Electricity Distribution Losses

Initial proposals

June 2003

Summary

This document sets out Ofgem's initial proposals on the review of electrical losses on distribution networks. It follows the initial consultation document published in January 2003 and an industry workshop held in April this year.

Electrical losses are an inevitable consequence of the transfer of energy across electricity distribution networks. On average, around 7 per cent of electricity transported across distribution systems in Great Britain is reported as lost.

Distribution Network Operators (DNOs) face, via their price controls, financial incentives to reduce costs, to improve or maintain quality of supply and to reduce electrical losses on their networks. There are important trade-offs between these three areas. It is therefore essential that the incentives are balanced to ensure that DNOs manage these trade-offs efficiently and thus make efficient investment and operating decisions. However, it appears that some DNOs are currently not giving sufficient weight to controlling losses in their decisions. This document therefore focuses on assessing a number of possible ways DNOs can be better encouraged to consider the costs of distribution losses and proposes a set of arrangements that is expected to promote efficient decisions.

There are a number of efforts DNOs can undertake to control electrical losses on their networks, many of which were set out in the January document. It is believed that, despite a number of problems in estimation, the best measure of DNOs' performance in controlling losses is an estimate of the actual level of losses. It also seems to be the case that one of the main reasons why the current incentive mechanism is not effective is that it does not give sufficient certainty to DNOs that they will be able to recover the additional expenditure associated with efforts to reduce losses. Ofgem therefore stresses that under the proposed arrangements it does not intend to disallow from the regulatory asset base any expenditure that is efficiently incurred by DNOs in order to reduce losses. It is proposed that the share of the benefits from reducing losses that is retained by DNOs in the form of the incentive reward is adjusted to be consistent with the equivalent retention share for the expenditure efficiency incentives. This should avoid any perverse incentives in the trade-off between reducing costs and reducing losses and ensure that efficient decisions are made. To improve DNOs' confidence in receiving rewards for reducing losses, it is further proposed that this reward is based on a fixed benchmark rather than a moving average as is currently the case.

To be able to reward DNOs for reducing losses, it is necessary to form a view on what the resulting benefits are. In the January document, Ofgem suggested a methodology for valuing the benefits of reducing losses in order to set the level of an incentive on losses. This document further explores how an appropriate value may be arrived at. To allow more up-to-date relevant information to be taken into account in deriving a value for the incentive, Ofgem will propose a value for the incentive together with the initial proposals on the price control review, scheduled for summer 2004. It is proposed that the level of the incentive should be revalued as part of the consecutive price control reviews.

One of the aspects considered in the review of distribution losses has been the contribution of distributed generation to the management of electrical losses on the distribution networks. To the extent that distributed generation impacts on losses, DNOs should be encouraged to reflect this in their charges. The current way losses are reported includes a correction that attempts to remove the impact of distributed generation from the losses incentive. This adjustment appears to be, in effect, arbitrary and it is therefore proposed that this adjustment is removed.

Ofgem has committed to publishing regulatory impact assessments from the end of June 2003 and is developing the framework for performing such appraisals. A draft regulatory impact assessment is therefore included in an appendix to this document.

Ofgem would welcome comments on the initial proposals presented in this paper by 5 September 2003.

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1. Introduction

1.1. Ofgem's principal statutory objective is to protect the interests of consumers in electricity and gas, wherever appropriate by promoting effective competition. Many areas of the energy industry are subject to, or are in the process of being opened to, competition.

1.2. There are some areas of the energy industry where companies retain a monopoly since it may not be possible or appropriate to introduce competition. This applies to the transportation of electricity and gas to consumers using the national and local networks of wires and pipes. In these circumstances, Ofgem has put in place price controls and other incentive regimes to protect the interests of consumers.

1.3. There are presently 14 licensed distribution network operators (DNOs) in Great Britain. Each of these distribution businesses owns and operates one or more networks[1]. Each distribution network consists of a range of assets that facilitate the transfer of electricity from the transmission system and distributed generators to customers' premises. The package of incentives faced by DNOs will influence the way that they utilise their existing assets and make investment decisions over the short, medium and longer-term. These decisions will influence the overall performance of the distribution network and may impact on the level of electrical losses on these networks. Therefore, it is important to strike the right balance between the different incentive mechanisms to ensure that the overall package of incentives encourages network companies to take appropriate decisions.

Issue

1.4. Electrical losses are an inevitable consequence of the transfer of energy across electricity distribution networks. On average, around 7 per cent of electricity transported across local distribution systems is reported as electrical losses. The level of reported losses in any given year will be influenced by a number of

[1] Some DNOs operate one or more networks outside their own distribution service areas.

factors, both technical and operational. It is important that industry parties face the appropriate incentives to manage these factors and thus optimise the level of losses in the most efficient way.

1.5. In total, about 20 TWh of electrical energy is lost per year in Great Britain during transportation across distribution networks. This results in substantial financial and environmental costs in producing the electricity that is lost and in transporting these units over the transmission and distribution networks.

1.6. Although the financial costs are borne by suppliers and their customers, neither group presently faces significant incentives to invest resources into reducing electrical losses. This is because the benefits from such efforts are largely smeared across all parties. Failure to ensure that those best placed to take actions face appropriate incentives to take or encourage those actions may result in an inappropriate allocation of resources. In light of this, Ofgem has initiated this review to ensure DNOs face adequate incentives to manage electricity losses on their networks efficiently.

1.7. It is also important to recognise that electricity generation has significant environmental impacts and reducing electricity losses will therefore have benefits for the environment. These benefits consist particularly, although not exclusively, of reductions in the emission of climate change gases. It is important that these effects are given due consideration when considering how strong incentives should be in place on DNOs.

1.8. DNOs presently face a financial incentive that encourages them to take operational and investment decisions to reduce losses by rewarding out-performance and penalising underperformance against a target level of losses derived from historic averages. In January 2003, Ofgem consulted on whether the present incentives on DNOs to manage losses remain appropriate[2].

1.9. From the consultation process, Ofgem has seen evidence that the current arrangements do not encourage efficient decisions. It has become clear that many DNOs do not expect additional expenditure on reducing losses to be

[2] 'Electricity distribution losses – initial consultation', January 2003.

allowed in the price control calculations. In their investment appraisals, these companies are therefore comparing the full additional costs of an effort to reduce losses with only a share of the resulting benefits, ie the share received from the incentive mechanism on losses (about 30 per cent of the total benefit). It is therefore unlikely that decisions currently being made are efficient.

1.10. The majority of respondents to the January consultation agreed with Ofgem's view that the current incentive scheme does not adequately encourage DNOs to consider losses in their investment and operation decisions. This document therefore discusses options for improving the incentives on DNOs and proposes a set of arrangements that is believed to address adequately what appears to be too weak incentives on DNOs to reduce losses.

1.11. This review also considers the potential contributions of distributed generation to the management of electrical losses and the treatment within the price control of imports from distributed generation. Although it has been noted that the presence of distributed generation may reduce distribution losses, the impact of a particular distributed generator on losses is dependent on the generator's location and may not be readily predictable in all network conditions. In general, losses on any network will tend to increase if additional generation is located in a position that is remote from demand and, conversely, decrease if additional generation is located close to demand.

Regulatory impact assessment

1.12. Ofgem has committed to publishing regulatory impact assessments for all significant proposals from end of June 2003 and is developing the framework for performing such appraisals. The assessments consider and weigh up the impacts of proposed options in terms of costs, benefits and risks – both in qualitative and quantitative terms. A draft regulatory impact assessment can therefore be found in appendix 1 to this document.

Objective

1.13. This review aims to

- assess whether the current incentive mechanism on DNOs to manage losses encourages efficient decisions with respect to losses; and, if not,
- develop and propose an incentive regime that does encourage such efficient decisions.

1.14. As set out above, Ofgem is of the view that the incentive scheme currently in place fails to encourage efficient decisions and the focus of this document is therefore to develop and propose an appropriate incentive regime.

Policy

1.15. In the January 2003 initial consultation document, Ofgem consulted on three broad approaches to the review of electricity distribution losses. These were

- modifying the current incentive mechanism
- adopting an incentive mechanism similar to the one in place in National Grid Company's system operator incentive; and
- requiring DNOs to purchase electricity to cover losses on their networks.

1.16. Respondents to the January document suggested the two following additional options

- rewarding DNOs for specific efforts to reduce losses, rather than for an estimate of what is achieved; and
- introducing minimum technical standards for plant installed on the networks.

1.17. This document discusses these options further and sets out Ofgem's initial proposals.

2. Timetable and responses

Project to date

2.1. Ofgem published an initial consultation paper on distribution losses in January 2003. The document

- discussed the current level of losses
- set out how DNOs are able to affect losses on their networks
- discussed principles that should underlie an incentive mechanism on losses; and
- suggested possible ways forward.

2.2. Ofgem received 23 responses to the January document. In addition to the DNOs, respondents included suppliers, consultants and other interested parties. A summary of responses is included in appendix 4 of this document. Copies of all non-confidential responses are available from the Ofgem website (www.ofgem.gov.uk).

2.3. Ofgem held an industry workshop in April 2003 to discuss possible ways of addressing why the current incentive mechanism does not appear to be effective and what remedies can be implemented. A brief summary of the event and slides from the presentations are available from the Ofgem website.

Purpose and structure of this document

2.4. The overall purpose of this document is to propose a set of arrangements that will encourage efficient investment in and operation of DNOs' networks with respect to losses.

- **Chapter 1** of this document is the introduction.
- **Chapter 2** sets out the purpose and structure of this document, the project timetable and addresses for responses.

- **Chapter 3** sets out the problems surrounding estimating losses on distribution networks, discusses how the distortions can be reduced and proposes a correction to the current method of calculating losses in the price control calculations.

- **Chapter 4** discusses how an incentive scheme should be designed and proposes an arrangement that should encourage DNOs to make efficient decisions with respect to losses.

- **Chapter 5** explores the issues involved in producing a robust estimate of the cost of losses, building on the work set out in appendix 3 to the January document.

- **The appendices** include:

  - a draft regulatory impact assessment
  - a worked example of option 1 discussed in chapter 4
  - a summary assessment of the options discussed in chapter 4; and
  - a summary of responses to the initial consultation paper published in January 2003.

Project timetable

2.5. This document is intended to be the last stand alone consultation on distribution losses. The project will be taken forward in three separate parts:

- In this document, Ofgem proposes a set of arrangements to apply from 1 April 2005 that should encourage DNOs to make efficient decisions with respect to losses. Considering the responses to the initial proposals, final proposals will be presented within the ongoing distribution price control review (DPCR 4) in the update paper expected to be published in October 2003.

