ELECTRICITY DISTRIBUTION LOSSES – RESPONSE TO OFGEM JANUARY 2003 CONSULTATION

Executive Summary

We welcome the opportunity to respond to this consultation. SP Transmission & Distribution supports Ofgem's aim of developing measures to incentivise the efficient management of losses. Accordingly, we would like to participate in Ofgem's working group to help develop thinking in this area.

The costs of reductions in network losses need to be considered against other means of limiting carbon dioxide emissions. Some estimates of the costs per tonne of carbon saved for initiatives under the Energy Efficiency Commitment are as low as £20 per tonne – well below the figure of £81 per tonne used in the paper for estimating the value of network losses. **Customer benefits and willingness to pay need to be adequately addressed in designing any new network losses incentive mechanism.**

It is also important to recognise the limitations on the DNOs' ability to reduce losses. Losses are affected by a number of factors outside the direct control of DNOs, including the following.

i. Price signals in DNO charges intended to smooth demand or influence power factor can be offset by other aspects of suppliers' charges, or otherwise 'lost' in final charges;

ii. 'Non-technical' errors such as metering errors, profiling errors and theft are largely outside DNOs' control. DNOs are not remunerated for providing revenue protection services; and

iii. The voltage mix of units distributed has an effect on losses largely outside DNOs' direct control.

We recognise the attractions of an output based approach to incentivise reductions in network losses. **However, prerequisites for this are:**

a) more accurate measurement of losses; and

b) **a robust methodology to normalise performance between networks of differing topography, design, and load configuration.**

An approach based on that applied to NGC is unlikely to be appropriate given the higher diversity of voltage levels, larger number of entry and exit points and non-half hourly metering on DNOs' networks.

An input-based approach has the advantage of focussing on matters within a DNO's direct control. Otherwise there will be a risk that enhanced investment undertaken to reduce distribution losses may be disallowed as 'inefficient' at the subsequent price review. If programmes that met preset criteria for evaluation of the cost of loss reduction were allowed in a separate RAB (subject to sample audit), this would incentivise companies to reduce losses in a way that would avoid some of the measurement and other problems associated with an output-based approach.

1 The current level of losses and the ability to control it

1.1 Non-technical losses

It is important to remember that measured distribution losses reflect a number of factors apart from network losses. The paper itself recognises a number of these, but also states the reported views of some DNOs that 'non-technical losses' account for less than 20% of total losses.

We believe that non-technical losses amount to a substantial proportion of overall units unaccounted for and are likely to contribute to significant variation in the reported loss percentages both across DNOs and over time. However, by their nature estimates of their magnitude are inevitably imprecise. Year on year fluctuations in reported losses can be significant – up to 1% or more – and it is reasonable to assume that this is in part due to non-technical losses.

Although Ofgem note the distinction between non-technical and technical losses there is apparently no consideration of the differing environmental impact of changes to these components. Recording the consumption of electricity more accurately does not reduce the physical amount of energy consumed and therefore does not directly change the environmental impact. Therefore, attributing an environmental benefit, based on greenhouse gas emissions, to the more accurate recording of electricity consumed is inappropriate. Indeed, an incentive to focus on non-technical factors would divert resources from addressing technical losses which would have an environmental benefit.

In our earlier response we identified a number of non-technical factors which contribute to units unaccounted for and these are set out in the table below:

<table>
<tr><th>Element of un-accounted for energy</th><th>Responsibility / governance</th></tr>
<tr><td>Profiling errors</td><td rowspan="3">Suppliers/Agents/BSC/SAS</td></tr>
<tr><td>Metering accuracy</td></tr>
<tr><td>Frequency and synchronisation of meter readings</td></tr>
<tr><td>Accuracy of un-metered supply inventories</td><td>Customer / connection agreement</td></tr>
<tr><td>Unregistered customers</td><td>Suppliers / MRA</td></tr>
<tr><td>Theft of electricity</td><td>Suppliers/Distributors (responsibility currently unclear, although access to premises is generally in the hands of suppliers.)</td></tr>
</table>

It is clear that DNOs have little direct control over most of these factors and consequently imposing a larger incentive on DNOs themselves is unlikely to have the desired effect.

