May 2000

# TRANSCO PRICING CONSULTATION PAPER PC59

## REVIEW OF LDZ TRANSPORTATION CHARGE FUNCTIONS


### SUMMARY

In May 1999 Transco reviewed its LDZ charges and put forward proposals[1] to rebalance the charges in order to improve cost reflectivity, particularly with respect to the low pressure system. Transco proposed phasing in the resultant changes in charges over a number of years in order to facilitate greater charging stability. Following consultation, a partial rebalancing, moving roughly a third of the way to the fully rebalanced charges was adopted from October 1999 with a view to reviewing the charges further when more data was available. Also, it was envisaged that the methodology as applied to transportation to connected systems would be examined in more detail. This paper covers both aspects of the further review which has been done this year

The review of the data underlying the standard LDZ transportation charges has concentrated on the use of the low pressure system by different sized loads. A substantially larger sample of use has been collected and analysed. Transco's conclusions from the review are that:

? use of the low pressure system by different sized loads is in line with the initial results obtained in 1999, and so further rebalancing of the charges to improve cost reflectivity is justified;

? the present form of charging function may not accurately reflect the system use for different load sizes. Charging functions based on a single log of the peak demand represent the data better and are proposed for application from October 2000; and

? in order to facilitate greater charging stability, and in line with the phasing proposal last year, it is proposed to move approximately half way to the proposed fully rebalanced charge for October 2000 and to move to the fully rebalanced charges for October 2001.

Transco's conclusions from the review of LDZ transportation charges to CSEPs are:

? on average, CSEP loads typically make less use of the LDZ system than other similar-sized loads. The difference is large enough to suggest that it may be appropriate to have separate LDZ charging functions for transportation to CSEPs;

? that the indicated maximum CSEP load is a better descriptor of the use made of the LDZ system for transportation to the CSEP than the current load is; and

? that the number of individual system exit points (ISEPs) is not relevant for determining the typical LDZ system use for transportation to CSEPs

On the proposed separate charging basis it is estimated that transportation charges to CSEPs will be, on average, around 15% lower than charges determined on the present basis using the final rebalanced standard charges.


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[1]PC38 Review of LDZ Transportation Charge Functions, May 1999

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## REVIEW OF LDZ TRANSPORTATION CHARGE FUNCTIONS

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Appendix B: Load factor variation

## 1. Introduction

LDZ transportation charges consist of capacity and commodity charge functions related to the supply point peak load. For domestic loads fixed unit rates apply. The charge functions are based on the typical use made of the system by loads of a given size rather than the particular use by each individual load.

In 1999 Transco reviewed the data underlying the LDZ charging methodology and published the results in PC38. The review concentrated on three areas, use of average or marginal costs, how system use varied with load size and the use in detail of the low pressure system. The review indicated that it is appropriate to use a charging methodology based on average costs and that large consumption loads were using more of the transportation system than previously thought. It was proposed to rebalance the LDZ charges on this basis, but to phase the rebalancing such that partial rebalancing was implemented on 1st October 1999. This paper covers the further review which has been done this year.

Concerns raised by some of the respondents to PC38 last year were:

? Robustness of sample size for the sub tiers of the low pressure system
  A substantially larger sample has been analysed, with the results providing the basis for this consultation paper.
? Transparency of calculations
  A revised explanation of the methodology has been included to try to aid clarity. This can be found in Appendix A.
? Appropriateness of standard LDZ charging to CSEPs
  This aspect of the data underlying the charging methodology has been reviewed by undertaking a detailed sample of the use of the system for transportation to the present CSEPs.

On 29 March Ofgem published a consultation document on Transco's LDZ Charging Methodology[2], and a summary of Ofgem's initial conclusions is attached. Comment was invited in particular on three potential improvements that Transco might introduce:

? an optional short-haul tariff for customers connected to its LDZ networks
  Transco's proposals for such a tariff are presented in consultation paper PC56.

? a separate basis for determining charges to Connected System Exit Points (CSEPs)
  This consultation paper covers this aspect.

? a phased or single-step shift in the LDZ capacity/commodity split
  In line with Ofgem's initial conclusions, Transco is not putting forward any proposals to change the capacity/commodity split at this stage.

[2]Review of Transco's LDZ Charging Methodology March 2000

## 2. Review of Data Underlying Standard LDZ Charging Methodology

### 2.1 Data items

The derivation of the LDZ charges depends on a number of data items:

- **Cost of each pressure tier**
  The latest available data on Transco's costs associated with each LDZ pressure tier are taken from 1999 ABC analysis. Compared to the previous year, there has been no significant change in the balance of costs between tiers.

- **Likelihood of connection to each of the main tiers**
  The likelihood of connection to each of the main tiers (LTS, IP, MP, LP) is based on a large sample of all supply points conducted in 1998. Transco believes that this is robust and hence it has not been updated.

- **Typical use of main system tiers**
  The typical use of main system tiers is based upon the connection likelihood (from above) and the typical flow of gas through the system. Again, Transco believes there is no reason to consider that the typical flow of gas from one tier to another has changed since this was initially determined, and so this has not been updated

- **Typical use of the low pressure system**
  Since the LP system is a large system it is split into four sub-tiers to determine typical use by different sized loads. A large new sample of the typical use has been collected in 1999/2000 to estimate this usage.

  Previously the size of the LPS sample required that the typical use be estimated for three load size groups. The much larger size of the new sample means that robust individual estimates of the LP usage can now be obtained for each of the eleven load groups used in the main analysis.

- **Fit of charging functions to charge data**
  The results of the 1999 review indicated that a log-log form of function did not represent the data derived in 1999 particularly well. The results of the 2000 review support this so an alternative charging function is proposed in this paper.

### 2.2 Sample size of load use of LP system

In PC38 Transco presented the results of a sampling exercise showing which sub-tiers of the LP system customers in three load bands were connected to. These results were used in the subsequent LP analysis.

Several respondents expressed the view that the sample was possibly unrepresentative because a large proportion of the customers were in East London. Transco explained that the use of the East London data was necessary to achieve a reasonable sample size in the time available but would undertake to carry out a larger survey before fully rebalancing.

Transco has now had the opportunity to increase the sample size and remove any possible bias due to the East London factor. With the increased sample size it has also been possible to increase the number of load bands to eleven, removing the need for one stage of averaging in the analysis. The new sample consists of 2,946,159 connections spread across 32 networks and split into eleven load bands. This compares with 712,559 connections spread across five networks and split into three load bands in the previous sample.

Further details of the sample population are provided in Appendix 2.

## 3. Results of updating data underlying standard LDZ charges

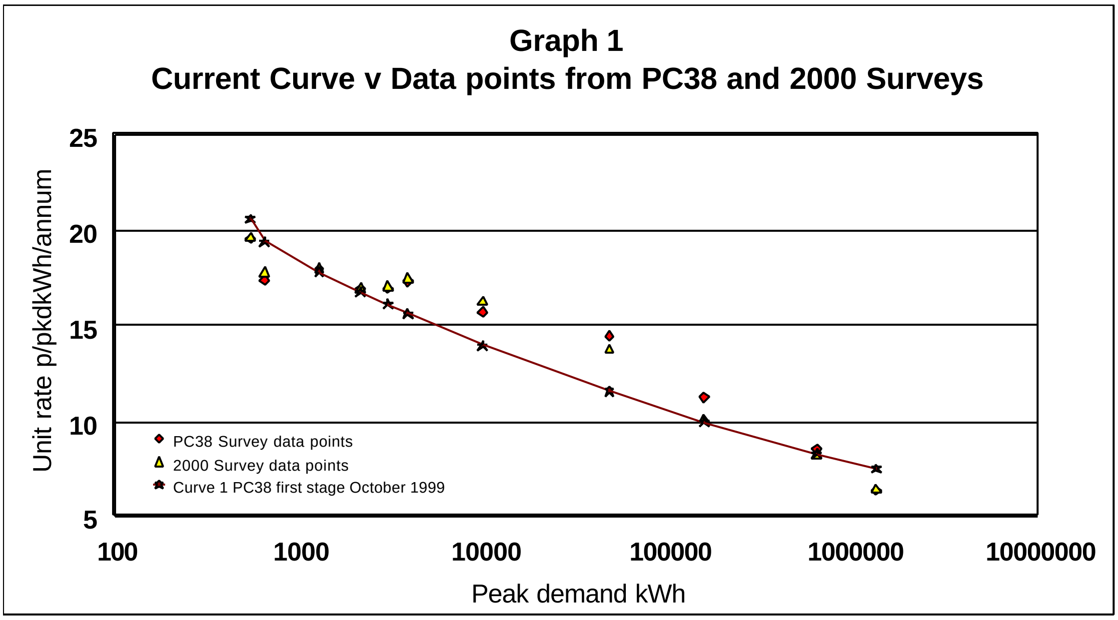
### 3.1 Sample

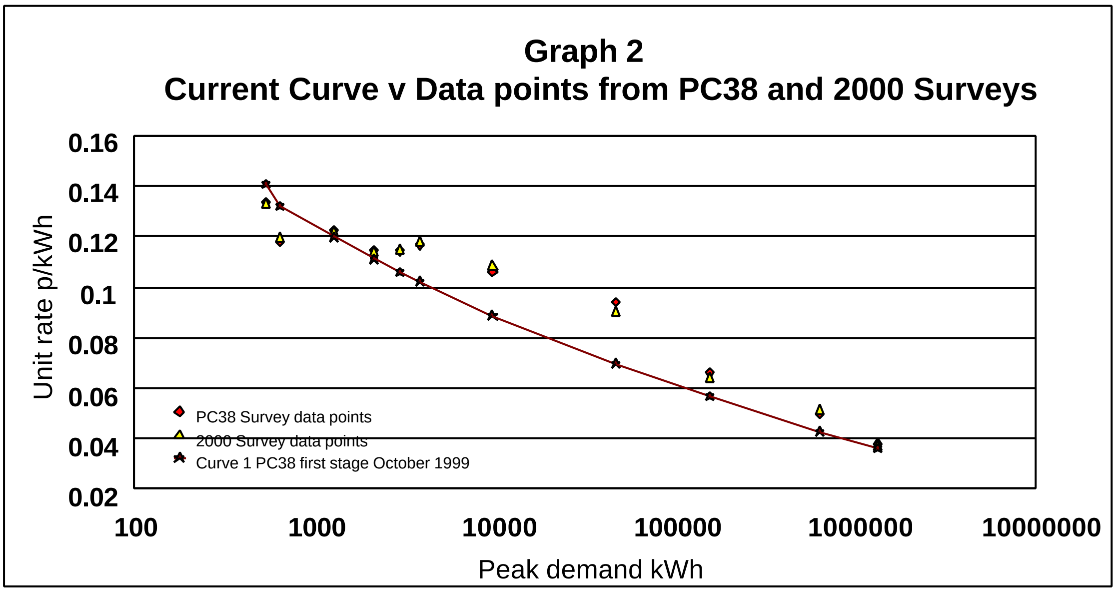
Comparison of the PC38 survey with the 2000 survey compacted into three load bands shows a broadly similar connection distribution for loads below 732 MWh per annum. For loads above 732 MWh per annum, the 2000 survey shows more customers connected to the smallest and largest pipeline groups and correspondingly fewer customers connected to the mid size pipelines.

The much larger sample size means that robust estimates of LP system use can now be estimated for each of the eleven load band groups. This basis has been used for the results quoted.

### 3.2 Comparison of total LDZ charges resulting from 2000 survey with PC38 survey

When total LDZ charges for typical loads are calculated using both the PC38 and 2000 survey and plotted (Graph 1, for capacity, and Graph 2, for commodity) it can be seen that at the upper and lower ends of the load scale there is excellent correlation between the two. For mid size loads there is still a good correlation but the 2000 survey suggests that smaller loads should be charged slightly more and larger loads slightly less.






### 3.3 Form of function

It has been suggested that Transco's use of a log(log) function for LDZ charging is overly complicated and does not provide the best fit to the data points.

