Electricity Distribution Losses Workshop
14 April 2003

Introduction

The purpose of the workshop was to develop further thinking on the subject of electricity distribution losses and to build upon the 23 responses to Ofgem's initial consultation document on losses[1]. The workshop consisted of four presentations given by a variety of speakers in the morning. Each presentation was followed by a brief discussion which are summarised below. Delegates participated in three separate discussion groups in the afternoon. Summaries of the issues covered by the groups are included below in this document. Background information provided for the discussion groups is also available on the Ofgem website (www.ofgem.gov.uk)

Presentations[2]

Lars Rognlien (Ofgem): Electricity distribution losses project – way forward

One delegate stated that Ofgem should consider placing incentives on non–DNO parties in areas where losses are not under the control of DNOs. It was noted that, in reference to the international comparison of losses, the level of illegal abstraction appears to be higher in the UK than in Germany.

Two delegates expressed support for the potential development of minimum technical standards designed to reduce losses on distribution networks. Lars replied that, although Ofgem will consider a range of options, it would prefer an output-based incentive.

Volatile loss percentages were cited by one delegate as undermining the potential for the development of an optimal, rather than historical, benchmark for losses. Another delegate stated that this volatility, which was probably driven by measurement errors, meant that the data was of little use. Lars replied that, despite the fluctuations, the overall trend was stable and gave an insight into the magnitude of the issue.

Andy Phelps (Aquila Networks): DNO perspective on electricity distribution losses

In response to a question on whether it would be suitable to introduce a NGC-style incentive for DNOs, Andy said that the distribution and transmission networks are too dissimilar for such a scheme to be effective. He outlined differences such as network structure, ease of measurement of losses and the divergence between NGC as system operator and DNOs as system owners. He added that it was not possible to develop benchmarking for distribution losses. It was noted by a DNO representative that there is little HH metering in place on DNO networks. Furthermore, variations in the mix of HV and LV units distributed will affect the losses percentages reported by different DNOs.

One delegate supported a consideration of the option of DNOs purchasing losses because DNOs may be best placed to bear the risk that will exist whoever is responsible for it. DNOs could manage it by tendering out the purchasing function to suppliers.

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[1] 'Electricity distribution losses. A consultation document' January 2003 (03/03)
[2] slides from all four presentations are available on the Ofgem website

It was noted that the short-run opportunities to reduce losses by moving open points are limited by the presence of IIP incentives. Locations of open points that minimise losses are typically not the same as the optimal positions for IIP purposes.

An Ofgem representative said that differences in the development of UK and European networks probably accounted for some differences in performance. For example, the larger amount of distributed generation on the Continent meant that demand was generally closer to generation than in the UK.

Gary Keane (Ofgem): the cost of losses

The presentation was followed by a discussion of the meaning of the cost of distribution losses. One delegate asked if the savings of avoiding losses should be the marginal costs of losses or the negative marginal costs. Gary replied that the cost of losses should reflect the costs and benefits to society, rather than simply fiscal costs. A DNO representative stated that the cost of a lost unit is the marginal cost of the additional unit if it were sold rather than lost. One delegate asked if in setting the incentive Ofgem would consider the perceived value of the loss to different parties, particularly with reference to non-technical losses. Gary replied that Ofgem has concentrated on evaluating the benefits of reductions in technical losses.

A DNO representative expressed support for a life-cycle approach that included the energy costs and environmental impact of equipment manufacture. It was noted by one delegate that carbon emissions from generation are independent of how the electricity is consumed. Therefore, life-cycle costs could be captured by a carbon tax that would be preferable to the climate change levy. An Ofgem representative noted that the White Paper has outlined Ofgem's position on the commitment to an emissions trading system. One delegate commented that although the electricity retail price includes an environmental element, a discrete environmental component should be included in the cost estimate because Ofgem is not using the retail price to evaluate losses.

In response to a question about the inclusion of energy purchases to allow for transmission losses, Gary noted that this approach had been mentioned in responses to the document and was being considered.