If improvements in metering accuracy were desirable then it would be necessary to introduce changes to the relevant regulations. With the introduction and growth of competition in metering, DNOs will have less and less influence over the type of meter installed.

More frequent meter readings would help to improve the accuracy of reported consumption but DNOs are no longer responsible for this activity and are unable to control the frequency of meter readings.

Technical developments could facilitate the future metering of supplies which are currently unmetered. However, this would again be more appropriately addressed through changes to the relevant regulations.

DNOs already have a substantial incentive to ensure, as far as they can, that all customers are registered. However, with the growth in connections provided by third parties they are increasingly reliant on information provided by third parties that do not have equivalent incentives.

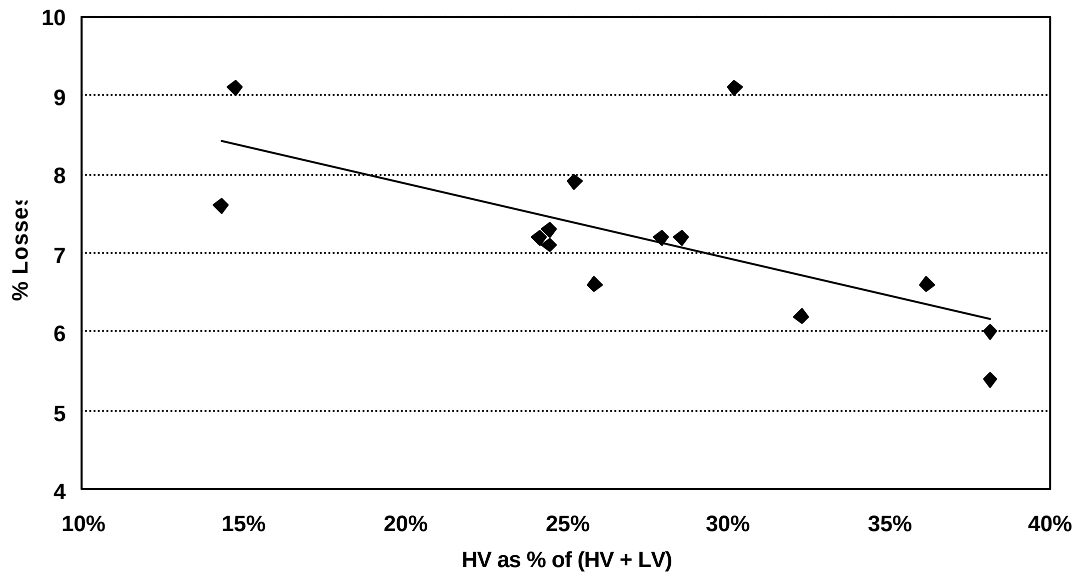
It is important that appropriate incentives and obligations are placed on all participants to reduce the illegal abstraction of electricity, and we look forward to the forthcoming consultation on this. There is historical evidence that illegal abstraction is significant, but there are currently split responsibilities (and means) for addressing this.

1.2 Technical losses

One of the factors not explicitly recognised in the paper is the changing mix in the demand for electricity between different categories of user, and therefore voltage level. For example, from 1990-2000, domestic sales of electricity in the UK rose by 19%, compared with only 4% for industrial users. These trends are the result of a number of factors, such as a relative decline in manufacturing and a growth in own generation. However, to the extent they are reflected in capacity utilisation and voltage mix, they will have an impact on distribution losses that is at least partially independent of actions on the part of distributors.

An important explanatory factor, though by no means the only one, in comparing reported losses between DNOs, is the proportion of units distributed at HV, which in part reflects the mix of users (domestic, commercial, industrial) connected to regional networks. This is illustrated in the chart below, which uses the data in table 4.1 of the paper. As one would expect, this shows a

GB Distribution Losses (Excl EHV sales) 2000/01



fairly high inverse correlation between reported loss percentages and the proportion of units distributed at HV.

