# Treatment of Electricity Losses by Network Operators
# ERGEG Position Paper

# Conclusions Paper

**Ref: E08-ENM-04-03c**
**19 February 2009**

European Regulators' Group for Electricity and Gas
Contact: Council of European Energy Regulators ASBL
28 rue le Titien, 1000 Bruxelles
Arrondissement judiciaire de Bruxelles
RPM 0861.035.445

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# 1 Introduction

## 1.1 Purpose of the paper

The European Regulators Group for Electricity and Gas's (ERGEG's) analysis of network losses introduced in the Treatment of Electricity Losses by Network Operators ERGEG Position Paper (the Position Paper) gives an overview of national practices regarding the definition, procurement and financial recovery of network losses. The Position Paper also covers incentives for the reduction of losses. Furthermore, the Position Paper demonstrates the actual practices regarding network losses in Europe by means of representative case studies from some Member States (MS) and comparative analysis.

Issues that need to be addressed in order to promote a level-playing field in the treatment of losses at a European-wide level were discussed. The Position Paper posed some questions for stakeholders to consider through the consultation. The public consultation on the Position Paper was held between 18 July 2008 and 30 September 2008.

This paper summarises the views of stakeholders from the responses to the public consultation on the Position Paper. The views of stakeholders, together with the Position Paper, will be used in the development of Guidelines of Good Practice for the treatment of losses. These will serve as the basis for future, more detailed technical rules and/or codes according to the proposed amended Regulation (EC) 1228/2003. The draft Guidelines of Good Practice will be consulted on accordingly.

This document draws conclusions from the comments received during the ERGEG public consultation on the Position Paper.  A summary table of the responses received and the viewpoints expressed by stakeholders is provided in the Annex.

## 1.2 Responses received

During the public consultation 20 non-confidential responses were received, from the organisations listed below. In addition, one response was received from an organisation that requested confidentiality All non-confidential responses are published on the ERGEG website.

| Respondents | | Country |
|---|---|---|
| ABDE | Abde solutions | Belgium |
| Centrica | Energy company | UK |
| E.ON | Energy company | Germany |
| EBL | Norwegian Electricity Industry Association | Norway |
| EDP | Distribution system operator | Portugal |
| EirGrid | Transmission system operator | Ireland |
| EnBW | Energy company | Germany |
| ETSO | European Transmission System Operators | EU |
| Eurelectric | Union of the Electricity Industry | EU |

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| EVN | Energy company | Austria, Bulgaria, FYROM |
| FEI | Finnish Energy Industries | Finland |
| GEODE | Association of European independent distribution companies of gas and electricity. | EU |
| Leonardo | Leonardo Energy, European Copper Institute | EU |
| NTUA | National Technical University of Athens | Greece |
| RWE | Energy company | Germany |
| SSE | Energy company | UK |
| T&D | European Association of the Electricity Transmission and Distribution Equipment and Services | EU |
| VEOE | Association of Austrian Electricity sector | Austria |
| VSE | Energy company | Slovakia |
| Wuppertal | Wuppertal Institute for Climate, Environment, Energy | Germany |

# 2 Conclusions

## 2.1 Regulatory definition of losses

***What is considered an acceptable definition of losses?***

Respondents define losses as the absolute difference between the volume of electricity entering the system (metered or estimated at the point of entry) and the customer related volume of electricity exiting the system (metered or estimated at the point of exit). Losses are better expressed as a percentage of the volume entering the system; losses can be expressed as a percentage of the customer related volume exiting the system. Respondents felt that an important step to being able to compare losses across network operators would be the adoption of a common standard for the expression of losses.

Although losses are defined as above, there are inaccuracies in their measurement as data collection time of input meters differs from data collection time of consumption meters. In addition, theft, which is electricity that is being consumed illegally, becomes a part of losses.

Losses can be divided into two types: technical and non-technical. Whilst technical losses are clearly defined as physical losses, non-technical losses are not clearly defined for all networks.

One respondent felt that there is no reason to standardise the definition of losses in different MSs. This respondent also felt that any attempt to harmonise the definitions of losses would fail due to the enormous differences in grids across MSs.

***Should power losses refer only to technical losses or is it acceptable to include also non-technical losses?***

Respondents agreed that both technical and non-technical losses should be included in the overall losses assessment since, for society as a whole, it does not matter where and how energy is lost between the generating plant and the point of consumption.

Some respondents are of the opinion that separating the contributions of technical and non-technical losses is a difficult task. One respondent feels that the reliance on estimates would have to increase if losses had to be defined net of non-technical losses; moreover, measuring non-technical losses is very expensive, often more expensive than the value of the lost energy.

***Which are the key components for defining losses?***

Respondents agreed that the two key components are technical and non-technical losses. On a second level of analysis, the network where losses occurs (distribution or transmission) has to be considered.

Technical losses can then be divided further, into fixed losses (not related to load) and into variable losses (load related): they depend on the design of the power grid, the voltage and transformation levels and the length of the power lines. One respondent commented that for their evaluation it is important to reflect the network that is actually in place rather than an idealised network.

Non-technical losses refer to metering issues and include theft, un-billed accounts, errors due to the approximation of consumption by un-metered supplies and metering errors.

One respondent considered that in house consumption and public lighting, even if often un-metered, should be excluded from non-technical losses and treated as any other type of load. This requires the presence of a meter or a proper estimation of the consumption.

## 2.2 Valuation procedures

***What ways exist to improve the evaluation of losses in distribution networks?***

First of all, the respondents think that improvements in metering will improve the evaluation of losses in distribution networks. They suggest implementing more metering points and taking losses into account in the cost/benefit analysis of new metering equipment.

The implementation of smart metering is supposed to allow a continuous metering process for losses. Nevertheless, the considerable investment involved in the implementation of smart metering demands a careful assessment of its economic feasibility and a clear definition of specifications and of the roll out design.

Secondly, the respondents believe that further research would be necessary to obtain reliable estimates for technical losses. A model respecting the existing grid topology, voltage levels, age of installations and grid load should lead to the most accurate results.

The respondents feel that methodologies for analysing losses should be simple, transparent, predictable, and reasonably cost reflective. They ask that the grid operators' methodologies for calculating losses are governed to ensure that any changes in the process of calculation can be taken account of so that improvements in losses can be monitored and comparisons conducted over time.

Some respondents suggest that specific non-technical losses that can be estimated (like public lighting) should be isolated and treated accordingly.