- Ofgem will propose a level of the incentive to apply from 1 April 2005 in the initial proposals consultation paper for the DPCR 4 due in the

summer of 2004. This will enable as up to date evidence as possible to be included in the analysis.

- Ofgem acknowledges the potential impacts on the effectiveness of an incentive mechanism and the business risk on DNOs caused by problems in estimating losses. It is expected that these problems will reduce over the coming years. However, Ofgem intends to monitor the progress made and, if necessary, undertake a further review after the current price control review concludes.

2.6. The table below sets out the timetable for the project.

Table 2.1: Project timetable

Deliverable	Objective	Date
Meeting with DNOs	Discuss issues in preparation for the initial consultation	October 2002
Initial consultation paper	Set out thinking and invite views	January 2003
Industry workshop	Further develop thinking	April 2003
Initial proposals (this document)	**Propose arrangements and invite views**	**June 2003**
DPCR 4 update consultation	Decision on arrangements	October 2003
DPCR 4 initial proposals	Proposals on level of incentive	June 2004
DPCR 4 final proposals	Decision on level of incentive	October 2004

Interaction with other projects

2.7. The project has important links with a number of other areas of work, including the work being carried out by:

- the Department of Trade and Industry (DTI), Ofgem and industry on the technical arrangements for the connection of distributed generation (Distributed Generation Coordination Group)

- Ofgem on the development of the price control framework for monopoly networks; and

- Ofgem on the structure of electricity distribution charges.

Responding to the document

2.8. It would be helpful to hear from those with an interest in the issues raised in this paper, including distribution businesses, suppliers, distributed generators, customers and their representatives. Views are invited by 5 September 2003. Where possible, responses should be sent electronically to:

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2.9. All responses will normally be published on the Ofgem website and held electronically in the Research and Information Centre unless there are good reasons why they must remain confidential. Consultees should try to put any confidential material to appendices in their responses. Ofgem prefers to receive responses in an electronic form so they can easily be placed on the Ofgem website.

2.10. Should you have any questions regarding the issues raised in this document, please contact Gary Keane on the above number.

2.11. A copy of this document and other material related to this project are available from the Ofgem website.

3. Estimating losses on distribution networks

Introduction

3.1. Electricity enters a distribution network at a few entry points, mainly at the Grid Supply Points (GSPs), and this electricity is measured relatively accurately. Electricity exiting the system at points of consumption, however, is estimated based on, to some extent, crude assumptions and aggregated across millions of exit points. The assumptions and the procedures involved in recording and aggregating these numbers lead to errors that distort the estimates of consumption.

3.2. The estimate of electrical losses on distribution networks is calculated as the difference between electricity entering and exiting the network and has been just below 7 per cent in recent years. However, the distortions in estimating consumption will inherently distort the estimate of losses. The estimate of losses does therefore not necessarily correspond to the actual (technical) losses on that network. The distortions to recorded consumption include

- errors in collecting and processing meter data
- inaccurate profiles
- meter errors[3]
- illegal abstraction of electricity
- inaccuracies in inventories of unmetered supplies[4]; and
- unregistered connections.

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[3] Due to mechanical wear it is generally accepted, and allowed for in regulations, that old technology 'Ferraris' meters tend to slow down over years of operation. These meters are being replaced by modern meters as they reach the end of their statutory lives. Therefore, the Ferraris meters remaining on the walls could reasonably be assumed to, in aggregate, cause a systematic underestimate of consumption. As mechanical meters are already being phased out for business reasons, this discrepancy will pass with time.

[4] Errors in inventories of unmetered supply are often caused by equipment being added, removed or upgraded without this being reflected in the inventories. Customers with unmetered supplies face incentives to update their inventories only if the changes result in lower consumption. It is therefore reasonable to assume, and experience has supported this, that these errors, in aggregate, cause an underestimate of consumption.

3.3. These distortions are often referred to as non-technical losses. The first two of the above factors cause consumption to be recorded in a different period from when it was actually consumed. These distortions can be thought of as timing errors and would cancel each other out if one considers a long enough time period. However, the magnitude of these errors may be significant, often causing some companies' reported losses to vary by 10 per cent year on year.

3.4. The last four of the above factors almost exclusively cause consumption to be underestimated and losses therefore to be overestimated. These distortions can be thought of as systematic errors. Some DNOs have estimated that such errors represent between 0.2 and 0.6 per cent of units supplied (between 3 and 9 per cent of reported losses).

3.5. It has been argued that the distortions to the estimated level of consumption may have undermined the effectiveness of the incentive on losses. It is, however, important to realise that an effort by a DNO that reduces actual, technical losses by, say, 1000 MWh will, irrespective of distortions, result in an estimated level of losses that is 1000 MWh lower than if the effort had not been made. Therefore, the potential rewards from efforts to reduce losses are not affected by the distortions. However, the volatility in reported losses reduces the DNOs' ability to observe the impact on losses of their actions. The volatility also causes uncertainty that may reduce the significance that DNOs attach to the potential benefits from such efforts. Reducing distortions may therefore strengthen the effectiveness of the incentive. Furthermore, customers are billed for their electricity based on these estimates of consumption and there would be merit in ensuring that customers' bills reflect their usage, both in terms of fairness and efficiency.

Ongoing work to reduce distortions

3.6. In many cases it may not be clear which parties in the industry have and should have responsibility to reduce or limit distortions. DNOs, however, can take measures to reduce errors in several areas, in particular for systematic errors. Some DNOs are taking steps to audit the inventories of unmetered supply, in some instances increasing estimated consumption by these sites by up to 40 per cent as a result. To avoid unregistered connections, DNOs have acknowledged

that it is important that they ensure that sites are not energised before they have been registered.

3.7. If systematic errors are reduced, the DNO will be rewarded as if physical losses had been reduced. In addition, the company's allowed revenue will increase owing to the revenue driver in the price control. Therefore, strong incentives are in place on DNOs to reduce errors that overstate losses.

3.8. A significant proportion of the timing errors over the last years have been caused by changes to billing systems in 1998/99. ELEXON, the company responsible for the settlement process, is working to resolve these teething problems and is making progress.

3.9. Ofgem is about to initiate a workstream to review the responsibilities of the industry with respect to illegal abstraction. This project plans to review the current arrangements for the detection and prevention of theft of electricity and gas, identifying whether there is a need for greater compliance monitoring of the existing obligations. It will also consider the current incentives on suppliers to investigate theft and consider whether other measures (such as the Reasonable Endeavours Scheme[5] as occurs in the gas market) would be appropriate in electricity. The project will also review whether DNOs should be obliged to provide a revenue protection service to suppliers in their distribution service area. A discussion paper is due to be published by Ofgem in July setting out the issues and proposing how they are to be taken forward.

3.10. Ofgem's Improving Customer Transfers (ICT) Project, begun in the summer of 2000, analysed the processes and arrangements of the domestic transfer process with a view to removing some of the difficulties experienced by suppliers in transferring customers correctly and in a timely manner. In June 2001 Ofgem set out a number of incremental improvements to the transfer process – in particular those related to erroneous transfers, improvements to data quality and access and changes to objection policy.

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[5] The Reasonable Endeavours Scheme, established under a gas transporters licence allows for a supplier's transportation charges to be adjusted to take account of the cost of the investigation and gas transported where this is not recovered from the customer.

3.11. Recent reports from ELEXON[6] and Gemserv[7] have highlighted a need for a more fundamental review of the gas and electricity transfer processes to enable transfers to be made more effectively, satisfying customer expectations.

3.12. In response to customer concern about the operation of the market, Ofgem and energywatch have challenged the industry to make improvements[8]. To this end, Ofgem and energywatch held a summit meeting on 11 June where commitment was sought from Chief Executives of industry participants to review and implement improvements. Ofgem has also published a discussion document[9], setting out progress since the ICT Project and challenging the industry to resolve its problems around the transfer process.

3.13. The ICT Project should improve the way that data is held and transacted between parties. This will simplify the transfer process and improve the accuracy of metered consumption.

3.14. It is expected that the strands of work mentioned in this section will contribute to reducing distortions to the estimated level of consumption over the next few years. However, given the possible effects on the losses incentive and on customers' bills, Ofgem intends to monitor the extent of these distortions and, if appropriate, initiate a more comprehensive review after the conclusion of the current price control review.

Treatment of distributed generation

3.15. Electricity entering the distribution network directly from distributed generators will have an impact on losses that is different to the impact on losses of electricity entering at the GSP. Under the assumption that electricity normally flows from GSP down through the voltage levels until it is consumed, inputting

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[6] **ELEXON** is the Balancing and Settlement Code Company (BSCCo) defined and created by the Balancing and Settlement Code (BSC). All licensed electricity companies are obliged to sign the BSC. The rules and governance for trading in the Balancing Mechanism and Imbalance Settlement process are contained within the BSC.

[7] MRASCo is the company established under the Master Registration Agreement (MRA) that provids the secretariat services that are required to administer the MRA. **Gemserv** has been contracted by MRASCo to provide these services.

[8] http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/2658_ofgem_energywatch_02april.pdf

[9] http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/3416_3503custtrans.pdf

electricity at a lower voltage would often reduce the distance it is transported and the number of voltage transformations required. This would result in lower losses than if the electricity had entered at the GSP.

3.16. However, if distributed generation entering a circuit already exceeds demand at any particular time, any additional generation will tend to increase overall losses on the circuit. Furthermore, if the generator is located in a remote area, connecting to the network might require long feeders, on which some electricity will be lost. Although distributed generation will in general reduce losses on distribution networks, it can therefore not be taken for granted that a particular distributed generator will have a positive (or negative) overall effect.

3.17. Losses, as currently reported, are adjusted in a way intended approximately to eliminate the effect of distributed generation on the networks. This is done by including in the reported figure an estimate of losses that would have occurred had the electricity entered at the GSP. The objective of this adjustment is to leave the DNOs neutral to any effects on losses by distributed generation.

3.18. For the year 2001/02, three DNOs reported no such adjustment, while eight DNOs reported adjustments of 1 per cent or less of the allowed losses benchmark. The remaining three DNOs reported adjustments between 1 and 1.3 per cent of allowed losses. Overall, the adjustments for saved losses for all DNOs account for about 0.6 per cent of allowed losses.

3.19. This adjustment might be appropriate if

- it does leave DNOs neutral to any resulting effects; and
- DNOs are considered not to have any influence on the location of generation on their networks.