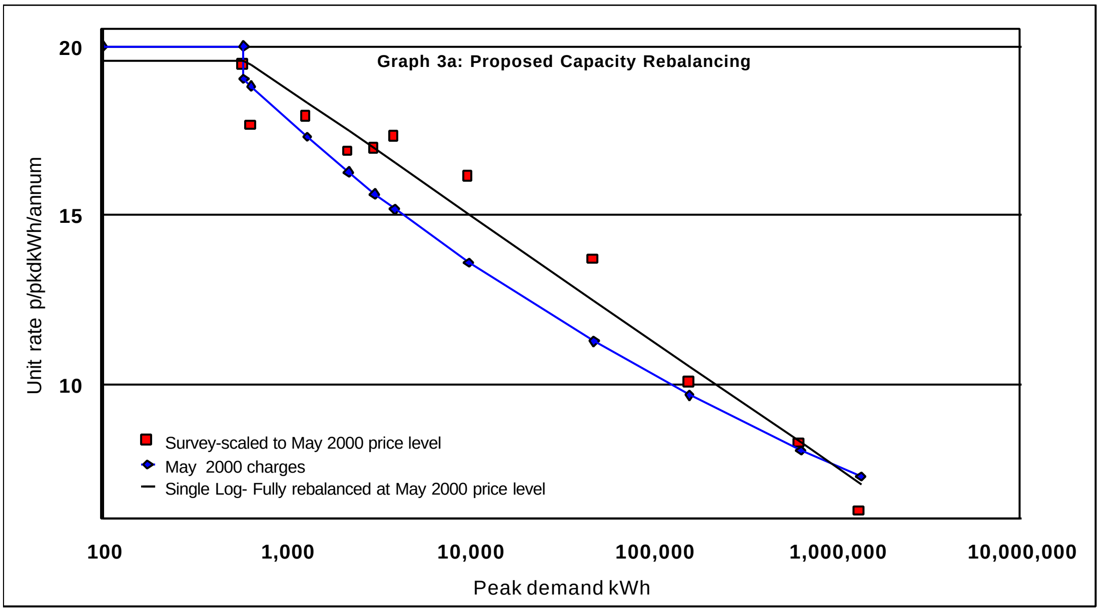
Transco noted last year, in PC38, that other function forms may fit the derived charge data better. The confirmation based on the latest data that the pattern of charge data is very similar to last years analysis gives added emphasis to the need to use a charging function form which fits the data better than the log(log) form.

Transco has therefore assessed various forms of function to both simplify and obtain a better fit than the present function. It has been found that a single log function provides a better fit than a log(log) function. A better fit may also be obtained by using a multi coefficient or power function, but these could be regarded as overly complex for charging purposes. Transco therefore believes a single log function offers a good compromise between fit and simplicity.

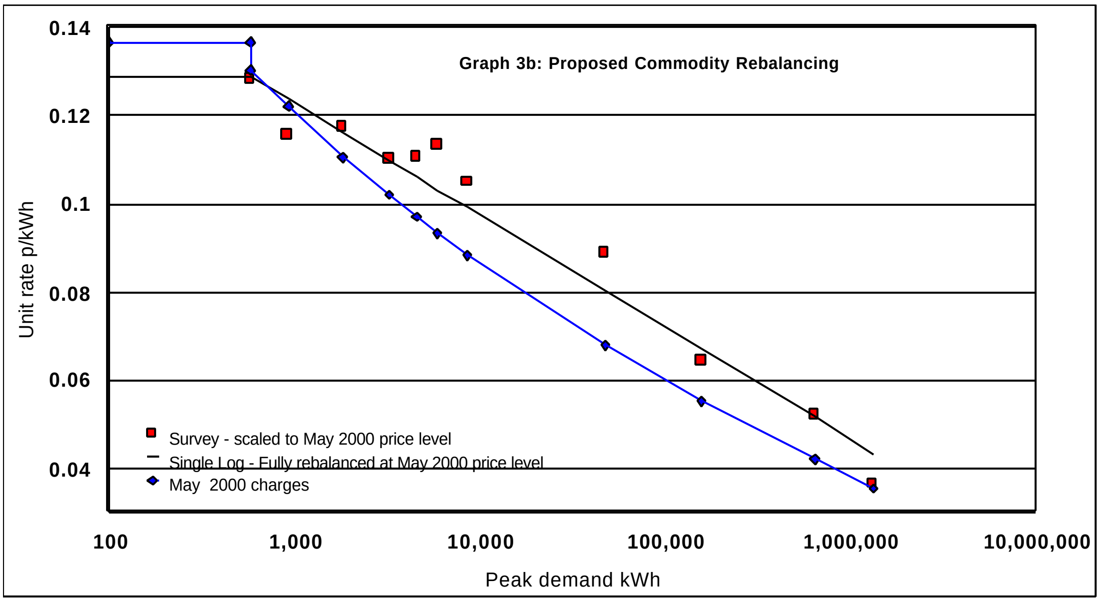
Graphs 3a and 3b below, show the fit of single and double log functions to the May 2000 charge data.

The single log function fits the underlying data, for both capacity and commodity data, better for almost every load size.

Transco considers that the implementation costs of moving to the slightly different form of function are likely to be relatively small. It is therefore proposed, on the basis of the improved cost reflectivity, that a single log form of function be adopted for LDZ charging from October 2000.



Graph 3a: Proposed Capacity Rebalancing
Unit rate p/pkdkWh/annum
20
15
10
Survey-scaled to May 2000 price level
May 2000 charges
Single Log- Fully rebalanced at May 2000 price level
100
1,000
10,000
100,000
1,000,000
10,000,000
Peak demand kWh

Graph 3b: Proposed Commodity Rebalancing
Unit rate p/kWh
0.14
0.12
0.1
0.08
0.06
0.04
Survey - scaled to May 2000 price level
Single Log - Fully rebalanced at May 2000 price level
May 2000 charges
100
1,000
10,000
100,000
1,000,000
10,000,000
Peak demand kWh

## 3.4 Rebalancing

In addition to proposing a single log function, Transco is proposing to reduce the level of LDZ transportation charges by an average of 7.4% from October 2000. This reduction will offset much of the increase some loads would otherwise see as a result of the rebalancing. The result of the rebalancing together with the average reduction in charges is shown in Graphs 4a and 4b.

As a result of higher growth in capacity than in throughput, due mainly to EUC load factor changes, the present LDZ charges would not recover revenue on a precisely 50:50 capacity:commodity basis, with instead a slightly higher capacity weighting. In moving back to a 50:50 basis for the indicative charges there is therefore a larger reduction in capacity charges than in commodity charges. As a result, even with full rebalancing, LDZ capacity charges would reduce for all loads. Transco therefore proposes to fully rebalance the capacity charge function from October 2000.

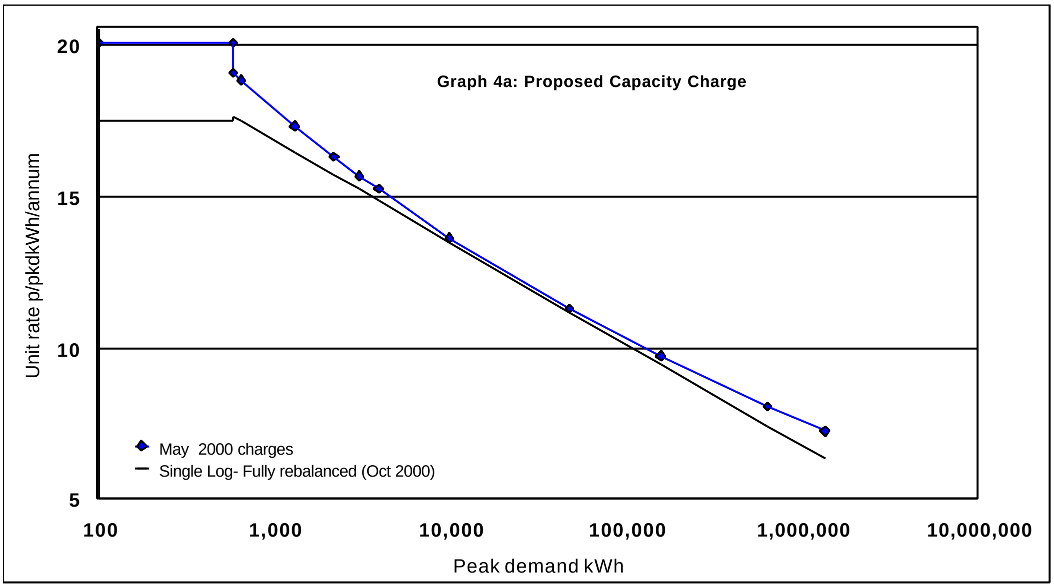
For the commodity charge Transco proposes to rebalance part way from October 2000 and to fully rebalance from October 2001. This is in line with Transco's usual approach of phasing significant changes in transportation charges. The impact of the combination of rebalancing and the reduction in LDZ charges are shown in Tables 1 and 2 below.

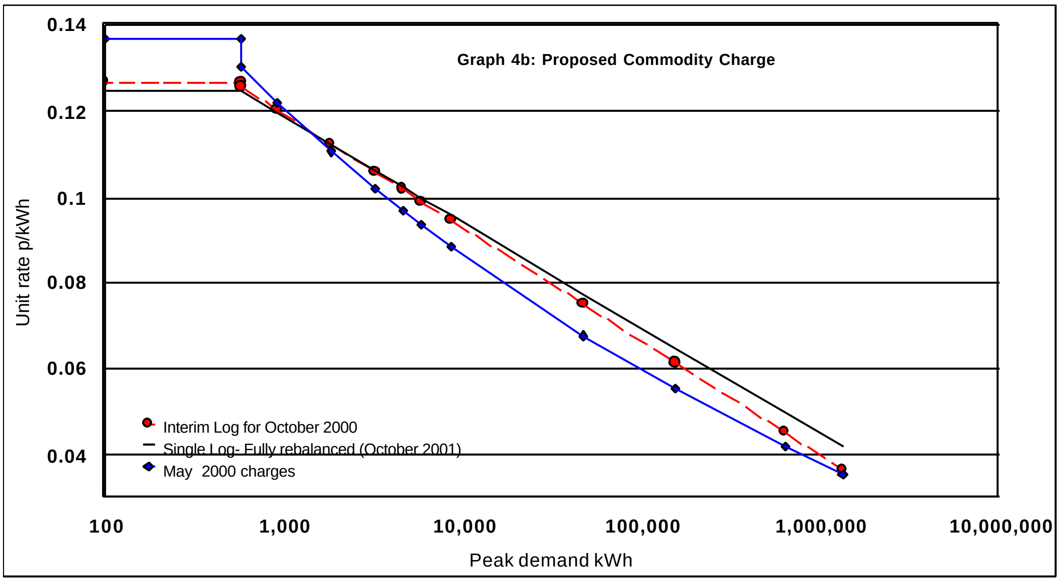
**Table 1: Impact of partial rebalancing on typical loads**

| | | | Percentage Change from May 2000 | | |
|---|---|---|---|---|---|
| Annual Demand kWh | Load Factor | Peak kWh | Capacity | Commodity | Total |
| Domestic | 36.5% | 150 | -12.6% | -7.2% | -10.0% |
| 200,000 | 35% | 1,566 | -4.9% | 0.9% | -2.3% |
| 1,000,000 | 43% | 6,313 | -2.0% | 6.1% | 2.1% |
| 10,000,000 | 56% | 49,276 | -1.4% | 10.7% | 5.3% |
| 100,000,000 | 63% | 438,356 | -7.1% | 9.1% | 1.8% |
| 500,000,000 | 80% | 1,712,329 | -15.9% | 1.1% | -6.0% |

**Table 2: Impact of full rebalancing on typical loads**

| | | | Percentage Change from May 2000 | | |
|---|---|---|---|---|---|
| Annual Demand kWh | Load Factor | Peak kWh | Capacity | Commodity | Total |
| Domestic | 36.5% | 150 | -12.6% | -8.9% | -10.8% |
| 200,000 | 35% | 1,566 | -4.9% | 0.6% | -2.4% |
| 1,000,000 | 43% | 6,313 | -2.0% | 7.0% | 2.5% |
| 10,000,000 | 56% | 49,276 | -1.4% | 14.4% | 7.3% |
| 100,000,000 | 63% | 438,356 | -7.1% | 18.3% | 6.8% |
| 500,000,000 | 80% | 1,712,329 | -15.9% | 16.9% | 3.2% |