One respondent proposes to use long run data to investigate specific impacts on losses by statistical evaluation method.

## 2.3 Values

***What should be a reasonable and acceptable level of power losses at the distribution level and the transmission level?***

As the level of losses varies due to a number of factors (evaluation methodology, network characteristics …), some respondents think that it is not possible to state for a generic country what is a reasonable and acceptable level of power losses. Some respondents state that the main loss drivers cannot be managed by the system operators. As a consequence, even within the same country, the level of losses will vary depending on the region. In comparing power losses between countries, it is important to take account of the differences that may apply.

For these reasons, the respondents feel that it is not possible to set a harmonised value of acceptable losses throughout Europe.

Some respondents argue that it is difficult for system operators to influence the volume of losses, particularly in the short run. Over longer timeframes, losses may be marginally influenced by investment decisions. However, some respondents note that external factors, such as the weather, may have a greater marginal impact on losses than technical improvements, particularly in the short run.

The acceptable level of losses will depend on the cost/benefit analysis of the political, environmental and technical choices which impact losses. Three respondents state that acceptable losses from an economic point of view would be the level of losses at which the cost of reducing the quantity of losses is equal to the total cost of procuring the additional electricity to offset the losses. The level of power network losses is acceptable when its environmental and economic impact does not justify additional measures to reduce losses.

A few respondents believe that, as a general rule, a reasonable level of losses can be defined by ensuring that investments in loss-reduction are economically feasible. It is agreed that it is necessary that losses are reduced over time by individual - for each grid - reasonable reduction goals.

***Which types of losses could be most easily reduced?***

One respondent commented that depending on the network design, those that are distance related may be easier to reduce than those linked to the transformer through improvement in insulation or line quality. The most common methods of reducing losses are to increase network capacity or to locate generation closer to consumption or vice versa. These solutions are expensive and long run.

The reduction of non-technical losses can be reached by incentives designed to reduce theft, improve metering and reduce unmetered supplies. In systems where non-technical losses are high, measures should be taken in order to reduce these losses. It should be noted that the potential for further reductions of non-technical losses may be limited given the levels of efficiency already attained.

One respondent commented that each network operator has to decide on their own where and how a reduction of losses is achievable: a generally applicable answer is not available. As these questions depend on the situation in each MS, it would not be appropriate to define a unique position about these subjects.

## 2.4 Procurement of losses

***Who should be responsible for procuring electric energy to cover losses?***

The most important comment, and common idea, is that it is more important to ensure that the procurement of electricity to cover losses is done through a market based mechanism than it is to identify a single buyer for the losses.

Regarding objectively who should be responsible for procuring losses, opinion is split into two groups with the same share of around 50% of the comments each.

For the first group, losses may be procured either by transmission/distribution operators or suppliers.

For the second group, TSOs/DSOs should have the responsibility for procuring energy to cover losses. In addition, in order to purchase grid losses efficiently, the losses procurement process should be transparent, neutral to market actors and competitive.

There is also one opinion defending exclusively that the suppliers should be responsible for procuring losses, since the supplier has an inherent incentive to minimise procurement costs and thereby network loading in order to offer the most competitive tariffs and maximise profits. In this case, where loss adjustment factors are to be applied to the output of generators, then these should be applied in a stable, predictable, non-discriminatory way.

***How should electric energy to cover losses be procured in a market oriented way? Which solution is the most efficient?***

Once again, as for the previous issue, the most common comment is that it is more important to ensure that the procurement of electricity to cover losses is done through a market based mechanism than it is to identify who should be responsible for procuring losses. The solution chosen to procure electric energy to cover losses should be a market-based, transparent, harmonised and non-discriminatory approach.

A significant group of respondents is in favour of any solution, through suppliers or network operators that will increase transparency and efficiency in the procurement of electricity to cover losses.

For respondents who believe that the grid operators should be obliged to procure the energy, they should do it in a transparent, non-discriminatory and market-based way. Tenders or auctions, supervised and controlled by the regulator, would comply with the requirement of market oriented procedures that enables TSOs/DSOs to benefit from competitive prices for the energy procurement to cover their losses. The procurement mechanism should therefore encourage TSOs/DSOs to be prudent and discourage risk-taking practices on power exchanges.

One special reference to the role of regulators is made, stating that a careful debate among the European regulators would be sensibly aimed at obtaining a single procurement method in the future. If regulators could agree on a single method it would promote cross-border competition among energy suppliers and keep the procurement costs for grid losses as low as possible.

***Should the cost of losses be covered by a special tariff?***

There are two major groups of comments which are not in favour of a special tariff to cover the costs of losses, with different reasons:

- for those in favour of losses procured by suppliers, the special tariff does not necessarily ensure that the procurement cost is market based. If the supplier is the responsible party for the procurement of losses, then this does not need to be included in any regulated tariff but will be included by the supplier in its prices to end-user customers; and
- for those in favour of losses procured by networks operators, the network tariffs cover the costs supported by TSOs/DSOs, including the costs of procurement for losses. Applying an additional special tariff for losses does not seem necessary.

There is also a smaller group of respondents who state that in most cases this special tariff seems to be preferable to the alternative of continuing to recover the cost of losses through the use of the network tariff. If the costs for the compensation of losses are included in the regular network tariff, the transparency of the costs of the regulated entity is significantly impaired. A separate tariff would enable all parties involved to discuss any issues in a more focused manner.

## 2.5 Regulatory incentives

***What are the advantages and disadvantages of the aforementioned incentive mechanisms?***

According to two respondents, a moderate incentive for both TSOs and DSOs to reduce the cost of their losses is an appropriate design element of a regulatory model. Regulatory measures should incentivise them to bring losses to an acceptable level in the medium to long term. It has been commented that only a small part of the costs of technical losses can be influenced by the grid operator. The cost element that can be influenced by the grid operator is the quantity of the losses when losses are bought using market-based methods as obliged by the Directive 54/2003/EC.

It has been commented that losses incentives must be designed to address the control of the volume of losses as directly as possible e.g. by applying efficiency factor for technical losses to encourage operator to improve system performance over time. Integrating incentives within the global objective of efficiency for TSO/DSO may not help to reduce the volume of losses as efficiently as setting a maximum rate for technical and non-technical losses to be covered by a tariff.

However, opposing opinions were expressed. An incentive mechanism that promotes the overall optimisation of grid operation can be used instead of focussing on separate targets, like the minimisation of losses, to avoid partial optimisation.