3.20. However, neither of these conditions holds. The current adjustment is based on loss adjustment factors that do not recognise that different distributed generators may have very different effects on losses. The adjustment therefore appears to distort reported losses in an arbitrary way and does not achieve its intended objective. For this mechanism to be effective, site specific loss adjustment factors would need to be derived.

3.21. Furthermore, DNOs are to some extent able to pass locational signals on to generation and demand customers via connection and use of system charges. Further opportunities to reflect users' impacts on losses will arise when modifications proposed in the ongoing review of the structure of electricity distribution charges are implemented from 1 April 2005[10].

Proposals

3.22. Ofgem proposes to remove the, in effect, arbitrary adjustment to reported losses[11] for electricity from distributed generation (*DG adjustment*). It is proposed that this change will be introduced from 1 April 2005. To avoid rewarding or penalising DNOs for past events, the allowed losses benchmark[12] would have to be adjusted accordingly. This can be done by, for the purpose of calculating the allowed losses, deducting the current DG adjustment (*DG correction*), eg in the year before these proposed changes are implemented, from each of the last ten years' reported losses. Care would be taken to ensure that the DG adjustment for the year used is not atypical – it may be more appropriate to use an average over the past two years.

3.23. Assume that L_t is the reported losses, DG* is the DG correction and D_t is consumption in year t. Under the current approach, the allowed losses benchmark for year t, AL_t, is calculated as

$$AL_t = \left(\sum_{t-1}^{t-11} L_t \Big/ \sum_{t-1}^{t-11} D_t \right) \times D_t$$

[10] See 'Structure of electricity distribution charges – initial conclusions', June 2003.
[11] By 'reported losses' is meant the Lt term in the price control.
[12] By the 'losses benchmark' is meant the ALt term in the price control.

3.24. Under the proposed approach the benchmark would be calculated as

$$AL_t = \left(\sum_{t-1}^{t-11} L_t * \Big/ \sum_{t-1}^{t-11} D_t \right) \times D_t$$

3.25. Where for all the 10 years prior to implementation $L_t* = L_t - DG*$ and for all other years $L_t* = L_t$.

3.26. To the extent that distributed generation contributes to reducing losses on distribution networks, this proposal is consistent with the government's Social and Environmental Guidance[13], which requires Ofgem to have regard to the desirability of removing barriers to embedded generation and provide fair recompense for benefits they afford to the network.

[13] The existing and draft revised Social and Environmental Guidance on Ofgem can be found on DTI's website at http://www.dti.gov.uk/energy/leg_and_reg/acts/soc_env_guid.pdf (existing) and http://www.dti.gov.uk/energy/consultations/seg.pdf (draft revised).

4. Incentive design

Introduction

4.1. Distribution Network Operators (DNOs) are required by the Electricity Act 1989 (as amended) to develop and maintain efficient networks, which implicitly requires them to consider electrical losses. If DNOs were allowed to pass any expenditure on reducing losses directly to their customers' via their charges, they would in principle be neutral as whether to incur such expenditure or not. However, there are financial incentive mechanisms in place on the DNOs to reduce costs and to maintain quality of supply, which might lead them to compromise on efforts to reduce losses in order to benefit from the rewards resulting from these incentives. Therefore, an incentive on reducing losses needs to be in place to ensure that the 'drive to efficiency' does not exclude losses.

4.2. The high level objective of an incentive scheme on reducing losses is therefore to encourage efforts to reduce losses that yield net benefits (ie that benefits exceed costs) and to ensure that the net benefits to consumers are maximised. As explained in chapter 1, it is Ofgem's view that the current scheme fails to achieve this and so this chapter assesses a number of options for improving the incentives.

4.3. To assess whether a particular form of incentive scheme is likely to achieve the above objective, several factors need to be considered, in particular that

- the scheme needs to address the areas where DNOs are able to affect losses
- the activity or effect of DNOs' efforts to reduce losses needs to be measurable with reasonable accuracy
- the expected net reward from an efficient (inefficient) effort should exceed (not exceed) DNOs costs of undertaking this effort (including forgoing receipts from other incentives)

- DNOs would have to be confident that they will receive a net reward from undertaking efficient efforts; and
- the resource requirements on the industry and on Ofgem of introducing and monitoring the scheme need to be assessed against its expected benefits.

4.4. The January document proposed three options, all of which reward DNOs on the basis of performance in loss reduction, ie an output based incentive[14]. The three options were to

- modify the current incentive mechanism
- adopt an incentive mechanism similar to the one in place in NGC's system operator (SO) incentive; or
- require DNOs to purchase electricity to cover losses on their network.

4.5. Also discussed in the document was an input based mechanism whereby DNOs would receive a reward for specific efforts to reduce losses, rather than based on an estimate of what is actually achieved. Some respondents to the January document proposed that Ofgem should introduce minimum technical standards for plant that is installed on the distribution networks. This option was further supported at the April workshop.

4.6. In addition to modifications to the structure of the incentive, Ofgem is reviewing the valuation of the benefits of reducing losses that should underlie any incentive structure. This is discussed in chapter 5.

4.7. The following section assesses these five options. A summary assessment of the options against the above criteria can be found in appendix 3.

[14] In terms of end-users, losses are an input rather than an output. However, for DNOs, the level of losses is a result of operational and investment decisions (over many years) and hence referred to here as an "output", while choices of equipment to install are considered "inputs".

Assessment of the options

4.8. This section should be read in parallel with the regulatory impact assessment in appendix 1.

Option 1: Modifying the current mechanism

4.9. By rewarding DNOs for their actual performance with respect to losses, all efficient efforts to reduce losses can be encouraged. Such an output based incentive will only reward DNOs where actual improvements are achieved. Although problems in estimating losses are causing distortions to reported losses, these distortions are, as set out in chapter 3, expected to reduce over the coming years.

4.10. It is also important to realise that, although the estimated losses in any given year do differ from actual losses in that year, the distortions will largely cancel out over a number of years. Furthermore, as argued in chapter 3, the volatility in estimated losses should not affect the expected reward from an effort to reduce losses.

4.11. Responses to the January document and views expressed at and after the April workshop seem to indicate that some DNOs do not expect expenditure on loss reduction to be allowed as expenditure in the price control review. This suggests that the desired outcome may be achieved by relatively minor adjustments to the current incentive scheme.

4.12. The current losses incentive mechanism rewards a DNO if its rate of losses in any one year is lower than the 10-year historic average rate. For an investment in an asset with a 40 year life, this allows the DNO to retain approximately 30 per cent of the benefits of reducing losses.

4.13. However, the capital expenditure efficiency incentive currently rewards DNOs if their actual capex is lower than the level forecast. Currently, DNOs retain about 40 per cent of an expenditure efficiency gain.

4.14. The losses incentive should aim to allocate the same proportion of the benefits from a reduction in losses to the parties as the expenditure efficiency incentives do. This would ensure an efficient outcome with respect to losses, by avoiding

perverse incentives in the trade-off between the capex and losses incentives, and share the resulting surplus benefits between DNOs and customers. Provided that any additional expenditure intended to reduce losses was efficiently incurred, Ofgem would expect such expenditure to be included in the RAB. No adjustment to the capital expenditure efficiency mechanism is required because the losse incentive remunerates the investment over the first five years. A worked example of how such a scheme may work can be found in appendix 2.

4.15. The reward to DNOs from an effort that reduces losses is given over a period of ten years (by which time the reduction is fully included in the benchmark), it has been argued that this benefit is subject to regulatory uncertainty. It has been proposed that the DNOs' share of the benefits should be given closer to the point of investment to reduce this uncertainty. This can be achieved by fixing the benchmark for the duration of the price control period. The level of the benchmark would be based on a ten-year average – potentially up to and including 2002/03. DNOs would then retain benefits of a reduction in losses over the first years after the reduction was achieved in the same way as the rolling retention arrangements for operating and capital expenditure. The retention period will be set to balance the strength of the losses incentive with that for one-off capex savings – likely to be at least five years and possibly slightly longer.

Option 2: NGC style incentive

4.16. It was suggested in the January document that an incentive scheme on distribution losses similar to the one currently in place on NGC with respect to transmission losses in their SO price control could be adopted. One of the attractions of this approach is achieving consistency between transmission and distribution with respect to the losses incentive.

4.17. The incentive currently in place on distribution losses is similar to the NGC scheme. In both cases, a reward is given based on a reference price on

deviations from a benchmark. Both reference prices are intended to reflect the benefit of reducing losses and both benchmarks change yearly[15].

4.18. There are important differences, however. The level of the incentive on NGC is set based on the prevailing electricity wholesale price at the time of the review and does not incorporate any other costs of losses. The benchmark is revised yearly to reflect NGC's forecast of losses over the coming year. Furthermore, the incentive on transmission losses is only one of a set of SO incentives and the overall revenue adjustment resulting from this SO incentive scheme has a cap and a floor. As this incentive structure focuses on short-term operating decisions, it may be suitable to ensure that NGC as a system operator gives due consideration to losses on their transmission network.

4.19. Although their operating decisions may have an impact on losses on their networks, the largest scope for DNOs to affect losses is through their investment decisions. An incentive that reflects the long term impacts of investment decisions is therefore required. Furthermore, the costs of transporting electricity to and on the distribution networks are higher and, as losses on distribution networks are significantly higher than on the transmission network, the overall financial and environmental impacts are much larger. It is therefore not clear that an incentive scheme similar to that in place in NGC's SO incentive scheme is appropriate for distribution losses.

Option 3: DNOs purchasing losses

4.20. A supplier wishing to deliver electricity to a consumer currently has to contract sufficient electricity for delivery at the GSP to cover the consumer's demand *plus* the losses associated with distributing that amount of power. Option 3 would require DNOs to become electricity market participants by requiring them to forecast losses on their networks and contract electricity in order to replace what is lost. Losses would be estimated or 'deemed' ex post and DNOs exposed to balancing costs. The distribution companies would be given a predetermined

[15] Although the review of NGC's system operator incentive scheme, of which the incentive on transmission losses is a part, has been done annually, it is likely that the system operator incentive scheme in future will cover more than one year.

allowance in the price control to cover the efficient costs of purchasing sufficient electricity to match losses for every half hour. This option is similar to the arrangements in place in the distribution of gas, where Transco is required to procure gas to replace gas shrinkage.

4.21. This approach is relatively intuitive as actual energy and transportation costs of losses would be assigned to DNOs. As the companies would be exposed to the cost of losses for every half hour valued at the prevailing electricity price, the approach should provide strong and accurate incentives, both in the long and short term.