The proposed interim functions for implementation from October 2000 are (at indicative October 2000 price levels):

| **Capacity** | Pence per peak day kWh per annum |
|---|---|
| Up to 73,200 kWh per annum | 0.0480 |
| 73,200 kWh per annum up to 17,894,429 kWh per peak day | 0.0736 - 0.0040 Ln (PL) |
| 17,894,429 kWh per peak day and above | 0.0068 |
| | |
| **Commodity** | |
| Up to 73,200 kWh per annum | 0.1269 |
| 73,200 kWh per annum up to 8,963,718 kWh per peak day | 0.1990 - 0.0115 Ln (PL) |

| | |
|---|---|
| 8,963,718 kWh per peak day and above | 0.0149 |

The proposed fully rebalanced functions for implementation from October 2001 are (at indicative October 2000 price levels)

| **Capacity** | Pence per peak day kWh per day |
|---|---|
| Up to 73,200 kWh per annum | 0.0480 |
| 73,200 kWh per annum up to 17,894,429kWh per peak day | 0.0736 - 0.0040 Ln (PL) |
| 17,894,429 kWh per peak day and above | 0.0068 |
| **Commodity** | |
| Up to 73,200 kWh per annum | 0.1246 |
| 73,200 kWh per annum up to 16,620,846 kWh per peak day | 0.1928 - 0.0107 Ln (PL) |
| 16,620,846 kWh per peak day and above | 0.0149 |

## 4. LDZ Charges to CSEPs

### 4.1 Analysis

At present, LDZ charges for transportation to CSEPs are determined in the same manner as for transportation to other supply points. The only difference is that the SOQ on which charges are based is the notional supply point capacity which is determined as the entire CSEP peak day load, divided by the number of physical connections to Transco's system (the number of shippers supplying the CSEP is not taken into account). This involves dividing the CSEP SOQ by the number of individual LDZ system exit points (ISEPs) supplying the connected system in order to determine the charging band and apply the notional peak day load in the unit charge formulae, where appropriate. This structure ensures that each shipper to the CSEP attracts identical LDZ unit charges, regardless of the proportion of gas shipped, and so facilitates competition between shippers to CSEP supply points.

There has been a significant increase in the number of CSEPs in the last few years. It has been suggested that these loads may differ from others in the use made of Transco's system. Transco has collected additional data on the use made of the LDZ system for transporting gas to CSEPs in order to inform the issue of whether the present LDZ charges are appropriate.

A survey has been carried out across CSEPs to obtain the pressure tier on Transco's system to which the connection is made, together with the size of pipe of the parent main at the connection. This CSEP specific data on probability of tier connection has then been applied using the standard methodology, as detailed in Appendix A, to determine CSEP specific rates for load use (capacity and commodity) of the distribution system.

For CSEPs some additional parameters have been analysed in that, as well as load use in terms of AQ at the CSEP, the relationship between the maximum AQ of the connected system and the size of the parent main at the connection to Transco's system has been analysed. Also, the use of the number of connections (ISEPs) to derive the peak load and concomitant unit rate has been examined.

## 4.2 Results

### 4.2.1 The survey

The methodology, described in Appendix A, shows how the charges are based on the costs attributed to a particular load size from the data sources. The survey of CSEPs provides information particular to CSEPs on the typical main connection tier (Table A in Appendix 1a) and the LP sub-tier connection where appropriate (Table D in Appendix 1a).

The number of connections within a CSEP often develops over a number of years and so the analysis has been done on the basis of both the AQ, as for the standard analysis, and the maximum AQ for the CSEP. A distinction is drawn between AQ and maximum AQ for CSEPs because connected systems tend to be new housing developments, and the premises therein start to consume gas as they become occupied. The AQ therefore reflects the consumption at that time whereas the maximum AQ is the estimated AQ of the completed development. The AQ therefore moves towards the maximum AQ over time.

Approximately 2000 CSEPs (roughly 50% of the present CSEPs) were sampled in the CSEP survey and the data from this is shown in Appendix 3.

Potential charging functions for transportation to CSEPs have been determined by combining the standard average tier costs used in the main analysis but applying the CSEP probability of connection tier. This can then be compared on a like-for-like basis with the standard LDZ data as described in section 3.

### 4.2.2 ISEPs

The rationale for the use of the number of ISEPs to determine the LDZ unit rates was based on the principle that a connected system of a given load size with multiple connections would be likely to be connected at a lower pressure tier and therefore to use more of Transco's system than an equivalent load with a single connection.

With the growth in the number of CSEPs it has now been possible to examine the size and pressure tier of connection of CSEPs with multiple connections relative to the whole CSEP sample.

Analysis has shown that only 5% of connected systems have multiple connections to Transco's system and that the large majority of these are double connections. Analysis of CSEPs with multiple connections shows that, as with CSEPs with a single connection, over

90% are connected to the LP tier. Due to the small number of CSEPs with multiple connections it is not possible to produce robust estimates by load band. However, comparison of the percentage connected to each of the LP sub-tiers shows that the distribution is similar to that for CSEPs as a whole.

| | LP sub-tiers | | | |
|---|---|---|---|---|
| | **0-100mm** | **101-200mm** | **201-300mm** | **>300mm** |
| **Multiple connections** | 21% | 50% | 24% | 6% |
| **All CSEPs** | 22% | 44% | 29% | 5% |

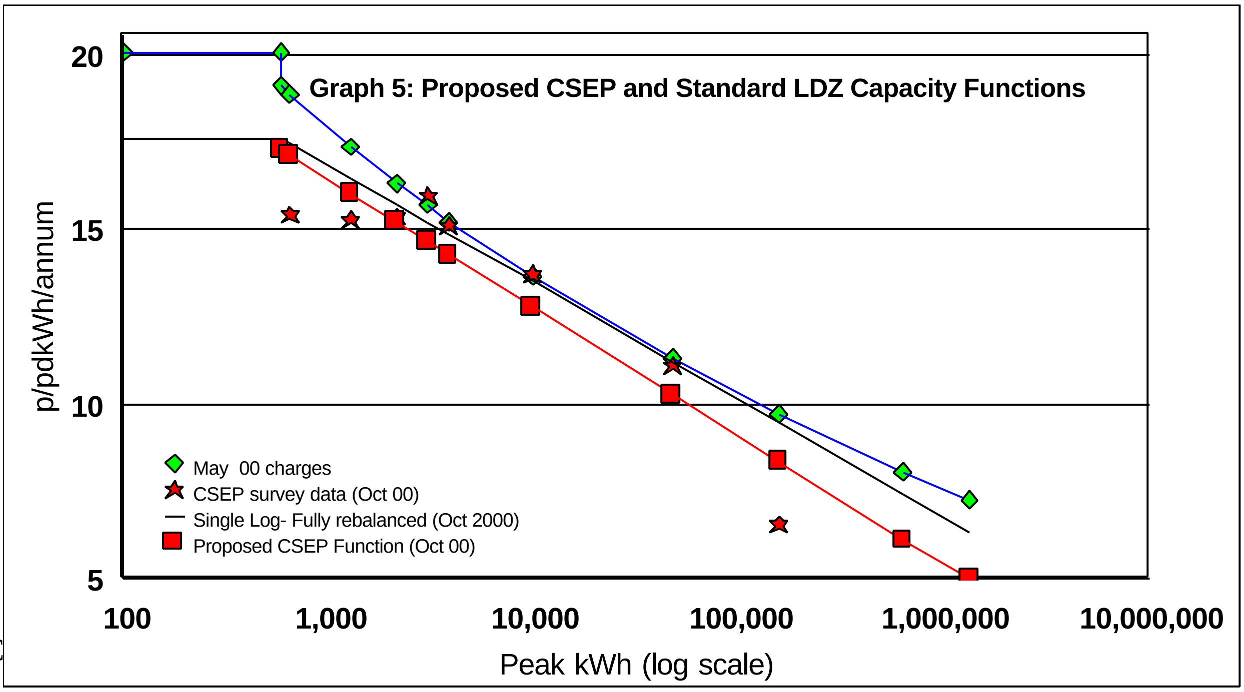
The use of the LDZ system for transportation to CSEPs does not appear, at this level of detail, to be strongly related to the number of ISEPs. It is proposed therefore that LDZ charges to CSEPs should be on a single connection basis. This will increase the connected system peak load used to generate the unit rates and result in lower LDZ charges for shippers to CSEPs with more than one connection to the Transco system.

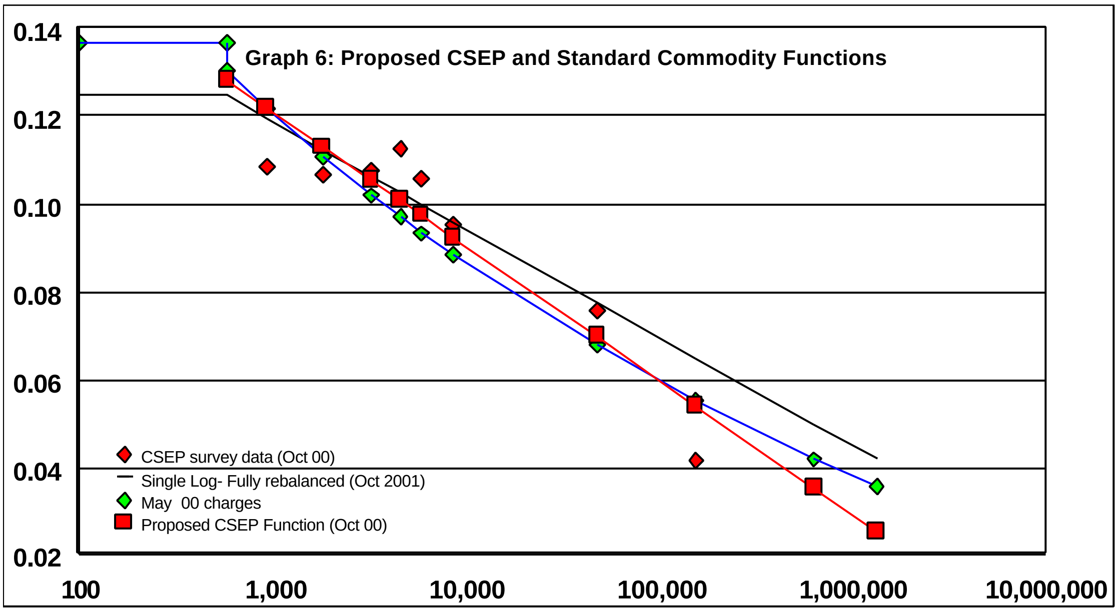
### 4.2.3 AQ versus Maximum AQ

The results of the analysis are shown as raw data in Appendix 3. The following discussion concentrates on the capacity data but similar comments would apply to the commodity charges.

For the analysis based upon the actual AQ, robust charge estimates can only be determined for the bottom seven load bands since there are very few loads in the higher load bands (see Appendix 3, Actual AQ Table D).

The data on the probability of connections for both the general tier and LP sub-tier information, shows that there is much less variation between the CSEPs of different sizes, in terms of their likelihood of connection to the different tiers, than for the general supply point data. This is reflected in the derived charge data points in Graphs 5 (Capacity) and 6 (Commodity). Note that the data points have been scaled to October 2000 LDZ charge levels.






For analysis based on the maximum AQ, robust charge estimates cannot be determined for the bottom load band and for the top two load bands, due to the small number of loads in these bands (see Appendix 3, Max AQ Table D).

The data shows greater variation in the likelihood of connection tier between CSEPs of different sizes than the analysis based on AQ, and a similar level of variation between load bands to the analysis for general loads. Graphs 5 and 6 shows the derived load points on this basis.

Given that the vast majority of CSEPs have been connected over the last couple of years, and that connections within a CSEPs often develop over a number of years, it is possible that the analysis based on the current AQ reflects a transitory state of CSEP development and that charges derived from it may not give cost reflective charges as the CSEPs develop. Also, the ratio of CSEPs partly developed to those fully developed will probably change from year to year, so that were the analysis to be repeated in future, it is possible that, on the basis of using the present AQ, quite different results would be obtained.

In addition, it has been suggested that, intuitively, the final size of the CSEP rather than the current AQ is more likely to be a robust basis for estimating the amount of LDZ assets typically used for transportation to CSEPs. One might expect that there would be a better relationship between the size of the parent main at the connection and maximum AQ rather than present AQ. The system would be designed to supply the load in the completed housing development rather than the load while individual premises started consuming gas.