In several comments it has been stated that rewards and penalties for outperforming or underperforming in the regulatory model should be balanced and capped to an acceptable level. However, it has been also stated that such maximum percentage for losses is not adequate because there is no possibilities to influence the amount of losses in a short term.

In the short term, external factors (e.g. weather) may have larger effects than efforts for loss reduction. If the costs related to network losses are treated like any other cost with the regulatory model they would be fixed for a relatively long period because adjustment of losses requires the redesign of the grid and/or investments in transformers and other equipment with lower losses. Thus, incentives should ensure that new equipment with lower losses is endorsed.

It has been also commented that different incentive mechanisms can exist in different MS without any harmful effects.

***Which key elements should be considered when assessing different regulatory incentive mechanisms?***

The comments emphasise that the incentive mechanism should be aimed at generating efficiencies only where regulated companies possess the control required to influence the outcome. It was stated that network operators cannot influence losses in the short-term but with some investments a decrease can be achieved in the long-term.

Furthermore, the targets set should be achievable and stepwise improvements over the longer term should be considered. The target should be measurable with minimal data collection and processing requirements. One respondent highlighted symmetrically designed incentives for underperforming and outperforming the target as advantageous for encouraging optimal performance against the target. The actual, prevailing rate of losses might be considered as the initial reference value for the mechanism. However, the performance targets should be forward looking and should be based on expected future conditions.

Furthermore, regulatory incentive elements should be fair and offer both risks and rewards to an equal extent implying that cost saving and cost increases are shared between regulated entities and their customers. However, the risk exposure to regulated entities should be limited.

One respondent considered it would be important to incentivise the reduction in the volume of losses.

Several respondents considered that it would be a fundamental error to design incentives that focused on encouraging the purchaser to reduce the price at which the energy to compensate losses is purchased. The regulator should accept market-based pricing and the fact that the purchaser would have a limited impact on the price.

However, hedging purchase policies of losses on the markets should be completed by hedging regulations that helps grid operators to support high market price variations. Furthermore, incentives to improve the losses forecasting would also reduce the imbalance costs paid through the balancing mechanism.

Incentives should be provided to obtain the right balance between investment and operational costs, including cost of energy, $CO_2$ emissions and energy saving targets.

Regulation that involves benchmarking could play a role in countries where a number of network operations (e.g. DSOs) exist. Sharing best practises and transparent performance in the treatment of losses is important.

Incentive mechanisms should be consistent and coherent with the regulatory system in place, i.e. with other incentive mechanisms (quality of supply, capital expenditure, operational expenditure etc).

Several respondents stated that the costs of losses should be covered by the tariff (or tariff component), where costs related to the reduction of losses and the purchase of electricity to cover losses have to be acknowledged by the Regulator and incorporated within the tariff.

***Are there advantages in setting separate mechanisms for technical and non-technical losses?***

The views on this issue differ. The majority of respondents have pointed out clear advantages to having separate mechanism for technical and non-technical losses because both the scope and the cost drivers to reduce each type of losses are different.

However, although this might apply in theory, a mechanism for total losses might be a better option in practise due to the difficulties in separately measuring technical and non-technical losses. A total losses mechanism would also avoiding the risk of partial optimisation. Furthermore, incentives to reduce non-technical losses are to a large extent dependent on the situation in the individual MS and might be difficult to harmonise.

Some respondents however do not see any need for separate mechanism. One reason for this is that at DSO level it is not cost-effective to separate different types of losses.

***Are there advantages in setting separate mechanisms for transmission and distribution losses?***

The majority of comments agree that there should be separate mechanisms for transmission and distribution because there are different drivers to losses in these two grids; e.g. transits in TSO grids, less non-technical losses in high voltage (transmission) grid than in low voltage (distribution) grid and the structure of transmission and distribution networks differs. However, to the opinion of some respondents is that it might be beneficial to have the same mechanism in principle but with separate parameters according to the specific condition within the distribution and transmission grids.

# ANNEX

## Summary of responses

This summary maps responses according to the topics and questions presented for stakeholders during the public consultation.

All the responses will be taken into account in the development of Guidelines of Good Practise on Losses. When drafting the Guidelines, ERGEG will form its opinion on issues where respondents have differing or opposing views.

| Issue | Number of Respondents |
|---|---|
| **Regulatory definition of losses** | |
| 1. What is considered an acceptable definition of losses? | |
| Losses are the absolute difference between the volume of units entering the system (metered or estimated at the point of entry) and the customer related volume of units exiting the system (metered or estimated at the point of exit). | 11 |
| For Transmission System Operators (TSOs) and Distribution System Operators (DSOs) at the High Voltage (HV) level, losses can be defined as the difference between the amount of electricity entering the system and the electricity leaving the grid. In medium and low voltage-levels technical losses have to be calculated because most of the connection points are subject to register metering with the result that only one data point is available for the metering period which is generally one year. Non-technical losses are the difference between energy input and output minus technical losses. | 1 |
| Losses shall be expressed as a percentage of the energy volume entering the system. | 2 |
| Losses may be defined as a percentage of energy electricity entering the system or electricity usefully exiting the system. The adoption of a common standard is regarded as an important step towards enabling the comparison of losses across network operators. | 2 |
| By evaluating losses as the difference between inputs and outputs, some conclusions are possible: there are inaccuracies in the result when the time that data is collected from input meters differs from the time that data is collected from consumption meters; theft of electricity becomes part of losses. | 2 |
| It is important to separate out and assess the different types of losses in order to better target their reduction. These different categories can then be aggregated to give a single figure for overall power losses. | 1 |