4.22. However, significant additional costs may be imposed on the companies. In addition to costs of establishing a trading agent and/ or capability, there will be balancing costs for any deviations in 'deemed' losses from the notified amount that are likely to be large, in particular given the difficulties experienced in estimating losses. It has been argued that uncertainty may be one of the reasons the current incentives are not effective. This option is likely to add to this problem.

4.23. It is Ofgem's view that a very similar outcome to option 3 may be achieved by an incentive mechanism that exposes DNOs to rewards and penalties for changes in losses based on an ex post assessment of losses against a benchmark, such as option 1. While retaining most of the benefits, option 1 is associated with much less risk and lower implementation and ongoing costs than option 3.

4.24. Nevertheless, depending on any improvement in the ability to estimate losses accurately, requiring DNOs to purchase electricity might be an option in the future. If controlling distribution losses continues to feature low on DNOs' agendas and they fail to take efficient investment and operational decisions, such a radical approach might be necessary to achieve an efficient outcome.

Option 4: Input based incentive

4.25. Although Ofgem expressed a strong preference for an output based incentive, many respondents to the initial consultation paper, in particular DNOs, were in favour of an input based incentive. An input based incentive rewards efforts to reduce losses based on their expected effects on losses rather than based on the

achieved effects. Thus total system losses would not need to be estimated for this purpose and the problems arising from distortions to reported losses will be avoided. The incentive can furthermore be targeted on those areas where DNOs can affect losses.

4.26. However, it is not clear how this approach would ensure that efficient decisions are made. For example, the expected benefit from installing a low loss transformer rather than a low cost transformer will depend on the local characteristics of the network where the transformer is installed. It will therefore be impossible to estimate the expected impact on losses accurately without spending significant resources. More realistically, in calculating the reward to DNOs, the same effect on losses would have to be assumed across networks and sections of networks.

4.27. Furthermore, it will be difficult to target more than a few of the areas in which DNOs may affect losses. Trade offs exists between the costs and benefits of over-sizing lines and cables that will be difficult to address using an input based incentive. There are also operational considerations that may affect losses, such as the location of system open points, which cannot without difficulties be targeted by an input based incentive.

4.28. It is therefore difficult to see how such an approach can encourage efficient decisions or innovative approaches to reduce losses.

Option 5: Minimum technical standards

4.29. The introduction of a minimum requirement or guideline on the specifications of equipment to be installed on a network should have similar effects to an input based incentive. Indeed, as DNOs would need to be compensated by means of higher capital allowance for the additional expenditure on higher quality equipment installed, this scheme is merely another form of input-based incentive. The scheme would appear to be less effective than an input incentive in encouraging the most appropriate equipment to be installed in a specific location as the DNO would be likely to choose the least costly option that fulfils the minimum standards. It is therefore difficult to see how such an effort could replace an incentive mechanism.

4.30. There may be economies of scale arising from a set of minimum standards. If DNOs purchase a large number of transformers of the same specifications, unit costs might come down. This is particularly the case for large transformers of high quality. If DNOs are of the view that any particular effort is appropriate and will result in efficiency gains, they have the option of undertaking this effort and consequently be rewarded via the incentive arrangements for achieving such efficiency gains.

Proposals

4.31. It is Ofgem's view that an input based incentive fails to encourage efficient decisions by DNOs, both because it is unable to address many areas where DNOs can affect losses and because it will in many cases not encourage the correct choice of equipment in the areas it is able to address. The same problems are inherent in establishing minimum technical standards.

4.32. Because of the likely size of the costs involved in establishing and operating a scheme where DNOs purchase electricity to cover losses, additional confidence would be needed in the incremental benefits to justify this approach. Ofgem also considers that an incentive scheme similar to the one in place on NGC to reduce transmission losses, which is a part of their SO incentive scheme, would not adequately address distribution losses.

4.33. It is therefore proposed to implement option 1, ie to modify the current incentive scheme by adopting an approach that matches the DNOs' retention rates for the losses incentive with those for the capital expenditure efficiency incentive. To reduce regulatory uncertainty, and thereby increase the significance placed on the incentive reward by the DNOs, the incentive mechanism will be based on a fixed benchmark rather than a mobbing average.

5. Valuing the benefits of reducing losses

Introduction

5.1. As part of any incentive scheme, it will be necessary to assign a value to the electricity that is lost. This enables a comparison of the costs and benefits of reducing losses. For an output based incentive, the value would provide the basis for how much a DNO is rewarded or penalised for changes in the rate of losses on their network. For an input based incentive, the value of reducing losses would inform the choice of equipment to reward.

5.2. Theoretically, the benefits of reducing losses are the avoidable costs of generation and transportation of electricity. One method of estimating the avoidable costs is to calculate the marginal costs of generation and transportation.

5.3. The most significant scope for controlling losses is by the choice of equipment that is installed. Long-term investment decisions should be made on the basis of long-term expectations, which are necessarily uncertain. As distribution assets often have lives of more than 40 years, the appropriate valuation of losses for the purpose of an incentive on losses may be one that considers an estimate of the marginal costs of generation and transportation over the next 40 years at least. However, it is very difficult to form a robust view of some of these costs over the next five years, let alone the next 40 years. Current costs and/or prices may, with appropriate adjustments, be the best available guide to future costs. Nevertheless, where robust indicators of future values exist, it may be appropriate to use these to inform the estimate.

Estimating the marginal cost of losses

5.4. In appendix 3 to the January 2003 initial consultation document, an analysis was presented that estimated the current costs of generating electricity. The estimate

of 1.79p/kWh was based on a loss weighted average of the half hourly UKPX[16] wholesale prices between June 2001 and May 2002.

5.5. However, this definition of the wholesale price does not necessarily represent the marginal value of generation and may not provide robust indications of future values of lost electricity. Other methods of arriving at estimates, such as prices in forward trades reported by exchanges or generation costs of new entrants, may be better, or at least alternative, estimates of the marginal costs as well as provide some forward looking signals. Trades for load shape 44[17] reported in Energy Argus Daily on 6 June 2003 indicate prices around 1.85 p/kWh for summer 2005 and around 2.5 p/kWh for winter 2005/06. Recent industry estimates have suggested new entrant costs of generation at around 2.4p/kWh.

5.6. In addition to the costs of generation, losses impose costs on transportation networks to the extent that they contribute to the overall capacity requirements. In the analysis in the January document, an assessment of transportation costs was developed that took into account both transmission and distribution use of system charges. This resulted in an estimate of between 0.4 and 0.8 p/kWh.

5.7. It is also possible to arrive at an estimate for the cost of losses based on retail prices net of suppliers' margins. For example, the IEA reports average ex-tax electricity prices for UK households of 6.7 p/kWh[18]. Ofgem has previously reported that suppliers' share of domestic bills is about 30 per cent[19], leaving 4.7 p/kWh as an estimate of the cost of losses caused by domestic consumers. The average electricity price for industry is lower at about 3.0 p/kWh, but the suppliers' share of industrial bills is likely to be significantly less that 30 per cent. Using 10 per cent as an estimate yields cost of losses caused by industrial customers of 2.7 p/kWh. However, these customers cause a relatively small proportion of overall losses.

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[16] Spot prices from the UK Power Exchange – www.ukpx.com.
[17] A product traded on the UK electricity forward market that comprises 5MW of baseload power and 5MW of additional power between 0700 hours and 1900 hours UK time on weekdays.
[18] 'Energy prices & taxes – quarterly statistics', IEA statistics, Q4 2002.
[19] http://www.ofgem.gov.uk/temp/ofgem/cache/cmsattach/2219_prices.pdf

5.8. Table 5.1 below shows broad estimates of the marginal costs of losses resulting from different approaches. These costs include costs of generation and transportation.

Table 5.1: Various possible estimates of the benefits of reducing losses

Cost of losses[20] (p/kWh)	Range of estimates	
Basis of estimates	**Low**	**High**
UKPX	2.2	2.6
Load shape 44	2.3	3.2
New entrant costs	2.8	3.2
Net retail price (less suppliers' margin)	2.7	4.7

5.9. It should be acknowledged that there are costs to society from generation that are not necessarily internalised in the electricity price. These costs arise mainly from greenhouse gas emissions and therefore particularly from fossil fuel generators.

5.10. The January analysis presented an estimate of the environmental costs of generation necessary to cover losses. The figure of 0.46 to 1.12 p/kWh was based on an anticipated trading price of £81/tC[21] for emission rights under the forthcoming EU greenhouse gas emissions trading scheme (EU-ETS). According to current timetables, fossil-fuel generation will be part of the EU-ETS from 1 January 2005. There are also moves to internalise costs of other pollutants such as SO_2 and NOx.

5.11. Responses to the January consultation paper broadly supported the consideration of costs to the environment arising from losses for the purpose of setting the level of an output incentive. However, some respondents suggested that the cost of carbon used was too high.

5.12. The value of an allowance in the EU-ETS is very uncertain since many of the features of the scheme are still to be decided (including the total number of allowances available) and abatement costs are not well known. When the emission trading schemes are fully functioning, energy prices will reflect the

[20] Apart from the net retail price, the estimates include the cost of transportation of between 0.4 and 0.8p/kWh.
[21] This figure represents the value associated with one tonne of carbon.

resulting market prices for emission rights. Forward contracts for electricity will incorporate market expectations of the impacts of these schemes.

5.13. In addition, it is widely recognised that at present there is a significant overcapacity in generation in Great Britain. This is expected to fall over time as overall consumption grows and generators are retired. Because of this, it is expected that wholesale prices may increase over the coming years. It may be appropriate to take account of these broad expectations by setting the level of the incentive towards the top end of the range of estimates based on current costs.

Frequency of revision of the estimate

5.14. The costs associated with losses vary across every single half hour. Technically, an output incentive could vary with half hourly electricity prices to reflect this. However, this would only be useful if it was possible to estimate losses for single half hours. As concluded in chapter 3, it is proposed that losses will continue to be reported on a yearly basis and it would therefore be sensible to revise the estimate of costs of losses every year at the most.

5.15. Revising the incentive frequently has the benefit of providing up to date signals to DNOs regarding the costs of losses. However, frequent revisions are both time consuming to perform and may impose inappropriate uncertainty on distribution businesses. In addition, there is less potential to influence short-term losses on distribution networks. It may therefore be desirable to revise the level of the incentive less often, for example every five years as part of the timetable of the distribution price control.

Differentiation between different types of losses

5.16. As explained in chapter 2, reported losses can be distinguished between technical and non-technical losses. While technical losses represent the physical loss of electricity, non-technical losses are merely consumption that is not properly accounted for, such as is associated with illegal abstraction and unregistered connections. The costs to society of technical losses may therefore be higher than of non-technical losses.