For these reasons, Transco considers that the maximum CSEP AQ, or more likely that estimated on an annual basis i.e. the AQ based on the annual phasing of the development, is likely to be a better descriptor on which to base the determination of the level of LDZ charges. However, in order for this to be a robust measure of system use, and hence useful for charging purposes, the parameter should not be susceptible to gaming and suitable controls will need to be in place. The controls will be needed to ensure the maximum CSEP AQ reflects the size of the completed development and the annual CSEP AQ reflects the expected phased size of the development. Also, it must be ensured that the actual AQ are updated as scheduled.

On the favoured maximum CSEP AQ basis the functions give virtually identical charges, to the proposed standard LDZ charges, for very small loads but the charge determined for CSEPs would be lower generally, with the difference increasing with load size.

## 4.3 Impact of proposed charges

The proposed LDZ charging functions for transportation to CSEPs are shown below.

| **Capacity** | pence per peak day kWh per day |
|---|---|
| Up to 73,200 kWh per annum | 0.0480 |
| 73,200 kWh per annum up to 5,513,594 kWh per peak day | 0.0751-0.0044 x LN(PL) |
| 5,513,594 kWh per peak day and above | 0.0068 |
| **Commodity** | |
| Up to 73,200 kWh per annum | 0.1269 |
| 73,200 kWh per annum up to 2,942,402 kWh per peak day | 0.2130-0.0133 x LN(PL) |
| 2,942,402 kWh per peak day and above | 0.0149 |

The effect of the methodology as applied to CSEPs is shown in Table 3. The analysis assumes premises have a consumption of 650 therms per annum and that the housing developments are 50% complete i.e. load is half the CSEP maximum load. No account is taken of the potential ISEP benefit.

**Table 3: Combined effect of CSEP Max AQ function and maximum SOQ in the unit rate (capacity and commodity combined).**

| Expected Number of premises | Present number of premises | Difference from present charges | Difference from fully rebalanced charges (2000) |
|---|---|---|---|
| 10 | 5 | -10% | -4% |
| 50 | 25 | -7% | -8% |
| 100 | 50 | -7% | -10% |
| 200 | 100 | -8% | -13% |

| | | | |
|---|---|---|---|
| 1000 | 500 | -14% | -22% |

For the present CSEP population as a whole, Transco estimates that the application of the CSEP specific function alone (not taking account of the changed SOQ basis) would reduce LDZ charge for transportation to CSEPs by an average of 8% compared to using the proposed final LDZ functions for standard supply points. In combination, it is estimated that the move to not using the number of ISEPs to determine the CSEP peak and the move to using the maximum CSEP SOQ rather than the current SOQ would reduce charges for transportation to CSEPs by 15%.

The estimated impact of the change to charging on the basis of the proposed CSEP-specific charges rather than the standard charges is to reduce LDZ transportation revenue in total by about 0.5%.

### 4.4 Load Factors

Recently concerns have been raised about the load factors used in calculation of LDZ charges for CSEPs. The following discussion explains the rationale for using the present load factors.

In calculating LDZ charges the methodology calculates the LDZ unit rate from the total CSEP peak load independent of the number of shippers or proportion of gas shipped. The peak load is generated from the AQ by applying the load factor appropriate to the End User Category of the supply points within the connected system. Most CSEPs are comprised of "domestic" only supply points. It has been suggested to Transco that it may be appropriate to apply higher load factors to CSEPs than those appropriate to the supply points within them, in order to reflect the diversified peak for the CSEP as a whole.

The demand models for the "domestic" EUCs (one in each LDZ) have been derived from aggregate sample data broadly consistent with the population at large and the load factor for each such EUC is itself derived from this aggregate sample data. The sample disposition and the derivation of the models from the aggregate sample data lead to ensuing load factors which are effectively already diversified across the "domestic" sector as a whole.

Transco considers it is reasonable to relate the level of transportation charges to supply point peaks based on diversified load factors since, in general, the design of the LDZ network is related to the diversified load characteristics of many supply points in total. For example, the sizing of the local transmission system within the LDZ will typically have the same relationship to the load characteristics of 100 individual downstream domestic supply points as to a downstream CSEP consisting of 100 domestic supply points.

If the design of the distribution system closer to the supply point is considered then there will be slightly less diversification of peak load characteristics as the load will relate to fewer supply points. However, analysis of data derived from Gas Legislation Guidance for Sub-7 Bar Systems, IGE/GL/1, which is commonly used by Transco and developers of IPGT systems, suggests that the benefits of diversification of peak load largely occur with as few as 30 domestic properties and so it may well be for only a very small part of the distribution system that less diversified load characteristics would be a more appropriate cost driver. Details of this analysis are provided in Appendix B.

It thus appears that it is probably appropriate for charges relating to the large majority of the LDZ system to relate to the diversified load characteristics, and thus that there is little justification for applying higher load factors to CSEPs than those appropriate to the supply points within them (or, more strictly, applying lower load factors for domestic supply points for some purposes).

Another justification which has been put forward for different load factors for CSEPs is that, because NDM CSEPs are generally made up of new housing, which is typically better constructed and insulated than domestic properties in general, then higher load factors should apply because they use less energy. This would be the case if the peak day consumption for such houses were reduced by proportionally more than the annual consumption. Transco considers that this is unlikely to be the case. Indeed, the reverse may be true. Newer, better-insulated housing, may have lower annual consumptions but the peak day consumption may be reduced by proportionally less, leading to a lower load factor.

Even if newer housing loads do have either higher or lower load factors in general, if a distinction were to be made, it would appear to be more appropriate to apply the different load factor to new housing loads in general and not just those within CSEPs. Transco considers that the likely additional implementation and ongoing administration costs of such a proposal would outweigh any benefits from improved cost-reflectivity.

Transco would be interested in the views of respondents on whether there is any empirical evidence indicating that it is more appropriate to apply some other load factors than at present used for determining transportation charges to CSEPs.

## 5. Conclusions

### 5.1 Standard LDZ Supply Points

Transco has undertaken a new survey of customers connected to the LP system. The survey results are broadly in line with those obtained previously but the larger sample size allows more accurate cost targeting. The new analysis suggests that, in order to improve cost reflectivity, the LDZ charges should be rebalanced in the same manner as indicated previously.

Following concerns about the fit and complexity of the log(log) function Transco is proposing a single log function which has been found to give a better fit to the 2000 Survey data.

The impact of these two changes is for charges to be rebalanced as indicated last year in PC38, but for charges for larger loads not to rise by as much as previously indicated. In addition, the indicative reduction in the average level of LDZ charges will offset the rebalancing effect in many cases.

### 5.2 CSEPs

Application of load use data specific to CSEPs using the standard methodology suggests that transportation to CSEPs typically makes less use of the LDZ than transportation to other similar-sized loads. In addition the analysis suggests that the maximum AQ may be a better basis for determining LDZ charges for transportation to CSEPs and that the number of ISEPs is not a relevant factor in determining the appropriate charge.

## QUESTIONS FOR CONSULTATION

**Transco propose to adopt the revised methodology described in this paper as the basis for calculating LDZ capacity and commodity charges from 1 October 2000. The proposed charges also reflect updated data for low pressure system use, revised charging functions for Transco supply points and separate charges for transportation to CSEPs.**

**Transco would welcome respondents views on the following:**

1. **Should the proposed rebalancing of the charges be phased in ?**

2. **Should the LDZ charges be based on a single log function rather than the present double log function ?**

3. **Should Transco adopt a separate charging basis for transportation to CSEPs ?**
   **If so, should the charges be set on the basis of the actual AQ, as at present, or the estimated maximum AQ and, if the latter is appropriate, what controls are needed to ensure that such a basis is both workable and not open to abuse ?**

# Appendix A: Description of LDZ methodology

## A1 Overview

The LDZ charging functions are based upon the peak day consumption at a customer's site rather than an explicit link to the pressure system to which a load is connected. Such an approach avoids inconsistencies that may arise if neighbouring sites, with similar quantities of gas offtaken, are actually connected to different pressure tiers.

Essentially the methodology calculates the average cost for using each of the main pressure tiers of the LDZ system and allies this to the probability of a load using that pressure tier to generate a charge for a load using the tier. The summation of the tier charges gives the charge for a load to use the LDZ system. The methodology uses average costs rather than marginal costs.

The process is a little more complex than this for a number of reasons:

- charges for using the distribution system have a capacity and a commodity element with a 50/50 split – the capacity charges are based on the peak demand use of the system and the commodity charges are based on annual quantities.
- the probability of loads using the pressure tiers is derived from the survey of the loads connected to a pressure tier and the probability of transportation to those loads using the other, higher pressure, tiers.
- the low pressure (LP) system is the largest asset within the distribution system and a more detailed model is used to attribute costs of using the system to load band.
- once typical charge data for loads of a given size has been calculated, regression analysis is performed to determine continuous charging functions for unit rate capacity and commodity charges.

## A2 Determination of system usage by consumption band

### A2.1 Main Tiers

The first step in calculating the charges is to identify the costs of each of the tiers. These costs are then scaled so that they sum to the target revenue for the LDZ charges. By calculating the relative costs of using the system the charges can then reflect these costs to generate the appropriate revenue.

Appendix 1a shows a schematic of the derivation of the LDZ charges, the tables shown there are also fed by the calculation of the LP charges which is shown separately in Appendix 1b and described in section A2.2. The examples only show the data for the calculation of capacity charges, a similar calculation is performed for the commodity element. The data shown is that from the most recent review.

In Appendix 1a there are essentially four data sources and these are shown by Table A, Table B, Table E and Table G.

- Table A presents the results of the survey (described in PC38) showing the probability of a load band connected to each of the 4 main tiers
- Table B shows the peak demands by loadband

- Table E shows the probability of gas in the lower tiers going through each of the higher pressure tiers.
- Table G shows the projected revenues from the LDZ capacity and commodity. charges broken down by pressure tiers. This of course is dependent on the capacity/commodity split which in this case is 50:50.

Table C is generated from Tables A and B such that the peak load leaving each tier by loadband is calculated from the probability of a load connected to a tier and the peak demand by load band. Table D is then generated from Table C by expressing the peak load leaving each tier by loadband as a percentage. This data is also used in the calculation of the LP charges shown in Appendix 1b.

Table F shows the firm load using each tier by loadband. This comes from the peak load leaving each tier by loadband (Table C) and the percentage use of higher tiers by loads exiting through lower tiers (from the survey). The probability of gas offtaken in each band using each tier (Table I) is then calculated by expressing the firm load using each tier (Table F) as a percentage of peak demand (Table B).

The average cost of using each tier (Table H) is generated from the revenue to be recovered from each tier (Table G) and the total firm loads using each tier (the totals in Table F). The probability of gas offtaken in each band using each tier (Table I) is then multiplied by the cost of using each tier (Table H) to give the cost of using each tier by loadband (Table J).

Average tier costs are used for the LTS, IPS and MPS tiers but because of the size and complexity of the LPS a more detailed model is used which is described in section A2.2.

Having obtained a cost for use of the system by loadband (Table J) then a function is then fitted to the unit charges, based on the peak demand for a supply point in each band. This results in the familiar charging function.