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| In transmission systems there is no theft: there are only technical losses. | 2 |
| Expert opinions differ on the aptness of the distinction between technical and non-technical losses. While standard classification criteria are important, the definition of non-technical losses is not entirely clear. | 1 |
| So far the process of determining non-technical losses is not finalised everywhere. It is evident that the level of non-technical losses depends on various factors that differ from MS to MS and are not only the result of different procedures, but also of different historical evolution. | 2 |
| There is no apparent reason to standardise the definition of losses in different MS. Any attempt to harmonise definition of losses would fail due to the enormous differences in grids in different countries. | 1 |
| Differences in losses definitions between countries should be acceptable, as they may depend on the metering system available, the allocation of consumption and the regulatory framework. | 2 |
| Some countries have reduced certain sources of losses either by installing meters or estimating consumption (with payment of a lump sum) for some consumption points (lighting, hidden losses), thus avoiding the community having to support this energy supply. It would not be relevant either to impose a step backwards (removal of meters), or impose an investment programme for countries that have not made such a choice. | 1 |
| What is important is not merely the definition of losses but the treatment of losses within the regulatory regime. | 1 |
| 2. Should power losses refer only to technical losses or is it acceptable to include also non-technical losses? | |
| Both technical and non-technical losses should be included in the overall losses assessment, since for the society as a whole it does not matter where and how energy is lost between the generating plant and the point of consumption. | 10 |
| Only technical losses are taken into account. Up to a certain extent non technical losses are considered, but only at lower voltage levels. | 1 |
| The main focus of attention should be technical losses. | 1 |
| The contribution of technical and non technical losses shall be separately highlighted. | 3 |
| Due to the presence of non continuous meters, difficulties will be greater and the reliance on estimates will increase if losses are to be defined net of non technical losses. In fact, non technical losses will always be defined as an estimate. | 2 |
| The separate measurement of non-technical losses is very expensive, since for | 3 |

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| that purpose all medium/low voltage local transformers and connections in low voltage need to be metered continuously. | |
| No separation is possible between technical and non technical losses with the actual metering systems. | 2 |
| For transmission, only technical losses shall be considered. | 1 |
| For distribution only data processing errors and theft shall be considered; unmetered supplies and own consumption have to be metered or correctly estimated. | 1 |
| There are some costs associated with decreasing of the volume of both technical and non-technical losses. It is efficient to decrease losses up to the point when net present value of saved losses is higher than net present value of costs associated with the reduction in losses. There exists an optimum volume of technical and non-technical losses beyond which it is not economically efficient to force grid operator to reduce losses further(as the costs would exceed the benefits). | 1 |
| Computing theft is more expensive than theft itself. | 1 |
| 3. Which are the key components for defining losses? | |
| Key component are technical and non technical losses. | 6 |
| The key components for defining losses are, on the one hand, the network where losses are to be defined – transmission or distribution, and, on the other hand, the source of the losses – technical or non-technical. | 2 |
| The key components for defining losses are the physical losses in transport and distribution of electricity. The "hidden" non-technical losses are more or less side effects. | 1 |
| The design of the power grid, the voltage and transformation levels and the length of the power lines are key components for defining losses. | 1 |
| Technical losses are the electrical system losses caused by network impedance, current flows and auxiliary supplies. | 5 |
| Technical losses are divided into fixed losses (not related to load) and variable losses (load related). | 1 |
| Network losses are separated into two sub categories: distance related (i.e. lost over the wires due to distance, heat, load etc.) and transformer losses (i.e. on-off loss at the transformer point). | 1 |
| In transmission lines and substation bus bars, losses are basically Joule effect losses and losses due to the corona effect. In transmission transformers there are Joule effect losses in the conductors of the windings and also losses in the | 1 |

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| magnetic cores due to the hysteresis phenomenon and to Foucault currents. | |
| Technical losses relate to investment in equipment (lines, transformers) and long term signals (compromise between investment costs and operational expenditure). They also relate to efficient planning and the design of distribution networks. The incentives are similar for any country; this is a general issue that can be treated globally. | 1 |
| Non technical losses include in-house consumption, measuring errors and theft. | 2 |
| Non-technical losses, sometimes referred to as commercial losses, arise from several areas including theft, un-billed accounts, estimated customer accounts, errors due to the approximation of consumption by un-metered supplies and metering errors. | 5 |
| Non technical losses basically refer to metering issues. They are to be treated on case by case basis. Their evaluation is based on particular situations depending on the country, region, specificities of public lighting and the, theft rate. | 1 |
| In the case of non-technical losses the distinction between losses that can be quantified and attributed to certain causes and those losses that cannot be differentiated from technical losses has to be made. Further detailed research into the causes of non-technical losses seems justified only for the first group. | 1 |
| In house consumption is excluded from losses, but it should be treated as any other type of energy consumption instead, whether metered or estimated. | 2 |
| Public lighting is excluded since it is a specific service to public entities and should be adequately contracted from an energy supplier. | 5 |
| Non-metered public lighting is included. | 1 |
| There are also unregistered supplies: this is a site recorded on the distribution network database but has no supplier appointed to it. If this site is connected and is taking electricity from the grid but no supplier is billed for this electricity, it will be included as losses. | 1 |
| The sources of power losses are clearly identified and quantified wherever possible in order to facilitate the comparison processes. | 2 |
| It is important to reflect the network that is actually in place rather than an idealised network. | 1 |
| **Valuation procedures** | |
| 4. What ways exist to improve the evaluation of losses in distribution networks? | |
| Improvements in metering. | 4 |
| Taking losses into account in the cost/benefit analysis of new metering | 1 |

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| equipment. | |
| The implementation of smart metering will allow a continuous metering process for losses. Nevertheless, the considerable investment involved in the implementation of smart metering demands a careful assessment of the economic feasibility and a clear definition of specifications and of the roll out design. | 7 |
| Further research would be necessary to obtain reliable estimates for technical losses. A model respecting the existing grid topology, voltage levels, age of installations and grid load would lead to the most accurate results. | 1 |
| Methodologies for analysing losses should be simple, transparent, predictable and reasonably cost reflective. The DSO should ensure that any changes in the methodology for calculating losses are governed so that improvements in losses can be monitored and comparisons conducted over time. | 1 |
| Specific non-technical losses that can be estimated (like public lighting) should be isolated and treated accordingly. | 2 |
| Long run data can be used to investigate specific impacts on losses by statistical evaluation method. | 1 |
| **Values** | |
| 5. What should be a reasonable and acceptable level of power losses at the distribution level and the transmission level? | |
| As the level of losses varies due to a number of factors (evaluation methodology, network characteristics …), it is not possible to state for a generic country what is a reasonable and acceptable level of power losses. In fact, the main loss drivers can not be managed by the system operators. As a consequence, even within the same country, the level of losses will vary depending on the region. In comparing power losses between countries, it is important to take account of the differences that may apply. It is not possible to set a harmonised value of acceptable losses throughout Europe. | 16 |
| It is difficult for system operators to influence the volume of losses, particularly in the short run. Furthermore, over longer timeframes, losses may be marginally influenced by investment decisions. | 2 |
| The acceptable level of losses will depend on the cost/benefit analysis of the political, environmental and technical choices which impact losses. An acceptable level of losses, from an economic point of view, would arise when the cost of reducing losses is equal to the cost of procuring the extra electricity required to offset them; i.e. the level of power network losses is acceptable when | 3 |