John Lindup (ELEXON): the settlement process

During his presentation John acknowledged the teething problems associated with the introduction of new software and data collection systems during the implementation of NETA. He stated that the accepted error on GSP metering is 0.2-0.5% and noted that Line Loss Factors (LLFs) are under DNO control and are outside ELEXON's remit.

One delegate suggested that it may be helpful to move away from applying standardised profiles. If a representative sample of NHH customers was HH metered, the subsequent results could be used to produce an estimate of consumption for each class of customers. An ELEXON representative stated that a profiling process review in 2000 had found the 0.5% disruption in demand-weighted costs to be within expected limits.

An ELEXON representative explained that the Group Correction Factor (GCF) is applied to NHH units and NHH losses but not to HH volumes because it was thought that NHH volumes would be subject to greater error. ELEXON may consider reviewing this process to assess the costs and benefits of applying the GCF to HH volumes.

It was noted that ELEXON is currently reviewing the process of adding illegally abstracted units after final reconciliation runs.

Discussion groups

Group A: Incentive design

Incentive design

There was a discussion of whether it is possible to share the benefits of loss-reduction with consumers. The group felt the incentive would only need to be modified if it appeared that 30% was not an appropriate sharing factor. One DNO delegate suggested that the value of the incentive should represent the entire value of the lost unit. Another DNO representative responded that a stronger incentive would increase the risk faced by DNOs, but may not change the pattern of capital expenditure.

One DNO representative suggested that it may be appropriate to design a combination of input and output based incentives with the additional possible development of broad standards. Input based incentives would focus on a capex allowance designated for low-loss transformers and equipment. Such incentives were criticised because of the difficulties of defining desirable behaviour and measuring the benefits of such investment before an unspecified point in the future. Output based measures would reward and penalise performance on losses. However the current incentive was criticised for providing benefits that are too far removed in time from when costs are incurred.

There was concern within the discussion group that making DNOs responsible for purchasing losses would increase risk and uncertainty and require significant changes to their core businesses. DNOs considered that they would seek appropriate reward for bearing such risk. Although caps and collars, such as in the NGC incentive, would limit DNO exposure, the group felt that an NGC-style incentive would not be appropriate for distribution networks owing to measurement errors and the fact that DNOs' main influence on losses is through investment decisions.

The suggestion that the introduction of technical standards for network design would be a possible method of reducing losses was opposed by most of the group. They highlighted the fact that because most losses occur on the LV network, there would be significant practical difficulties experienced in setting standards for domestic users. In addition, minimum standards may reduce the scope for efficiency gains through innovation.

One DNO representative stated that the volume of losses is only one of the factors that influence capital expenditure decisions. Several DNOs felt that the opex and capex incentives in the price control outweigh the losses incentive. Other considerations suggested as being important include network reinforcement, quality of supply and taxation. However, an Ofgem representative stated that a consideration of the impact on losses could tip the balance in some investment decisions.

Benchmarking

There was strong opposition to the setting of an optimal benchmark for performance on losses. Delegates felt that benchmarking would not recognise those factors that affect losses. These factors include voltage mix, demand levels and geographical differences.

Disaggregating information, as under IIP, would create another work stream with consequent extra regulatory costs. One DNO representative supported the retention of the historical benchmark because it captures the differences between the distribution networks.

Measurement issues

The group discussed measurement problems and the implications for uncertainty and difficulty of incentive design. With the current measurement errors, the group felt that it would be difficult to monitor the outcome of any incentive scheme. It was suggested that the apparently stable trend in losses was possibly owing to measurement errors. It was noted that any incentive with a sufficiently long-term measurement period, such as 10 years, will be neutral with respect to measurement errors.

One DNO delegate distinguished between two types of losses. Fixed and variable losses were respectively defined as being determined by factors within and outside DNO control. Fixed losses were estimated to be one quarter of total losses. It was suggested by two DNO representatives that variable losses are increasing.

The measurement of losses could become more complicated owing to the potential separation of metering assets and because meter reading is no longer undertaken by DNOs. Consequently, it may be very difficult to estimate non-technical losses and perverse incentives may be created for suppliers to not report figures accurately. A DNO representative responded positively to the Ofgem suggestion that a reduction in settlement errors would create a more stable picture of losses.