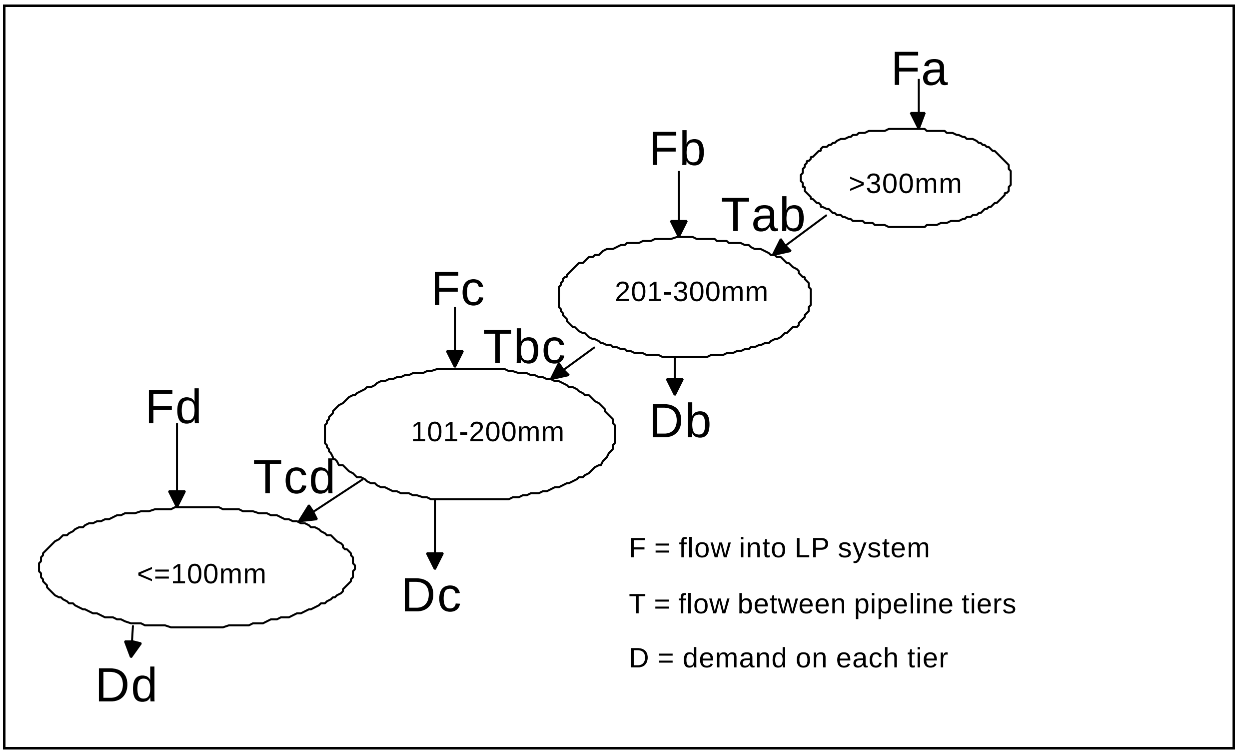
## A2.2 LP system

A schematic of the LP system is shown in Figure 1 below. The system is divided into four sub-tiers depending on the diameter of main. The direct flow into and out of each sub-tier is known. The inter-tier flows are then calculated and, together with the asset values of each of the sub-tiers, the unit cost of using a sub-tier is calculated. By applying the sub-tier use by loadband the cost for each loadband using a sub-tier can be calculated. This is explained in more detail below.

Appendix 1b shows an example of the calculation. Table K shows the regulatory asset values of the sub-tier of the LP as a percentage. The revenue to be recovered from the LP is shown in Table G and from this the sub-tier income is calculated.

Table L shows the peak day entry and peak day exit by load band gas flows by LP sub-tier. This data together with the sub-tier income (Table K) generates a unit cost of a load using the sub-tier (Table M).
From the load use of the sub-tiers (Table O) and the unit costs of each sub-tier (Table M) the unit costs of using the sub-tiers can be calculated and their summation (Table N) gives the cost of the loadband using the LP. This data then feeds back to Table J.

**Figure 1 : Schematic of LP system**




The calculation to generate the unit costs is:
Average charge AC1 for use of pipelines > 300mm

? $AC1 = \frac{15\ \%\ \text{LP revenue}}{Fa}$

Average charge AC2 for use of pipelines 201 to 300mm

? $AC2 = \frac{18\%\ \text{LP revenue}}{Fb + Tab}$

Average charge AC3 for use of pipelines 101 to 200mm

? $AC3 = \frac{26\%\ \text{LP RAB}}{Fc + Tbc}$

Average charge AC4 for use of pipelines <= 100mm

? $AC4 = \frac{41\%\ \text{LP RAB}}{Fd + Tcd}$

Where:

- ✍ Tab = Fa - Da
- ✍ Tbc = Fb + Tab - Db
- ✍ Tcd = Fc + Tbc - Dc

Note that, in the LP model, since flows are always assumed to go from one pressure tier to the next, lower, pressure tier, the costs of using the higher LP pressure tiers can be related to the connection tier for a load by estimating the probability of gas using the higher tiers, derived from the flow model. Thus the various tier usage costs are all related to the connection tier information. The tier usage costs (which include the likely costs of using higher LP pressure tiers) can then be multiplied by the probability of a load of a given size connecting to a particular tier.

This method is equivalent to the method used for determining costs and probability of use for the main system tiers (LTS, etc.) However, for the main system tiers more detailed data on the inter-tier flows is available, showing that gas does not always flow from one tier directly to the next lower pressure tier. For the main tiers it is therefore easier to model the gas use of each tier from the original data on probability of connection to each tier. The average cost of using each pressure tier alone can then be multiplied by the derived information of the probability of a given load size using a particular tier.

## Appendix 1a: Derivation of LDZ Charges

**Table A**

Proportion of survey connected to each tier by loadband

| Loadband (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.0% | 6.3% | 93.7% | 100.0% |
| 73.2 - 146.5 | 0.0% | 0.0% | 9.4% | 90.6% | 100.0% |
| 146.5 - 293 | 0.0% | 0.0% | 4.2% | 95.8% | 100.0% |
| 293 - 439.6 | 0.0% | 0.9% | 12.9% | 86.2% | 100.0% |
| 439.6 - 586.1 | 0.0% | 0.7% | 13.1% | 86.2% | 100.0% |
| 586.1 - 732.7 | 0.0% | 0.0% | 10.6% | 89.4% | 100.0% |
| 732.7 - 2,931 | 0.0% | 1.4% | 16.6% | 82.0% | 100.0% |
| 2,931 - 14,654 | 0.6% | 1.0% | 28.7% | 69.7% | 100.0% |
| 14,654 - 58,614 | 1.7% | 4.8% | 54.8% | 38.6% | 100.0% |
| 58,614 - 293,071 | 5.2% | 14.9% | 64.9% | 14.9% | 100.0% |
| > 293,071 | 27.5% | 31.4% | 39.2% | 2.0% | 100.0% |
| All loads | 1.2% | 2.9% | 26.2% | 69.7% | 100.0% |

**Table B**

Peak demand by loadband (GWh)

| | |
|---|---|
| 0-73.2 | 2,923 |
| 73.2 - 146.5 | 114 |
| 146.5 - 293 | 121 |
| 293 - 439.6 | 68 |
| 439.6 - 586. | 51 |
| 586.1 - 732. | 43 |
| 732.7 - 2,93 | 286 |
| 2,931 - 14,6 | 346 |
| 14,654 - 58, | 209 |
| 58,614 - 29 | 148 |
| > 293,071 | 22 |
| total | 4,330 |

*Multiply A by B*

**Table C**

Peak load leaving each tier by loadband (GWh)

| Loadband (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0 | 0 | 183 | 2,740 | 2923 |
| 73.2 - 146.5 | 0 | 0 | 11 | 103 | 114 |
| 146.5 - 293 | 0 | 0 | 5 | 116 | 121 |
| 293 - 439.6 | 0 | 1 | 9 | 59 | 68 |
| 439.6 - 586.1 | 0 | 0 | 7 | 44 | 51 |
| 586.1 - 732.7 | 0 | 0 | 5 | 38 | 43 |
| 732.7 - 2,931 | 0 | 4 | 48 | 235 | 286 |
| 2,931 - 14,654 | 2 | 3 | 99 | 241 | 346 |
| 14,654 - 58,614 | 4 | 10 | 114 | 81 | 209 |
| 58,614 - 293,071 | 8 | 22 | 96 | 22 | 148 |
| > 293,071 | 6 | 7 | 8 | 0 | 22 |
| total | 19 | 47 | 585 | 3,678 | 4330 |

*Express C as a percentage of the overall total*

**Table D (table 3.3.2d in Blue Book)**

Peak load leaving each tier by loadband as a %

| Loadband (MWh) | LTS | IPS | MPS | LPS |
|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.0% | 4.2% | 63.3% |
| 73.2 - 146.5 | 0.0% | 0.0% | 0.2% | 2.37% |
| 146.5 - 293 | 0.0% | 0.0% | 0.1% | 2.68% |
| 293 - 439.6 | 0.0% | 0.0% | 0.2% | 1.36% |
| 439.6 - 586.1 | 0.0% | 0.0% | 0.2% | 1.01% |
| 586.1 - 732.7 | 0.0% | 0.0% | 0.1% | 0.89% |
| 732.7 - 2,931 | 0.0% | 0.1% | 1.1% | 5.42% |
| 2,931 - 14,654 | 0.0% | 0.1% | 2.3% | 5.56% |
| 14,654 - 58,614 | 0.1% | 0.2% | 2.6% | 1.86% |
| 58,614 - 293,071 | 0.2% | 0.5% | 2.2% | 0.51% |
| > 293,071 | 0.14% | 0.16% | 0.20% | 0.01% |
| total | 0.4% | 1.1% | 13.5% | 85.0% |

**Table E**

Percentage use of higher tiers by loads exiting through lower tiers from survey

| | | Uses | | |
|---|---|---|---|---|
| | | LTS | IPS | MPS |
| Load Exiting Through | IPS | 97.7% | | |
| | MPS | 95.6% | 43.0% | |
| | LPS | 97.9% | 44.8% | 94.0% |

*Apply E to C to give F*
*For example, for 293-439.6MWh*

| LTS | IPS | MPS | LPS |
|---|---|---|---|
| 0<br>+(97.7%*1)<br>+(95.6%*9)<br>+(97.9%*59) | 1<br>+(43%*9)<br>+(44.8%*59) | 9<br>+(94%*59) | 59 |
| 67 | 31 | 64 | 59 |

**Table F**

Firm load using each tier by loadband (GWh)

| Loadband (MWh) | LTS | IPS | MPS | LPS |
|---|---|---|---|---|
| 0-73.2 | 2,857 | 1,306 | 2,759 | 2,740 |
| 73.2 - 146.5 | 111 | 51 | 107 | 103 |
| 146.5 - 293 | 118 | 54 | 114 | 116 |
| 293 - 439.6 | 67 | 31 | 64 | 59 |
| 439.6 - 586.1 | 50 | 23 | 48 | 44 |
| 586.1 - 732.7 | 42 | 19 | 41 | 38 |
| 732.7 - 2,931 | 279 | 130 | 268 | 235 |
| 2,931 - 14,654 | 336 | 154 | 326 | 241 |
| 14,654 - 58,614 | 202 | 95 | 190 | 81 |
| 58,614 - 293,071 | 143 | 73 | 117 | 22 |
| > 293,071 | 21 | 11 | 9 | 0 |
| total | 4226 | 1947 | 4043 | 3678 |

*Express F as a percentage of B*

**Table I**

Probability of gas offtaken in each band using each tier

| Loadband (MWh) | LTS | IPS | MPS | LPS |
|---|---|---|---|---|
| 0-73.2 | 97.76% | 44.69% | 94.38% | 93.73% |
| 73.2 - 146.5 | 97.68% | 44.63% | 94.57% | 90.57% |
| 146.5 - 293 | 97.80% | 44.73% | 94.25% | 95.83% |
| 293 - 439.6 | 97.60% | 45.04% | 93.97% | 86.21% |
| 439.6 - 586.1 | 97.60% | 44.94% | 94.14% | 86.21% |
| 586.1 - 732.7 | 97.66% | 44.61% | 94.64% | 89.36% |
| 732.7 - 2,931 | 97.51% | 45.27% | 93.69% | 81.97% |
| 2,931 - 14,654 | 97.25% | 44.57% | 94.20% | 69.70% |
| 14,654 - 58,614 | 96.66% | 45.72% | 91.16% | 38.65% |
| 58,614 - 293,071 | 96.49% | 49.55% | 78.97% | 14.94% |
| > 293,071 | 97.51% | 49.11% | 41.06% | 1.96% |

**Table G**

Revenue to be recovered (£m)

| | LTS | IPS | MPS | LPS | total |
|---|---|---|---|---|---|
| Capacity | 180.6 | 25.0 | 117.4 | 451.5 | 774.5 |
| Commodity | 180.6 | 25.0 | 117.4 | 451.5 | 774.5 |

*Divide G by totals from F*

**Table H (table 3.3.2e in Blue Book)**

Cost per kWh per tier (p/kWh)

| | LTS | IPS | MPS | LPS |
|---|---|---|---|---|
| | 4.27 | 1.28 | 2.90 | 12.27 |

LPS data not used, data derived from Table N is used

*Multiply H by I*

*Average cost for LPS is not used. The LPS figures below come from a more detailed model of the LPS which results in different unit costs for each load band.*