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| its environmental and economic impact does not justify additional measures to reduce losses. | |
| A reasonable level of losses can be defined by ensuring that investments in loss-reduction are economically feasible. What seems to be really necessary is that losses are reducing over time by individual (for every single grid) reasonable reduction goals. | 7 |
| 6. Which types of losses could be most easily reduced? | |
| Depending on the network design, those that are distance related may be easier to reduce than those linked to the transformer through improvement in insulation or line quality. In order to reduce technical losses, the most common way is to increase network capacity or locate generation closer to consumption or vice versa. These solutions are expensive and long run. | 10 |
| The reduction of non-technical losses can be reached by incentives designed to reduce theft, improve metering and reduce unmetered supplies. In systems where non-technical losses are high, measures should be taken in order to reduce these losses. It should be noted that the potential for further reductions of non-technical losses may be limited given the levels of efficiency already attained. | 7 |
| Each network operator has to decide on their own where and how a reduction of losses is achievable; a generally applicable answer is not possible at all. As these questions depend on the situation of each country, it would not be appropriate to define a unique position about these subjects. | 3 |
| **Procurement of losses** | |
| 7. Who should be responsible for procuring electric energy to cover losses? | |
| It is more important to ensure that the procurement of electricity to cover losses is done through a market based mechanism than it is to identify a single buyer for the losses. | 1 |
| TSO/DSO should have the responsibility for procuring energy to cover losses. | 8 |
| The consistency and effectiveness of the mechanism implies that such responsibility be assigned to the network operators which can forecast the total volume of losses, and have the optimisation means to cover them through wholesale procurement. | 2 |
| Mechanisms that make the producers or suppliers responsible for supporting these losses would not provide any direct nor effective incentive to the TSO or the DSO to limit or reduce the losses which are then passed on to the customers. | 1 |
| In order to purchase grid losses efficiently, the losses procurement process | 1 |

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| should be transparent, neutral to market actors and competitive according to the principles of the EU public procurement directive. To that end, TSOs, who should publish their practices of procurement, are the natural actors to buy the losses:<br>• the fact that the volume of losses can be monitored in daily operation explain why TSOs should be preferentially responsible for procuring losses; and<br>• market transactions are also simplified by this situation because the transmission service is complete: when 1 MW is injected on the network, 1 MW can be sold without any complicated hourly variations based on a percentage of losses to be compensated. | |
| In the long run, harmonisation of the losses procurement process would be preferable as the market integration proceeds. The rationale is as follows: it is not possible to determine exactly which grid users have caused losses in each operational situation. This applies particularly to losses caused by transit flows. Therefore, the model where supplier is responsible for purchasing losses;<br>• does not treat players fairly, which has a detrimental impact on competition and market integration; and<br>• is complicated and lacks of transparency because it means that users need to know in advance which quantity of electricity they have to purchase over their own consumption.<br>Moreover, as in daily operation losses are defined by generation, demand and exchange patterns, compensation in kind by users of the network will never give the quantity of energy equal to the volume of losses: TSOs will have to compensate the unbalance anyway. | 1 |
| The grid operators – both TSOs and DSOs are responsible for the level of losses that can to a certain extent be influenced at least in the medium and long term. What is relevant rather than who should be responsible for procuring losses is the level of losses allowed by the regulator and the regulatory mechanism to give incentives to grid operators to reduce losses. The responsibility of losses procurement does not by itself automatically ensure a reasonable and acceptable level of losses, if no target or standard is set by the regulator. EURELECTRIC supports any solution that brings efficiency as far as the procurement of losses is concerned. Losses may be procured either by TSOs, DSOs or suppliers. | 1 |
| This is definitely the responsibility of the grid operators – both TSOs and DSOs. As the level of losses can to a minor extent be influenced at least in the long term, transferring the responsibility for the procurement would separate grid development from losses. It would then be much more difficult to plan for an | 1 |

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| optimum in both dimensions.<br>Substitution through the implementation of complex regulatory mechanisms could provide compensation to a certain extent, but will always remain second choice.<br>The much simpler and straightforward solution is to leave all relevant aspects to the responsibility of the grid operator, who will then automatically strive to achieve the optimum trade-off between investment and losses.<br>The alternative that the electric energy to compensate for losses is procured by the grid users directly is not efficient for the following reasons:<br>• Neither the grid users directly nor the entities responsible for the balancing groups have sufficient knowledge about the current state of losses especially at the TSO level;<br>• In any case the lower level of flexibility on the part of the grid users would most probably result in some differences remaining with the grid operator in any case, which would result in multiple actors sharing responsibility. This cannot be advantageous;<br>• Distributing the responsibility for the procurement of losses to various actors provides less transparency than concentrating this task at the grid operator;<br>• The task of minimising the cost of grid losses and of improvements in the infrastructure is distributed over many actors. Any optimisation will then require complex regulatory estimates instead of the implementation of an incentive mechanism that is directed only at the grid operators. The necessary information that is needed by the regulator to solve this optimisation problem is most probably not readily available. | |
| The responsibility of the grid operator does not exclude however the possibility of outsourcing the procurement of electric energy to a trading unit, e.g. via public tenders or service level agreements. This could be an option which might be explored in more detail. | 1 |
| If the supplier is obliged (as in the UK arrangements) through Loss Adjustment Factors (LAFs) determined by network operator, there is no chance for the supplier to control the volume of energy required to cover losses, but does at least have some control over the time and hence network loading within its overall energy procurement plan. We therefore believe that the suppliers should be responsible for procuring losses.<br>If the network operator has to procure losses but can include the costs of procurement in its tariffs, then the supplier loses control of the costs as well as the volume. | 1 |