5.17. Some parties have noted that setting the level of the incentive to reflect the costs of technical losses may provide an inefficiently strong incentive for the reduction of non-technical losses. However, because the costs to society of technical losses may be higher than of non-technical losses, an estimate weighted by an approximate ratio of technical and non-technical losses will provide too weak an incentive to reduce technical losses.

5.18. It is not currently possible to disaggregate technical and non-technical losses in order to provide a separate incentive on each. However, the vast majority of reported losses are technical losses and it is important that companies face a suitably strong incentive to encourage efficient reductions in these. Furthermore, there are significant merits from reducing non-technical losses, such as improving the accuracy of reported consumption. Ensuring that consumption is paid for in full will encourage an efficient use of electricity. These factors may warrant an incentive that exceeds the immediate value of non-technical losses.

Proposals

5.19. Ofgem intends to form a final view on the value of losses that would encourage efficient loss-reduction investment as part of the ongoing review of the distribution price controls. It will present a proposed level of the incentive in the initial proposals consultation scheduled for June 2004. This will enable contemporary relevant information to be taken into account when setting the incentive to apply from 1 April 2005. This information includes the latest market data and the effect of future environmental policies such as EU-ETS. At present, for the reasons outlined in paragraphs 5.12 and 5.13, it is expected that the value will not deviate significantly from the range of estimates presented in appendix 3 to the January document.

5.20. In proposing the level of the incentive next year, Ofgem will consider possible developments in future electricity prices, including the extent to which environmental considerations may become reflected in prices, for example due to the introduction of emissions trading schemes. In the context of current policy including the existing and draft revised Social and Environmental

Guidance to Ofgem[22], it would at present seem premature for Ofgem to take responsibility for incorporating a component in the value of the incentive to cover environmental externalities to a greater extent than would be involved by the expected price effects of emission trading schemes and other specific schemes with environmental objectives.

5.21. Ofgem proposes to revise the level of the incentive as part of the five-yearly price control review process. In addition to facilitating a coherent approach with other price control incentives, this should strike a balance between providing some certainty for planning decisions and revising estimates to reflect contemporary levels. Ofgem would retain the option to propose licence modifications to revise the estimate outside price control reviews in exceptional circumstances.

5.22. It is also proposed that the level of the incentive shall be based on the marginal cost of technical losses as these account for the vast majority of reported losses. This may give too strong incentives on reducing non-technical losses, but it is Ofgem's view this is preferable to providing too weak incentives on technical losses.

[22] The existing and draft revised Social and Environmental Guidance on Ofgem can be found on DTI's website at http://www.dti.gov.uk/energy/leg_and_reg/acts/soc_env_guid.pdf (existing) and http://www.dti.gov.uk/energy/consultations/seg.pdf (draft revised).

Appendix 1 Draft regulatory impact assessment

Introduction

1.1 This appendix is Ofgem's draft regulatory impact assessment for its initial proposals on the form of incentive mechanism for electricity distribution losses. The outcome of this assessment informs the initial proposals in the main paper. In developing its decision, Ofgem will take into account respondents' views on its initial proposals, including any comments on this draft regulatory impact assessment. This draft assessment is in the form that Ofgem proposes to use in developing new policy proposals in the future.

1.2 It is important that any changes to the regulatory system provide benefits to consumers over the short, medium or long-term. However, it may be difficult to quantify these benefits accurately, especially where the benefits may accrue over a number of years. RIAs will be presented from the early stages of consultations in order to develop estimates of costs, benefits and risks alongside policy proposals and decisions. As this is the first RIA for this project, it is therefore recognised that the estimates here are quantified to a lesser extent that what is expected in the future at similar stages of a project.

1.3 Ofgem therefore particularly welcomes comments from interested parties on the cost, benefit and risk estimates associated with the options considered in this RIA. Views are also invited on the form and structure of this assessment. The responses will be taken into account when the decision is made in the distribution price control review update paper, expected in October 2003.

Objectives

1.4 This review aims to

- assess whether the current incentive mechanism on DNOs to manage losses encourages efficient decisions with respect to losses; and, if not,
- develop and propose an incentive regime that does encourage such efficient decisions.

1.5 As set out above, Ofgem is of the view that the incentive scheme currently in place fails to encourage efficient decisions and the focus of this document is therefore to develop an appropriate incentive regime.

Overview of key issues

1.6 Around 20 TWh of electricity is lost every year on distribution networks in Great Britain, costing around £600m. The level of losses in any given year will be influenced by a number of factors. A change in losses of only 0.1 per cent of demand (about 0.3 TWh – 1.4 per cent of losses) may have financial and environmental impacts valued in excess of £8m a year.

1.7 DNOs face financial incentives to reduce costs of operating and maintaining their networks. As there often are trade-offs between reducing these costs and lowering the level of losses, it is essential that DNOs also face incentives on losses that encourage DNOs to achieve an efficient balance between the two.

1.8 From the consultation process it has been indicated that, under the current framework, many DNOs do not expect additional expenditure on reducing losses to be allowed in the price control calculation and it is therefore unlikely that decisions currently being made are efficient.

Options

1.9 This regulatory impact assessment considers the 5 options set out in chapter 4 in the main paper against option 0; keeping the current arrangements. The options for consideration are, in short;

- modifying the current incentive mechanism by increasing DNOs confidence in being able to recover efficient expenditure (option 1)
- adopting an incentive mechanism similar to the one in place in NGC's system operator incentive (option 2)
- requiring DNOs to purchase electricity to cover losses on their networks (option 3)

- rewarding DNOs for specific efforts to reduce losses, rather than for what is achieved, ie an input based incentive (option 4); or
- introducing minimum technical standards for plant installed on the networks (option 5).

1.10 For a further description of the options, see chapter 4.

Costs and benefits

1.11 The outcome of the project could affect the following groups:

- DNOs, which may face changing priorities, increased costs (of implementation or ongoing), and increased exposure to rewards and penalties
- customers or suppliers may face increased prices in the short term, while an improved regime on losses should decrease costs in the long term
- distributed generators as they may affect the level of losses on the distribution systems and DNOs may pass on signals placed on them with respect to distribution losses; and
- customers in general, as distribution networks may be operated and maintained more efficiently, yielding both economic and environmental benefits.

1.12 The following sections will assess the costs and benefits of each option before summarising the findings and recommending one option. Please refer to chapter 4 for a more thorough description of the options.

Costs

1.13 The estimated costs will mainly occur in the following categories:

- **Project costs:** The direct costs to Ofgem and the industry of developing proposals for change, including carrying out the necessary research and industry consultations. Ofgem's budget for this project is around £300,000. Actual spend is now expected to be significantly less. In

addition to the costs on Ofgem, there have been costs on the industry in participating in this project. All these costs are now sunk.

- **Implementation costs:** The costs of implementing any changes, both on Ofgem and on the industry.

- **Ongoing costs:** There may be ongoing costs on the industry or on Ofgem of monitoring and reviewing the incentive scheme that might differ from the current costs.

- **Costs arising from efforts to reduce losses:** As set out above, it is Ofgem's view that the current arrangements do not lead to efficient decisions. To the extent that the options discussed below result in efficient decisions being made, the efforts made to control the level of losses will yield net benefits. These net benefits will be accounted for in the section on benefits below and the costs of reducing losses (eg the additional costs of installing lower loss transformers rather than the standard choice) are therefore not included in this section.

1.14 If the level or the structure of the incentive is changed, there may be changes to the business risks faced by DNOs resulting from the exposure to possible variations in allowed revenue under the losses incentive arrangements. Comments on the likely impacts on risks are made under each option below.

Option 1: Modifying the current mechanism

1.15 The costs associated with this option include:

- **Implementation costs:** There should not be any significant implementation costs to Ofgem or the industry as a result of option 1 because it involves simple adjustments to the current arrangements.

- **Ongoing costs:** Ongoing costs on Ofgem will mainly consist of reviewing performance as part of the compliance process. These costs will not be higher than under the current scheme.

1.16 There may be some larger variations in revenue resulting from increased exposure to rewards and penalties from the incentive. However, the

arrangements should result in increased confidence for DNOs in receiving their share of benefits resulting from efficient investments. Overall, there may be some increase in risks on DNOs.

Option 2: NGC style incentive

1.17 The costs associated with this option include:

- **Implementation costs:** There should not be any significant implementation costs to Ofgem or the industry as a result of option 2.
- **Ongoing costs:** NGC's SO price control, of which the incentive on transmission losses is a part, is reviewed yearly. A yearly review of the incentive on distribution losses will result in higher ongoing costs than under the current scheme.

1.18 The yearly review of the incentive mechanism will reduce the DNOs exposure to revenue variations. However, reviewing the scheme yearly may introduce additional regulatory risk. On balance no significant change in risk is expected.

Option 3: Requiring DNOs to purchase losses

1.19 The costs associated with this option include:

- **Implementation costs:** This option would require significant implementation costs, in particular relating to DNOs needing to establish trading agents and/ or capabilities. It might also require additional costs in modifications to the balancing and settlement code (BSC) and other industry arrangements. For Ofgem, it is expected that significant expenditure will be required on consultants and that the full budget will be used.
- **Ongoing costs:** Significant ongoing costs are also expected to be incurred by DNOs in the balancing market, as distortions to estimated losses may make it difficult for the distribution businesses to match contracted electricity with reported consumption (losses).

1.20 The risk of high balancing costs will also increase the business risks of the distribution businesses.

Option 4: Input based incentive

1.21 The costs associated with this option include:

- **Implementation costs:** The project costs are similar to Option 1, but will require some additional work on developing the scheme.
- **Ongoing costs:** There will be some additional costs on Ofgem in monitoring and administrating the scheme.

1.22 As this approach will not require ex-post estimation of losses and as the benefits to DNOs from a particular effort to reduce losses will be certain at the time of investment, the business risks on DNOs from incentives on losses will be reduced.

Option 5: Technical minimum standards

1.23 The costs associated with this option are the same as for Option 4.

Benefits

1.24 The benefits of the different options will mainly be due to efficiency gains due to more efficient decisions being made. The current incentive mechanism appears not to encourage the right decisions and that DNOs' decisions resulting from any changes proposed should be more efficient than if the current scheme was maintained. More efficient decisions mean a net benefit to society, both environmental and economic, in particular in the long term.

Option 1: Modifying the current mechanism

1.25 Under this option changes to DNOs' behaviour will occur if, and only if, the change leads to more efficient decisions, allowing for an efficient outcome that encourages all possible, efficient efforts to reduce losses.