It is also important to take account of measurement and definitional issues in considering comparative losses 'performance'. For example, table 4.2 in the paper indicates rising (transmission and distribution) losses in the UK in the period 1990-2000, while table 1.1 shows falling distribution losses in GB over that period. The inconsistencies here do not appear to be readily explicable in terms of transmission or Northern Ireland.

The paper reports actions by Midlands Electricity to replace its 33 kV network in favour of direct transformation from 132 kV or 66 kV to 11 kV. We understand, however, that this is being carried out in selected locations on specific engineering grounds rather than being a general programme to remove the entire 33 kV network as a loss reduction initiative. It is also probably worth noting that Midlands Electricity has one of the highest proportions of units distributed at HV amongst the DNOs, which largely explains their relatively low reported losses.

There are of course actions that DNOs can take which have a beneficial impact on losses. For example, new specification transformers and conductors tend to have improved losses performance compared to older equipment. However, there is a regulatory risk that financing costs of investment deemed inefficient (whatever the impact on loss reductions) will not be allowed at the ensuing 5 yearly price review.

The paper states that many companies have moved away from reactive power charges. That suggests that DNOs could do more to encourage suppliers to separately identify reactive power charges on bills to end-customers so as to incentivise their behaviour in installing correction equipment. However, even where reactive charges are applied, it is not clear to us what means we have for influencing how suppliers present use of system charges to their customers. It is also worth noting that suppliers' standardisation of their charges across DNO areas, or the impact of energy charges, may lead to cost signals from distribution use of system charges being obscured or even absent in the structure of charges to final users.

It is important not to overemphasise what could reasonably be achieved by DNOs to reduce losses. The paper states that a 1 percentage point reduction in distribution losses might contribute to 4% of the government's target reduction in $CO2$ emissions by 2010. Whilst such a reduction is theoretically possible, it would require a very substantial investment programme over a prolonged period of time, and the financing of this would need major changes to the mechanism for price control. Further, it may in part conflict with the priority for meeting targets for renewable generation (although in some cases, investments to reduce losses may actually be favourable to distributed generators).

To illustrate this point, let us assume that a new 132/33 kV transformer has losses of 750 MWh per year less than an older model and costs £500,000 to procure and install. A capital investment of £2bn would then be required to save losses of 3 TWh - roughly 1% of GB units distributed. Over a 10 year period, this would be equivalent to around 30% of DNOs' average annual non-load related capex, or incremental investment of around £8 per customer per year. Although these figures are illustrative, they do serve to give an indication of the order of magnitude involved in attaining such a target.

This analysis tends to indicate that a 1% reduction in network losses may be unrealistic and exceed what customers are willing to support. **It is important to compare costs against benefits for different kinds of measures to achieve reductions in carbon dioxide emissions.** We understand, for example, that some estimates of the cost per tonne of carbon saved for measures under the Energy Efficiency Commitment are around £20 per tonne. This is well below the implied figure of around £300 per tonne in the above example and also the figure of £82 per tonne used in the paper.

The paper mentions research by UMIST indicating that low capacity utilisation (i.e. 'oversizing' transformers and lines) may be optimal if loss performance is taken into account. Our experience at previous price reviews has been that consideration of losses has not played a major part in Ofgem's assessments of efficient capital expenditure. We look forward to discussing possible implications of this research for capital expenditure at the forthcoming price review. It is also important that companies that have achieved high levels of utilisation are not penalised through a shift in the balance of incentives from utilisation to reduced losses.

As the paper says, distributed generation, may have a beneficial impact on losses in certain cases. There is no evidence to suggest that this may not be balanced, or even outweighed, by an adverse impact where local load is relatively small. In one case in SP Manweb's area, a renewables generator whose output is significantly in excess of local demand is estimated to be adding approximately 0.1% to annual distribution losses.