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| If loss adjustment factors are to be applied to the output of generators, we believe that these should be applied in a stable, predictable, non-discriminatory way. | |
| 8. How should electric energy to cover losses be procured in a market oriented way? Which solution is the most efficient? | |
| It is important to use a market based mechanisms to procure electricity for losses. The solution chosen should be transparent and non-discriminatory. | 4 |
| A careful debate among the European regulators would be sensible aiming at a single procurement method in the future. If regulators could agree on a single method it would promote cross-border competition among energy suppliers and keep the procurement costs for grid losses as low as possible. | 2 |
| One respondent advocate a market-based, transparent, harmonised and non-discriminatory approach to procure electric energy to cover losses. | 1 |
| Tenders or auctions, supervised and controlled by the regulator, do comply with the requirement of market oriented procedures that enables TSOs/DSOs to benefit from competitive prices for the energy procurement to cover their losses.<br>With regard to the procurement method, it should be recommended that the TSOs/DSOs spread their purchases over time using futures products, to reduce the risk of price volatility.<br>The procurement mechanism must therefore encourage TSOs/DSOs to be prudent and discourage risk-taking practices on power exchanges. | 3 |
| For several reasons (the energy markets in different countries are not standardised, national or regional energy markets exist, often there is limited interconnection capacity…) in different countries, different market based methods of purchasing electricity to offset losses may result in different costs and efficiencies of the purchases. Therefore, there is no European wide most efficient model and the best-suited marked based method should be found and agreed between network companies and respective regulatory authorities for each country. That said, there are common principles in existing regulations such as transparency non-discrimination that could be applied, particularly for risk hedging.. | 1 |
| When the grid operators as regulated entities are obliged to procure the energy, they should do so in a transparent, non-discriminatory and market-based way, although confidentiality of relevant information provided by bidders must be maintained in any case. However, harmonisation of procurement procedures across all MS may not be needed.<br>As shown above, both TSOs and DSOs can reduce the amount of technical | 3 |

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| losses only to a small degree and only in the medium to long term. The fact that the amount of losses thus basically cannot be easily influenced by the grid operators makes it even more important to have clear rules on how the energy for the compensation of losses is procured and accordingly the price that is paid for it. This is the major reason why market-based procedures are important. On the other hand, if the grid operators adhere to agreed procurement procedures (based on the EU Procurement Directive), the cost incurred should be acknowledged by the regulator as a cost component to include in the grid tariffs in a transparent way. | |
| Several respondents were favour of any solution that will increase transparency and efficiency in the procurement of electricity to cover losses. They prefer that the procurement of electricity to cover losses be based on market principles, e.g. through an auction system or through bilateral long-term agreements to be concluded on the basis of open and non-discriminatory tender. | 3 |
| One respondent believes that procurement of the energy for losses should ideally be with the supplier. The supplier has an inherent incentive to minimise procurement costs and thereby network loading in order to offer the most competitive tariffs and maximise profits. | |
| 9. Should the costs of losses be covered by a special tariff? | |
| Three respondents were not in favour of a special tariff to cover the costs of losses as they believe that this would not necessarily ensure that the procurement cost is market based.<br>If the supplier is the responsible party for the procurement of losses, then this does not need to be included in any regulated tariff but will be included by the supplier in its prices to end-user customers. | 3 |
| If the costs are to be included within the network tariff, then an allowance should be included within the network costs that can be adjusted within certain boundaries at the end of the tariff period to take account of unexpected wholesale price fluctuations. A tariff allowing for pass through of costs to customers should only be allowed where a stiff incentive is also applied on the network operators to reduce the level of losses. | 1 |
| The network tariffs cover the costs supported by TSO/DSO, including the costs of procurement for losses. Applying an additional special tariff for losses does not seem necessary. | 6 |
| Today, there is much variation in how TSOs cover the costs of losses. Some countries use a marginal loss tariff while other countries just cover the cost of losses in the same way as any other cost. | 2 |

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| A more important question is whether the costs of losses should or should not be allocated to customers by time period or according to the location of the connection point. The impact of a time or of a spatial differentiation based on losses should be studied as a way to create a price signal addressed to users of the network. This signal could be used to give an incentive to their demand (injection or off-take) and then could contribute to reduce the volume of losses on the network. | |
| Nevertheless one has to remember that the tariff must remain simple and understandable by users before being implemented and adapted to the national market conditions. | 1 |
| In most cases this seems to be preferable to the alternative of continuing to recover the cost of losses through the use of the network tariff.<br>If the costs for the compensation of losses are included in the regular network tariff, the transparency of the costs of the regulated entity is significantly impaired. A separate tariff would enable all parties involved to discuss any issues in a more focussed manner. In any case it is most important that the costs incurred can be recovered by the grid operator.<br>In the case of a single tariff there is a danger that higher costs for losses may be compensated by deeper cuts in other costs of the grid operators or vice versa. On the other hand in the case of lower costs for losses it might happen that these are not fully used to the benefit of grid users, but rather to give room for rising costs in other areas. | 3 |
| **Regulatory incentives** | |
| 10. What are the advantages and disadvantages of the aforementioned incentive mechanisms? | |
| Losses incentives must be designed to address the losses as directly as possible. Thus, as there are numerous types of losses, a number of incentive regime variations may need to be developed to ensure that the individual incentive mechanisms are as targeted as possible. Where the losses type relates to network performance then an efficiency factor may be suitable to encourage the operator to improve system performance over time. However, an efficiency factor may not be as suitable for other, non-technical losses such as theft or non-metered consumption such as public lighting. For such elements of losses, improved estimation or test metering can be used to improve understanding of their contribution to electricity losses. | 1 |
| A maximum percentage for losses (particularly technical losses) is not adequate especially for TSOs because nearly no possibilities exist to influence the amount | 1 |

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| of losses within a regulation period of 5 years and the external influencing factors will outweigh such effort. A preset reference percentage value ignores external influencing factors (such as weather). If the costs related to network losses are treated like any other cost with the regulatory model they would be fixed for a relatively long period. As a consequence, the particularities of the network losses might be disregarded, which is not acceptable for system operator because the costs related to network losses are significant and depend on very volatile and recently extremely increasing market prices. There is very limited opportunity for the system operator to reduce technical losses by redesigning his grid or to buy transformers with lower losses. | |
| Any mechanism based on capped volumes should take into account the factors influencing the volume of losses in order to adapt it to the real way in which losses are created in the transmission networks. It means that it is very difficult, not to say impossible, to fix any simple rate of losses. Any realised rate of losses must be analysed in regards of the operating conditions. | 1 |
| A moderate incentive for both TSOs and DSOs to reduce the cost of their losses is an appropriate design element of a regulatory mechanism. Regulatory measures should incentivise them to bring losses to an acceptable level in the medium to long term. However, only a small part of the costs of technical losses - and only in the long term - can be influenced by the grid operator and the regulator should take this carefully into account.<br>The incentives must be tailored to the adaptable part of the technical losses in the respective time frame. Furthermore, incentive schemes must be fair in the sense that the underlying targets have to be achievable by the regulated entity. Rewards and penalties for out- or under-performing these targets should be balanced.<br>The price of the energy cannot be influenced. The only element that can be influenced by the grid operator is the quantity of the losses – and this only in the long term. The overall objective should be to have a global cost/quality optimisation. Nor are overly ambitious targets for reducing the cost of losses used to lower grid fees in general helpful for grid users, as they will also fail to set proper incentives for the grid operator to obtain an optimum configuration. Here a maximum degree of transparency will help to ensure that the mechanisms are tailored to the targets at hand. The best way would be to install an incentive mechanism that promotes the overall optimum of grid operation instead of focussing on separate targets like the minimisation of losses at the expense of other objectives. | 2 |

