Energy UK Gas Retail Group Study into the effect of shrinkage on domestic customers

Final Report

Version 5

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For Energy UK

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1 Executive Summary

The overall brief for this project was to study the determination and calculation of shrinkage and to review the methodology used to calculate gas shrinkage and assess whether it needs updating or improving.

The methodology followed was based on a review of:

- The technical and regulatory literature produced by the regulator and operators in the UK
- Similar literature for other jurisdictions
- The open academic literature
- Material from other industry sectors (e.g. water, offshore oil and gas).

These were coupled with some engineering analysis of the data and published models.

This report has reviewed:

- The GDN shrinkage and leakage model and its input factors
- Similar models and factors used elsewhere
- Evidence from a variety of leakage measurements
- Practices in other industries
- Regulation and policy around shrinkage

These are some of the key findings:

Model

- The model is most sensitive to
    - the metallic length
    - the leakage rate for the metal service connected to metal main
    - the number of relays per km
    - the leakage rates of polyethylene (PE) mains
- There is evidence that a zero leakage rate (as assumed by the model) for polyethylene services is highly unlikely in practice (although this number is low)
- The sample-based approach from the 2002 study to generate the leakage factors is likely generate a bias towards underestimation as the leakage rate distribution is skewed, with large amounts of leakage being caused be relatively few leaks in large systems; such leaks could be missed in small samples.
- We have found that there are some important anomalies in the shrinkage model which are not consistent with theory; that some of the data are not in line with international estimates and some assumptions border on the optimistic. It has been over 12 years since the last calibration study and it would be reasonable to request another one, especially considering the intervening improvements in technology.

- More evidence to justify the network composition assumptions should be made available to shippers and other stakeholders to generate more confidence in the SLM. We were not available to find evidence on network composition on the gas governance website.
- The elapsed time means that knowledge of how the model was developed and the assumptions made and procedures for model maintenance are not as clear as they could be.
- Note that the same model is used in each region/area.

Measurements

- There is evidence from an review of actual international methane emission measurements in cities that reported leakage rates based on estimation models underestimate actual leakages. For example, a London study described in section 4.2 indicates that actual leakage rates could be up to three times higher.
- This will of increasing concern as countries will be required to provide increasingly accurate greenhouse gas (GHG) emissions inventories. For example, DEFRA/DECC must provide such statistics to the European Commission and UNFCC.

Regulation/Policy

- The Shrinkage Allowance and Environmental Emissions Incentive have had some effect on improved system pressure management which has had a moderate impact but may increasingly not deliver the desired effect.
- The HSE based IMRP (REPEX) process has potentially had a larger impact on shrinkage than the Ofgem shrinkage allowance and emissions based incentives, although both policies generate similar outcomes. Around 80% of the shrinkage reduction arises out of mains replacement.
- The model assumptions around iGTs are leading to an underestimate of shrinikage: iGTs started off as a small part of the system but they are now quite substantial and efforts should be made to include them properly in the estimation of shrinkage and to require the relevant reporting. There are around 1.5 million meter points and the actual shrinkage could constitute up to 2-5% of the current estimate, i.e. £1.4-3.5m. Furthermore, no figures are available for estimates of third party damage/interference; it may be expected that relatively higher amounts of excavation are taking place in iGT areas as they are areas of new development.

Possible Developments in Accuracy Improvement

- The water industry equates leakage rate estimation with unaccounted for supply and bases it on actual measurements using on the balance between water entering the network and that consumed. A total/integrated flow method is used for the whole network and a “night-flow” method for smaller sub-networks.
- The oil and gas production industry uses “age factors” to indicate that older equipment is expected to have higher leakage rates. This could be particularly relevant to AGIs and preheaters. It also applies temperature and pressure corrections which could be used to improve shrinkage estimates. Finally, it has developed a range of leak detection and

measuring methods (e.g. IR detection, bagging) which might be exploited in distribution networks.

- The Netherlands survey their GDNs every 5 years, leading to good quality network composition data (less than 0.4% unknown). This is an example of best practice.

Core Recommendation

It has been over 12 years since the last calibration study and it would be reasonable to request another one, especially considering the intervening improvements in technology. Although the cost might be of the order of £10m, when compared to the uncertainty of the shrinkage measures the figure is not large. For example, it could easily be argued that the shrinkage estimate error is at least 20% which is of the order of £15m p.a. (based on a total estimate of £75m p.a.), hence the uncertainty resolution cost which would apply over several years is very low compared to the level of uncertainty. The cost may be reduced through new non-invasive technologies as well (or semi-invasive methods such as the "suction method" used in the Netherlands study[xlvi] described later in this report); these could be evaluated using low carbon innovation network funding. Furthermore, this is important for the National Emissions Inventory which must be reported by DEFRA every year.

It has been stated that an updated study might be made redundant by smart meters, however since these may be able to evaluate shrinkage more accurately but not apportion it and hence not lead to actionable data, this should not be the case. The new study would therefore be future proof. This could be coupled with periodic, non-invasive leak detection activities.

This could be co-managed/supported by stakeholders interested in better national emissions inventories (e.g. DECC/DEFRA) and the means to reduce emissions.