**Table J**

Cost per kWh per loadband

| Loadband (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 4.18 | 0.57 | 2.74 | 12.18 | 19.68 |
| 73.2 - 146.5 | 4.17 | 0.57 | 2.75 | 10.34 | 17.83 |
| 146.5 - 293 | 4.18 | 0.57 | 2.74 | 10.62 | 18.11 |
| 293 - 439.6 | 4.17 | 0.58 | 2.73 | 9.58 | 17.06 |
| 439.6 - 586.1 | 4.17 | 0.58 | 2.73 | 9.68 | 17.16 |
| 586.1 - 732.7 | 4.17 | 0.57 | 2.75 | 10.03 | 17.53 |
| 732.7 - 2,931 | 4.17 | 0.58 | 2.72 | 8.83 | 16.30 |
| 2,931 - 14,654 | 4.16 | 0.57 | 2.74 | 6.35 | 13.82 |
| 14,654 - 58,614 | 4.13 | 0.59 | 2.65 | 2.77 | 10.14 |
| 58,614 - 293,071 | 4.12 | 0.64 | 2.29 | 1.29 | 8.35 |
| > 293,071 | 4.17 | 0.63 | 1.19 | 0.24 | 6.23 |

**Table N**

*A function is fitted to the unit charges, based on the demand for a supply point in each band. This results in the familiar log-log function.*

**Table L**

## Appendix 1b: Derivation of LP Charges

**Table K**

From analysis of the regulator
asset value of the low pressu
system a percentage of the t
LP RAV can be applied to ea
pipeline group

| Pipeline group | Sub-tiers <=100 | 101-200 | 201-300 | >300 | Total |
|---|---|---|---|---|---|
| Percentage of LP RAV | 41% | 26% | 18% | 15% | 100% |
| LP income (£m) | 185.1 | 117.4 | 81.3 | 67.7 | 451.5 |

From table G the LP tier inco
£451.5m. The proportion to b
recovered from each pipeline
is in proportion to the precent
of the RAV for that group

**Table L**

From the analysis of gas entering and exiting the LP s
table of use can be developed. In contrast to the 1998
which used only three load bands to ensure there were
numbers from the survey in each band, this analysis u
load bands

From Table I
LPS column

| Peak day Entry to LP system <=100 | 101-200 | 201-300 | >300 |
|---|---|---|---|
| 0.32% | 9.07% | 22.67% | 52.85% |

| Loadband (MWh) | Peak day Exit from LP system <=100 | 101-200 | 201-300 | >300 | Total |
|---|---|---|---|---|---|
| 0-73.2 | 35.9% | 19.2% | 6.1% | 2.2% | 63.3% |
| 73.2 - 146.5 | 1.1% | 0.8% | 0.4% | 0.2% | 2.4% |
| 146.5 - 293 | 1.1% | 0.8% | 0.5% | 0.3% | 2.7% |
| 293 - 439.6 | 0.6% | 0.4% | 0.2% | 0.1% | 1.4% |
| 439.6 - 586.1 | 0.4% | 0.3% | 0.2% | 0.1% | 1.0% |
| 586.1 - 732.7 | 0.4% | 0.2% | 0.2% | 0.1% | 0.9% |
| 732.7 - 2,931 | 2.2% | 1.7% | 0.9% | 0.6% | 5.4% |
| 2,931 - 14,654 | 1.5% | 2.0% | 1.3% | 0.8% | 5.6% |
| 14,654 - 58,614 | 0.3% | 0.6% | 0.6% | 0.4% | 1.9% |
| 58,614 - 293,071 | 0.1% | 0.1% | 0.2% | 0.0% | 0.5% |
| > 293,071 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Total | 43.58% | 26.09% | 10.40% | 4.87% | 85.0% |

derive peak da
exit from Tabl

**Table O** **Sample Data**

| Loadband (MWh) | Load use of sub-tiers <=100 | 101-200 | 201-300 | >300 | Total |
|---|---|---|---|---|---|
| 0-73.2 | 56.7% | 30.3% | 9.6% | 3.4% | 100.00% |
| 73.2 - 146.5 | 44.5% | 32.6% | 15.0% | 7.8% | 100.00% |
| 146.5 - 293 | 42.6% | 30.9% | 16.9% | 9.5% | 100.00% |
| 293 - 439.6 | 43.1% | 30.3% | 16.6% | 10.0% | 100.00% |
| 439.6 - 586.1 | 43.5% | 31.6% | 15.2% | 9.6% | 100.00% |
| 586.1 - 732.7 | 44.7% | 27.2% | 18.1% | 10.0% | 100.00% |
| 732.7 - 2,931 | 40.4% | 31.2% | 16.9% | 11.5% | 100.00% |
| 2,931 - 14,654 | 27.2% | 35.2% | 22.5% | 15.1% | 100.00% |
| 14,654 - 58,614 | 14.0% | 32.3% | 31.2% | 22.6% | 100.00% |
| 58,614 - 293,071 | 27.3% | 18.2% | 45.5% | 9.1% | 100.00% |
| > 293,071 | 50.0% | 33.3% | 16.7% | 0.0% | 100.00% |
| Total | | | | | |

**Table M**

Calculate the unit cost for loads connected to each sub tier by tak
of their cost and likelihood of using other tiers

| | | | |
|---|---|---|---|
| >300mm | £67.7m / 52.85%pk demand | = | 2.9568p/pkdkWh |
| 201-300mm | £81.3m / 70.65%pk demand + 67.9% * 2.9568 | = | 4.6645p/pkdkWh |
| 101-200mm | £117.4m / 69.32%pk demand + 86.9% * 4.6645 | = | 7.9637p/pkdkWh |
| <=100mm | £185.1m / 43.56%pk demand + 99.2% * 7.9637 | = | 17.7129p/pkdkWh |

cost = tier cost / gas using tier + probability of using next higher tier * cost of next higher tier

probability calculati
is shown in Appendi
1c overleaf - using t
peak entry and exit
flows through the tie
from Table L

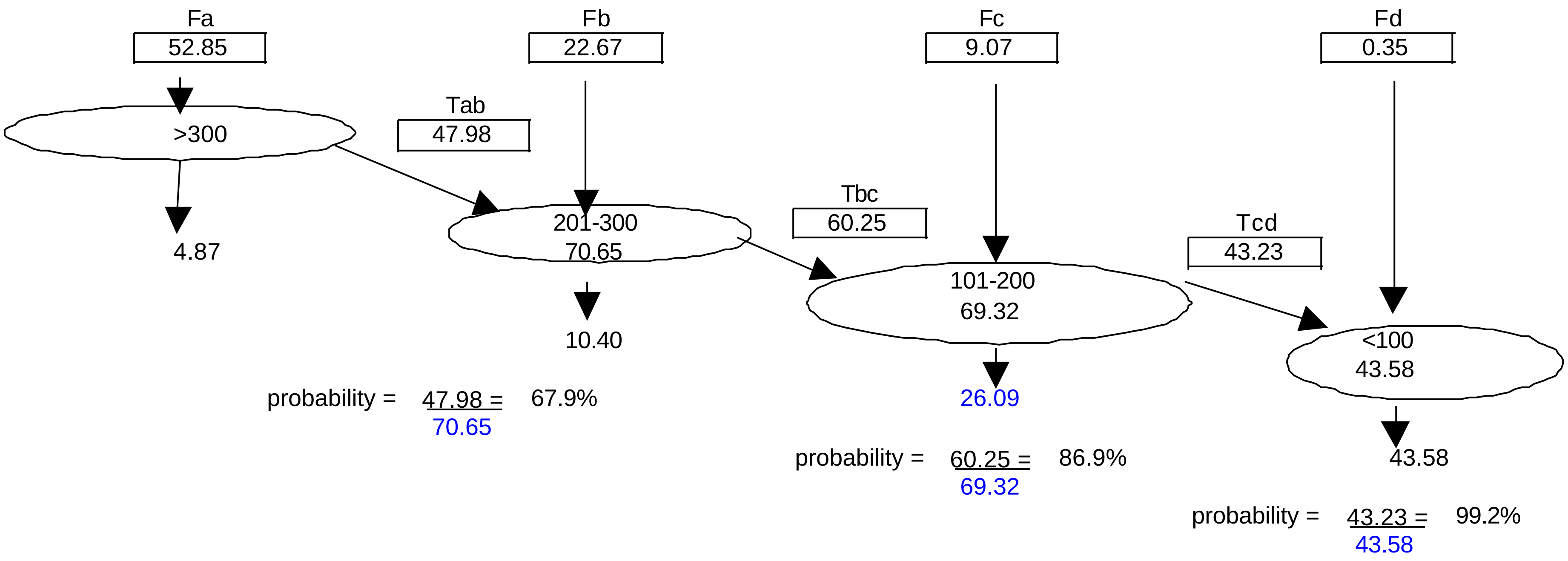
These replace the average of 1
determined in Table H and fee
Table J

**Table N**
Breakdown of sub tier use by load band

| Loadband (MWh) | Unit costs of using sub-tiers (p/pkdkWh) <=100 | 101-200 | 201-300 | >300 | Totals | Revenue (£m) | Total Unit Cost (p/pkdkWh) |
|---|---|---|---|---|---|---|---|
| 0-73.2 | 10.04 | 2.41 | 0.45 | 0.10 | 13.00 | 356.13 | 12.18 |
| 73.2 - 146.5 | 7.88 | 2.60 | 0.70 | 0.23 | 11.41 | 11.74 | 10.34 |
| 146.5 - 293 | 7.55 | 2.46 | 0.79 | 0.28 | 11.08 | 12.86 | 10.62 |
| 293 - 439.6 | 7.63 | 2.42 | 0.77 | 0.30 | 11.12 | 6.53 | 9.58 |
| 439.6 - 586.1 | 7.71 | 2.52 | 0.71 | 0.29 | 11.22 | 4.92 | 9.68 |
| 586.1 - 732.7 | 7.92 | 2.17 | 0.84 | 0.30 | 11.23 | 4.31 | 10.03 |
| 732.7 - 2,931 | 7.16 | 2.49 | 0.79 | 0.34 | 10.77 | 25.29 | 8.83 |
| 2,931 - 14,654 | 4.82 | 2.80 | 1.05 | 0.45 | 9.11 | 21.95 | 6.35 |
| 14,654 - 58,614 | 2.48 | 2.57 | 1.45 | 0.67 | 7.17 | 5.78 | 2.77 |
| 58,614 - 293,071 | 4.83 | 1.45 | 2.12 | 0.27 | 8.67 | 1.92 | 1.29 |
| > 293,071 | 8.86 | 2.65 | 0.78 | 0.00 | 12.29 | 0.05 | 0.24 |
| Total | | | | | | 451.49 | |

Table J

**Appendix 1c: Probability of gas using higher tiers**



## Appendix 1d: All sample - Commodity

**Peak load leaving each tier by loadband as a % (Table A)**

| Loadband (M | LTS | IPS | MPS | LPS |
|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.0% | 3.2% | 48.2% |
| 73.2 - 146.5 | 0.0% | 0.0% | 0.2% | 1.93% |
| 146.5 - 293 | 0.0% | 0.0% | 0.1% | 2.18% |
| 293 - 439.6 | 0.0% | 0.0% | 0.2% | 1.10% |
| 439.6 - 586. | 0.0% | 0.0% | 0.1% | 0.82% |
| 586.1 - 732. | 0.0% | 0.0% | 0.1% | 0.72% |
| 732.7 - 2,93 | 0.0% | 0.1% | 1.0% | 4.80% |
| 2,931 - 14,6 | 0.0% | 0.1% | 2.3% | 5.47% |
| 14,654 - 58,( | 0.2% | 0.5% | 5.4% | 3.78% |
| 58,614 - 293 | 0.7% | 1.9% | 8.3% | 1.91% |
| > 293,071 | 1.33% | 1.52% | 1.90% | 0.09% |
| total | 2.2% | 4.1% | 22.7% | 71.0% |

**Demand by loadband (GWh) (Table B)**

| | |
|---|---|
| 0-73.2 | 376,461 |
| 73.2 - 146.5 | 15,588 |
| 146.5 - 293 | 16,627 |
| 293 - 439.6 | 9,362 |
| 439.6 - 586. | 6,980 |
| 586.1 - 732. | 5,905 |
| 732.7 - 2,93 | 42,832 |
| 2,931 - 14,6 | 57,422 |
| 14,654 - 58, | 71,635 |
| 58,614 - 293 | 93,714 |
| > 293,071 | 35,406 |
| total | 731,931 |

