

## Estimation of CSEPs Leakage

Network Code defines Shrinkage as "...gas in a System which is used by the Transporter in connection with the operation of, or which is unaccounted for as offtaken from, a System". For Gas Distribution Networks (GDNs), gas 'used by the Transporter', or Own Use Gas (OUG), represents gas used for pre-heating purposes to prevent the gas temperature falling below zero degrees during pressure reduction (the Joule-Thompson effect). 'Unaccounted for' gas includes leakage and theft.

CSEPs do not require pre-heating facilities, therefore, OUG does not apply.

GDNs estimate leakage from a number of different sources; Low Pressure mains and services, Medium Pressure mains, Above Ground Installations and Interference Damage

Of these categories, only 'Low Pressure mains and services' may contribute a significant amount of leakage for a CSEP. The low pressure mains leakage calculation is estimated by multiplying the length of main by a leakage rate with an adjustment for the average pressure within the system. The leakage rates currently in use were determined in 2002/03 by means of a national leakage test programme. The average system pressure (ASP) of the networks is determined from network analysis, which is used to simulate the operation of the systems at assumed annual average demand condition of 25% peak demand.

Gas Distribution networks do not hold details of the CSEP infrastructure. Therefore, in order to estimate the leakage from these systems, it is necessary to estimate the length of main and the ASP. It is a reasonable assumption that all the mains are Polyethylene (PE) and that the services are also PE; the 2002/03 leakage tests determined that PE services to PE mains have a zero leakage, so service leakage on CSEPs can be discounted.

In order to estimate the length of PE main on CSEPs, the total number of supply points can be used in conjunction with an estimated number of supply points per km of main on all-PE systems. To determine the ratio of supply points to length of main, the number of connections and length of main on the National Grid all-PE systems were analysed. This gave an average figure of 77.3 connections per km. Using this figure together with the total number of supply points on CSEPs (data provided by Xoserve), the length of mains on CSEPs can be estimated. This calculation has been carried out for eight (National Grid and Wales & West Utilities) of the thirteen LDZs that make up the UK's gas distribution supply network.

With regard to average system pressure (ASP), Gas Distribution Networks calculate two values; one represents the calculated ASP for all networks and the other for those networks that contain mixed materials (i.e. with the all-PE systems excluded). For the purpose of this analysis, the ASP for all networks has been used as this best represents CSEPs as being a combination of extensions to the GDNs' mixed-material networks and some discreet single fed systems, which tend to operate at a higher pressure.

In summary, for the eight LDZs analysed, the calculation gives:

- No. Supply Points = 912,664 @ 77.3 Supply Points/ km
  - = 11,808km of PE Main; multiplied by
- PE leakage rate of 63.509 m<sup>3</sup>/km/annum @ 30mbarg x 29.4mbarg (average ASP)
  - = 734,915m<sup>3</sup>/annum; converted to energy
- @ Average Calorific Value for the eight LDZs of 39.2MJ/m<sup>3</sup>
  - = 734,915 x 39.2 / 3.6x10<sup>6</sup> = 8GWh

As the nature of CSEPs is that they grow in number year-on-year, it would be useful to consider this as a factor of annual consumption. For the eight LDZs analysed, the total CSEP AQ was 12,970GWh; this gives a leakage factor of 0.06%.

Scaling up, the analysis suggests an overall leakage equivalent to 13GWh for CSEPs in all LDZs. To put this into context, 13GWh is of a similar magnitude to the amount of gas procured in a large LDZ for Theft and Own Use Gas combined. When considered as a factor of throughput, 0.06% is approximately double the sum of the factors used by GDNs to estimate Theft and OUG, 0.02% and 0.0113%, respectively.