It was suggested that it may be possible to model losses on the HV system. However, a DNO representative noted that accurate measurement is possible on the transmission system because NGC has sufficient information on import from generators and exports to GSPs and directly connected customers. Although DNOs possess accurate information on the imports from the GSP, they have inaccurate information about exports.

Although much discussion focused on the measurement of non-technical losses, there was also a consideration of the measurement of technical losses. An Ofgem representative stated that it may be possible to provide a definition of line loss factors. A DNO delegate noted that although a standard definition would reduce cross-contamination of data, it would not reduce uncertainty because approximately only a half of losses are due to technical causes. Others were concerned that this approach might lead to micro-management of the companies by the regulator and that Ofgem may stifle innovation by being too prescriptive

Group B: Measurement issues

The group considered that it was necessary to measure losses in order to make an effective incentive and to try to assess the broad proportions represented by different types of losses. It was noted that the losses figure is the difference between two large numbers that both contain some errors. The group felt that NHH export volumes are the source of most of the errors. The group agreed that the magnitude of distortions and measurement methodology varied across DNOs.

Main sources of distortion

The group agreed with the suggested list of distortions set out by Ofgem - settlement errors, meter/metering inaccuracies, illegal abstraction, inaccuracies in inventories of

unmetered supplies and unregistered customers. They added a further one of registered connections that are not trading. The group recognised the actions taken by ELEXON to address the problems of settlement errors.

One DNO representative stated that metering was a major source of distortion because most meters are programmed with an error range in favour of the customer. The tolerance range was noted as +2.5% to -3.5%. The recent improvement in meter accuracy is expected to continue, particularly with the uptake of static meters in the NHH market that are expected to have a zero mean error rate.

The current incentives on revenue protection were criticised by the group. Recognised as a key issue by one DNO representative, it was felt that a consideration of revenue protection incentives was needed in order to support other measures to improve data quality.

Two types of theft were identified, differentiated by whether there is or is not a registered supplier. Although unregistered connections should in principle not be energised, it was noted that they often were. Suggested reasons for this included contractors connecting premises or pressure from large companies on DNOs to connect quickly.

Other examples of difficulties in reducing illegal abstraction were outlined. The problem of 'serial switchers' was highlighted by one delegate – these are customers who switch suppliers frequently in order to avoid paying for the electricity they consume. Although suppliers are supposed to obtain a new read when a customer switches, this does not always happen. There was a discussion of the unwillingness of suppliers to prosecute because of the cost, low rate of success and likelihood of generating an energywatch investigation. An Ofgem representative agreed to look into the issue of revenue protection reports that suppliers are supposed to send to Ofgem.

Although DNOs appeared to be taking action to reduce distortions caused by unmetered supplies, it was noted that it would be very costly for DNOs to audit all such exit points. Furthermore, large organisations often exert pressure on DNOs to connect unmetered sites before DNOs have received a detailed inventory.

Suggested explanations for the apparent increase in unregistered connections included the absence of a default data collector, competition in connections and the development of supply regulations under which DNOs cannot object to connections on commercial grounds. A DNO representative noted that the identification of theft had been easier under a monopoly data collector that would report all premises not on its list.

The parties responsible for reducing distortions

There was some discussion of whether suppliers should face incentives to reduce losses. They can influence the quality of settlements data via their relationship with the data aggregator (DA) as part of the supplier hub. It was noted that although this relationship places some incentives on DAs to provide good quality settlements data, suppliers have little power to penalise DAs for poor quality data provision until all of the new metering contracts were in place. A DNO representative cited this as another reason why any incentive design should consider the role of suppliers as well as DNOs.

Reducing distortions

One delegate expressed their belief that the final losses figure is not measured accurately enough and consequently the industry should set a long term objective of carefully considering how consumption is metered. One proposed modification was that all customers' premises should be fitted with two-register meters that would switch between registers at the end of each incentive period. This would allow more precise analysis over the incentive period. The regime could begin with a small sample initially and could be helpful in reducing errors in the long term.