Option 2: NGC style incentive

1.26 This approach will adequately encourage all efficient operating decisions. However, it does not acknowledge that losses are mainly affected by investment decisions. The resulting benefits will therefore be limited.

Option 3: Requiring DNOs to purchase losses

1.27 This approach should provide DNOs with the most accurate short and long term incentives on all efforts to reduce losses, matching losses incurring in each half hour with the electricity and transportation prices for that half hour. This should in isolation provide for a very efficient outcome. The resulting benefits are therefore likely to be as least as great as for option 1.

Option 4: Input based incentive

1.28 This approach should provide DNOs with broad incentives on reducing losses in specific areas and reduce costs on DNOs of undertaking investment appraisals. In addition, there will be cost savings for DNOs as this option does not require specific attention to losses in investment appraisals. However, it will be necessary to focus the incentive on a limited set of efforts, such as installing transformers, and then only provide a general incentive that does not reflect that an effort might have different impacts on losses depending on the characteristics of the area of the network where the effort is made. As a result, the decisions falling within the scheme will be broadly efficient, but many decisions will not be incentivised. It is therefore Ofgem's view that this option will yield significantly less benefits that option 1.

Option 5: Technical minimum standards

1.29 Although this option is very similar to option 4, option 5 will only set a minimum level of equipment to be installed rather than encouraging the broadly most appropriate equipment in individual situations. The benefits from this option are therefore expected to be lower than for option 4.

Environmental effects

1.30 The most significant environmental impacts of losses are those associated with the generation of the lost electricity. This includes the emission to air of CO_2, SO_2, NO_x and particulates; waste (including ash, discharges to water and waste water); and the amenity loss associated with the visual impact of the plant and the noise of plant operations. However, there are also environmental impacts associated with the additional capacity of the transmission and distribution networks required to reduce losses, eg amenity impacts.

1.31 The European ExternE study examined the impacts at all stages of the fuel cycle over all space and time scales and estimated the environmental cost of different types of generation. The analysis showed that a high proportion of the environmental damage was caused by emissions to air from generation. Emissions of SO_2, NO_x and particulates are controlled under the Large Combustion Plant Directive so this impact analysis focuses on CO_2 emissions. This is consistent with the Social and Environmental Guidance.

1.32 Considering the marginal emission rate[23], every 0.1 percentage point change in losses (for example from a 7 to 6.9 per cent loss rate) would result in a reduction in carbon dioxide emissions of around 0.08 MtC per year. This is equivalent to about 0.4 per cent of the reduction in UK emissions required under the Kyoto Protocol.

1.33 Any reduction in distribution losses is likely to result in environmental benefits. Therefore, on environmental grounds, the decision between the alternative options is likely to be that which is most likely to produce the maximum reduction in the level of losses cost effectively. It is not possible to assess which of the options will lead to the greatest reduction in losses, which makes it difficult to choose between the options on environmental grounds.

1.34 Incentives that are based on outputs, and which value the reduction of losses appropriately (options 1, 2 and 3), should result in a cost effective level of losses. Reduction in losses to cost effective levels will result in environmental benefits at zero or negative financial cost. Reduction in losses beyond that level may be justified on environmental grounds if this would be likely to deliver environmental benefits at limited additional cost.

Security of supply

1.35 In the operation of and investment in distribution networks, there are obviously important trade-offs between electricity losses and expenditure. There are, however, also important trade-offs between losses and quality of supply. For example, where two transformers are operating in parallel, switching off one

[23] The marginal rate of emissions is taken as the average emission rate of all plant that would not be generating if losses were reduced to zero. Plants are identified on the basis of NGC's ranking order,

transformer might be a possibility in periods of low demand. This would reduce losses, but increase the risk and duration of interruptions in supply. However, often efforts to reduce losses will bring benefits in terms of quality of supply and vice versa. Encouraging efficient decisions with respect to losses will ensure that these trade-offs are managed appropriately, and Ofgem considers that options 1 and 3 best encourages such decisions.

Summary

1.36 Following the above analysis, three options can be immediately discarded. Option 2 is associated with higher costs and less benefits than option 1. The additional benefits obtainable by option 3 over option 1 are at present considered unlikely to exceed the significant additional implementation and ongoing costs of that option. Option 1 therefore appears superior to both option 2 and 3.

1.37 Option 5 has very similar costs to option 4, but the expected benefits are lower. Option 4 is therefore superior to option 5. The remaining discussion therefore focuses on the assessment of option 1 and 4.

1.38 Although option 1 is associated with lower project costs and increased ongoing costs on Ofgem than option 4, this is likely to be compensated by lower risk and lower ongoing costs on the DNOs from option 4. However, option 1 is considered to significantly better encourage efficient decisions than option 4 and therefore significantly higher benefits are expected. Table 1 below summarises the assessment of options.

Table 1: Summary of the assessment of impacts on costs, benefits and uncertainty

	Implementation costs	Ongoing costs	Benefits	Uncertainty
Option 1: Modifying current mechanism	Insignificant.	Same as under current scheme.	Efficient outcome.	Some increase.
Option 2: NCG SO style incentive	Insignificant.	Slightly higher than under current scheme.	Broadly efficient outcome.	Same as under current scheme.
Option 3: DNOs purchasing losses	Large in current situation.	Significant ongoing costs on DNOs in the balancing market in the current situation.	Very efficient outcome in principle, but uncertainty may distort outcome.	Increased uncertainty.
Option 4: Input based incentive	Some additional costs.	Some additional monitoring and administrative costs.	Savings in costs on DNOs. Somewhat efficient outcome.	Reduced uncertainty on DNOs.
Option 5: Minimum technical standards	Some additional costs.	Some additional monitoring and administrative costs.	Savings in costs on DNOs. Unlikely that outcome is efficient.	Reduced uncertainty on DNOs.

Distributional effects

1.39 Ofgem has considered the possibility that adjustments to the losses incentive mechanism might result in net transfers between the following groups:

- existing and new customers
- different types of customers, including large and small or rural and urban consumers; and
- different parties in the industry, in particular DNOs, suppliers and consumers.

1.40 It is proposed that DNOs should be allowed to retain the benefits from an effort to reduce losses for the first five years, allowing consumers the benefits of all subsequent years. Although an efficient reduction in losses will bring efficiency gains, these gains will therefore not be passed on to consumers until after five years. If a revised incentive arrangement on distribution losses encourages

significant expenditure on reducing losses, consumers may face higher costs in the short term. There might therefore be some temporary distributional effects between existing and future consumers. These effects are, however, expected to be small.

1.41 Ofgem does not consider that this project is likely to result in other significant distributional issues.

Risks and unintended consequences

1.42 With all options there is a need to estimate the benefit of reducing losses in order to set the level of the incentive[24]. There is therefore a risk that this value is incorrectly estimated and the incentive on losses will send the wrong signals to DNOs. However, this should affect all options to a similar degree.

1.43 There is also a risk that the incentive proposed does not encourage efficient decisions. It will therefore be necessary to review the performance of DNOs, as set out in 'Review and compliance' below, to ensure that the desired outcome is achieved.

Competition

1.44 No significant impacts on competition should result from any of the options.

Review and compliance

1.45 Implementation of the chosen option, including any licence modifications, will take place as part of the ongoing distribution price control review. Compliance will be checked as part of the regular price control compliance process.

1.46 The success of the proposed scheme will be reviewed as a part of the next price control review, expected to commence around 2008. As it is difficult to assess changes in losses over such a short period of time, given the fluctuations in reported losses, the focus of a review of the proposed scheme will be on assessing DNOs behaviour.

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[24] To be set in the distribution price control review.

Conclusions

1.47 Ofgem considers there to be scope for improvement in the overall efficiency of the distribution network with respect to losses, but it is not possible to conclude on the magnitude of this scope. However by increasing DNOs' confidence in being able to recover efficient expenditure in reducing losses, option 1 has the strong merits of encouraging any efficient effort if, and only if, the associated benefits exceed the costs. The scope for benefits is therefore high and the costs of achieving these are moderate. Although some risk will remain on DNOs owing to distortions in estimating losses, the distortions are expected to reduce over time. It is therefore concluded that option 1 is the preferred alternative.

Appendix 2 Worked example of option 1

2.1 Consider the following example that works for either investment or operating decisions. Assume that an effort to reduce losses will cost £C and will result in benefits of £B and that the expenditure was not included in the price control projections. The DNO will have to bear a share, p, of the initial outlay due to the expenditure efficiency incentive and the cost to the DNO will therefore be £pC. However, because of the resulting reduction in losses, the DNO will also receive an incentive benefit. If the DNO is allowed to retain the same proportion, p, of the benefits, the incentive payment will be £pB. The DNO only has an incentive to act if $pB > pC$ so it is clear to see that the effort will take place if and only if $B > C$, ie when it is efficient to do so.

2.2 The benefit to society of the above effort is (B – C). The DNO will retain p(B – C), while the customer receives (1 – p)(B – C). Thus, not only is an efficient outcome achieved, but the sharing factor of the surplus benefit between DNOs and customers is also exactly the same as what is considered appropriate for the expenditure efficiency incentives.

2.3 For the first five years following an investment under this scheme, a DNO will receive increased revenue owing only to the losses incentive. After five years, the expenditure will enter the regulatory asset base (RAB) and so the DNO will be able to recover this over the life of the asset. This is consistent with how the capital efficiency incentive operates. Inclusion of costs in the RAB in advance or at the time the expenditure occurs would amount to double counting as the DNO would both earn a full return on the expenditure and an additional reward through the losses incentive.