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| The advantage of an effective and functioning system would be the earliest possible reduction of losses, which would achieve all the positive side effects (e.g. environmental, cost efficiency etc.). When costs for procurement of losses and investments in loss-reduction are not fully covered by the grid-tariff, the DSO runs into serious financial problems and the required investments cannot be carried out. | 1 |
| The costs related to network losses should be treated within the regulation like any other cost and not handled separately. Otherwise we run into severe problems caused by partially optimisation. The total cost of network losses is the best key figure because this can be affected by both optimising the technical structure of the network and procuring the energy from the market by the most economical way. | 1 |
| The network company should have an incentive when adopting investment decisions addressed to reduced losses. | 1 |
| Technical losses are difficult to reduce in the short term due to the long life of plant. Non-technical losses may be more amenable to reduction by increased attention to theft prevention and to the data acquisition procedures. Thus both input and output incentive mechanisms should be utilised. It is also important that incentives are aligned, particularly in areas where competitive provision of networks is permitted. For example in making a competitive offering for a new connection, the tendency would be to choose the cheapest equipment available which may not be compatible with loss reduction. One option is to ensure that all infrastructure providers have the same obligations or incentives for loss reduction. A second option is to specify more stringent minimum standards for new electrical plant consistent with the best available loss reduction technologies. | 1 |
| An incentive for both TSOs and DSOs to reduce the cost of losses should be included in the design of any regulatory mechanism. However, only a small part of the costs of losses can be influenced by the grid operator and that only in the medium to long-term. This limits the effectiveness of any incentives aimed at the grid operator.<br>Cost-benefit issue exist in reducing network losses. Therefore any reduction of losses requires investment from the grid operator and thus a long enough timeframe for incentive regulation is important to achieve the desired results - that is a reduction of the overall grid costs. | 1 |
| Different incentive mechanism can exist in different MS without any harmful effect. | 3 |

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| Additional regulations in existing regulatory schemes are urgently needed to remove existing disincentives and to set incentives for investment in energy-efficient distribution transformers. | 1 |
| 11. Which key elements should be considered when assessing different regulatory incentive mechanisms? | |
| Incentives should be aimed at generating efficiencies where regulated companies effectively possess the ability to exert significant control. | 5 |
| The achievement of losses reductions must be measurable and capable of being monitored in order to be able to reward good progress; Be manageable in the sense that data collection and processing requirements should be minimal | 3 |
| Achievable - a target that is too high may not be achievable or realistic (not over generous) and could dissuade the actors concerned from attempting any improvements at all. | 2 |
| It must be suited to the national industry structure and wider regulatory regime. Where a country has a number of network operators, comparative regulation could play a role in sharing best practice and making performance transparent. | 1 |
| The level of reward should not be greater than the benefit of the reduction of losses. | 1 |
| Incentives should be coherent with the regulatory system in place, namely with other incentive mechanisms (quality of supply, capital expenditure (CAPEX), operating expenditure (OPEX), etc) | 3 |
| An integral approach that considers simultaneously technical and non-technical losses should be used. | 1 |
| Symmetrically designed incentives for underperforming and outperforming the target should be set in order to motivate grid operators to outperform the target. | 1 |
| Regulatory acceptance that there is a limitation of how much network operators can influence losses in the short run is low. With some investments a decrease can be achieved in the long-term; improvements should be achieved in a stepwise approach, while setting reasonable targets and a well balanced implementation schedule. | 5 |
| There should be an immediate recovery of planned costs for losses (to avoid a contradictory effect against the incentive); costs of losses should be covered by the tariff (or tariff component) | 2 |
| The main issue is the control of the volume of losses, once the climate hazard neutralised. | 2 |
| An incentive to improve the losses forecast would also reduce the imbalance costs paid on the balancing mechanism. | 1 |

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| Incentives should establish a link between reasonable estimated input (investment or operational costs) and reasonable targeted outputs (such as the intended loss reduction target) | 3 |
| Incentives should share the efficiency gains between industry and customers. | 2 |
| Incentives should be simple in their conception being easily understandable for all concerned parties. | 2 |
| Any incentive should minimise regulatory risk, taking into account the long useful life expectancy of the network assets and their impact on the overall long term system efficiency. | 2 |
| The mechanism should allow consideration of services that may offer value to customers on their own and may also broaden the level of influence of the network operators over losses. | 2 |
| The incentive should allow TSOs/DSOs to seize opportunities to renew network assets. | 2 |
| Regulators should take into consideration costs that have not yet been internalised in market prices; all investments and costs related to the reduction of losses and the purchase of electricity to cover losses have to be acknowledged by the Regulator and incorporated within the grid-tariff. | 3 |
| Hedging purchase policies of losses on the markets must be completed in line with hedging regulations that help TSOs to deal with high market price variations. Transmission tariffs should be easily adaptable to the quick variations of market prices. | 1 |
| A fundamental error would be to design incentives for either TSOs or DSOs not only to reduce the amount of losses, but also the price at which the energy is procured. There should be neither a benchmark regarding the procurement price nor any other reductions in the costs incurred, as the procurement price cannot be influenced by the grid operators. The regulator should accept market driven pricing. | 3 |
| The application of an incentive mechanism requires existing capabilities for improvements, while respecting that investments are economically feasible. | 1 |
| The actual, prevailing rate of losses has to be considered as the initial value for the mechanism. | 1 |
| Saving energy: reduction of energy losses due to inefficient network equipment and operation. Incentives should be provided to obtain the right balance between investment and operational costs, including cost of energy, $CO_2$ emissions and energy saving targets provided by the European Commission. | 1 |