**Percentage use of higher tiers by loads exiting through lower tiers from survey (Table E)**

| | | Uses | | |
|---|---|---|---|---|
| | | LTS | IPS | MPS |
| Load | IPS | 99.2% | | |
| Exiting | MPS | 97.8% | 35.3% | |
| Through | LPS | 97.9% | 44.1% | 93.9% |

**Cost per kWh per tier (p/kWh) (Table H)**

| | LTS | IPS | MPS | LPS |
|---|---|---|---|---|
| | 0.0253 | 0.0075 | 0.0179 | 0.0869 |

**Annual Entry to LP system (Table L)**

| <=100 | 101-200 | 201-300 | >300 |
|---|---|---|---|
| 0.27% | 7.58% | 18.96% | 44.20% |

**Annual Exit from LP System**

| | 0-100 AC4 | 101-200 AC3 | 201-300 AC2 | >300 AC1 |
|---|---|---|---|---|
| 0-73.2 MWh | 27.3% | 14.6% | 4.6% | 1.7% |
| 73.2 - 146.5 | 0.9% | 0.6% | 0.3% | 0.2% |
| 146.5 - 293 | 0.9% | 0.7% | 0.4% | 0.2% |
| 293 - 439.6 | 0.5% | 0.3% | 0.2% | 0.1% |
| 439.6 - 586. | 0.4% | 0.3% | 0.1% | 0.1% |
| 586.1 - 732. | 0.3% | 0.2% | 0.1% | 0.1% |
| 732.7 - 2,93 | 1.9% | 1.5% | 0.8% | 0.6% |
| 2,931 - 14,6 | 1.5% | 1.9% | 1.2% | 0.8% |
| 14,654 - 58, | 0.5% | 1.2% | 1.2% | 0.9% |
| 58,614 - 293 | 0.5% | 0.3% | 0.9% | 0.2% |
| > 293,071 M | 0.0% | 0.0% | 0.0% | 0.0% |
| totals | 34.8% | 21.7% | 9.8% | 4.7% |
| | | | | 71.01% |

**Unit costs of sub-tiers (Table M)**

| | |
|---|---|
| >300 | 0.0209333p/pkdkWh |
| 201-300 | 0.0331362p/pkdkWh |
| 101-200 | 0.0571895p/pkdkWh |
| <=100 | 0.1294589p/pkdkWh |

**Cost per kWh per loadband (Table J)**

| | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 MWh | 0.0247 | 0.0034 | 0.0169 | 0.0887 | 0.1337 |
| 73.2 - 146.5 | 0.0247 | 0.0034 | 0.0170 | 0.0751 | 0.1201 |
| 146.5 - 293 | 0.0247 | 0.0034 | 0.0169 | 0.0771 | 0.1221 |
| 293 - 439.6 | 0.0247 | 0.0034 | 0.0168 | 0.0696 | 0.1145 |
| 439.6 - 586. | 0.0247 | 0.0034 | 0.0169 | 0.0703 | 0.1153 |
| 586.1 - 732. | 0.0247 | 0.0034 | 0.0170 | 0.0729 | 0.1179 |
| 732.7 - 2,93 | 0.0247 | 0.0034 | 0.0168 | 0.0641 | 0.1090 |
| 2,931 - 14,6 | 0.0247 | 0.0034 | 0.0169 | 0.0460 | 0.0909 |
| 14,654 - 58,( | 0.0247 | 0.0035 | 0.0163 | 0.0199 | 0.0645 |
| 58,614 - 293 | 0.0244 | 0.0034 | 0.0142 | 0.0094 | 0.0513 |
| > 293,071 M | 0.0249 | 0.0037 | 0.0074 | 0.0018 | 0.0378 |

## Appendix 2: Standard LDZ supply poi

### Survey results: 11 loadbands

**Numbers**

| Loadband | 0-100 | 101-200 | 201-300 | >300 | Totals |
|---|---|---|---|---|---|
| 0-73.2 MWh | 1,634,575 | 874,000 | 276,713 | 99,348 | 2,884,636 |
| 73.2 - 146.5 | 13,982 | 10,238 | 4,727 | 2,464 | 31,411 |
| 146.5 - 293 | 6,527 | 4,739 | 2,591 | 1,458 | 15,315 |
| 293 - 439.6 | 2,193 | 1,544 | 844 | 509 | 5,090 |
| 439.6 - 586. | 1,119 | 813 | 390 | 248 | 2,570 |
| 586.1 - 732. | 801 | 487 | 324 | 179 | 1,791 |
| 732.7 - 2,93 | 1,761 | 1,360 | 736 | 500 | 4,357 |
| 2,931 - 14,6 | 239 | 309 | 198 | 133 | 879 |
| 14,654 - 58, | 13 | 30 | 29 | 21 | 93 |
| 58,614 - 29 | 3 | 2 | 5 | 1 | 11 |
| > 293,071 M | 2 | 2 | 1 | 0 | 5 |
| > 50M tpa | 1 | 0 | 0 | 0 | 1 |
| Totals | 1,661,216 | 893,524 | 286,558 | 104,861 | 2,946,159 |

**Percentages (as in Table O)**

| Loadband | 0-100 | 101-200 | 201-300 | >300 | Totals |
|---|---|---|---|---|---|
| 0-73.2 MWh | 56.7% | 30.3% | 9.6% | 3.4% | 100.0% |
| 73.2 - 146.5 | 44.5% | 32.6% | 15.0% | 7.8% | 100.0% |
| 146.5 - 293 | 42.6% | 30.9% | 16.9% | 9.5% | 100.0% |
| 293 - 439.6 | 43.1% | 30.3% | 16.6% | 10.0% | 100.0% |
| 439.6 - 586. | 43.5% | 31.6% | 15.2% | 9.6% | 100.0% |
| 586.1 - 732. | 44.7% | 27.2% | 18.1% | 10.0% | 100.0% |
| 732.7 - 2,93 | 40.4% | 31.2% | 16.9% | 11.5% | 100.0% |
| 2,931 - 14,6 | 27.2% | 35.2% | 22.5% | 15.1% | 100.0% |
| 14,654 - 58, | 14.0% | 32.3% | 31.2% | 22.6% | 100.0% |
| 58,614 - 29 | 27.3% | 18.2% | 45.5% | 9.1% | 100.0% |
| > 293,071 M | 40.0% | 40.0% | 20.0% | 0.0% | 100.0% |
| > 50M tpa | 100.0% | 0.0% | 0.0% | 0.0% | 100.0% |

**Survey results compacted into 3 loadbands for comparison with PC38 results**

| Loadband | 0-100 | 101-200 | 201-300 | >300 | Totals |
|---|---|---|---|---|---|
| <73.2 MWh | 56.7% | 30.3% | 9.6% | 3.4% | 100.0% |
| 733.2-732M | 43.8% | 31.7% | 15.8% | 8.6% | 100.0% |
| >732MWh | 37.8% | 31.9% | 18.1% | 12.3% | 100.0% |

**PC38 Survey**

| Loadband | 0-100 | 101-200 | 201-300 | >300 | Totals |
|---|---|---|---|---|---|
| <73.2 MWh | 58.1% | 31.6% | 7.7% | 2.6% | 100.0% |
| 733.2-732M | 40.6% | 32.8% | 16.6% | 10.0% | 100.0% |
| >732MWh | 25.1% | 41.1% | 27.8% | 6.0% | 100.0% |

## Appendix 3: CSEP results

### Survey results

**CSEP - Actual AQ (Table A)**

Connections to each tier : breakdown for each band

| Load (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.2% | 9.1% | 90.7% | 100.0% |
| 73.2 - 146.5 | 0.0% | 0.6% | 7.3% | 92.2% | 100.0% |
| 146.5 - 293 | 0.0% | 0.0% | 5.8% | 94.2% | 100.0% |
| 293 - 439.6 | 0.0% | 0.9% | 8.0% | 91.0% | 100.0% |
| 439.6 - 586. | 0.0% | 0.0% | 6.7% | 93.3% | 100.0% |
| 586.1 - 732. | 0.0% | 1.6% | 8.8% | 89.6% | 100.0% |
| 732.7 - 2,93 | 0.0% | 0.6% | 11.9% | 87.5% | 100.0% |
| 2,931 - 14,6 | 0.0% | 5.3% | 10.5% | 84.2% | 100.0% |
| 14,654 - 58, | 0.0% | 0% | 0% | 0% | 100% |
| 58,614 - 293 | 0.0% | 0% | 0% | 0% | 100% |
| > 293,071 | 0.0% | 0% | 0% | 0% | 100% |
| All loads | 0.0% | 0.5% | 8.5% | 91.0% | 100.0% |

**CSEP - Max AQ (Table A)**

Connections to each tier : breakdown for each band

| Load (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.0% | 0.0% | 100.0% | 100.0% |
| 73.2 - 146.5 | 0.0% | 0.0% | 0.0% | 100.0% | 100.0% |
| 146.5 - 293 | 0.0% | 0.0% | 4.4% | 95.6% | 100.0% |
| 293 - 439.6 | 0.0% | 0.5% | 5.5% | 94.0% | 100.0% |
| 439.6 - 586. | 0.0% | 0.0% | 3.8% | 96.2% | 100.0% |
| 586.1 - 732. | 0.0% | 0.0% | 5.1% | 94.9% | 100.0% |
| 732.7 - 2,93 | 0.0% | 0.3% | 5.8% | 93.9% | 100.0% |
| 2,931 - 14,6 | 0.0% | 1.5% | 22.2% | 76.4% | 100.0% |
| 14,654 - 58, | 0.0% | 3.8% | 30.8% | 65.4% | 100.0% |
| 58,614 - 293 | 0.0% | 0.0% | 40.0% | 60.0% | 100.0% |
| > 293,071 | 0.0% | 66.7% | 0.0% | 33.3% | 100.0% |
| All loads | 0.0% | 0.5% | 8.3% | 91.2% | 100.0% |

**CSEP - Actual AQ (Table D)**

Connections to each tier : overall breakdown

| Load (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.1% | 2.3% | 23.0% | 25.3% |
| 73.2 - 146.5 | 0.0% | 0.1% | 0.7% | 9.3% | 10.1% |
| 146.5 - 293 | 0.0% | 0.0% | 1.0% | 15.5% | 16.5% |
| 293 - 439.6 | 0.0% | 0.1% | 1.0% | 10.9% | 11.9% |
| 439.6 - 586. | 0.0% | 0.0% | 0.7% | 9.4% | 10.1% |
| 586.1 - 732. | 0.0% | 0.1% | 0.6% | 6.3% | 7.0% |
| 732.7 - 2,93 | 0.0% | 0.1% | 2.1% | 15.7% | 18.0% |
| 2,931 - 14,6 | 0.0% | 0.1% | 0.1% | 0.9% | 1.1% |
| 14,654 - 58, | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| 58,614 - 293 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| > 293,071 | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| All loads | 0.0% | 0.5% | 8.5% | 91.0% | 100.0% |

**CSEP - Max AQ (Table D)**

Connections to each tier : overall breakdown

| Load (MWh) | LTS | IPS | MPS | LPS | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% |
| 73.2 - 146.5 | 0.0% | 0.0% | 0.0% | 1.6% | 1.6% |
| 146.5 - 293 | 0.0% | 0.0% | 0.3% | 5.9% | 6.2% |
| 293 - 439.6 | 0.0% | 0.0% | 0.5% | 8.6% | 9.1% |
| 439.6 - 586. | 0.0% | 0.0% | 0.3% | 7.9% | 8.2% |
| 586.1 - 732. | 0.0% | 0.0% | 0.4% | 7.5% | 7.9% |
| 732.7 - 2,93 | 0.0% | 0.1% | 2.9% | 46.7% | 49.8% |
| 2,931 - 14,6 | 0.0% | 0.2% | 3.4% | 11.9% | 15.5% |
| 14,654 - 58, | 0.0% | 0.0% | 0.4% | 0.8% | 1.2% |
| 58,614 - 293 | 0.0% | 0.0% | 0.1% | 0.1% | 0.2% |
| > 293,071 | 0.0% | 0.1% | 0.0% | 0.0% | 0.1% |
| All loads | 0.0% | 0.5% | 8.3% | 91.2% | 100.0% |