There was some discussion of the costs and benefits of this proposal. Some DNO representatives stated that it would not eradicate the problem of errors and would be costly. One DNO representative suggested that if the industry is prepared to commit the finance for such a scheme, it may be preferable to introduce universal HH metering. One delegate responded that two-register meters are cheaper and provide only one data point per period, compared to the 17,000+ provided by HH meters.

Improving knowledge about distortions

There was a mixed response from DNO representatives on the usefulness of introducing metering at all DNO substations. Although it would provide more accurate information about system losses, it would not provide any information about other types of losses, such as illegal abstraction. In addition, the error margins involved meant that the proposal would do little to support suitable incentive design.

It was suggested by one delegate that if DNOs improved the metering of their networks, measurement distortions could be slowly but surely reduced over the long term. One DNO representative warned that improved measurement and metering might provide higher quality data but may not lead to greater knowledge about losses. However, another delegate stated that improved data would enable more useful benchmarking at different voltage levels and would aid incentive design. It was noted that intermediate metering may be costly and difficult. This was acknowledged by one delegate who nevertheless noted that because most possible loss-reduction measures are costly, none should be discounted without due consideration.

General

It was noted by a DNO representative that if an incentive scheme rewards or penalises DNOs for good or bad performance, it would be easier to present loss-reduction business cases to DNO management.

One DNO representative expressed his belief that the most significant issue was whether a magnitude could be assigned to each contributing factor to assess the impact on the final overall losses figure.

It was noted by another delegate that it appeared as though much of the industry was now keen to conduct some form of cost-benefit analysis of options in order to make some progress on the issue of losses.

One DNO representative suggested that settlements data supports a volatile profile of losses and therefore it is unclear how some DNOs are able to report apparently stable trends. A delegate asked whether this meant that DNO loss calculations should be more

transparent and should be made available to external parties. One DNO representative stated this was not currently done because some information is confidential in nature. Possible resolutions suggested included making anonymous data publicly available and developing industry trust in the ability of Ofgem to check loss calculations correctly and consistently.

Group C: Cost of losses and other issues

There was much debate of whether the estimation methodology can compensate for perceived imperfections in other markets or if it should be assumed that other markets function in a socially desirable fashion. If so it would not be appropriate to include an environmental element in the valuation of losses. One DNO representative questioned whether this approach is being proposed because it is appropriate or because any other system is too difficult. In addition, it was noted that different techniques will be needed to estimate half-hourly costs or an annual average cost.

The discussion centred on the evaluation of the cost of technical losses because they were assumed to represent the majority of losses. Most of the group felt that in the long term, losses would be primarily affected by investment decisions rather than by changes to operating procedures. One DNO suggested that the location of open points may only significantly affect losses at the extremes. A minority of the delegates noted the potential for operational improvements on highly meshed networks. It was agreed that investment decisions about asset replacement and refurbishment should be evaluated at forward LRAC (calculated on the basis of a 40 year discounted mean) with the benefits of loss reduction achieved through operational measures evaluated using present costs.

It was noted that given the trade off between cost reflectivity and simplicity, it may be appropriate to consider a range of estimation methods that provide flexibility to develop more sophisticated techniques in the longer term. For example, one Ofgem representative suggested that while it may be more suitable to apply a single cost to all losses in short-term, losses could be disaggregated over the longer term as greater understanding of measurement distortions is developed.

It was suggested that the option of DNOs purchasing losses could be used as a reference case because it would in principle lead to the minimisation of the overall cost of capex, opex and losses. Therefore, to achieve the same result at the margin, purchase costs should be replicated where possible.

Appropriate components of the cost of losses

One suggestion was that the cost estimate should reflect the marginal cost of providing a supply of electricity to the GSP. This would include the cost of energy purchases, including an allowance for transmission losses, and the costs of transportation capacity.

There was some discussion about the inclusion of a specific environmental component to compensate for the failure of current wholesale prices to adequately reflect environmental costs. It was noted that in two to three years time, generators will be participating in an emissions trading scheme that should lead to environmental costs being reflected in wholesale prices. One delegate said that if the estimate of the cost of losses informs cost-benefit analysis of investment decisions looking forward over the next forty years, a significant environmental component should be included. However,

another delegate expressed support for the inclusion of environmental components in market prices but felt that there should not be a specific environmental cost included for distribution only.