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| Tariffs should reflect additional costs incurred as a result of loss reduction efforts. | 1 |
| The incentive should take into account the method for determining recognised losses and its feasibility in practice (greenfield vs. actual network topology and plant) as well as the feasibility of action to reduce commercial losses. | 1 |
| Regulatory incentive elements should be<br>• forward looking – performance targets based on expected future conditions;<br>• fair – offer both risks and rewards to an equal extent, cost saving and cost increases shared between regulated entities and their customers; and<br>• moderate – risk exposure to regulated entity should be limited and compliant with the business model of TSOs. | 1 |
| Incentives should exist for economically reasonable procurement and a reasonable mains operation as well as for the reduction of non-technical losses. | 1 |
| 12. Are there advantages in setting separate mechanisms for technical and non-technical losses? | |
| There are clear advantages in setting separate mechanisms for technical and non-technical losses. The actors best placed to address the losses may be different, e.g. network operators or suppliers; the work that can be undertaken to reduce the losses may be different, e.g. installing more efficient equipment or improving internal data processes. A global incentive mechanism to reduce all losses will be too generic and lack the ability to target the most appropriate actors to carry out their activities in any particular way in order to reduce losses. To succeed, an incentive must be designed to be specific, measurable, achievable, realistic and timely. It is desirable that separate mechanisms are in place regarding technical and non-technical losses because both the scope and the cost drivers to reduce each type of losses are different. | 1 |
| No. | 1 |
| Respondent does not see any advantage with regard to the procurement method, since losses have to be compensated globally. However, the control of non technical losses is a fundamental issue for DSOs, and more generally for the actors of the electricity market. The implementation of theft detection strategies is based on effective and experienced techniques whose results are available in the short or medium term. One respondent considers that it would be interesting to provide for a specific incentive mechanism dedicated to non technical losses. Nevertheless, it is noticeable that a reallocation of resources should be | 1 |

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| necessary in most DSOs and that it would probably have an impact on the OPEX trajectory of the DSO. | |
| One respondent considers that theoretically it would be preferable to put in place separate mechanisms for technical and non-technical losses because both the scope and the cost drivers to reduce each type of losses vary. Referring to overall losses could be a better option. The design of incentive mechanisms should rely on a realistic estimation of what room for manoeuvre grid operators really have to influence the compensation costs of losses. The ability to influence costs depends on varying parameters when it comes to technical and non-technical losses. Accordingly, the incentive mechanisms should have a fundamentally different design as well. An even better alternative would be to have an incentive mechanism set for total losses with no distinction between the specific types of losses. However, as a large part of non-technical losses cannot be separated from technical losses, setting separate mechanisms may be difficult to apply. | 1 |
| Non-technical losses may still be treated separately. However, the reduction of these costs is only rarely the sole responsibility of the DSO. Political targets and country-specific regulatory configurations contribute to the situation. For these reasons, incentives to reduce non-technical losses are to a large extent dependent on the situation in the individual MS and are sometimes difficult to harmonise. | 2 |
| No separate mechanisms are needed. But targets to be set will depend on different parameters (e.g. social component for theft). | 1 |
| Yes, when considering regulatory incentives, technical and non-technical losses should be treated separately, because they can be affected by different measures. This should, however, be done only to a certain limit. The risk of partial optimisation should be avoided. | 1 |
| If it were possible to meter properly the different types of losses, which is not easy, the company could establish clear and different improvement targets. | 1 |
| The design of incentive mechanisms should be drafted along the criteria of what extent the grid operators are able to influence the costs for the compensation of losses. This ability to influence the costs is obviously dependent on very different parameters for technical and non-technical losses. Accordingly, the incentive mechanisms have to have a fundamentally different as well. An even better alternative would however be to have an incentive mechanism set for total losses with no distinction of the specific types of losses. | 1 |
| At the distribution level, it is very difficult to separate technical and non-technical | 1 |

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| losses (with the exception of unmetered and own consumption which can be estimated). An overall loss reduction incentive will ensure that the losses reduction effort is targeted where there can be quick wins – possibly in the non-technical area of enhanced theft prevention or improved data collection and aggregation. | |
| At the DSO level it is not cost-effective to separate different types of losses. Therefore, there should be incentive mechanism set for total losses with no distinction of the specific types of losses. | 1 |
| It is difficult to distinguish between the two as they are cover different aspects and efforts to reduce them will thus differ too. | 1 |
| Yes, because they result from completely different circumstances. Technical losses occur whenever electricity distribution or transmission takes place. Non-technical (e.g. theft, data and billing errors) can theoretically be avoided but the efficiency of any effort has to be proven. | 1 |
| 13. Are there advantages in setting separate mechanisms for transmission and distribution losses? | |
| The mechanism could in principle be the same but parameters have to be set separately according to the specific condition within the distribution and transmission sector. | 2 |
| Distribution and Transmission are legally separated business. As such, there are advantages in setting separated mechanisms for transmission and distribution.<br>Distribution and transmission businesses are characterised by different planning and operational issues and are subjected to different constraints.<br>Metering accuracy and metering estimations typically impact on lower voltage distribution systems. Also, standard marginal nodal pricing techniques may not be equivalently applied as a losses cost signal for both transmission and distribution networks. | 2 |
| TSOs and DSOs face different challenges in limiting the costs for the compensation of losses. For this reason, the incentive mechanisms should be designed with the respective problems of TSOs and DSOs in mind. In particular TSOs normally have no or only very limited non-technical losses.<br>Technical losses at the TSO level are extremely dependent on the load flows, which might change fundamentally from year to year and are heavily influenced by external factors such as absence or presence of wind energy, cross border flows, etc. As the amount of losses can only be influenced in the medium to long-term, any incentive mechanism faces the challenge of isolating the dominant effects of year-to-year changes from the longer-term effects generated by the | 8 |

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| actions of the TSO. In consequence, designing an incentive mechanism for TSOs can raise difficulties.<br>As far as DSOs are concerned, it should be kept in mind that an increase in decentralised generation and changing load patterns resulting mostly from industrial customers being connected or disconnected also contribute to significant changes in load flows from year to year. These changes will in most cases be larger than any influence the DSO has on losses, which can only be reduced in the long term. This makes it rather difficult both to isolate the effects of loss reduction in the responsibility of the DSO and to design a mechanism that provides the proper incentives. | |
| There won't be advantages in setting separate mechanisms. But priorities for transmission and distribution will be diverging. (e.g. theft, frequency of metering etc.) | 1 |
| Theft should not exist in transmission and currently it is possible to meter at "transmission/distribution border-points" the amount of transmission losses and by difference the distribution losses. | 1 |