Appendix 3 Summary assessment of options

	Covers areas where DNOs able to affect losses	Effect on losses can be estimated accurately	Incentivises efforts if and only if expected net benefit to society.	Certainty of reward from incentive	Implementation costs and ongoing resource requirements
Option 1: Modifying current mechanism	Yes, all	Problems in estimating losses distort observed effects of efforts. However, DNOs can still make ex ante assessments of impacts of an effort that will match impact on their revenue.	Yes, company optimum coincides with social optimum.	DNOs' rewards will be provided over the first years to minimise uncertainty.	No significant implementation costs. Not higher ongoing costs on DNOs than at present. For Ofgem it may require a review of the estimation of losses.
Option 2: NCG SO style incentive	Yes, all	Problems in estimating losses distort observed effects of efforts. However, DNOs can still make ex ante assessments of impacts of an effort that will match impact on their revenue.	Broadly. Focused on short term, operational efforts. May not provide sufficient reward for capital efforts.	Regular review of benchmark to reflect current losses weakens the certainty of the rewards.	No significant implementation costs. Not higher ongoing costs on DNOs than at present. For Ofgem it may require a review of the estimation of losses.
Option 3: DNOs purchasing losses	Yes, all	Problems in estimating losses distort observed effects of efforts. However, DNOs can still make ex ante assessments of impacts of an effort that will match impact on their revenue.	Broadly. High risk and uncertainty may distort outcome.	Overall benefits are fixed. Cost of contracting losses should be relatively certain, but large balancing costs will create significant costs.	Significant implementation and ongoing costs on DNOs. Higher requirements on Ofgem in monitoring in the short term, possible lower in the longer term.
Option 4: Input based incentive	Yes, but only a few areas. However, it allows DNOs to focus on these areas.	No need to estimate system losses. Only ex ante assessment of impacts needed. Little risk on DNOs.	Broadly, but difficult to acknowledge the different impacts a piece of equipment will have in different uses or areas.	Capitalised, one-off benefits allow very easy assessment for DNOs of the costs and benefits resulting from use of a particular piece of equipment.	Some implementation costs. Lower ongoing requirements on DNOs, higher on Ofgem.
Option 5: Minimum technical standards	Yes, but only a few areas. However, it allows DNOs to focus on these areas.	No need to estimate system losses. Only ex ante assessment of impacts needed to establish the standard. Little risk on DNOs.	Only to the extent that the minimum requirement reflects what is efficient.	No reward for DNOs.	Some implementation costs. Lower ongoing requirements on DNOs. Work may be required in updating and monitoring the standards.

Appendix 4 Summary of responses to the January consultation

4.1 Ofgem received 23 responses to the 'Electricity distribution losses' initial consultation document (January 2003). In addition to the DNOs, respondents included suppliers, consultants and other interested parties.

4.2 Responses to the questions set out in the document in 4.39 and 5.43 are summarised below.

Are there any other areas (than those mentioned in the paper) in which losses can be reduced?

4.3 DNOs suggested that losses could be reduced by greater meter accuracy, increased energy efficiency of buildings and appliances and fewer registration errors. Metering errors are expected to fall because of the gradual introduction of new electronic meters. However, one DNO stated that it is important that the metering arrangements developed for domestic combined heat and power equipment (dCHP) do not contribute to increased losses.

4.4 Non-DNO respondents suggested five areas in which losses could be reduced. These included more precise metering of feeders, local heating systems to recover heat lost from transformers, voltage reduction on LV networks, intelligent metering and a review of the policy of oversized transformers.

What is the scope for further reducing losses on the 14 DNOs in England, Scotland and Wales?

4.5 DNOs generally noted that the scope for reducing losses depends on its weighting relative to other constraints, such as cost, network performance, behaviour of suppliers, geography and environmental concerns. Several DNOs stated that this balance must be appropriate for customers and that the current weighting is such that the cost of losses enters investment appraisals but is not a key investment driver.

4.6 Several DNOs stated that there may be limited scope for reducing losses in the short-term given the low rate of asset replacement - estimated by one DNO to be

1 per cent per annum. However, a respondent noted the opportunities provided by the need for significant replacement of ageing networks in the near future. Furthermore, if higher distribution use of system (DUoS) charges are offset by lower energy purchases, there may be a net fall in customer costs.

4.7 Some DNOs noted that some of the loss-reduction activities set out in the document should already be part of good engineering practice – for example, one DNO stated that average load factors on their network are already between 20-30 per cent. The benefits from investment in new transformers are restricted by the trade-off between fixed and variable losses and by the limited availability of amorphous core transformers. Furthermore, several respondents said that switching off transformers in off-peak periods increases the risk of premature asset failure.

4.8 Three DNOs highlighted several difficulties with the removal of voltage levels in order to reduce losses. The policy, primarily designed to improve capital efficiency, is generally limited to urban areas because the increased substation cost needs to be spread over a greater capacity.

4.9 DNOs noted that the scope for loss reduction may depend on factors beyond their control. These include voltage mix and non-technical losses (NTLs) – such as profiling and metering errors, inaccurate unmetered supply inventories and unregistered supplies. There was broad support for a reassignment of the rights and responsibilities with regard to revenue protection.

4.10 Two DNOs noted that distributed generation will affect the pattern of power flows on distribution networks. Therefore, they expressed concerns that the political and regulatory commitment to the development of distributed generation could undermine expected long-term benefits of loss-reduction investment. One DNO supported the redefinition of the losses term in the price control to take account of the impact of distributed generation.

4.11 Several DNOs discussed the interaction with other regulatory policies. They expressed concerns that competition in connections will lead to the provision of low cost rather than low loss connections. They also noted that third parties have little incentive to ensure accurate registration of customers.

Is Ofgem's view that the current incentive on distribution losses is too weak and that losses are currently higher than what is optimal the correct one?

4.12 Two DNOs agreed that the incentive is weak and fails to stimulate appropriate investment in low-loss equipment. One DNO stated that it is unclear if the weakness of the incentive is driven by its value or its structure. They noted that the value of the incentive is below the estimated average cost of losses and that energy prices are likely to rise with increased non-carbon generation. One DNO noted that a benefit received over 10 years was inconsistent with slow turnover of the asset base.

4.13 However, several DNOs stated that the incentive is strong enough to encourage suitable efforts to reduce non-technical losses and for the cost of losses to sometimes enter investment appraisals. Two DNOs noted that the valuation of losses in the document is close to the current level of the incentive.

4.14 The DNOs noted the difficulties of determining a socially optimal level of losses as a function of net environmental and financial costs. In addition, lower utilisation rates may not be desirable for consumers. Therefore, several DNOs and other respondents felt that there should be a comparison of the costs and benefits of loss reduction as opposed to other methods of emission reduction. In addition, one DNO noted that the presence of long-lived assets means that it is difficult to achieve optimal network configuration for current load patterns at any point in time.

4.15 Both DNOs and non-DNOs agreed on the importance of a consistent methodology that minimises the variations driven by settlement errors. Based on a consensus definition, the methodology would incorporate standard measurement techniques with adjustments made for network design, network configuration and energy efficiency standards for buildings. Although one non-DNO representative supported the use of network modelling to determine optimal levels of losses, one DNO stated that the results from optimal loss models should be treated with caution.

4.16 Seven DNOs noted that for a DNO, the optimal level of losses is driven by the overall balance of regulatory incentives. For example, the capex incentive and

improved loading information have driven higher utilisation rates. A non-DNO respondent stated that the trade-off between reducing losses and reducing capex appeared to be too heavily weighted towards capex efficiency.

4.17 The evidence suggested by respondents that losses may be higher than optimal included the variation of performance across DNOs, international comparisons and variations in the Group Correction Factor. Although it was suggested that Ofgem could review the performance of best performing countries, it was noted that the significant fall in international loss percentages since 1980 is inconsistent with the significant rise in utilisation over that period.

What specific efforts are likely to be overall cost effective, bearing in mind that the cost of losses may be 3p/kWh?

4.18 It was noted that commercial attractiveness depends on the reward mechanism developed. Some DNOs stated that the current incentive provides a cap to transformer losses and an incentive to reduce NTLs. Any focus on NTLs and demand management may need the correct incentivisation of suppliers.

4.19 One non-DNO representative stated that innovation in metering and checking on unregistered connections would be cost effective. It may also be possible to incorporate loss reduction in emissions trading but careful monitoring will be needed to avoid double counting.

4.20 Some DNOs felt that it would be helpful if Ofgem set out the implications of each loss-reducing activity for costs and standards of service.

What is the appropriate valuation of losses? Is it appropriate to include a value for environmental impact, and if so, is the method and level used in this document the appropriate?

4.21 Six DNOs and two non-DNO respondents agreed that all costs to society should be included in the incentive. These costs include generation, excess capacity and environmental damage. One respondent stated that the estimate of the value of losses given in the document would be associated with lower optimal utilisation rates than had been stated in the document.

4.22 The appropriate level of the losses incentive was stated by three DNOs to be the level that encourages an efficient level of loss reduction activity. In contrast, three other DNOs stated that the appropriate value should be the NPV of the benefits over 40-years of a one-off 1 kWh reduction in losses. Two DNOs stated that the correct valuation should reflect costs of other means of reducing aggregate energy consumption. For example, the National Audit Office has estimated the costs of achieving energy savings under the original Energy Efficiency Standards of Performance schemes as 1.8p/kWh, which is close to the level of the current incentive over ten years. One respondent noted that the statutory rights enjoyed by a DNO enable to recover the retail price of a stolen unit of electricity. One non-DNO representative stated that there will be a paradigm shift in demand over the next forty years because of factors such as global warming, domestic air conditioning and distributed generation. This needs to be built into the long-term equation.

4.23 Four DNOs and one other respondent stated that environmental costs should not be part of the incentive unless they are included in the costs faced by the rest of the supply chain. Four DNOs proposed that environmental costs should only be incorporated for technical losses. One DNO stated that the inclusion of environmental costs should be reliant on proof of expected environmental benefits. Three DNOs noted that if externalities are not included in the incentive, it may be possible to fully offset for customers the impact of the increase in distribution charges designed to fund loss reduction activities. It was suggested by three DNOs that the inclusion of externality in incentive and/or customer cost may be a matter for primary legislation.

4.24 One non-DNO representative supported the inclusion of environmental costs until the start of an emissions trading scheme. Thereafter there may be scope for additional carbon credits to reflect the concerns of the White Paper to encourage carbon reduction investment.

4.25 Four DNOs suggested that the value of the environmental component should be derived from emissions trading schemes. Two DNOs suggested that the environmental costs should be extended to incorporate life-cycle emissions. However, two non-DNO respondents noted that uncertainty about the valuation of carbon has led to a broad range of estimates for environmental cost. The

regulatory inclusion of environmental costs outside the energy price should be done on a consistent basis. Therefore, they supported the incorporation of the values derived from Renewable Obligation Certificates (ROCs) and the Climate Change Levy (CCL) in the incentive.

4.26 Two DNOs stated that that the costs of excess transportation infrastructure are not sunk because if losses fall, the capacity could be used in response to load growth. Therefore, the incentive should include the costs of premature reinforcement rather than total reinforcement.

4.27 Two DNOs noted that while the valuation method in the document appeared sound, there is an inconsistency in the approaches to losses on the transmission and distribution networks. A non-DNO respondent echoed the need for consistent derivation of incentive values. The value of a lost unit in the document is nearly twice the value used in the NGC incentive scheme. One non-DNO respondent suggested that it may be appropriate for the losses incentive to differ across DNOs to reflect different TNUoS and transmission loss factors.