### LP Survey results

**CSEP - Actual AQ (Table O)**

Connections to each tier : breakdown for each band

| Load (MWh) | 0-100 | 101-200 | 201-300 | 301-400 | Total |
|---|---|---|---|---|---|
| 0-73.2 | 22.8% | 42.6% | 30.1% | 4.4% | 100% |
| 73.2 - 146.5 | 20.0% | 44.8% | 28.5% | 6.7% | 100% |
| 146.5 - 293 | 29.7% | 44.2% | 21.0% | 5.1% | 100% |
| 293 - 439.6 | 19.2% | 47.2% | 29.0% | 4.7% | 100% |
| 439.6 - 586. | 29.9% | 40.1% | 25.7% | 4.2% | 100% |
| 586.1 - 732. | 19.6% | 48.2% | 29.5% | 2.7% | 100% |
| 732.7 - 2,93 | 13.6% | 43.4% | 35.1% | 7.9% | 100% |
| 2,931 - 14,6 | 6.3% | 18.8% | 56.3% | 18.8% | 100% |
| 14,654 - 58, | | | | | |
| 58,614 - 293 | | | | | |
| > 293,071 | | | | | |
| All loads | 22.0% | 43.7% | 28.9% | 5.4% | 100% |

**CSEP - Max AQ (Table O)**

Connections to each tier : breakdown for each band

| Load (MWh) | 0-100 | 101-200 | 201-300 | 301-400 | Total |
|---|---|---|---|---|---|
| 0-73.2 | 50.0% | 50.0% | 0.0% | 0.0% | 100% |
| 73.2 - 146.5 | 31.4% | 37.1% | 28.6% | 2.9% | 100% |
| 146.5 - 293 | 32.8% | 40.5% | 19.8% | 6.9% | 100% |
| 293 - 439.6 | 33.9% | 46.0% | 14.3% | 5.8% | 100% |
| 439.6 - 586. | 36.0% | 49.1% | 13.1% | 1.7% | 100% |
| 586.1 - 732. | 32.5% | 38.0% | 24.7% | 4.8% | 100% |
| 732.7 - 2,93 | 18.5% | 47.1% | 29.5% | 4.8% | 100% |
| 2,931 - 14,6 | 8.0% | 34.4% | 49.2% | 8.4% | 100% |
| 14,654 - 58, | | | | | |
| 58,614 - 293 | | | | | |
| > 293,071 | | | | | |
| All loads | 22.3% | 43.9% | 28.4% | 5.4% | 100% |

**CSEP - Actual AQ (Table L)**

Connections to each tier : overall breakdown

| Load (MWh) | 0-100 | 101-200 | 201-300 | 301-400 | Total |
|---|---|---|---|---|---|
| 0-73.2 | 5.8% | 10.8% | 7.6% | 1.1% | 25.2% |
| 73.2 - 146.5 | 2.0% | 4.6% | 2.9% | 0.7% | 10.2% |
| 146.5 - 293 | 5.1% | 7.5% | 3.6% | 0.9% | 17.1% |
| 293 - 439.6 | 2.3% | 5.6% | 3.5% | 0.6% | 11.9% |
| 439.6 - 586. | 3.1% | 4.1% | 2.7% | 0.4% | 10.3% |
| 586.1 - 732. | 1.4% | 3.3% | 2.0% | 0.2% | 6.9% |
| 732.7 - 2,93 | 2.4% | 7.5% | 6.1% | 1.4% | 17.3% |
| 2,931 - 14,6 | | | | | |
| 14,654 - 58, | | | | | |
| 58,614 - 293 | | | | | |
| > 293,071 | | | | | |
| All loads | 22.0% | 43.7% | 28.9% | 5.4% | 100.0% |

**CSEP - Max AQ (Table L)**

Connections to each tier : overall breakdown

| Load (MWh) | 0-100 | 101-200 | 201-300 | 301-400 | Total |
|---|---|---|---|---|---|
| 0-73.2 | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% |
| 73.2 - 146.5 | 0.5% | 0.6% | 0.5% | 0.0% | 1.7% |
| 146.5 - 293 | 2.1% | 2.6% | 1.3% | 0.4% | 6.5% |
| 293 - 439.6 | 3.2% | 4.3% | 1.3% | 0.5% | 9.4% |
| 439.6 - 586. | 3.1% | 4.3% | 1.1% | 0.1% | 8.7% |
| 586.1 - 732. | 2.7% | 3.1% | 2.0% | 0.4% | 8.3% |
| 732.7 - 2,93 | 9.5% | 24.2% | 15.1% | 2.5% | 51.2% |
| 2,931 - 14,6 | 1.0% | 4.5% | 6.4% | 1.1% | 13.0% |
| 14,654 - 58, | 0.0% | 0.2% | 0.4% | 0.1% | 0.8% |
| 58,614 - 293 | 0.0% | 0.0% | 0.1% | 0.0% | 0.1% |
| > 293,071 | | | | | |
| All loads | 22.3% | 43.9% | 28.4% | 5.4% | 100.0% |

### Raw data

Cost per kWh per loadband

| | CSEP AQ | | CSEP Max AQ | |
|---|---|---|---|---|
| | 11 loadbands | | 11 loadbands | |
| | Capacity | Commodity | Capacity | Commodity |
| 0-73.2 MWh | 16.32 | 0.1037 | | |
| 73.2 - 146.5 | 16.14 | 0.1024 | 17.41 | 0.1169 |
| 146.5 - 293 | 17.53 | 0.1125 | 17.19 | 0.1153 |
| 293 - 439.6 | 16.04 | 0.1016 | 17.34 | 0.1164 |
| 439.6 - 586. | 17.35 | 0.1113 | 18.00 | 0.1213 |
| 586.1 - 732. | 16.01 | 0.1015 | 17.03 | 0.1142 |
| 732.7 - 2,93 | 14.94 | 0.0936 | 15.50 | 0.1028 |
| 2,931 - 14,6 | | | 12.57 | 0.0816 |
| 14,654 - 58, | | | 7.41 | 0.0447 |
| 58,614 - 293 | | | | |
| > 293,071 M | | | | |

## Appendix B: Load Factor Variation

### B1 Introduction

The present diversified load factors for domestic properties (strictly, sub 73.2 MWh loads) are based on analysis of load data for typically 150 to 200 domestic properties with data recorders in each LDZ. At present the LDZ domestic load factors are determined so as to give a national average of 36.5%. For CSEPs consisting solely of domestic properties the SOQ used to determine the level of both the LDZ commodity and capacity functions is derived from the aggregate AQ for the CSEP and the relevant domestic load factor.

An argument which has been put forward for applying a higher load factor for CSEPs is that the load characteristic of a CSEP is already diversified whereas the load for a single domestic property is only diversified when it mingles with the load for many other properties and so, in reflecting the level of costs for part of the local distribution system, it may be more appropriate to use a less diversified load factor. The question of how quickly fully diversified load characteristics develop for a co-mingled load, as the size of the load grows with the number of properties, may inform this issue.

Such considerations of cost reflectivity are made more complex by the fact that the design of the distribution system is likely to be related to the peak hourly or six minute flow rather than the peak day flow, which the load factor is based on. The use of the SOQ to determine cost-reflective charges for these parts of the network is thus already a proxy for the true cost drivers.

The Gas Legislation Guidance for Sub-7 Bar Systems, IGE/GL/1 is commonly used by Transco and developers of IPGT systems to determine the sizing of low pressure systems. This Guidance indicates how the peak hourly load for a group of domestic properties can vary with the number of properties, due to the diversification of the individual property peak loads.

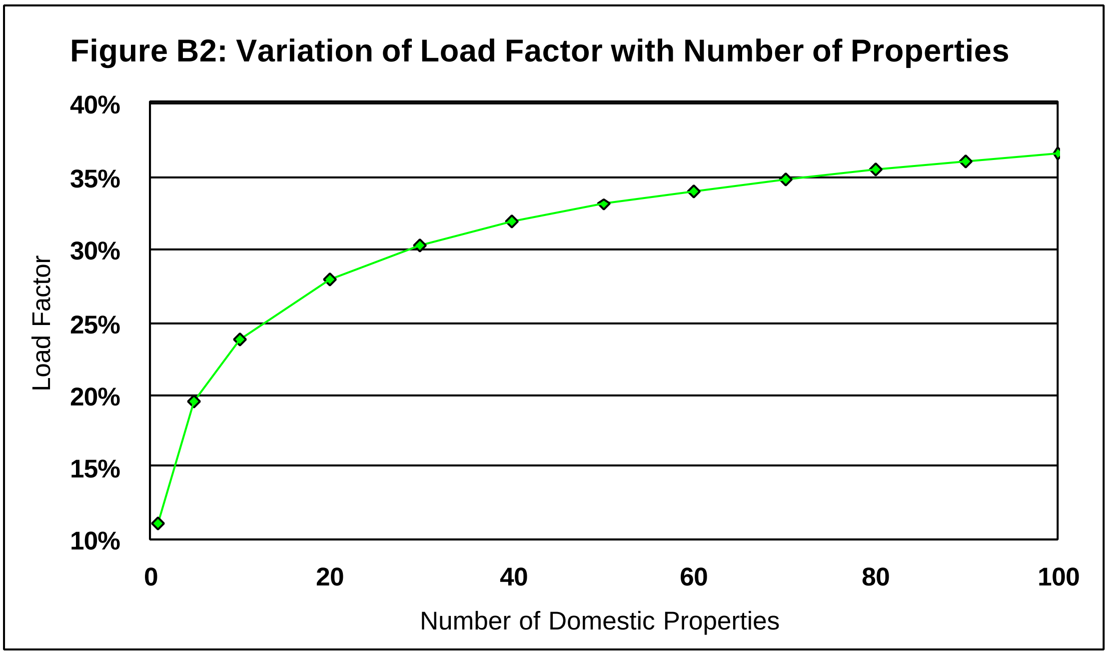
Table B1 below shows the variation in the implied domestic load factor for different sized groups of domestic properties based upon the variation in the design peak hour flowrate (SHQ) given by IGE/GL/1. The peak hour flowrate has been converted to an estimated peak day rate, which the load factor relates to, assuming that the peak hour rate is 7.5% of the peak day rate. This conversion factor has been chosen so as to give an implied load factor for the grouping of 100 houses of 36.5%. However this factor is roughly consistent with past research which indicated that the peak hour rate is typically around 8% to 9% of the peak day rate for domestic properties.

**Table B1: Variation of Load Factor with Group Size**

| No. of Properties | AQ kWh/annum | Design SHQ [1] kWh | SOQ kWh[2] | Implied Load Factor |
|---|---|---|---|---|
| 100 | 2,000,000 | 1124 | 15,012 | 36.5% |
| 90 | 1,800,000 | 1026 | 13,703 | 36.0% |
| 80 | 1,600,000 | 926 | 12,368 | 35.4% |
| 70 | 1,400,000 | 825 | 11,019 | 34.8% |
| 60 | 1,200,000 | 724 | 9,670 | 34.0% |
| 50 | 1,000,000 | 620 | 8,281 | 33.1% |
| 40 | 800,000 | 515 | 6,878 | 31.9% |
| 30 | 600,000 | 407 | 5,436 | 30.2% |
| 20 | 400,000 | 294 | 3,927 | 27.9% |
| 10 | 200,000 | 173 | 2,311 | 23.7% |
| 5 | 100,000 | 105 | 1,402 | 19.5% |
| 1 | 20000 | 37 | 494 | 11.1% |

1. Based on IGE/GL/1 Gas Legislation Guidance for sub-7 bar systems
2. Assumes SHQ is 7.5% of implied SOQ. 7.5% factor is chosen to give 36.5% diversified load factor for 100 properties, but is consistent with previous empirical research data.

The change in the implied load factor is shown graphically in Figure B2 below.




This analysis suggests that the benefits of diversification of peak load largely occur with as few as 30 domestic properties and so it may well be for only a very small part of the distribution system that less diversified load characteristics would be a more appropriate cost driver. It should be noted that the assumed constant 7.5% peak hour rate to peak day rate conversion factor may not be appropriate for individual properties, or very small groups of properties, and so their load factor may typically be higher than shown. However, this does not alter the above conclusion.