1.3 Views on the current incentive on distribution losses

The current incentive mechanism to reduce losses involves an adjustment to allowed revenue based on the variance of 'actual' distribution losses against a 10 year moving average. This means that:

- It is based on total reported losses – i.e. non-technical factors such as metering errors, profiling errors and theft are included – which are outside DNOs' direct control;
- The reducing benefit over a 10 year period severely limits the incentive to carry out loss reducing initiatives – the existing incentive is equivalent to a required payback period of less than 5 years at 3p/unit;
- It is prone to errors due to the incorrect treatment of embedded generation or losses for EHV units (as adjustments for each these require to be made); and
- Background variations in overall reported losses (due to such factors as weather) may obscure underlying savings achieved through loss reduction initiatives.

1.4 Ofgem's view that the current incentive is too weak and losses are higher than optimal

We agree that the current incentive is too weak to act as a significant driver of DNO behaviour. Our networks are designed and maintained in order to meet the demands of customers and comply with our statutory requirements at an efficient cost. To achieve a significant (1 percentage point or more) change in reported losses by DNOs implies a very substantial work programme that, due to constraints on allowed investment and available resources, may conflict with other priorities, including providing for connections of embedded generation. Also, as stated above, there is a need to compare costs and benefits of network-related measures with other means of controlling CO2 emissions, such as energy efficiency programmes.

2 How to encourage efforts to achieve an efficient level of losses

2.1 What is the appropriate valuation of losses?

It is not clear that the valuation of losses should necessarily include the full cost of 'excess' transportation infrastructure. Any additional capacity involved should have a positive value, for example in being available to meet future growth in demand, were corresponding reductions in losses to take place. However, there may be a disbenefit due to it being required ahead of need in order to transport 'lost' units at peak periods. We agree that it is appropriate to take some account of both infrastructure costs of losses as well as energy costs. In addition, we also see the case for including a measure of environmental cost, and the revealed valuations for carbon in emissions trading schemes represent an objective basis for this. Overall, a range of around 2.9-3.6p a unit, as given in Appendix 3 of the paper, appears to be reasonable.

The main problem in assessing distribution losses by individual half-hour is that accurate measurement is not possible at present. There is therefore little alternative but to consider losses on an average basis. Even "average" losses cannot be accurately measured at present due to metering limitations and other factors.

We agree in principle with the statement in Appendix 3 that *"It would be efficient for the costs of losses to be allocated to those parties that can exert significant control over the main factors that affect the magnitude of losses."* This is consistent with our view that a more effective mechanism to manage distribution losses would come from an input based approach that focused on areas within the control of distributors.

Given the above points, we believe that

- An average value is appropriate for distribution losses;
- It would be reasonable to take some account of infrastructure and environmental costs, as well as energy. Prices for CO_2 indicated in emissions trading schemes provide one measure of environmental costs; and
- The range of 2.9-3.6p per unit in Ofgem's paper as a valuation of distribution losses is broadly reasonable.

2.2 The important factors in assessing the merits and demerits of alternative incentive schemes.

It is critical that a losses incentive scheme is applied to areas within the direct control of DNOs. One of the flaws in the existing scheme is that it is applied to unaccounted units as a whole (i.e. including metering and other errors) rather than focussing on where a distributor can influence the level of losses. Further, as pointed out above, distributors have limited influence over the demand profile of customers or the voltage mix of units distributed, both of which affect network losses.

It is also important that an appropriate period is taken into account. For example where additional investment takes place in order to reduce losses, price controlled companies must be allowed to recover their costs over the economic life of the scheme.

Thirdly, any incentive scheme should make adequate allowance for risk. Under the existing arrangements, as the impact of any initiatives intended to reduce losses may be offset by other factors outside DNOs' control, there is a risk that additional costs will be incurred without any means of recovering these through price control. One of the benefits of an input-based scheme is that it reduces the risk to the distributor of undertaking initiatives based on approved criteria.

Finally, any incentive scheme must be based on robust measurement criteria. A weakness of the current arrangements is that they are based on the residual between two large quantities, one of which is not directly measured. They are therefore prone to metering and other errors as identified above. A well constructed input-based scheme should avoid these problems.

2.3 The merits and demerits of the alternative options for incentivising losses?

Option 1 – Adjusting the current incentive scheme

We have referred above to the flaws in the current scheme, primarily that it does not address factors directly under the control of DNOs. Benefits from any changes to the scheme would therefore be limited.