4.28 A DNO noted that the attribution of half-hourly prices to a loss profile will be affected by uncertainty in sales profiling. Given large data errors, it may be appropriate to have average values rather than half-hourly values.

What are the important factors in assessing the merits and demerits of alternative incentive schemes?

4.29 Several respondents suggested that a scheme should be appraised on its likely effectiveness in producing the desired outcome. There should be a published cost-benefit analysis of potential schemes to reduce losses. Other factors proposed included the impact on other users, the absence of perverse incentives, fairness and equity. One respondent suggested that an incentive should be asymmetrical – rewarding loss reductions but not penalising increases in losses.

4.30 There was significant support for disaggregated incentives that covered areas in direct control of DNOs rather than all unaccounted units. Other criteria for desirable incentive design included the time frame – eg over economic life of assets - a historical benchmark and appropriate benefit-sharing between DNOs

and customers. There was some disagreement over whether the value of the incentive should be fixed over the price control period or should be responsive to market conditions. One respondent noted that any incentive should be robust enough to provide DNOs with certainty of investment. Other issues discussed included the appropriate vehicle for incentive – price control or SO incentive – a guaranteed return and a risk allowance to for costs not recovered through price control.

4.31 Some respondents stated that the incentive scheme should complement other existing regulatory incentives and initiatives – for example, competition in connections and government targets on renewables. Some DNOs suggested that the scheme should reflect the principles for distributed generation incentives set out by the Chairman of the Authority, Callum McCarthy, in an open letter to DNOs.

4.32 There was some discussion of desirable operational features of an incentive scheme. There was support for a clear, simple and predictable scheme that minimises costs of operation. Respondents felt it would be helpful if there were robust measurement criteria available on which to assess performance. Some DNOs noted their opposition to a retrospective adjustment made as part of the last price control review.

4.33 One non-DNO representative stated that there should be a comparative model of the effects of the three options outlined in the document. This includes the net present value of reductions in losses, volume exposure, exposure to real costs of losses and impact on operational and investment decisions.

What are the merits and demerits of an input based versus an output based incentive scheme?

4.34 Several respondents expressed support for the principle of an output incentive because it would produce an optimal outcome in size and cost of loss reduction. One DNO stated that network modelling of investment scenarios may be useful, if costly, in developing a long-term output incentive.

4.35 However, criticisms of output incentives included the need for measurable outcomes and the incomplete extent of DNO control over outcome. It was noted

that although individual incentives could be imposed on areas under DNO control, segmentation is clearly difficult because of data imperfections. Furthermore, the short duration of such schemes provide weak incentives to invest in long-lived equipment. One respondent discussed the need for greater co-operation with asset manufacturers about the appropriate capex-losses trade-off.

4.36 Some respondents supported the development of input incentives because they address issues directly under DNO control and provide an auditable means of measuring performance. In addition they enable the quantification of net costs and benefits of loss reduction activity, which facilitates cost recovery over asset life. One DNO noted that an input incentive may be appropriate to arrest a rise in losses.

4.37 Criticisms of input incentives included the difficulties of objectively setting criteria for quantitatively rewarding effort and of identifying specific costs incurred in loss reduction activities. There was a discussion of the possible distortions to investment caused by a procurement-based incentive that uses standardised loss assessments for particular inputs. These include unnecessary investment in low loss equipment, a neglect of non asset-replacement expenditure and a stifling of innovation. It was stated that it may be beneficial to minimise administrative costs by restricting the incentive to schemes with significant costs and benefits.

4.38 Several respondents discussed the interaction between the incentive and the price control. Two DNOs and a general respondent noted that if loss-reduction investment is disallowed at a subsequent price control, the capex efficiency frontier comparison in the price control review provides strict cost disincentives. If the investment is allowed, the output incentive is merely reinforcing.

What are the merits and demerits of the alternative options for incentivising losses?

Option 1

4.39 Some respondents praised the current scheme for being simple to understand and for driving loss reductions where costs are negligible. One DNO noted that

the current incentive should only be replaced if there is something better. Four DNOs expressed a preference for option 1 as it offers most scope to respond to failings of the current scheme. They felt that the current framework should be retained in the face of data constraints, which provide advantages for a historical benchmark. Two DNOs stated that the current level of the incentive is appropriate.

4.40 Some DNOs criticised option 1 for covering areas that are not under DNO control. Therefore, an increased level of incentive or longer benefit period will raise income exposure and risk, which are not limited by caps and collars. It was noted that the current incentive is weak because of the probability of a net revenue loss from the capex and opex incentives. One non-DNO respondent criticised the incentive as weak and unsophisticated for bearing little resemblance to either volume of losses or to real prices of electricity lost.

4.41 Several suggestions for modifications were put forward. Three DNOs supported an increase in the level of the incentive to match the lifetime customer value of loss reductions and an extension of the reporting period to mitigate the problems of settlement reconciliation. Two DNOs stated that the benefit should be received over the average life of an asset in order to provide an incentive closer to the actual activity required to reduce losses. Others suggested a shift to fixed benefit that is received for five years and benchmarking against an efficient level of losses.

Option 2

4.42 Some respondents asserted that it was not appropriate to extend an NGC-style incentive on the distribution networks because of the higher number of voltage levels and entry and exit points. However, one non-DNO respondent supported the extension of the NGC incentive to the 132kV network only. It was noted that DNOs lack the clarity of data received by NGC because some consumption is profiled or unmetered.

4.43 There was broad opposition to the development of an optimal benchmark for losses without a better understanding of the many factors that differentiate performance, such as topography, network design and load configuration. It was claimed that an optimal benchmark would increase risk and would contradict

Ofgem's broad approach of establishing incentives that allow companies to determine optimal levels themselves. However, two DNOs noted that the presence of caps and collars limits risk. One DNO noted that the incentive would measure aggregate losses. However, one non-DNO respondent stated that it would be unrealistic to set an efficient level for each individual component of losses.

4.44 One non-DNO respondent noted that, as has been done for NGC, safeguards would need to be developed to restrict the percentage of end costs that can be passed on to customers. Three DNOs stated that option 2 is not particularly different to the existing incentive scheme. One non-DNO respondent noted that option 2 could provide scope to allow sufficient benefits to provide certainty for investment. This would depend on the period over which benefit reduction is allowed.

4.45 Three DNOs discussed possible extensions to the scheme. These included linking targets for technical loss reduction to capex allowances. A penalty/reward scheme would mean that the DNO would only receive the capex allowance if the loss reduction target is achieved.

Option 3

4.46 There was some support for the principles underlying option 3 because it would lead to DNOs facing the real cost of their actions. Two non-DNO respondents noted that the interactions with other Ofgem incentives would have to be considered.

4.47 DNOs made several criticisms of option 3. These included the large costs involved for DNOs in developing new skills and expertise and the large undesirable increase in risk, even if the incentive results in price control adjustments rather than the purchasing of losses. option 3 was criticised for undermining the independence of network companies that has been developed since vesting and providing an unfair competitive advantage for DNOs who are already affiliated to companies that participate in the energy market. In addition, loss-reductions are driven by incremental investment not short-term operation, and DNO management may be diverted from main task of network asset management. Option 3 would place increasingly complex demands on Ofgem

– reworking price control, additional and complex regulatory monitoring and checking for gaming.

4.48 Furthermore, accurate measurement of electricity flows will be required. One non-DNO respondent highlighted the need for a clear distinction between losses and wholesale trades. One non-DNO respondent criticised Option 3 for providing risk without significant benefits compared to pure volume incentive or ex-ante fixed price that would allow certainty for manufacturers of low-loss equipment.

4.49 It was noted that option 3 could be extended to include caps, collars and other limits on exposure to variations in price and volumes. A non-DNO respondent suggested that DNOs could purchase energy according to a defined loss profile. Any difference between ex-ante and ex-post losses would be treated as a settlement error.

Would it be appropriate to introduce an incentive scheme that differentiates between variable, fixed and non-technical losses? Would it be appropriate to introduce an incentive scheme that differentiates between losses occurring at different points in time?

4.50 Some respondents argued that there should be a separate incentive for technical and non-technical losses because any reduction in non-technical losses will increase economic efficiency but will have no direct effect on aggregate energy consumption.

4.51 Others highlighted the associated practical complexities, particularly data errors. One non-DNO respondent, that opposed differentiation by types of losses, pointed out that the lost revenue from non-technical losses should represent a strong driver for supplier and DNO action in this area.

4.52 One non-DNO respondent supported differentiation into peak and off peak periods. Five DNOs opposed time differentiation because of the data difficulties in establishing losses on an annual aggregate basis. In addition, the demand profile is driven by customers responding to supplier price signals. One DNO opposed differentiation because it will increase complexity and undermine the fairness and effectiveness of the regime. They noted that the potential for

intelligent metering and spot pricing has been lost owing to competition in metering.

4.53 Another respondent supported differentiation by voltage because they felt that any differentiation should be focused on factors that DNOs are capable of influencing.

General Points

4.54 Several respondents highlighted the importance of measurement issues, which one non-DNO respondent felt was understated in the document. It was noted that losses are the difference between two large numbers – one known with certainty and one estimated with a settlement tolerance of 1.5 per cent. One DNO stated that accuracy increases with length of measurement period and time since settlement period. They noted that reconciliation can occur over three financial years. Four DNOs and one non-DNO noted that the Information and Incentives Project (IIP) had overcome similar measurement challenges – variable measurement standards, and poor understanding of divergent performances.

4.55 Three DNOs supported the production of an RIA of the project – this should assess all areas of the supply chain to identify the most cost-effective reductions in emissions – in particular, several parties highlighted the scope for improved energy efficiency.

4.56 One DNO welcomed the timetable as allowing sufficient time for proposed changes to affect planning for next price control review. However, three DNOs noted that the timetable was ambitious and may need to be extended.

4.57 One non-DNO respondent expressed concern that customers should not have to contribute excessively to DNO solutions to reduce losses – eg increased capacity of cables.

LIST OF RESPONDENTS

Distribution Network Operators

Aquila Networks
East Midlands Electricity
LE Group
Northern Electricity Distribution / Yorkshire Electricity Distribution
Scottish and Southern Energy
SP Transmission & Distribution
United Utilities
Western Power Distribution

Other respondents
Addenbrookes NHS Trust
British Gas Trading
Box Ten Ltd
Energy Saving Trust
FEC Services
Innogy
JL Rolf
National Grid Transco
Power Technologies International
Ralph Turvey
Rothside Technology
Scottish Council for Development and Industry
United Kingdom Revenue Protection Association
Warwick Business School