Estimation of cost components

Although it was stated that the fall in wholesale prices has led to a reduction in concerns about losses, a delegate noted that variations in energy costs do not directly affect DNOs because they do not purchase the lost units.

An Ofgem representative commented that the energy cost provides the base of the estimate and that the forecast of future energy costs will be uncertain. The group suggested that it may be appropriate for the energy component to be a long-run estimate looking forward over the next forty years.

There was some discussion of appropriate proxies for energy costs. Suggestions included wholesale prices[3] or generation costs, such as new entrant price[4], which would be more appropriate because the estimate is forward-looking, or the cost of the marginal generation technology. A DNO representative noted that pre-privatisation estimates of energy costs were based on the bulk supply tariff, which led to estimated energy costs of about 3p/kWh – about twice the current wholesale price. One delegate discussed the need to disentangle the effect of government policies designed to support renewable technology.

One delegate suggested that base load losses, which are largely fixed, and peak losses, which are mainly variable, should be valued by a time-weighted average and by a demand-squared weighted average respectively. It was stated that prices are currently relatively flat over a typical day because of excess capacity, which is expected to be eliminated in the future. It was noted that the plant that is new now will provide future peaking capacity because it will be technically superseded over time

The group discussed how use of system charges should be employed to proxy costs of transportation. The group agreed that it is likely that transportation costs will rise over the next forty years. It was noted that a monopoly network levies charges that are designed to recover both marginal costs and sunk capital costs.

Some delegates supported a partial pass through, for example a third, of use of system charges in order to proxy the incremental savings in transportation costs caused by a reduction in losses. These delegates felt that an incentive based on full pass through of charges may drive economically wasteful investment because, as noted by a DNO representative, use of system charges may not properly reflect historic or future investment.

However, another delegate remarked that during the morning presentations, it had been stated that the cost of a unit of electricity is independent of its end use. Therefore, all costs should be fully passed through as occurs in energy efficiency schemes, which are evaluated using average retail prices.

Suggestions of suitable proxies for an environmental component included the ROC price or an estimate derived from the emissions trading scheme. However, it was noted

[3] such as UKPX or APX
[4] estimated to be £22/MWh

that the latter estimate would represent an abatement cost rather than a damage cost. Furthermore, one delegate commented that an emissions trading system will result in a market-determined price and a fixed volume of emissions. In contrast, a carbon tax would drive a market-determined quantity of emissions at a fixed price.

Investment decisions

There was a discussion of why, as suggested by anecdotal evidence, DNOs have reduced their purchases of low loss transformers. Suggested reasons include the lack of economic justification for renewal of contracts for low loss transformers and increased commercialisation that has discouraged the installation of transformers as part of good engineering practice. One DNO representative noted that the slow rate of asset replacement means that each investment decision has long-lasting implications.

There was some discussion about optimal loading levels. It was noted that a paper produced by UMIST suggested an optimal loading rate of 30% for cables. One delegate added that the optimal load is 13-20% on overhead lines and 20-40% on 11kVA circuits. It was noted that many circuits already have loading levels below 50%. It was acknowledged that, although low utilisation rates may be considered in the design of a new network, they may not determine the timing of replacement investment. It was seen to be helpful if further analysis was conducted on the optimal timing and magnitude of replacement investment.

Timing of revisions of estimate

It was noted that a forecast should be revised when new information becomes available. However, the group agreed that there was a balance between cost-reflectivity and incentive strength. For example, in negotiating three-year contracts with asset manufacturers, the DNOs would benefit from certainty. In addition, a DNO representative noted that costs and planning are driven by the price control cycle. Revisions outside this cycle may increase risk, for which DNOs would seek greater return. It was suggested that there may be a provision for revision in the case of significant events, as designated by Ofgem.