Option 2 – The NGC approach

Like the current scheme, this addresses overall 'losses'. However, unlike the NGC system, which operates at two voltages, with a limited (low 100's) number of entry and exit points, and half-hourly metering throughout, DNOs operate with many thousands of exit (and entry) points, at four (or more) voltages, with limited half-hourly metering and significant unmetered supplies. As argued above, we believe that the non-technical errors concerned are significant, but in the nature of things difficult to quantify.

Further, due to the greater diversity and volatility of load flows within distribution networks, DNOs are less able to manage losses on an active basis than NGC.

Also, due to the many factors differentiating the network performance of DNOs, there is no robust basis for a benchmark figure for distribution losses comparable to that for NGC.

Option 3 – DNOs purchasing electricity to cover losses

The paper itself recognises a number of flaws with such an approach, including the implied appearance of a new set of major energy purchasers in the wholesale market that would go against the whole process of business separation as carried out since 1998.

Even if such an arrangement involved adjustments to price control based on reported 'losses' rather than physical purchases of the energy involved, the means available to DNOs to manage losses in any short term time period are so limited that this would amount to a lottery.

2.4 The case for an input –based scheme

The year on year reported outturn for losses and relative position of companies is subject to a wide range of factors as explained above, many of which are outside a DNO's direct control. This suggest that an output based scheme is inappropriate since it introduces considerable uncertainty and risk. **We strongly believe that an input-based scheme, whereby DNOs are incentivised according to objective *ex-ante* loss reductions, has a number of advantages over the existing arrangements, and over the alternative options mentioned in the paper:**

- It addresses activities over which DNOs have direct control;
- It provides an auditable means of measuring performance by a DNO in carrying out the programmes involved; and
- It enables costs to be recovered over the life of the assets concerned.

It is important that DNO's do not receive "perverse" incentives to divert investment from projects necessary to ensure the long term safety and sustainability of the asset base in order to maximise short term benefit arising from a loss incentive regime. It is also important that the level of investment takes account to an appropriate degree of customer benefit and willingness to pay. These issues are similar to those already addressed within the Information & Incentives Project whereby an additional, specified allowance (currently £2.30 per customer per annum) has been included in the RAB for performance improvement initiatives. We believe that a similar approach could be appropriate for the losses regime.

We believe that the input based regime should focus on the incremental loss reductions achieved through new investment. One possible approach here would involve specific schemes or programmes to reduce losses being appraised against a benchmark cost of p/kWh (or per tonne of Carbon). Programmes meeting that threshold would be "logged up" up to a maximum additional allowance. At the time of the Price Control Review, an independent engineering audit of these schemes would be performed by Ofgem on a sample basis. We expect that the audit would involve a simple "desktop" review of the engineering detail / supporting analysis and that "on-site" measurement of losses would be unnecessary. Subject to a satisfactory audit, schemes would be included in a separate RAB. A further incentive element could be added by allowing an additional rate of return for schemes within this RAB.

Another possible approach that we believe is worth looking at in more detail would involve companies 'bidding' for additional funding to carry out network transformation intended to reduce losses. Independent engineering studies could be used to provide an assessment of the ex-ante losses reductions to be expected. The resulting plan would be assessed against the value of losses. Subject to the agreement of Ofgem, the additional cost involved would be recoverable through price control. An incentive element could be added be allowing an additional rate of return for schemes whose costs are below a preset threshold. It would also be possible for companies to be given quotas for *ex-ante* loss reductions, with funding of approved schemes achieved through price control.

These approaches would avoid problems with a 'procurement'-based input scheme (i.e. one based on standardised loss assessments for particular models of transformers and other items of line and plant).

The paper argues that an input based approach fails to address other areas where losses might be reduced, such as operational practices and demand smoothing. As regards demand smoothing, it can be argued that companies already have an incentive to encourage this through its impact on network capacity and hence investment requirements.

In summary, we continue to believe that an input-based approach to losses can address the flaws in the current incentive mechanism, and we would be happy to work with Ofgem to develop a workable methodology in greater detail.