by 0.036mb causing decreased emissions. Low Pressure metallic mains length decreased by 283.2km. MEG saturations increased 6% Demand decreased by -6.2% impacting OUG and TOG by the same amount.	122.6 GWh 67%	-8.5 GWh -6.5%
MP Leakage	18.6 GWh 10%		16.9 GWh 9%	-1.7 GWh -8.9%
Other (AGI's, OUG, Theft & Interference)	45.3 GWh 23%		44.4 GWh 24%	-0.9 GWh -2.0%
Total	195 GWh 100%		183.9 GWh 100%	-11.1 GWh -5.7%

North West LDZ Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	186.7 GWh 70%	System pressures increased by 0.01mb causing increased emissions. Low Pressure metallic mains length decreased by 423.3km. MEG saturations increased 9.5% Demand decreased by -7% impacting OUG and TOG by the same amount.	174.5 GWh 68%	-12.2 GWh -6.5%
MP Leakage	14.5 GWh 5%		14.6 GWh 6%	0.1 GWh 0.4%
Other (AGI's, OUG, Theft & Interference)	67.2 GWh 25%		67.1 GWh 26%	-0.1 GWh -0.2%
Total	268.4 GWh 100%		256.2 GWh 100%	-12.2 GWh -4.6%

West Midlands LDZ Network Performance

Component	2021/22	Drivers of Change	2022/23	Difference
LP Leakage	172.4 GWh 70%	System pressures decreased by 0.164mb causing decreased emissions. Low Pressure metallic mains length decreased by 304km. MEG saturations decreased 2.4% Demand decreased by -5.5% impacting OUG and TOG by the same amount.	164.2 GWh 70%	-8.2 GWh -4.8%
MP Leakage	19.6 GWh 8%		19.5 GWh 8%	-0.1 GWh -0.7%
Other (AGI's, OUG, Theft & Interference)	52.8 GWh 22%		51.7 GWh 22%	-1.1 GWh -2.1%
Total	244.8 GWh 100%		235.3 GWh 100%	-9.5 GWh -3.9%

Modelling Consistency SLM Methodology Rules

Special Condition 4.4 Part D of the Transporter Licence specifies that Licensees must review the methodologies for the SLM to verify comparability of the Shrinkage and Leakage volumes produced by each DN Operator.

GDNs ensure reporting consistency by a combination of applying the approved SLM methodology and through regular GDN Shrinkage meetings. The methodology is applied as part of the regulatory reporting process.

GDNs also adhere to Data Assurance Guidelines (DAG) procedures which involve multiple internal approval processes as listed:

1. Second Person Review
2. Internal Expert Review
3. Senior Manager Sign-off
4. Director Sign-off

The acquisition, processing, and validation of this large volume of data results in lead times of approximately 4 months each year (April-July) to produce the final Leakage and Shrinkage figures. These are subject to detailed internal scrutiny and formal approval processes prior to being sent to the Authority as part of the GDNs' Regulatory Reporting Packs (RRPs) and is used to compile the annual Assessment and Adjustment Report published at the end of July. GDNs have previously undertaken multiple workshops to ensure a consistent approach is taken to applying the below methodology and all GDNs use the following assumptions to complete the SLM which were approved by the Authority:

- Own Use Gas quantities are calculated as 0.0113% of annual gas throughput.
- Theft Of Gas (or more precisely theft in conveyance) quantities are calculated as 0.020% of annual gas throughput.
- Low Pressure leakage rates are categorised by material and diameter type as directed in the latest National Leakage Test. Leakage rates for Low Pressure mains increase or decrease depending on the localised annual average system pressure.
    - PE 63.5 cu.m/annum/km at 30mbar system pressure
    - Steel 3,416.3 – 3,854.3 cu.m/annum/km at 30mbar system pressure
    - Ductile Iron 576.4 – 719.2 cu.m/annum/km at 30mbar system pressure
    - Pit Cast 1639.8 – 7,463.4 cu.m/annum/km at 30mbar system pressure
    - Spun Cast 1,075.7 cu.m/annum/km at 30mbar system pressure
- Medium Pressure leakage rates were derived from those used for LP Mains Leakage.
    - PE 63.5 cu.m/annum/km
    - Steel 3416.3 – 3854.3 cu.m/annum/km

    - Ductile Iron 576.4 – 719.2 cu.m/annum/km
    - Pit Cast 1075.7 cu.m/annum/km
    - Spun Cast 1075.7 cu.m/annum/km
- Medium Pressure average system pressure is assumed to be 30mbar – no provision is made within the approved SLM for calculating leakage volume based on MP average system pressure.
- AGI Leakage rates are split into 5 categories with a leakage rate applied to each category:
    - Holder Station: 7,692 m^3/year/site
    - NTS Offtake: 31,075 m^3/year/site
    - Local Transmission: 6,485 m^3/year/site
    - District Governor: 407 m^3/year/site
    - Service Governor: 8 m^3/year/site
- AGI Venting rates are specified for each LDZ and remain static.
- Interference Damage Mains >500kg incidents:
    - Emissions use a flat rate of 500kg per incident.
- Interference Damage to mains <500kg incidents, the quantity of incidents are split by the following ratios:
    - LP Incidents: 95%, leakage rate 42.45m^3/hr (response time of 3.92 hours)
    - MP Incidents: 5%, leakage rate 283m^3/hr (response time of 3.92 hours)
- Interference damage to services are calculated using a set of assumptions (once the number of incidents has been determined). The first is that the incidents are split 50:50 between severing of service and puncturing of service, both of which have a different set leakage rate.
    - Severed service – 17m^3/hr (response time 2 hrs),
    - Punctured service – 5.6m^3/hr (response time 2 hrs).
- Percentage of Pit Cast population that is Lead Yarn Jointed is 88.5%. Percentage of Spun Cast population that is Lead Yarn Jointed is 18.5%.
- MEG saturations and net leakage impact follow an exponential pattern, so for a known saturation you could calculate net leakage benefit using the following exponential calculation:
    - Net Leakage benefit = exp (-0.899 * Saturation).