Incentive design

It was noted that a cost evaluation will be needed independently of how the incentive is designed. A DNO representative suggested that the incentive should be strong enough for the investment decision to be relatively simple. One DNO representative stated that the discount rate was more important than the length of the benefit period.

There was support for an input incentive because it may make it easier to guide investment. However, it was suggested that an output incentive will lead to innovation. One delegate expressed support for a decentralised investment process.

Some delegates supported the development of minimum standards for network design and equipment purchase; particularly as transaction and decision making costs may undermine a market incentive. However, it was observed that the use of standards is essentially an input approach and that Ofgem tends to favour the use of market-based incentives. Criticisms of minimum standards included that they discourage innovation and result in DNOs not facing real prices. One delegate suggested that it may be preferable to impose performance standards, as done under IIP. It was also noted that

measurement of the cost of losses would need to form part of the development of standards.

There was some debate over the parameters of an output incentive – notably the sharing factor and the losses target. Some delegates suggested that the losses target should lead to a coincidence in the interests of government and shareholders such that overall social costs of losses are minimised. There was a brief debate about the existence and desirability of a government target to reduce losses. One delegate suggested that it may be appropriate for a DNO to bear a proportion of the costs and benefits for the first five years only. In order to avoid distortions, this proportion should equal the capex sharing factor.

There was some discussion of how the reduction of NTLs should be incentivised, if it is assumed that they can be identified. There was some debate concerning the effectiveness of incentivising losses that may not be under complete control of DNOs. For example, it was noted that there may be a range of parties potentially responsible for countering theft. However, a delegate questioned who will act to counter theft if DNOs do not. One delegate stated that the incentive to reduce NTLs (particularly through revenue protection or better management of unmetered supplies) is stronger if companies are vertically integrated rather than benefits being shared across many parties.

Closing Remarks

Martin Crouch stated that the publication of a further consultation document was planned for the end of May or early June. This would summarise the responses to the January 2003 document, and would present an update on Ofgem's thinking on the issue, which would be informed by the discussions at this workshop. Martin added that no major changes would be introduced until at least April 2005, coinciding with the start of the next price control period.

In a response to a comment by a DNO representative that Ofgem should commission a study to review the significant issues on which there are gaps in knowledge, Martin acknowledged that a study was one of the options.

List of attendees

Discussion Group A:

Martin Crouch (Chair)	Ofgem
John Benson	Ofgem
Kristian Myhre	Ofgem
David Young	Ofgem
Andrew Neves	East Midlands Electricity
Jim Morrell	Yorkshire Electricity Distribution Ltd
Aileen Wilson	Scottish and Southern Energy
Jeremy Blackford	SP Transmission & Distribution
Andy Phelps	Aquila
Tahir Majid	LE Group
Srdjan Curcic	Power Technologies International
Zoe Keeton	Innogy
David Chamberlain	National Grid Transco

Discussion Group B – Measurement issues

Lars Rognlien (Chair)	Ofgem
James Richardson	Ofgem
Mark Allen	Ofgem
Andrew Wallace	Ofgem
Ian Anthony	Ofgem
Mike Harding	Yorkshire Electricity Distribution Ltd
Jeff Hunt	SP Transmission & Distribution
Richard Smith	Aquila Networks
Max Lalli	Scottish and Southern Energy
Jonathan Purdy	LE Group
Mike Boxall	United Utilities
Mark Dawson	Npower
Alan Dick	UKRPA
Nick Carter	Centrica
John Chennells	Logica CMG
Don Stickland	Box Ten
John Lindup	ELEXON

Discussion Group C – Cost of losses and other issues

Colin Green (Chair)	Ofgem
Gary Keane	Ofgem
Gail Crick	Ofgem
John Costyn	Ofgem
Tariq Khan	LE Group
Paul Eveleigh	East Midlands Electricity
Brian Hoy	United Utilities
Nigel Turvey	Western Power Distribution
Ralph Turvey	LBS
Andy Limbrick	Association of Electricity Producers
Gaynor Hartnell	RPA
Carys Rhianwen	Centrica

David Tolley — Innogy
Andreas Biermann — The Energy Saving Trust
Nick Jenkins — UMIST